Pacific-German Regional Programme
Adaptation to Climate Change in the Pacific Island Region

Fiji REDD Policy Scoping Report

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Abbreviations and Acronyms

A/R	Afforestation/Reforestation
ACCPIR	Adaptation to Climate Change in the Pacific Island Region
AFOLU	Agriculture, Forestry and Other Land Uses
CDM	Clean Development Mechanism
COP	Conference of Parties
CTU	Carbon Trading Unit
DNA	Designated National Authority
FAO FRA	Food and Agriculture Organization Forest Resources Assessment
FLIS	Fiji Land Information System
GHG	Greenhouse Gas
GIS	Geographical Information System
GPG	Good Practice Guidance
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit
IPCC	Intergovernmental Panel on Climate Change
LCA	Long Term Collaborative Action
LULUCF	Land Use, Land Use Change and Forestry
MRV	Measurement/Monitoring Reporting and Verification
NAPA	National Adaptation Programme of Action
NEC	National Environment Council
NFI	National Forest Inventory
NGOs	Non-Governmental Organizations
PES	Payment for Ecosystem Services
REDD	Reducing Emissions from Deforestation and Degradation
REDD+	REDD and A/R
R-PIN	REDD Readiness Plan Idea Note
R-PLAN	REDD Readiness Plan
SBSTA	Subsidiary Bodies for Scientific and Technological Advice (UNFCCC)
SFM	Sustainable Forest Management
SPC	Secretariat of the Pacific Community
UNFCCC	United Nations Framework Convention on Climate Change
USP	University of the South Pacific

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Executive Summary

INTRODUCTION

The SPC/GTZ Pacific-German Regional Program on Adaptation to Climate Change in the Pacific Island Region (ACCPIR) is undertaking a Project in Fiji to develop a national Fiji REDD[1] program designed to assist Fiji prepare for and take advantage of carbon and climate related finance for sustainable management in the forest sector, enabling the protection and enhancement of resilient forested landscapes in the face of future climate change.

This project is proceeding in close collaboration with the Secretariat of the Pacific Community (SPC) and the main national counterparts: the Fiji Forestry Department and the Fiji Department of Environment.

While it is clear that sustainable management of forests is an integral component of climate change adaptation in Fiji, there are important strategic synergies between climate change adaptation and mitigation that can be used to maximize the financing opportunities for building and maintaining resilient forested landscapes capable of providing many ecosystem services to the people of Fiji.

A national planning workshop held in May 2009 in Suva, Fiji identified 3 phases for the Fiji REDD programme:

Phase 1: Policy and scoping – output "National REDD Strategy"

Phase 2: Detailed planning – output "National REDD Strategic Action Plan"

Phase 3: Implementation – output "National REDD strategy outcomes and monitoring"

This report encompasses one of the outputs for Phase 1 in the form of a National REDD Strategy Framework arising from a National REDD Policy & Scoping Consultation. The centerpiece of the multistakeholder consultation was a 5 days workshop where participants from different ministries, resource owners, national and international NGO, private sector and CROP agencies were trained in various strategic and technical aspects of REDD and elaborated a draft REDD policy and a road map

[1] 'REDD' in the context of the Fiji National REDD Strategy Framework refers to REDD+ - encompassing Reducing Emissions from Deforestation and Degradation'; and afforestation/reforestation; and any activity capable of addressing the drivers of deforestation and degradation, or amplifying the drivers of afforestation/reforestation.

for further actions. Separate meetings with different stakeholder groups were held before and after the workshop (see Appendix 1). This consultation involved:

1. Policy and technical training
2. Policy consultations with key stakeholders at a national level
3. Technical input to policy dialogue
4. Data and capability assessment for a national forest carbon monitoring programme for Fiji, and the design of a strategy and methodology to fill data and capability gaps
5. Refinement of a draft National REDD Policy

Policy and technical consultations resulted in the refinement of a National REDD Strategy Framework which elaborates the following:

- Scale (national, project or combination)
- Scope (activity types and priorities)
- Reference Level (how emissions/carbon stocks are measured and the development of a national reference level for future negotiations at the UNFCCC)
- Financing (target sources of funding for a National REDD Programme)
- Distribution (how benefits arising from REDD activities will be distributed)
- Governance
- Capacity Development
- International Policy Engagement

For further information see Part 1: Overview and Section 2.1 in Part 2: Policy and Strategy.

SCALE

The consultation process led to agreement that Fiji adopt a “hybrid” scale approach to REDD enabling both national and project scale activities where appropriate. This allows for both national and project level engagement with REDD financing instruments as part of a coordinated national programme designed to maximise opportunities and minimise costs.

This approach was adopted in order to gain the benefits of both national and project scale approaches and avoid the pitfalls. Here, a national approach provides a national reference level and national Monitoring, Reporting and Verification (MRV) which will facilitate higher level quality

assurance for any project scale activities. A fully devolved program would be less strategic and potentially result in lost opportunities.

In particular, a hybrid scale approach would enable certain activity types to be managed on a national scale and others managed at a project scale. Those activity types managed on a national scale could then be strategically linked to (in the form of benefit sharing) certain activity types at a project scale (see below).

For further information see Section 2.2 in Part 2: Policy and Strategy.

SCOPE/FINANCE

The scope (activity types) of a National REDD Programme is closely linked to financing instruments that prescribe eligibility criteria. Consultations agreed that the Fiji REDD Programme should be open to all available financing instruments for the REDD sector including:

- UNFCCC instruments (REDD, CDM)
- USA domestic emissions trading scheme
- Voluntary carbon market
- Payment for Ecosystem Services (PES) market, and
- Grant finance from the private or public sector

Accordingly, a number of different activity types were identified as potentially eligible (in theory) in a National Fiji REDD Programme:

1. Reducing emissions from deforestation via forest protection
2. Reducing emissions from deforestation via sustainable forest management
3. Reducing emissions from degradation via forest protection
4. Reducing emissions from degradation via sustainable forest management
5. Afforestation/reforestation
6. Forest/energy sector linkages (biomass electricity generation)
7. Forest/agriculture linkages (biomass residue/biochar)
8. Combination linking A/R with REDD

National priorities for action are best assessed strategically whereby highest returns can be gained via least cost. One way of approaching this is to apply a marginal cost analysis to forest sector REDD activity types. An economic analysis of this form can be used to identify the “low hanging fruit” and

drive strategic decisions focused on generating the largest emission reduction/sequestration returns from investments. It is recommended that a marginal cost analysis be undertaken as an aspect of National REDD Strategic Action Plan (Phase 2). This strategic approach to the selection of project types lends itself to a nationally coordinated programme rather than one that is devolved to the project scale. However, such a nationally coordinated approach could combine national scale activities (highest carbon returns on lowest investments) with strategically selected project scale activities (e.g. high priority from a biodiversity point of view but less financially competitive in isolation).

In line with keeping options open, it will also be important for Fiji to monitor the UNFCCC policy development and the USA domestic emissions trading legislation to ensure that the national REDD programme is appropriately aligned with these international policy developments.

The workshop participants also agreed on the need for the development of pilot project activities that would assist the development of a national programme. These pilot activities would be most useful if they were somehow representative of the opportunities open to the Fiji forest sector and were of particular relevance to Fiji priorities.

The workshop identified activity types that warranted attention in the form of interventions. These activity types included those that caused the loss of carbon to the atmosphere and those that sequestered carbon from the atmosphere. The two most important activities leading to the loss of forest carbon stocks in Fiji were identified as:

1. Forest conversion for expansion of agriculture (deforestation)
2. High intensity selective logging of native forests (degradation)

The most important activity type leading to the sequestration of carbon into forests was new forest establishment on marginal grassland.

A national strategy would therefore need to focus its attention on stopping or changing the drivers of forest conversion for agriculture (reduced deforestation) and high intensity selective logging of native forest (reduced degradation), as well as encouraging the drivers for the establishment of new forest on marginal grassland (afforestation/reforestation).

It is recommended that a marginal cost assessment is first undertaken to help identify an economic basis for allocating resources to different activity types including pilot project activities.

For further information see Section 2.2 and Section 2.4 in Part 2: Policy and Strategy.

REFERENCE LEVEL

Consultations led to agreement that Fiji needs to develop a national forest carbon monitoring, reporting and verification (MRV) system as a necessary step in developing the national reference level. This will also need to be defined in close association with more detailed analysis of deforestation and degradation drivers. This is particularly important for strategic development in agriculture in the face of a growing population and future food security challenges.

Two central elements for establishing a reference level and for continuous reporting on forest carbon changes are a national forest carbon monitoring system and a forest carbon inventory.

National Forest Carbon Monitoring System

The workshop participants agreed that Fiji will need to follow a specific set of internationally approved requirements for establishing a national forest carbon monitoring system for REDD implementation. They include:

- The considerations of a national REDD implementation strategy (requires a coordinating national/international process – ongoing for Fiji)
- Systematic and repeated measurements of all relevant forest-related carbon stock changes
- The estimation and reporting of carbon emissions and removals on the national level using the IPCC Good Practice Guidelines on Land Use Land Use Change and Forestry (LULUCF)
- Independent review of national forest carbon monitoring systems.

The establishment of a national forest carbon monitoring system should be undertaken in three phases: 1. Planning and Design; 2. Monitoring; 3. Analysis and Reporting.

Planning and design of a national forest carbon monitoring system should specify the monitoring objectives and implementation framework based on an understanding of:

- the status of international UNFCCC decisions and related guidance for monitoring and implementation;
- the national REDD implementation strategy and objectives;
- knowledge in the application of IPCC LULUCF good practice guidelines;
- existing national forest monitoring capabilities;
- expertise in estimating terrestrial carbon dynamics and related human-induced changes;
- the consideration of different requirements for monitoring forest changes in the historical (reference period) and for the future (accounting period)

Monitoring GHG emissions and removals requires data collection capabilities derived from national forest inventories including permanent plot measurements, and remote sensing-based monitoring.

All relevant data and information needs to be stored, updated, and made available by means of a common data infrastructure (i.e. as part of a national GHG information system). The information system provides for the transparent estimation of emissions and removals of greenhouse gases.

The national GHG information system will be used in the analysis of the data, support for national and international reporting, the implementation of quality assurance procedures, and international expert peer review. The analysis and use of existing forest carbon data is most important for the estimation of historical changes and for the establishment of the national reference level of emissions from the forest sector.

National Forest Carbon Inventory

The scoping dimension of the National Policy and Scoping Workshop involved an assessment of the national forest data set and capability for the generation of a national carbon stock assessment and future national carbon monitoring, reporting and verification.

Consultations and scoping led to agreement that it would be appropriate for Fiji to undertake a national carbon stock and stock change assessment using existing data sets from the national forest inventory, and then improve the quality of this carbon stock and stock change assessment through time. Existing data sets enable the generation of a national carbon stock and stock change assessment but there are some important data gaps. Immediate next steps include a process of filling these gaps.

Data Gap 1 - Wood density data in National Forest Inventory

The National Forest Inventory (NFI) only focused its wood density data collection on commercial indigenous timber species. A full assessment of national forest carbon stocks will need to account for the wood density of non-commercial species. This will require the generation of default data separated into density classes.

Data Gap 2 - Forest area change

The National Forest Inventory (indigenous forest) did not include lands cleared for agriculture (which lay outside its terms of reference). This data gap can be filled by undertaking an historical forest area change assessment using remote sensing data currently available. Workshop participants were in agreement that a forest area change assessment is a high priority as an immediate next step and could be undertaken by the Department of Forestry in association with SOPAC/SPC.

Data Gap 3 - Inventory data quality

Improvements in data gathering methods in future national forest inventory (indigenous forest) and improved permanent sample plot methods have been identified as a means of improving data quality for future forest inventory for national forest carbon stock assessments.

Data Gap 4 – Frequency of National Forest Inventory

The National Forest Inventory currently recurs approximately every 15 years. A national forest carbon monitoring reporting and verification system will benefit from a more frequent national forest monitoring cycle. It is recommended that the National Forest Inventory be undertaken at least every 10 years. One way of approaching this is to establish a rolling inventory process where some work is being undertaken every year. This has the benefit of maintaining a skilled human resource pool, is easier on funding streams, and enables a constant (annual) updating of the national carbon stock calculation.

Data Gap 5 – Plantation Forest Inventory

The plantation forest data set needs to be upgraded by using a carbon stock: stand-age curve to generate a default for carbon stock change through the harvest cycle. Individual plot data can then be gathered to ensure that the carbon stock: stand-age curve is as accurate as possible. The next stage in improving the plantation forest carbon data set will involve migrating the plantation carbon stock methodology to one that is equivalent to that used in the indigenous forest with permanent sample plots in a grid fashion. It would however, be prudent to first undertake an international peer review of the plantation inventory methodology (and the national indigenous methodology) prior to any such decision to upgrade the methodologies. This would enable the peer review process to evaluate the need (if any) and the cost effectiveness of such an upgrade.

Data Gap 6 – Carbon pools

Current carbon pools available to the national carbon stock inventory are restricted to only above ground live biomass. This encompasses only one of the five carbon pools needing to be assessed in terms of international best practice (IPCC Tier 2 and 3). Ideally a national forest carbon monitoring system will include the following pools: Above ground live, below ground, deadwood, litter, and soil organic matter. The national forest carbon inventory will benefit from a progressive (staged) improvement in the number of carbon pools included in the data set.

For further information see Section 2.3 in Part 2: Policy and Strategy, Part 3: National Forest Monitoring and Part 4: Forest Carbon Inventory.

DISTRIBUTION

The distribution of benefits arising from a National REDD Programme will need to focus primarily on

1. maximising benefits to landowners
2. maximising strategic benefits to Fiji

In relation to 1 above, the National REDD Policy draft included the following wording:

> *"The landowners of the vast majority of Fiji's forests are the indigenous people of Fiji and therefore the Fiji REDD Program shall guarantee the indigenous people's rights to land, customary domains and ecosystems and provide maximum opportunities for indigenous communities."*
>
> *"Sectors other than Forestry may benefit from actions that reduce emissions from the forest CO_2 sources, avoid emissions from forest CO_2 sources, and enhance removals by forest CO_2 sinks, where these co-benefits include:*
>
> *i. Biodiversity conservation*
>
> *ii. Water catchment management*
>
> *iii. Livelihoods in the forest sector"*

Clarification is yet needed on forest carbon property rights and legal dimensions of any transfer of these property rights. A legal review is planned (and strongly recommended) in order to clarify the legal means by which benefits arising from forest carbon trading will be distributed in the context of a National REDD Programme. This is particularly important in terms of defining the architecture of a 'hybrid' scale programme that combines national and project based activities.

In terms of maximising the benefits to Fiji, a national REDD programme will need to develop its activity types in a strategic manner in order to maximise opportunities arising from carbon financing. This will sometimes mean that certain activity types are best managed at a national scale, while others can be most effectively and strategically managed at a local (devolved) project scale. One of the key considerations in terms of the generation and distribution of the benefits of REDD activities is economies of scale. Certain activity types will generate little benefit if undertaken at a small scale (and may not overcome transaction cost barriers). This is where increasing scale is important and managing large scale activities is something that could be undertaken by the Government or national scale agency. Indeed the National REDD Programme itself could be managed as a national entity outside (but including) government.

There are also opportunities to link different project types in order to redistribute some of the benefits (e.g. linking a reforestation project with a rainforest protection project) and maximise the gains from a national REDD programme (as indicated under Scope/Finance above).

For further information see Section 2.5 in Part 2: Policy and Strategy

GOVERNANCE & INSTITUTIONAL STRENGTHENING

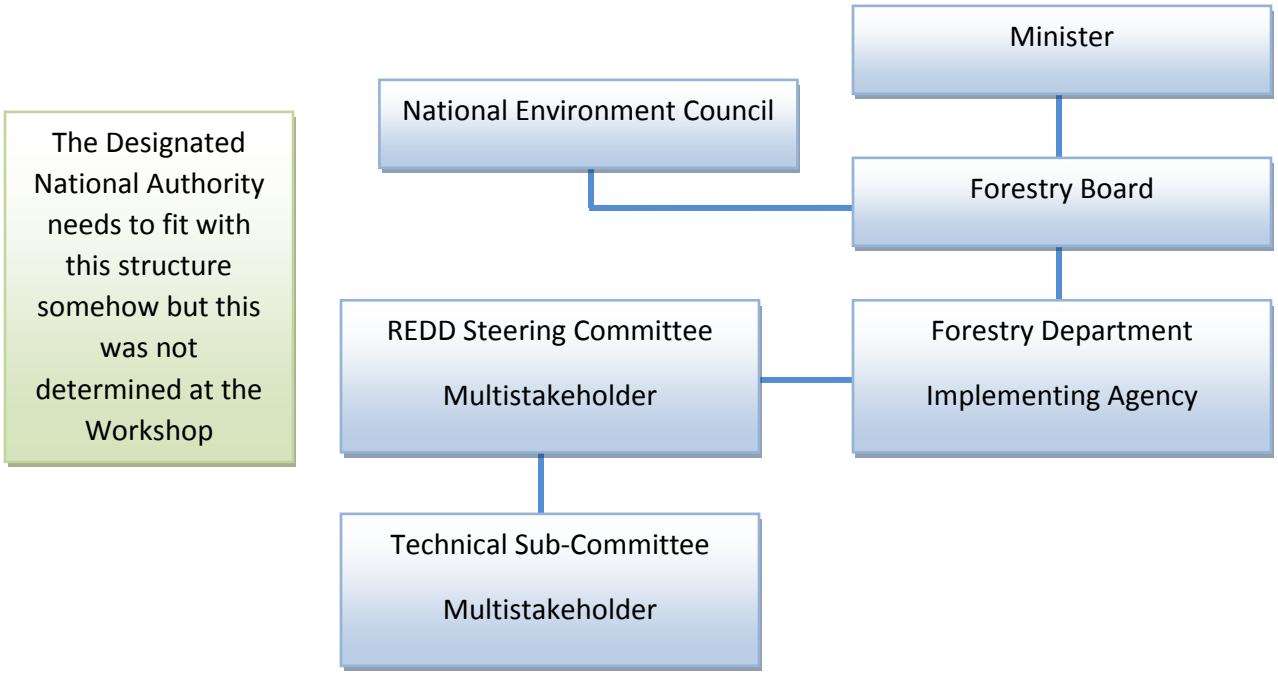
Transparent and effective multistakeholder programme governance was seen as an important part of a National REDD Programme aiming to gain support of resource owners, donors, and investment. It was clear that existing institutional arrangements should be used where possible and strengthened where necessary. Policy consultations agreed that programme governance needed to produce the shortest path between the generation of a mandate and action on the ground.

A key task in national scale REDD programme governance is the strategic alignment of policy (strategic goal, roadmap, decision structure, financing strategy) and technical (forest carbon monitoring) dimensions of a national programme.

The governance structure of a national REDD programme will be of considerable interest to donors/buyers in the REDD sector, particularly because they will want to be confident that their money will be used efficiently and effectively. For this reason it is useful to develop a governance structure that is capable of:

a. Providing a transparent mandate for REDD programme activities, and preferably including all relevant participating stakeholders (including resource owner representatives) in the decision structure
b. Providing a transparent link between the funding source and the activities on the ground (financial discipline)
c. Ensuring compatibility between the REDD programme and other national environment and development priorities
d. Supporting a transparent communication strategy
e. Ensuring effective strategic linkages between policy and technical components, landowners and the private sector

The workshop participants agreed on the following draft structure:



Here the REDD Steering Committee would form the core "engine room" of the national REDD programme. This committee would be a multistakeholder committee mandated to make recommendations on the strategic direction of a national programme, and able to provide a work programme for the Forestry Department to oversee and/or undertake implementation.

The Workshop identified institutional strengthening requirements for a national REDD programme and agreed upon necessary changes as follows:

a. Improved legal structures for carbon finance and carbon property rights, including clarification of original ownership & rules for the transfer of carbon property rights (high priority)

b. Strengthening the Fiji Designated National Authority (DNA) (high priority)

   i. Requirement for all CO_2e property right transfers to be approved by the DNA (i.e. including voluntary carbon market transactions)

   ii. Provide a transparent decision and advisory structure to enable relevant departmental directors to have input into carbon trading approval procedures. The likely sectors to be involved in carbon trading activities in Fiji include Forestry, Energy, Agriculture, and Public Utilities.

iii. Develop transparent eligibility criteria for REDD project types arising from a robust policy platform and make publically available (e.g. via website to project developers and landowners)

iv. Develop transparent and efficient approval procedures for project proposals.

For further information see Section 2.6 in Part 2: Policy and Strategy

CAPACITY DEVELOPMENT

The Workshop participants agreed that increasing domestic capability in REDD will need to arise from targeted training of incumbent staff where necessary, together with formal (tertiary) education in key areas of need.

The major themes of the national REDD programme are:

a. Policy & strategy development

b. Monitoring, Reporting and Verification

c. Project design, development & implementation

Targeted training and education in these three areas would assist the rapid transition towards a domestic-only capability. The educational component could include a master's thesis topic funded and supported by the national REDD programme each year for each of these three themes. This would provide an "apprentice" programme with the postgraduate student working alongside and assisting key programme staff members. Supervision for these students could be gained from domestic and external technical and policy expertise linked to the programme.

For further information see Section 2.7 in Part 2: Policy and Strategy

INTERNATIONAL POLICY ENGAGEMENT

At the final plenary session, the Workshop participants agreed upon the need for improved international policy engagement in REDD as follows:

a. Improve communication linkages between Foreign Affairs, UNFCCC Focal Point, DNA, and relevant departments (e.g. Forestry, Environment, Energy, and Agriculture) to enable greater responsiveness to opportunities to attend and participate in UNFCCC REDD/forest sector policy and technical initiatives.

b. Commitment for Fiji to attend UNFCCC COP-15 in Copenhagen (December 2009) with representations from Environment, Forestry, and a Technical/Policy Advisor.

c. Aim for a Fiji/Vanuatu joint side event in 2010 at UNFCCC SBSTA or COP-16 to report on progress in the regional effort in REDD and Forest Sector climate change adaptation.

d. Begin active attendance by Forestry (and/or representation by technical/policy advisor/s) at UNFCCC and UNFF REDD/Forest Sector technical and policy meetings and workshops (and take advantage of any funding by UNFCCC/UNFF).

e. Begin active attendance by Forestry (and/or representation by technical/policy advisor/s) at the Coalition of Rainforest Nations (CRfN) Workshops (and take advantage of funding by CRfN).

f. Explore opportunities to engage more actively in the Pacific Island Forum with particular reference to regional collaboration as recommended at the 2009 Pacific Heads of Forestry Meeting.

For further information see Section 2.7 in Part 2: Policy and Strategy

Part 1: Overview

1.1 FORESTS & CLIMATE CHANGE

Forests play an important role in our climate system. Through photosynthesis trees absorb carbon dioxide from the air, turning it into sugar and eventually wood. About 50% of the wood volume in trees comes from carbon dioxide. As such trees and forests are a reservoir of carbon. When trees and forests are growing they absorb (sequester) carbon dioxide from the atmosphere and act as a carbon sink. When trees and forests are cut down or burnt they release carbon dioxide to the atmosphere and act as a source of carbon dioxide emissions.

Deforestation and forest degradation are a major source of greenhouse gases to our atmosphere. At this stage in history most of this is occurring in developing countries in tropical regions. According to the Intergovernmental Panel on Climate Change (IPCC) emissions from tropical deforestation during the 1990s amounted to 1.6 billion tonnes of carbon per year equating to 20% of global carbon emissions. Designing a mechanism for reducing emissions from deforestation and degradation (REDD) is therefore an important component of global climate change mitigation.

> "*If we lose the battle against tropical deforestation we lose the battle against climate change*" – Charles, Prince of Wales.
>
> "*If a post-Kyoto climate agreement fails to act on avoiding tropical deforestation, the achievement of overall climate change goals will become virtually impossible*" – President of Guyana.

REDD is expected to be a key component of the negotiations at the Conference of Parties (COP) to the United Nations Framework Convention on Climate Change (UNFCCC), at Copenhagen in 2009, and any resulting post-2012 global agreement on climate change.

1.2 WHAT IS REDD?

REDD, or 'Reducing Emissions from Deforestation and Degradation' encompasses a response to the global climate policy challenge of tropical deforestation and degradation. The term REDD arose at the 11th Conference of Parties of the UNFCCC in Montreal in December 2005, with a proposal from the governments of PNG and Costa Rica. This proposal was to bring tropical deforestation back onto the UNFCCC policy agenda after it failed to be included in the Kyoto Protocol.

For many developing countries without large industrial sectors, the principal source of carbon emissions is from deforestation and forest degradation. 'Deforestation', as understood in international policy language, involves the removal of over 90% of the forest canopy and a permanent change in land use (e.g. from forest to agriculture). Unsustainable high intensity selective logging of indigenous forest will remove the vast majority of the carbon in a forest, but often will not result in a permanent change in land use. This is called 'degradation' and in many countries accounts for a large proportion of forest-based emissions.

The international policy agenda for REDD involves the development of incentive mechanisms and associated quality assurance criteria to reduce the rate of forest-based carbon emissions in developing countries. Incentive mechanisms are likely to include technical support, grant funding, and possibly market or market-linked financial instruments (carbon credits).

REDD incentive mechanisms are designed to enable developing countries and/or their forest resource owners to gain financial support for activities that result in a reduction in forest-based carbon emissions. This is designed to provide a counter-balance to the current situation whereby existing financial incentives tend to motivate countries and/or resource owners to increase their emissions through unsustainable timber harvesting and conversion to agriculture.

REDD incentive mechanisms encompass a means of assigning a monetary value to the climate-related ecosystem services that are provided by in-tact forest ecosystems. For such incentive mechanisms to work effectively they need to address the social and economic drivers of deforestation and forest degradation. Addressing deforestation and degradation drivers commonly requires redirecting economic production in the rural landscape, in a way that can satisfy resource owners and the strategic development interests of developing country governments. Accordingly, activities that reduce deforestation and degradation will often need to be linked to other rural development activities such as afforestation and reforestation (A/R) (activities that sequester atmospheric carbon).

Furthermore, natural forests that have never been logged are not generating carbon emissions. Forest conservation activities that prevent such forests from being degraded or deforested, therefore, do not involve "reducing emissions" and thereby lie outside the scope of 'REDD'. In addition, changing forestry practices from unsustainable logging practices to sustainable forest

management (SFM), or undertaking SFM instead of deforestation also forms an important part of an effort to reduce forest-based emissions in developing countries.

For these reasons the scope of 'REDD' policy has broadened to include A/R, SFM, and forest conservation – now framed as 'REDD+'.

1.3 NON-UNFCCC PLAYERS

The UNFCCC is the forum for the intergovernmental policy debate on REDD. The REDD policy framework arising from Copenhagen in December 2009 will bring REDD into the post-2012 international climate agreement, and link developing country and developed country participants (e.g. developed country buyers of potential REDD credits from developing countries)

But there are also other contexts for the development of incentive mechanism for REDD activities. These include:

1. The USA domestic emissions trading scheme (outside the UNFCCC process)
2. Multilateral financial institutions (e.g. the World Bank Forest Carbon Partnership Facility)
3. Bilateral initiatives (e.g. the governments of Norway and Australia are both supporting REDD in Asia/Pacific)
4. The voluntary carbon market

1.4 REDD & CLIMATE CHANGE ADAPTATION

REDD is about protecting and enhancing existing forests and growing new permanent forests as a climate change mitigation exercise (i.e. reducing emissions from sources and removing emissions by sinks). Forest protection and growing new permanent forests are important components of climate change adaptation for countries with forests and/or the potential to grow and maintain them. This form of forest management helps to maintain the ability of forest ecosystems to provide a range of climate-related ecosystem services including:

- water supply in the face of projections of a warming and drying climate (e.g. under a stronger El Nino climate pattern for the Pacific)
- flood mitigation in the face of projections of more frequent and intense rainfall events
- cyclone mitigation in the face of projections of more intense cyclone events

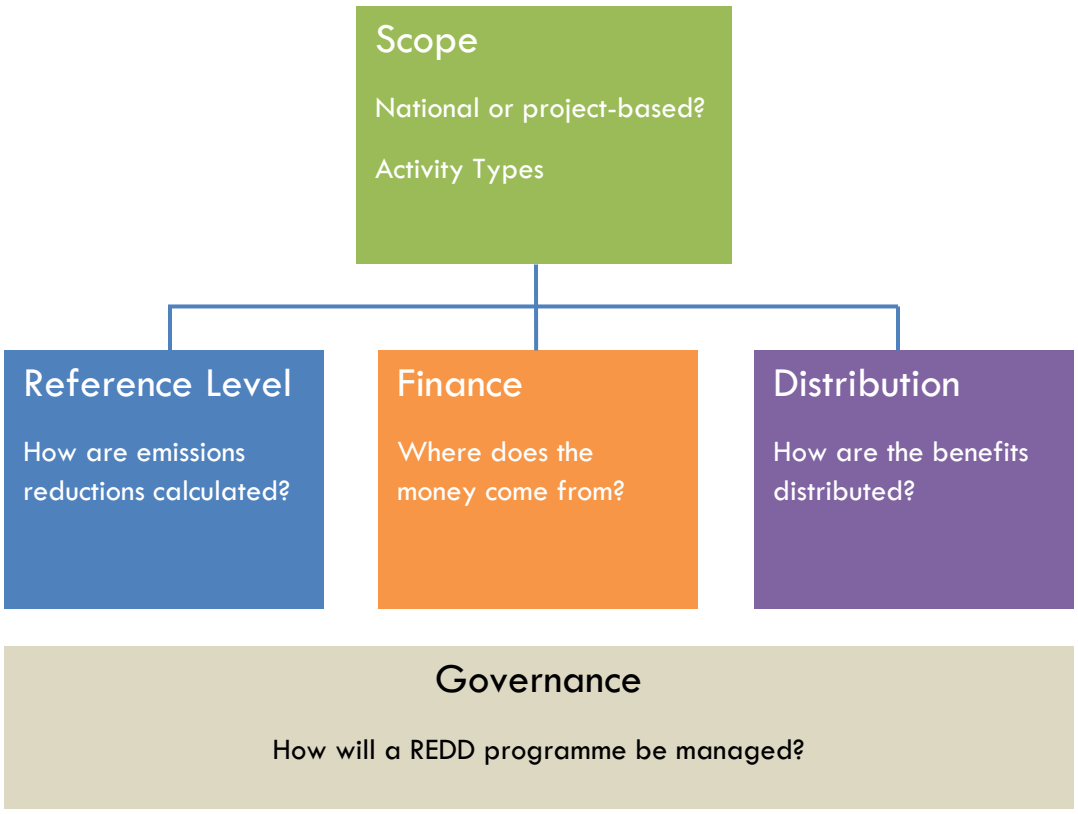
- sea defences (mangroves) in the face of projections of sea level rise

In Vanuatu for example, the sustainable management of forests featured as one of the six priorities for climate change adaptation in the Vanuatu National Adaptation Programme of Action (NAPA).

REDD can therefore be seen as an integral component of a national climate change adaptation strategy, and furthermore, as a component capable of being financed through climate change mitigation funding channels. This is particularly relevant in countries for which climate change adaptation is the highest priority in terms of climate change policy – a situation prevalent for many Pacific Island nations.

1.5 HOW WOULD A FIJI NATIONAL REDD PROGRAM WORK?

The nature of the UNFCCC REDD instrument arising from Copenhagen is yet to be determined. Either way the basic architecture of a REDD program will need to include the following components:



Policy and technical consultations resulted in the refinement of a National REDD Strategy Framework which elaborates the following:

- Scale (national, project-based or combination)
- Scope (activity types and priorities)
- Reference Level (how emissions/carbon stocks are measured and the development of a national reference level for future negotiations at the UNFCCC)
- Financing (target sources of funding for a National REDD Programme)
- Distribution (how benefits arising from REDD activities will be distributed)
- Governance

1.6 MULTISTAKEHOLDER CONSULTATION

The Fiji National REDD Policy & Scoping Workshop was designed to generate a National REDD Strategy Framework by means of a combination of training and multistakeholder consultation and dialogue. Training was a necessary precursor to multistakeholder consultation to enable the generation of informed dialogue and decisions. Training sessions involved presentations from policy and technical experts, questions and answers, discussion and commentary from participants, and (in the technical stream) hands-on activities.

The consultation process was organised by means of presentations to frame the issues and options, questions and answers for clarification, breakout groups for detailed discussion and drafting, commentary from different stakeholders, and the synthesis of consensus views.

The discussion and consultation dynamic was organised in three formats:

1. Plenary sessions to set the scene and provide necessary background to the workshop as a whole and to elaborate the specific tasks required in the policy and technical streams.
2. Breakout groups during plenary sessions that enabled policy and technical specialists to work together but focus on particular areas of interest
3. Parallel sessions with technical and policy streams working separately on specific policy or technical themes.

Stakeholder groups represented at the workshop plenary and plenary breakout group sessions are presented in detail in Appendix 2 and included the following:

Resource Owner Representatives	GTZ
Forestry Department	Native Lands Trust Board (NLTB)
Environment Department	NGOs
Carbon Trading Unit	University of the South Pacific
Ministry of Education	Private sector (project developers)
Secretariat of the Pacific Community (SPC)	Vanuatu Forestry Department representative
SOPAC	Department of Land Resources
Fijian Affairs Board	Trusts

The plenary breakout groups and parallel sessions (policy and technical) were self selected. The technical stream attracted technical staff from different organisations and some organisations were able to be represented in both the technical and the policy streams (e.g. Forestry, Environment, SPC, NLTB, GTZ). The policy stream was attended by senior staff of the organisations present and attracted all of the landowner representatives.

The consultative process differed depending on the task at hand. Some sessions were explanatory / training focused and consultations took the form of presentations followed by questions and answers.

Sessions designed to gather information (e.g. plenary breakout groups) were facilitated by the technical specialists, involved gathering information from participants but where the information recorded was done so only if there was agreement among participants on accuracy and content.

Sessions designed to scope out opinions on policy direction and the design of a national REDD programme involved presentations to clarify the scope of the task, questions and answers for clarification, and the detailed expression of stakeholder views. These views were summarised in tabular documentation arising from these sessions (e.g. presented in appendices in this document) and presented back to the plenary on the final day in a negotiation designed to arrive at a consensus outcome overall.

The draft Fiji REDD Policy was prepared following stakeholder presentations, dialogue and consultations, and were then presented in the final plenary for a line-by-line negotiation and consensus. The outcome of this policy design process is presented in Appendix 4.

Different opinions arising from the multistakeholder process were few and tended to be concentrated in the policy stream during the parallel sessions and were a minor component of the overall process. The means of addressing differences of opinion was to include different views in an output, or agree to an output capable or addressing different views in the architecture of the strategy framework arising from this consultative process.

The following sections present the detailed outcomes arising from the workshop.

Part 2: Policy and Strategy

2.1 INTRODUCTION

The National REDD Policy and Scoping Workshop (hereafter denoted as 'the Workshop') was structured to generate the following outcomes:

a. Define strategic goal (destination) and define means of achieving goal (roadmap)
b. Understand & define capability requirements for participation
c. Assess existing data and capability, and undertake gap analysis
d. Define strategy for filling data and capacity gaps

2.1.1 Strategic Goal

Defining the strategic goal and the means of achieving that goal (a. and b. above) was determined at a general level at the National REDD Policy & Scoping Workshop (Strategy Framework), but will also need to involve more detailed work in specific areas in the development of a Strategic Action Plan (Phase 2).

An initial assessment of national deforestation and degradation was undertaken at the Workshop using existing data from the National Forest Inventory and by means of a breakout group that explored the drivers of forest carbon stock change. This was a necessary step in the process of defining a programme capable of stopping or slowing drivers of forest carbon emissions and enhancing drivers of forest protection and forest carbon sinks.

Defining the strategic goal also required the determination of the scope (activity types) and scale (national or project based) of a national REDD programme in Fiji.

2.1.2 Capability Requirements

Understanding the capability requirements for participation in a REDD instrument seeking international funding or engagement with international market instruments required policy training and dialogue to clarify the institutional and technical requirements for a robust programme capable of meeting international standards. This policy training and dialogue was undertaken at the early stages of the National REDD Policy and Scoping Workshop. This included the elaboration of REDD strategy options & institutional / legal implementation framework necessary to realize these options.

2.1.3 Data and Capability Assessment

The assessment of existing data sets for forest carbon monitoring, reporting, and verification (MRV) was undertaken in association with technical training in forest carbon remote sensing and forest carbon inventory. The national forest inventory data set was evaluated by reviewing the Fiji forest sector remote sensing data, data sources, data infrastructures, and data management capability in order to understand clearly the current state of technical and human resources for a national forest carbon monitoring system.

This review also identified any gaps that need to be filled by means of acquiring new data, new technical resources and new capabilities consistent with development of a national forest carbon monitoring program. In particular, this assessed existing data sets for national forest carbon monitoring and carbon inventory in line with the 2003 IPCC Good Practice Guidance for LULUCF sector and the 2006 IPCC Greenhouse Gas Inventory criteria.

At breakout sessions during the National REDD Policy and Scoping Workshop participants contributed to the

- design of a national forest carbon monitoring system using existing data sets and systems where appropriate and filling gaps in national data where necessary (using IPCC guidelines described above).
- definition of steps required for the development of a national reference level for forest sector carbon emissions also in line with UNFCCC approved methodologies.
- development of a draft operational plan for implementation of national forest carbon monitoring and inventory program.

2.2 SCOPE

The scope of a national REDD programme concerns the scale of approach (e.g. national or project based) and the activity types that the programme will focus on. In turn both the scale and the activity types are influenced by the financing mechanism to target for the programme. This is because different financing mechanisms have different eligibility criteria in terms of scale and activity type.

Participants at the Workshop agreed that Fiji would adopt an approach that would be open to all available financing instruments and would therefore need to be designed to enable maximum eligibility in terms of scale and activity types. In line with keeping options open, it will be important for Fiji to monitor the UNFCCC policy development and the USA domestic emissions trading legislation to ensure that the national REDD programme is appropriately aligned with these international policy developments.

2.2.1 Scale: National Vs Project-Based Approach

One possibility arising from the UNFCCC post-2012 agreement at Copenhagen in December 2009 is for REDD to operate through the UNFCCC only at a national scale, and only for countries with an internationally certified national forest carbon monitoring programme in place. The focus here would be for countries to spend the near term years developing their national forest carbon monitoring, reporting and verification (MRV) systems. This infrastructure development and capacity building would be eligible for grant finance through a UNFCCC REDD grant instrument.

Once countries have their national forest MRV systems in place they will be able to measure any changes in their emissions and carbon stocks relative to the national reference level (more below), and gain access to REDD financial rewards (e.g. carbon credits) for the volume of carbon stock change demonstrated.

It is also possible that the UNFCCC REDD instrument will allow for project-based or sub-national initiatives to be eligible for REDD financing. It is likely, however, that project based or sub-national initiatives will be linked to national scale forest carbon monitoring and reporting due to the risks of domestic leakage in project-scale activities. Leakage (or displacement of emissions) occurs when a project reduces emissions in one location (e.g. a forest is protected), without addressing the drivers of these emissions (e.g. demand for agricultural land), which then shift to another location (deforest another area) and generate the same emissions at that second location. The net benefit to the atmosphere will be zero or close to zero in these circumstances.

At present project-scale REDD activities are eligible for carbon financing through the voluntary carbon market. Here emissions reduction/emissions avoidance activities need to be certified according to a reputable voluntary carbon standard to provide project-scale quality assurance. In countries where the voluntary carbon market is unregulated (most countries), there is a risk that carbon projects are undertaken without appropriate quality assurance and potentially without genuine benefits to the atmosphere. This is the domain of "carbon cowboys" whose unregulated activities risk disenfranchising resource owners and the host country, if their activities are not measurable, verifiable, and additional, and if their projects fail to adequately deliver benefits to resource owners.

There may be good reason for a country to regulate the voluntary carbon market to ensure that voluntary carbon market activities are compatible with a national strategic approach to REDD, and are genuinely beneficial to resource owners. One way of regulating the voluntary carbon market is to require that all transfers of carbon property rights be approved by the Designated National Authority (DNA) of that country. In addition the DNA will need an appropriate policy platform and assessment criteria and procedure for this to work.

The consultation process involved a scoping exercise to explore advantages and disadvantages of a national vs. project based approach to a Fiji REDD Programme. The results of this scoping exercise are provided in Appendix 5 and summarised in Table 1 below:

Table 1. National vs. Project-Based Approaches to REDD in Fiji

	National Scale (fully centralised)	Hybrid	Project Scale (fully devolved)
Advantages	• Nationally strategic • Easier to demonstrate additionality • Attractive to buyers/funders	• Nationally strategic • Easier to demonstrate additionality • Attractive to buyers/funders • Enables public-private partnerships	• Low cost to government • Can happen immediately in voluntary carbon and PES market • Market actors find most cost effective activities
Disadvantages	• First need approved MRV system • Can exclude private sector innovators • Government REDD policies and compliance not always effective	• First need approved MRV system • Government REDD policies and compliance not always effective	• Difficult to demonstrate additionality • Open to low quality project developers • Not nationally coordinated

In terms of scale, the workshop participants agreed to a 'hybrid' scale approach (blending national and project scale activities in the context of a national programme). This approach was adopted in order to gain the benefits of both national and project scale approaches and avoid the pitfalls, under the understanding that a national approach provides a national reference level and national MRV which will facilitate higher level quality assurance for any project scale activities. A fully devolved program would be less strategic and potentially result in lost opportunities, particularly as Fiji is not a large nation. A hybrid approach thereby facilitates both national and project level engagement with REDD financing instruments as part of a coordinated national programme designed to maximise opportunities and minimise costs. The hybrid scale approach will enable

- a blend of (or options for) national and project-scale activities (this will partly depend on the outcomes of the REDD instrument arising from the Copenhagen climate agreement in December 2009)
- the establishment of a national REDD monitoring, reporting and verification infrastructure that will be capable of supporting both national and project scale activity types, and
- a nationally strategic approach to REDD and associated activities (e.g. linking REDD with afforestation and reforestation).

2.2.2 Activity Types

The activity types able to be undertaken in a National REDD Programme are closely linked to financing instruments that prescribe eligibility criteria. Consultations agreed that the Fiji REDD Programme would be open to all available financing instruments for the REDD sector including:

- UNFCCC instruments (REDD, CDM)
- USA domestic Emissions Trading Scheme
- Voluntary carbon market
- Payment for Ecosystem Services (PES) market, and
- Grant finance from the private or public sector

Options for activity types in a Fiji REDD Programme include:

1. Avoided deforestation/degradation by means of forest conservation
2. Avoided/reduced deforestation/degradation by means of sustainable forest management
3. Avoided sustainable forest management by means of forest conservation
4. Afforestation/Reforestation of permanent new forest for timber harvesting

5. Afforestation/Reforestation
6. Combination linking A/R with REDD
7. Forest/energy sector linkages (biomass electricity generation)
8. Forest/agriculture linkages (biomass residue/biochar)

Workshop participants undertook an analysis of the drivers of forest carbon stock change (loss of carbon to the atmosphere and sequestration of carbon from the atmosphere) during a breakout group in a plenary session. This was undertaken by means of identifying drivers and ranking the importance of the activity. The results of this exercise identified activity types that warranted the most attention in the form of management interventions. The two most important activities leading to the loss of forest carbon to the atmosphere were: 1. Forest conversion for expansion of agriculture (deforestation), and 2. High intensity selective logging of native forests (degradation).

The most important activity type leading to the sequestration of carbon into forests was the establishment of new forest on marginal grassland.

A national strategy would therefore need to focus its attention on stopping or changing the drivers of forest conversion for agriculture (reduced deforestation), high intensity selective logging of native forest (reduced degradation), as well as encouraging the drivers for the establishment of new forest on marginal grassland (afforestation/reforestation).

What is also important from a strategic point of view is to prioritise REDD activities in areas where the largest gains can be made from the smallest investment. Some REDD activity types are relatively costly per tonne of carbon compared with others. A key component in a strategic analysis of a potential national REDD program is a cost analysis (per tonne of CO_2) of the emissions reductions or sequestration offered by the different options. This is equivalent to a 'marginal abatement cost' analysis common to emissions reduction strategies by developed country businesses and governments. Such an analysis may demonstrate that it is far more cost effective to concentrate REDD efforts in two or three of the six options listed above (e.g. options 2, 4, and 1 in order of ranking).

Different activity types are needed in order to address different deforestation drivers. Furthermore, the activity types that are chosen by a national REDD programme are best selected strategically from an economic efficiency point of view in terms of the greatest carbon finance gains from the lowest investment. This can be undertaken by means of a marginal cost analysis of forest sector REDD/carbon financing activity types. An economic analysis of this form can be used to identify the "low hanging fruit". Then following such an analysis, any priority activity types that are shown to be less economically efficient can be linked to activity types that are, or become subject to a different financing strategy.

Market based carbon finance is simply not feasible for activity types that generate financial costs that are higher than their financial returns, unless

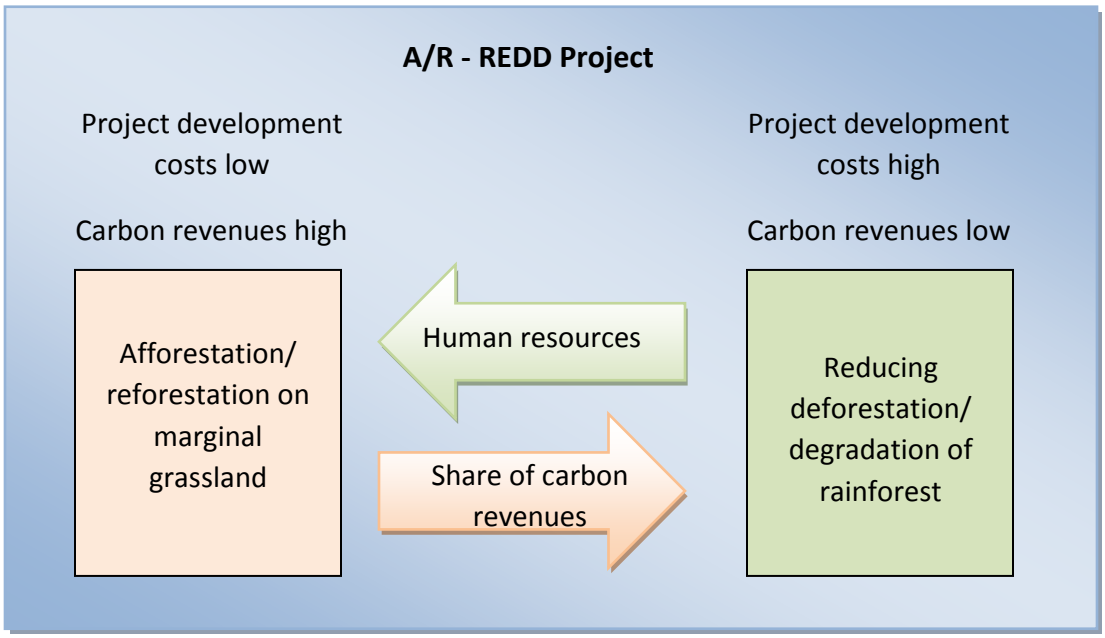
a. they are linked to grant finance, or
b. where the carbon finance gains made in one activity type can be partly distributed to other areas where carbon finance gains are low (see the section on 'Distribution' below).

It is recommended that a marginal cost analysis be undertaken as an aspect of National REDD Strategic Action Plan (Phase 2) and as a component of a plan focusing on the distribution of benefits.

An example of this kind of approach might be where the lowest cost project development and greatest gains from carbon units are generated from afforestation/reforestation of marginal grasslands (with low opportunity costs) and where some of the carbon revenues from these activities are distributed to rainforest protection activities.

Similarly, the design of afforestation/reforestation activities on marginal grasslands could include rural employment benefit sharing between the owners of the marginal grassland and the owners of a rainforest area strategically linked to that afforestation/reforestation activity. If both activity types are linked as components of the same overall project, then buyers of carbon units from afforestation/reforestation will be helping to cause the protection of rainforest (biodiversity co-benefits) and the provision of rural employment to rainforest owners (social co-benefits).

Figure 1. Afforestation/Reforestation – REDD Linked Project Concept



This strategic approach to the selection of project types lends itself to a nationally coordinated programme rather than one that is devolved to the project scale. However, such a nationally coordinated approach could combine national scale activities (highest carbon returns on lowest investments) with strategically selected project scale activities (e.g. high priority from a biodiversity point of view but less financially competitive in isolation).

2.2.3 Pilot Project/s

The workshop participants agreed on the need for the development of pilot project activities that would assist the development of a national programme. These pilot activities would be most useful if they were somehow representative of the opportunities open to the Fiji forest sector (e.g. afforestation/reforestation on marginal grasslands, and/or reducing deforestation in natural forests, and/or reducing degradation through sustainable forest management).

It is recommended that a marginal cost assessment is first undertaken to help identify which pilot project activity types are more valuable from a strategic point of view. It is clear though that the highest priority activity types relevant to the choice of pilot project should coincide with the highest priorities identified in the analysis of deforestation drivers mentioned above:

1. Reduced deforestation from agricultural expansion
2. Reduced degradation from high intensity (unsustainable) selective logging
3. New forest establishment on marginal grassland

Given the potential synergies generated by linking new forest establishment with reducing deforestation or degradation, it may be appropriate for a pilot project to be undertaken that tests the potential to strategically link different activity types in the same project in the manner suggested in Figure 1.

Another factor to consider in a pilot project is high priority forest areas that present an opportunity due to the current level of threat. Lowland rainforest currently allocated to conversion to agriculture on Taveuni would present a potentially valuable pilot project activity of this kind. Such a project could potentially be linked to new forest establishment elsewhere if necessary. It is worth considering the co-benefits associated with such a pilot project, which include biodiversity benefits high on the agenda of the National Environment Strategy.

2.3 REFERENCE LEVEL

The 'reference level' is level of annual emissions from the forest sector during a reference period calculated at a national scale. The 'reference level' is another way of referring to the national baseline, which is the 'business-as-usual' emissions prior to REDD activities. The UNFCCC will probably determine the reference period (e.g. 1990 to 2005) and countries will then have the opportunity to calculate their rate of emissions during that period by means of a national (historical) carbon stock and stock change evaluation. This can be measured by using existing data sets such as logging concessions, commercial timber licenses, forest inventory, agricultural leases over forest lands, and national forest area change assessment (using remote sensing data).

The reference level is the basis on which REDD incentive mechanisms will operate at a national scale, in a similar way to the base year used by developed countries that ratified the Kyoto Protocol (1990 emissions). Developed country performance under the Kyoto Protocol is measured during 2008-2012 and compared with 1990 levels of emissions for that country. The basic formula for establishing the national binding Kyoto target for developed countries is 5 times the 1990 level of emissions (i.e. for the 5 year period of 2008 to 2012). Different country circumstances led some countries to successfully negotiate an emissions allowance above their 1990 level (e.g. Australia has 108% of their 1990 levels as their binding target, whereas most of the EU nations have 92% of their 1990 levels for their binding target).

After the Copenhagen agreement REDD nations (i.e. developing countries with forests) will negotiate their reference level in a similar way that developed countries negotiated their binding targets. This is likely to be based on

a. a transparent calculation of the level of emissions during the base period (e.g. 1990–2005 – this period is yet to be determined at the UNFCCC), in combination with
b. a transparent understanding of national development circumstances that may justify an upward adjustment to the reference level above that of the base period (e.g. to allow for acceptable expansion of agricultural lands to keep pace with population growth).

Any negotiation for reference level based on an adjusted baseline (see figures 2 and 3 below) will need to be supported by a transparent understanding of the national development priorities in combination with the drivers. The historical emissions are calculated using historical data sets such as the National Forest Inventory and a forest area change assessment (remote sensing), and need to be calculated using UNFCCC approved methodologies. The actual emissions during the crediting period are calculated by a UNFCCC approved MRV system.

Figure 2. Historical Baseline

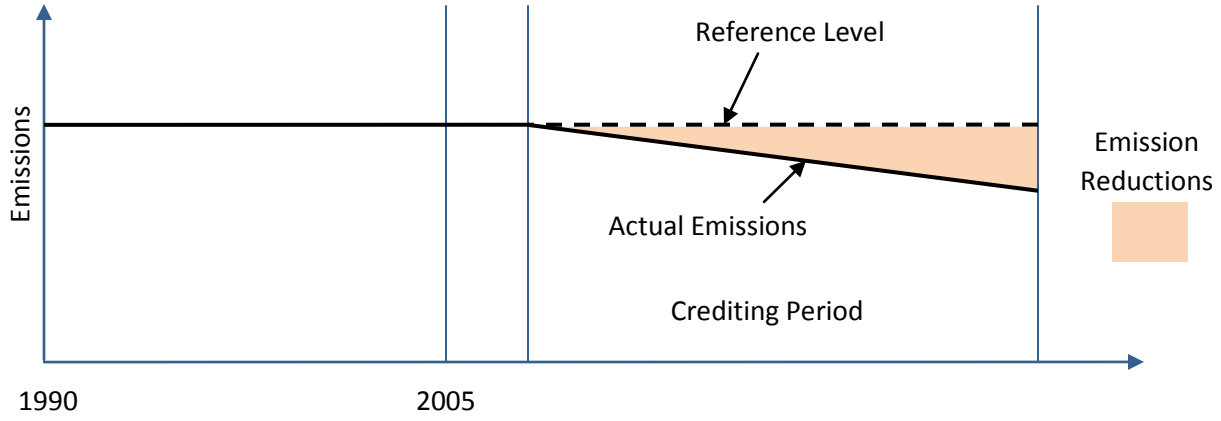
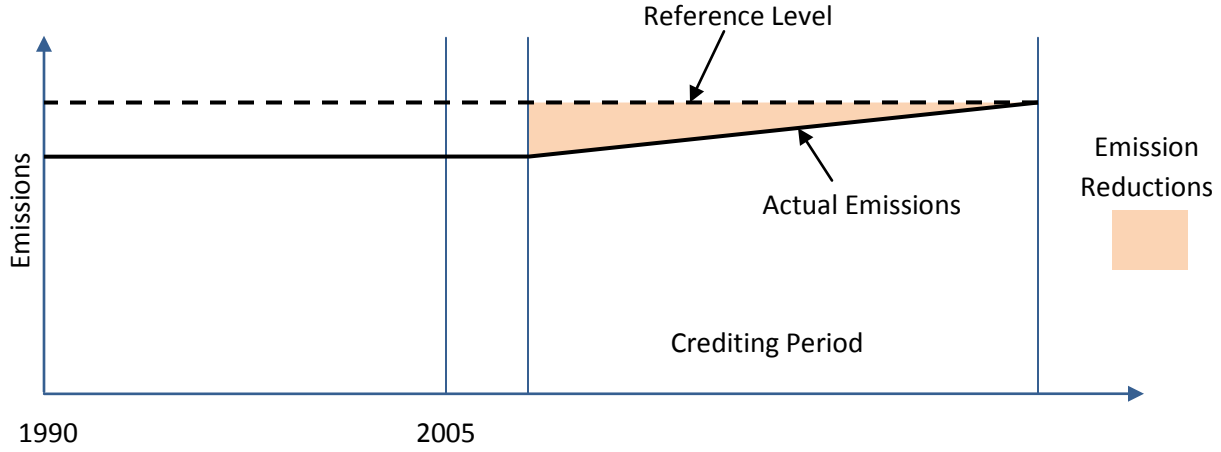


Figure 3. Historical Adjusted Baseline



The scoping dimension of the National Policy and Scoping Workshop involved an assessment of the national forest data set and capability for the generation of a national carbon stock assessment and future national carbon monitoring, reporting and verification programme.

Consultations led to agreement that it would be appropriate for Fiji to undertake a national carbon stock and stock change assessment using existing data sets from the national forest inventory, and then improve the quality of this carbon stock and stock change assessment through time. Existing data sets enable the generation of a national carbon stock and stock change assessment but there are some important data gaps. One data gap arises from the national forest inventory only focusing on commercial timber species and also not including lands cleared for agriculture. Improvements in data gathering methods in future forest inventory have been identified, and a national forest area change assessment planned.

This will also need to be defined in close association with more detailed analysis of deforestation and degradation drivers and national development priorities. This is particularly important for strategic development in agriculture in the face of a growing population and future food security challenges. An initial assessment of deforestation drivers arising from a breakout group is presented in Section 3 below.

2.3.1 Data Gaps

Existing data sets enable the generation of a national carbon stock and stock change assessment but there are some important data gaps associated with a national forest carbon monitoring system. Immediate next steps include a process of filling these gaps.

Data Gap 1 - Wood density data in National Forest Inventory

The National Forest Inventory (NFI) only focused its wood density data collection on commercial timber species. A full assessment of national forest carbon stocks will need to account for the wood density of non-commercial species. This will require default data separated into density classes.

Data Gap 2 - Forest area change

The National Forest Inventory (indigenous forest) did not include lands cleared for agriculture (which lay outside its terms of reference). This data gap can be filled by undertaking an historical forest area change assessment using remote sensing data currently available. Workshop participants were in agreement that a forest area change assessment is a high priority as an immediate next step.

Data Gap 3 - Inventory data quality

Improvements in data gathering methods in future national forest inventory (indigenous forest) and improved permanent sample plot methods have been identified as a means of improving data quality for future forest inventory for national forest carbon stock assessments.

Data Gap 4 – Frequency of National Forest Inventory

The National Forest Inventory currently recurs approximately every 15 years. A national forest carbon monitoring reporting and verification system will benefit from a more frequent national forest monitoring cycle. It is recommended that the National Forest Inventory be undertaken at least every 10 years. One way of approaching this is to establish a rolling inventory process where some work is being undertaken every year. This has the benefit of maintaining a skilled human

resource pool, is easier on funding streams, and enables a constant (annual) updating of the national carbon stock calculation.

Data Gap 5 – Plantation Forest Inventory

The plantation forest data set needs to be upgraded by using a stand-age carbon stock curve to generate a default for carbon stock change through the harvest cycle. Individual plot data can then be gathered to ensure that the stand-age carbon stock curve is as accurate as possible. The next stage in improving the plantation forest carbon data set will be to migrate the carbon stock methodology to one that is equivalent to that used in the indigenous forest with permanent sample plots in a grid fashion. It would however, be prudent to first undertake an international peer review of the plantation inventory methodology (and the national indigenous methodology) prior to any such decision to upgrade the methodologies. This would enable the peer review process to evaluate the need (if any) and the cost effectiveness of such an upgrade.

Data Gap 6 – Carbon pools

Current carbon pools available to the national carbon stock inventory are: above ground live biomass. This encompasses only one of the five carbon pools needing to be assessed in terms of international best practice (IPCC Tier 2 and 3). Ideally a national forest carbon monitoring system will include the following pools: Above ground live, below ground, deadwood, litter, soil organic matter. The national forest carbon inventory will benefit from a progressive (staged) improvement in the number of carbon pools included in the data set.

2.3.2 National Development Priorities

National land sector development and environment priorities and challenges were explored in a breakout group at the Workshop and are presented in Appendix 6. In summary, the national land sector development priorities for the forest sector included the need for Permanent Forest Estates, improved plantation forest estates, improved natural forest conservation (including protected areas), sustainable supplies of forest services (particularly in the face of future climate change impacts), increased employment in the forest sector. Key challenges identified in the forest sector included the need for more involvement of stakeholders in implementation of sustainable forest management requirements under the Forest Decree, and increased resources both in terms of capacity and funding. Another challenge is the intersection of climate change adaptation priorities with climate change mitigation financing.

In the agriculture sector key priorities included food security, import substitution, and export production & promotion. Key challenges in agriculture included the lack of a national land use plan,

losses from pest & disease, inconsistency of supplies, funding constraints, the structure of the land tenure system, and conflict between traditional & commercial use of land.

In the environment sector key priorities included the need for improved conservation of forest bio-diversity, water catchment & soil fertility, and a variety of challenges associated with climate change adaptation. Challenges included insufficient resources for enforcement, pressure from resource owners, lack of awareness of the value of ecosystem services arising from forests, antiquated laws, and the need for the protection of catchment areas for water quality and water security.

A national REDD programme will need to integrate its strategy and outcomes with national development priorities as much as possible.

2.4 FINANCE

For REDD to function successfully as an international instrument to reduce forest-based carbon emissions, a mechanism will need to be established that is capable of linking demand for incentives (REDD countries seeking support to reduce forest-based emissions) with a supply of finance capable of meeting demand. A key question in the finance sector is: where is the money going to come from?

Different countries and organizations have different preferences on the money supply issue, and there are advantages and disadvantages associated with the different options. The two main types of finance are grant finance and market finance. Under a grant finance instrument REDD countries would apply for funding based on certain eligibility criteria. Under a market instrument REDD countries would participate in emissions trading according to the rules of the trading instrument.

2.4.1 Carbon Market Instruments

A key advantage with a market instrument is that a significant proportion of the money can come from the private sector in developed countries. Here private sector entities would be able to buy REDD carbon units as a way to meet their binding emissions reduction obligations in a domestic emissions trading scheme. Similarly, countries could also buy REDD carbon units as a means of meeting their national binding targets, but here the money supply would come from taxes. Both of these examples are similar to the way that the Clean Development Mechanism (CDM) works under the Kyoto Protocol.

A market instrument could operate at a national scale or a project scale for the REDD country. At a national scale the "person" selling the REDD units would be the government. At a project scale the "person" selling the REDD units would be a resource owner.

A key disadvantage with a market instrument for REDD is that there needs to be a high level of national scale quality assurance for the carbon units to have any integrity. This is particularly important because every REDD unit sold would allow an equivalent volume of emissions in the buyer country (i.e. they would be bought as offsets). For this reason it is likely that the option to sell REDD units will only be available to countries that have fully developed their national forest carbon monitoring systems.

This leads to another disadvantage of a market instrument for REDD that is relevant from a global climate change point of view. Because REDD units would be used to offset emissions in buyer nations, every REDD unit sold to a buyer would enable the buyer to emit exactly that volume of emissions in their country. Furthermore, if a very large number of REDD units are generated and sold, the carbon price in developed countries may drop (driven by high supply relative to demand). This would lower the incentive to reduce emissions in developed nations because it may be cheaper to buy REDD units than invest in clean technologies.

There are ways to address some of these disadvantages and they are likely to be the subject of intense negotiations at Copenhagen. For a REDD market instrument to benefit the climate system the post-2012 climate agreement will need to involve a significantly tighter global cap arising from significantly tougher binding targets for developed country nations (compared with the first commitment period of the Kyoto Protocol – 2008-2012). This will lower the risk of REDD units lowering the international carbon price, and also increase demand for carbon units sufficient to absorb an increase in supply from the REDD sector.

As mentioned above, consultations agreed that the Fiji REDD Programme would need to be open to all available financing instruments for the REDD sector including:

- UNFCCC instruments (REDD, CDM)
- USA domestic Emissions Trading Scheme
- Voluntary carbon market
- Payment for Ecosystem Services (PES) market, and
- Grant finance from the private or public sector

Fiji will need to wait till after the UNFCCC COP-15 agreement in Copenhagen to see what the UNFCCC REDD policy and financing instrument will look like in terms of scale, scope, eligibility and technical requirements. A similar situation exists for the USA domestic Emissions Trading Scheme (the American Clean Energy and Security Bill) which at the time of writing had been passed by the

Congress but was awaiting a hearing in the Senate. Indications are that this legislation will not be passed until sometime in 2010.

The current draft of this legislation indicates that smaller countries like Fiji will be potentially eligible to sell credits into the USA domestic carbon market but that participation will require the establishment of a national forest carbon monitoring system and a national reference level. Whether participation in this instrument will be at a national or project scale is yet to be finalised.

The rules and eligibility criteria for participation in the voluntary carbon market are already clear and Fiji has an opportunity to use the voluntary carbon market if the UNFCCC or USA carbon market instruments are unsuitable to Fiji circumstances. Many of the quality assurance criteria in the higher quality voluntary carbon market standards track closely with UNFCCC requirements, and so any development of national infrastructures for accessing the compliance carbon market will at the same time enable participation in the voluntary carbon market.

The Payment for Ecosystem Services (PES) market (including Direct Barter[2]) is also worth considering for some activity types that for one reason or another may be less suitable for a carbon market instrument. This instrument is less tightly defined as carbon markets, partly because they are not selling carbon units to offset emissions. Fiji's options to engage in this market instrument will remain open as it develops its capability for participating in carbon market instruments.

2.4.2 Grant Instruments

A key advantage of grant finance is that it can be used to help build national REDD infrastructures such as national forest carbon monitoring systems, and demonstration activities. Another advantage is that it does not involve the generation and sale of carbon units to offset emissions in developed countries, and may thereby be more beneficial to the atmosphere than a market instrument. Grant finance can also be used to buy REDD carbon units in a way that prevents these units from entering into the carbon market (i.e. preventing REDD units from flooding into the carbon market and driving down the carbon price).

A key disadvantage with grant finance is how to answer the questions:

a. where will the grant finance come from?, and
b. will there be enough grant money around to do the job that REDD needs to do?

[2] Direct Barter is a variation on Payment for Ecosystem Services with its primary difference being that payment may not be in financial terms but could include any number of units of value including a trade deal, technology transfer, education and training, migration.

A common feature of international/intergovernmental grants is where the flow of actual funds does not match the volume of pledges made. Attempts by the G8 to fund world poverty reduction is a good example.[3]

One way of supplying money to a large scale REDD fund is to auction or charge a fee for emission allowances normally assigned for free (grandparented) in intergovernmental or domestic emissions trading schemes.

If Fiji develops its national infrastructures to target carbon market instruments, it will at the same time be establishing infrastructures that will be very useful in gaining access to grant finance for REDD. This is because all forms of financial support tend to require a need analysis arising from a clear strategy, a quality assurance process capable of delivering high quality outcomes, and clearly defined roles and responsibilities. Grant finance is already being used for the development of the national Fiji REDD programme, and there is likely to be more need for such support in the future. If however, Fiji is able to build its capability for accessing market based finance for REDD then this can increase the value of outputs generated from grant funds which can be market linked.

2.5 DISTRIBUITION

The effectiveness of a REDD programme in any country will depend on the ability to effectively address the drivers of forest-based carbon emissions. Many of these drivers are associated with the development needs and aspirations of resource owners, combined with the strategic development priorities of the government. An effective REDD programme will need to be capable of distributing the benefits gained from incentive mechanisms, so that the development needs and aspirations of resource owners and the government are actually met.

This may at times involve the generation of REDD financial benefits by focusing on the most cost effective activity types (see 'Scope' above), and then redistributing a portion of these benefits to strategically important activity types that are less cost effective (e.g. distributing a portion of the carbon finance benefits generated from new plantations to protecting areas of natural forest).

It became clear in the policy consultations that the distribution of benefits arising from a National REDD Programme will need to focus primarily on ensuring benefits to landowners. The National REDD Policy draft included the following wording:

[3] See 'World lags on poverty goals: G8' Reuters: http://www.reuters.com/article/worldNews/idUSTRE53I1Z520090419

"The landowners of the vast majority of Fiji's forests are the indigenous people of Fiji and therefore the Fiji REDD Program shall guarantee the indigenous people's rights to land, customary domains and ecosystems and provide maximum opportunities for indigenous communities."

"Sectors other than Forestry may benefit from actions that reduce emissions from the forest CO_2 sources, avoid emissions from forest CO_2 sources, and enhance removals by forest CO_2 sinks, where these co-benefits include:

i. *Biodiversity conservation*
ii. *Water catchment management*
iii. *Livelihoods in the forest sector"*

There was also agreement of the importance in clarifying forest carbon property rights and legal dimensions of any transfer of these property rights. A legal review will be undertaken as an output of Phase 1 of the National REDD Programme in order to clarify the legal means by which benefits arising from forest carbon trading will be distributed in the context of a National REDD Programme. This is particularly important in terms of defining the architecture of a 'hybrid' scale programme that combines national and project based activities.

2.6 GOVERNANCE & INSTITUTIONAL STRENGTHENING

Countries aiming to participate in REDD activities will need to develop a national programme capable of fulfilling the quality assurance criteria necessary for accessing incentive mechanisms. This is particularly relevant to the REDD instruments in development at the UNFCCC, the World Bank, domestic emissions trading schemes (e.g. USA), multilateral (e.g. European Commission) and bilateral arrangements (e.g. GTZ).

A key minimum requirement tends to be the identification of a strategic goal (desired destination and commitment) and a path (roadmap). Some donors will assist the generation of these first steps. The New Zealand Government funded the first national workshop in Vanuatu in early 2008, and the German government funded the same process for Fiji in early/mid 2009.

Core agenda items for the development of a national REDD strategy or programme should include:

1. Policy considerations (strategic goal, roadmap, governance structure, financing strategy)
2. Technical considerations (build and/or enhance the forest carbon monitoring capability)

2.6.1 Governance Structure

The governance structure of a national REDD programme will be of considerable interest to donors/buyers in the REDD sector, particularly because they will want to be confident that their money will be used efficiently and effectively. For this reason Workshop participants agreed that it is desirable to develop a governance structure that is capable of:

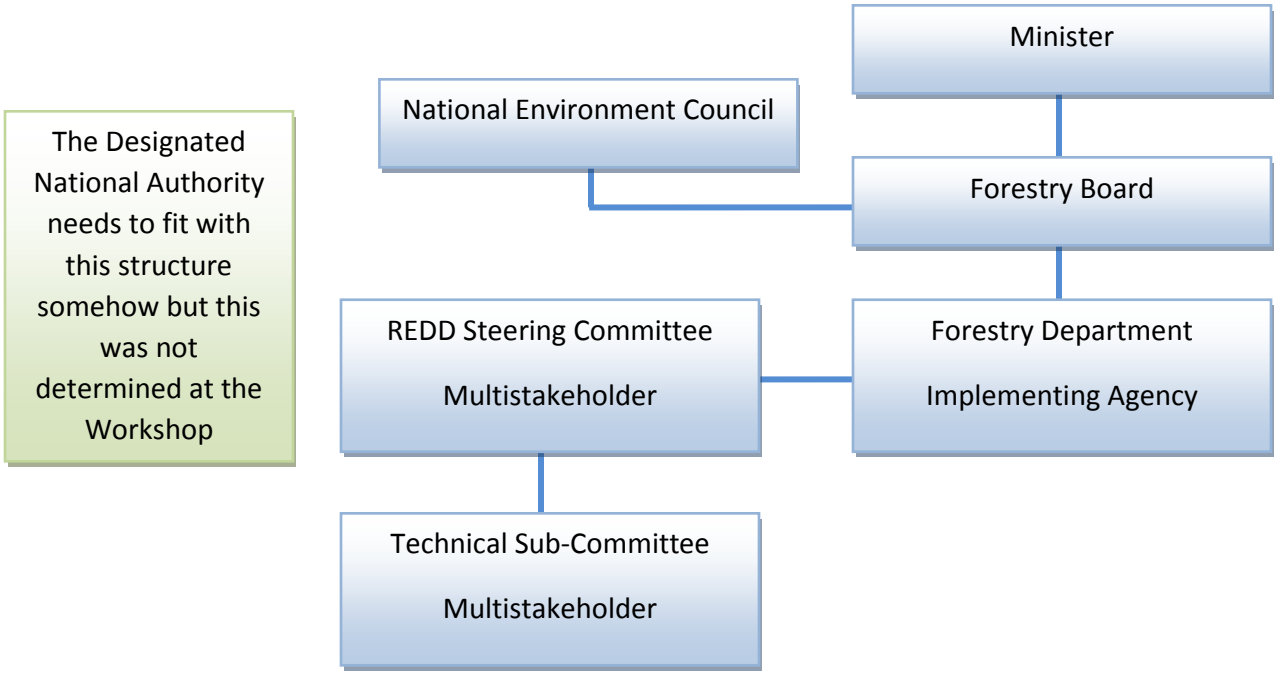
a. Providing a transparent mandate for REDD programme activities, and preferably including all relevant participating stakeholders (including resource owner representatives) in the decision structure
b. Providing a transparent link between the funding source and the activities on the ground (financial discipline)
c. Ensuring compatibility between the REDD programme and other national environment and development priorities
d. Supporting a transparent communication strategy
e. Ensuring effective strategic linkages between policy and technical components, landowners and the private sector

Transparent and effective multistakeholder programme governance was seen as an important part of a National REDD Programme aiming to gain support of resource owners, donors, and investment.

It was clear that existing institutional arrangements should be used where possible and strengthened where necessary. Policy consultations agreed that programme governance needed to produce the shortest path between the generation of a mandate and action on the ground.

Workshop participants agreed that a National REDD Programme Steering Committee ought to be a multistakeholder entity with a direct link to the Forestry Department as the implementing agency. The multistakeholder role in governance was determined through a plenary breakout group focusing on roles of different stakeholders for a national programme with details provided in Section 2.6.3 and Appendix 7.

The workshop participants explored a possible programme structure as follows:



2.6.2 Institutional Strengthening

An important strategic consideration is the way a governance structure and a programme overall is capable of accommodating a fruitful partnership between landowners, government and the private sector. A national REDD programme has the opportunity to harness the energy of the private sector in a way that benefits landowners and the country as a whole. It is important therefore to ensure that governance is not overly bureaucratic and does not impose unnecessary financial and time costs onto private sector players.

The need for effective and efficient governance of a national REDD programme links to the need for institutional strengthening in certain areas. One of these areas is the need to protect landowners from low quality forms of private sector project development in a carbon "gold rush" context that risks diminishing benefit generation for landowners, and lost opportunities – particularly in the voluntary carbon market. While the voluntary carbon market presents many opportunities it also presents risks from less scrupulous entrepreneurs that have become a common feature in some countries. Here landowners may be engaged in long term exclusive contracts in an unregulated setting that by-passes appropriate quality assurance processes and infrastructures. This is particularly relevant to the fact that it is not compulsory for any third party quality assurance layer in the voluntary carbon market. While there are many robust international voluntary carbon market standards, there is no guarantee that private sector project developers will use them in the

generation of carbon credits, whilst offering financial dreams-come-true to landowners in exchange for signatures on exclusive contracts.

For this reason it is worth considering a level of quality assurance to ensure that the energy of the private sector (including international private sector operators) is indeed harnessed for the good of the landowners and the country. Such a level of quality assurance could include the regulation of the voluntary carbon market by requiring that all transfers of carbon property rights be subject to a quality assurance approval process. This could happen by means of the Designated National Authority (DNA) gives and a requirement by the DNA that voluntary carbon projects are accompanied by a voluntary carbon market standard, and where the DNA lists acceptable standards. Such standards could include (but not restricted to) the Voluntary Carbon Standard, the Climate Community and Biodiversity Standard, Social Carbon, and in future perhaps a domestic voluntary carbon standard capable of linking local (domestic) buyers and sellers through a locally controlled standard that used local auditors and verifiers and lowered transaction costs.

Because forest carbon projects are likely to feature significantly in future carbon trading in Fiji, it is important that the Designated National Authority (DNA) incorporates the Department of Forestry in its approval process and structure. This could be achieved by structuring the DNA approval process whereby Forestry Department approval is required for any carbon project involving forestry activities (including forest-energy projects). Such approval could be mandated by an amendment to Fiji carbon property rights law by means of language such as:

> "All projects and programs taking place in the Fiji forest sector that involve the transfer of carbon property rights, whether in the compliance or the voluntary carbon markets, are required to gain the approval of the Designated National Authority."

This layer of quality assurance could also happen through a restructuring of the DNA to include a committee made up of the Director of Environment (chair), the Conservator of Forests, the Director of Energy, and the Director of Agriculture, but where only two of these office holders need approve a project but where the Director of Environment must be one of those two.

This would have some potential benefits for the structure of the DNA because it would

1. Spread the gatekeeper role from one to at least two senior public servants for any one approval thereby helping to safeguard good governance through transparency
2. Streamline the bureaucratic process for project developers who would only need approval from one office rather than two, thereby potentially cutting down on the time it would take to gain approval for a project.

The Workshop identified institutional strengthening requirements for a national REDD programme and agreed upon necessary changes as follows:

a. Improved legal structures for carbon finance and carbon property rights, including clarification of original ownership & rules for the transfer of carbon property rights (high priority)

b. Strengthening the Fiji Designated National Authority (DNA) (high priority)

    i. Requirement for all CO_2e property right transfers to be approved by the DNA (i.e. including voluntary carbon market transactions)

    ii. Provide a transparent decision and advisory structure to enable relevant departmental directors to have input into carbon trading approval procedures. The likely sectors to be involved in carbon trading activities in Fiji include Forestry, Energy, Agriculture, and Public Utilities.

    iii. Develop transparent eligibility criteria for REDD project types arising from a robust policy platform and make publically available (e.g. via website to project developers and landowners)

    iv. Develop transparent and efficient approval procedures for project proposals.

2.6.3 Stakeholders and Roles

One of the policy stream breakout groups focused its attention on the role of different stakeholders in a national REDD programme. This generated a detailed list of relevant stakeholder groups and also the assignment of recommended roles for each of these groups. In summary the Workshop participants were in agreement that the national REDD programme needed to be operated in an inclusive manner with particular regard to transparent and effective communications and decisions across different sectors of government. The Workshop participants also were in agreement that a national REDD programme needed to fully engage resource owners in terms of education and awareness of options, and involvement in decisions.

In turn, it was also clear that there is a responsibility among resource owner representatives to ensure that they are indeed representing the best interests of resource owners in a transparent manner. This will require all stakeholder representatives to mobilise their own communication networks in order to generate a mandate from the bottom up, and also to distribute information from the top down.

Workshop participants identified the following roles and agency types:

Role	Agency types
Funder	NEC & SDC
Buyer	Government departments
Regulatory/Policy	Regional/provincial government
Seller/Beneficiary	Statutory bodies
Technical Capability	Landowners
Training Education	Consultants
Communication	Donors
Quality Assurance	Faith based organisations
Facilitating Participation	Research/education
Governance	NGOs
Advisory	Private sector
Affected Party	International agencies
International Relations	

One key role identified was that of Programme Governance. Participants agreed that a national REDD programme should have a multistakeholder governance structure with representatives from the following agencies:

> National Environment Council, Sustainable Development Committee, Department of Forestry, Department of Environment, relevant Tikina and Village Councils, Native Land Trust Board, Fiji Pine, Fiji Hardwood Corporation, project developers, Fiji-based NGOs, University of the South Pacific, International University or Research Agency, faith based organisations, landowners, multilateral banks, bilateral donors, technical and policy consultants, South Pacific Commission, and the South Pacific Regional Environment Programme.

The full detail of the stakeholder analysis arising from this breakout group is contained in the table presented in Appendix 7.

2.6.4 Communication Strategy

The workshop identified the development of a national REDD communication strategy as a high priority to strengthen operational communications across government departments, and between government and other stakeholder groups. It was recognised that an effective communication strategy is fundamental to effective and transparent REDD program governance.

Recommendations arising from the Workshop breakout group were as follows:

a. There is a strong need for effective two-way communication linkages between landowners and national & international policy.
b. There is a need to use simple language wherever possible, and translate into Fijian
c. Different communication styles for different target audiences
d. A draft REDD communication strategy to be developed by Forestry with help of SPC

2.7 CAPACITY DEVELOPMENT

It became clear in the Workshop that Fiji already has considerable capacity to develop and implement a national REDD programme using existing institutions and infrastructures, although combined with key areas of institutional strengthening.

Consultations resulted in agreement that a national REDD programme should be structured as a "learning-by-doing" exercise with expert support for key tasks, but phasing out external support through time as domestic capability increases. This increase in domestic capability will need to arise from targeted training of incumbent staff where necessary together with formal (tertiary) education in key areas of need.

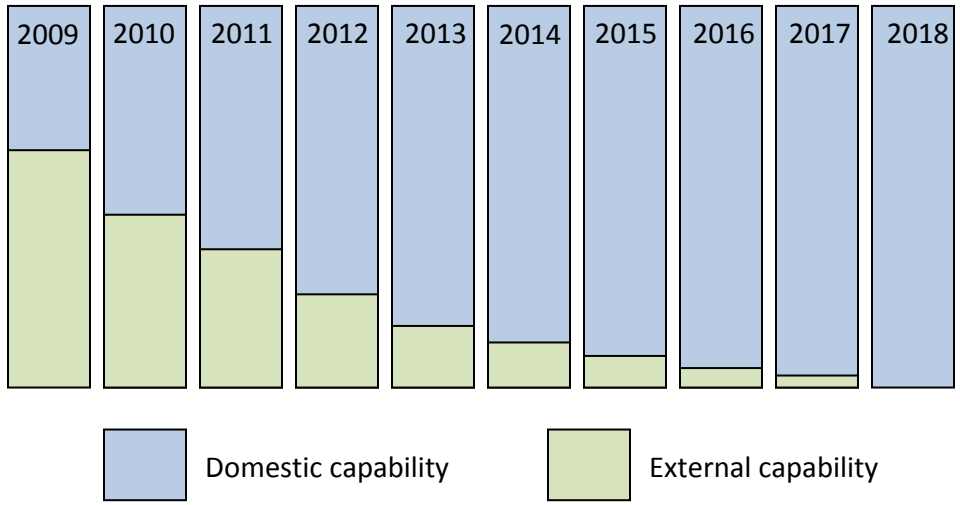
The major themes of the national REDD programme are:

d. Policy & strategy development
e. Monitoring, Reporting and Verification
f. Project design, development & implementation

Targeted training and education in these three areas would assist the rapid transition towards a domestic-only capability. The educational component could include a master's thesis topic funded and supported by the national REDD programme each year for each of these three themes. This would provide an "apprentice" programme with the postgraduate student working alongside and assisting key

programme staff members. Supervision for these students could be gained from domestic and external technical and policy expertise linked to the programme.

Figure 4. Capacity building and capability transfer through time



From a capacity building point of view, the development of a National REDD Strategic Action Plan will help to identify relevant tasks, necessary capacities, and resourcing required to fully implement the programme. It became clear in the Workshop that much of the necessary capacity in terms of technology and expertise already exists in Fiji for a national REDD programme that improves through time. It may be appropriate (e.g. more cost effective), however, to continually outsource certain capabilities in an on-going way, but this will be determined as the national REDD programme progresses.

2.8 INTERNATIONAL POLICY ENGAGEMENT

The success of a national REDD programme is partly dependent on effective communication linkages between international policy developments and the implementation of projects and programmes on the ground. The workshop participants agreed that there was a strong need to strengthen the two way flows of information from international policy forums such as the UNFCCC through to landowners. Furthermore, there is an on-going international policy development and technical support process in REDD and the forestry sector at the UNFCCC through the annual Conference of Parties, the twice yearly Subsidiary Bodies for Scientific and Technological Advice (SBSTA) and a variety of REDD policy and technical workshops throughout the year.

It is common practice (and considered necessary) for many countries to engage their Forestry Department in these workshops and negotiations. It would be highly beneficial to Fiji if the Forestry Department were to engage in these processes. This would provide a valuable opportunity for

a. Fiji's forest sector interests to be appropriately represented from a technical and policy point of view
b. UNFCCC technical and policy developments to inform domestic forestry policy and technical arrangements
c. Valuable on-going training opportunities in international best practice in REDD and LULUFC for the Forestry Department

The UNFCCC provide financial support for developing country participation at these events (including specialist workshops) and it would greatly benefit Fiji to take advantage of this financial support by routinely sending Forestry Department representatives and/or technical advisors.

It is a common practice for many developing countries to engage technical and policy advisors to assist with active participation in these international meetings.

Fiji is also a member state of the Coalition of Rainforest Nations (CRfN) which also holds technical and policy meetings throughout the year as part of coordinated approach to the UNFCCC REDD negotiations. The CRfN also provides financial support for member states to participate in their meetings and this provides another opportunity for Fiji to benefit from increased international policy engagement.

One of the advantages arising from attending such meetings (particularly the UNFCCC) is that they provide a networking environment linking host countries with funders and technical and policy support agencies such as the UNFF, the UNEP, the UNDP, research institutions, and international NGOs.

The UNFCCC for example, provides opportunities for developing countries to host "Side Events" at the SBSTA and COP meetings. This presents an opportunity to showcase national REDD developments and signal the need for support in certain areas. It also facilitates international collaboration, and helps to get Fiji on the 'radar' of donors seeking to support interesting initiatives and innovations.

Fiji has an opportunity therefore to provide some leadership in the context of Pacific Island Nations representation in the international REDD process. To date, only Vanuatu has participated at the UNFCCC REDD process through the efforts of the lead author of this document (Weaver) and with technical support from the remote sensing expert (Herold) and others in the Carbon Partnership team (O'Sullivan, Ward, Hewitt). This has helped to influence UNFCCC REDD policy development and presented opportunities to engage funders in providing significant financial support for the development of national climate change initiatives in Vanuatu.

In order to facilitate this, Workshop participants agreed that it would be highly beneficial if the Fiji Forestry Department were to begin engagement in international climate change policy developments in the REDD and LULUCF sector at the UNFCCC and other related forums such as the Coalition of Rainforest Nations.

At the final plenary session, the Workshop participants agreed upon the need for improved international policy engagement in REDD as follows:

g. Improve communication linkages between Foreign Affairs, UNFCCC Focal Point, DNA, and relevant departments (e.g. Forestry, Environment, Energy, and Agriculture) to enable greater responsiveness to opportunities to attend and participate in UNFCCC REDD/forest sector policy and technical initiatives.

h. Commitment for Fiji to attend UNFCCC COP-15 in Copenhagen (December 2009) with representations from Environment, Forestry, and a Technical/Policy Advisor.

i. Aim for a Fiji/Vanuatu joint side event in 2010 at UNFCCC SBSTA or COP-16 to report on progress in the regional effort in REDD and Forest Sector climate change adaptation.

j. Begin active attendance by Forestry (and/or representation by technical/policy advisor/s) at UNFCCC and UNFF REDD/Forest Sector technical and policy meetings and workshops (and take advantage of any funding by UNFCCC/UNFF).

k. Begin active attendance by Forestry (and/or representation by technical/policy advisor/s) at the Coalition of Rainforest Nations (CRfN) Workshops (and take advantage of funding by CRfN).

l. Explore opportunities to engage more actively in the Pacific Island Forum with particular reference to regional collaboration as recommended at the 2009 Pacific Heads of Forestry Meeting.

Part 3: National Forest Monitoring

3.1 BACKGROUND MATERIAL

3.1.1 Policy Background

While policy and compensations mechanisms for implementing REDD (particularly the question of whether they should be market or fund based) are still under discussion by the UNFCCC (in the process of long-term collaborative action- LCA), the draft text on methodology for REDD produced by SBSTA30 in June 2009 (UNFCCC 2009) makes it clear that not only reduced emissions from deforestation and degradation, but also forest conservation, sustainable forest management (SFM) and forest enhancement are likely to be included in the agreement which will be finalized at the climate summit in Copenhagen in December 2009. These three elements are usually jointly referred to as 'REDD Plus'. The draft also refers to the need to establish monitoring systems that use an appropriate combination of remote sensing and ground-based forest carbon inventory approaches with a focus on estimating anthropogenic forest-related greenhouse gas emissions by sources, removals by sinks, forest carbon stocks and forest area changes. All estimates should be transparent, consistent, as accurate as possible, and should reduce uncertainties, as far as national capabilities and capacities permit. It is further indicated that these monitoring systems and their results will be open to independent review as agreed by the Conference of the Parties (COP).The draft text makes particular reference to the need to involve local communities in measuring and monitoring carbon stocks.

This creates some certainty about the contours of the agreement and what will be credited, as well as opportunities to use a variety of approaches to measuring and monitoring, but there remain some important conceptual gaps before the necessary modalities for this interesting and progressive policy can be implemented and operationalized in specific country circumstances. One key measure to quantify the role of a forest for climate change mitigation is the sum of the carbon stored in its terrestrial pools (i.e. vegetation biomass and soil carbon). REDD assumes that any change in the forest carbon stocks from direct or indirect human activities has an impact on the climate with the overall goal to reduce the amount of emissions to the atmosphere and to maintain or increase the overall terrestrial carbon pool. Thus, climate change mitigation activities currently under discussion encourage:

- the long-term conservation of forests to maintain its current or natural carbon reservoir,
- to change the impact of human activities (i.e. causing carbon emissions from land use) in forests to stabilize or increase terrestrial carbon stocks in the long-term,
- a change in current human activities towards reforestation of land to increase the terrestrial carbon sink.

These generic and fundamental objectives are addressed in the REDD and the LULUCF discussions in a number of concepts, such as deforestation, forest degradation, forest conservation etc. These reflect the need to specify policies to alter human activities towards a more climate friendly way, means to measure and report their carbon impact on the local, national and global level, and the link between the two. Since current REDD discussions are dealing with both cause-oriented and emission-oriented approaches dealing with these concepts becomes even more critical and sensitive.

It is currently not practical nor efficient to measure and report the stocks and changes for the global terrestrial carbon reservoir with the level of detail and certainty to address all drivers and processes that have a carbon impact on the land. REDD readiness activities are encouraged to start right away and the current primary aim should be how the three objectives noted above can be addressed given that:

- current human land use impacts causing carbon emissions are focused in specific areas and regions and should, perhaps, be primarily addressed in the very near-term, however, it is the long-term stabilization or increase of the terrestrial carbon reservoir as a whole that will decide on the effectiveness of the activities initiated today,
- many developing countries start from a diverse set of backgrounds in terms of historical drivers and changes in forest carbon, expected future land use changes due to their development objectives, and current capabilities for measuring and monitoring forest carbon on the national and local level,
- resources to address REDD will be limited and not suitable to address all issues everywhere at the same time. While all countries should be encouraged to participate from the beginning, their entry points will vary and priority setting and efficient implementation strategies will be needed on the international, national and sub-national level.

Thus, we should understand the use of concepts like deforestation, degradation and conservation as means to provide agreed international frameworks and to scope and define practical and efficient implementation strategies (policies and MRV) for countries and actors to start REDD actions. This should include the definition of long-term targets and the specification of near-term priorities. For example, in the case of national monitoring, it is not practical to measure each ton of carbon or each tree individually on a regular basis. However, it is possible and efficient to achieve some level of national monitoring with most detail and certainty in spatially limited areas of “REDD actions” that proof and verify the positive effect of policies and implementation for the climate.

3.2 IMPORTANT BACKGROUND DOCUMENTS

The following set of documents should be circulated and printed for the workshop:

1. UNFCCC/SBSTA technical paper on costs of monitoring for REDD published in June 2009 (printed copies should be distributed at the workshop): http://unfccc.int/resource/docs/2009/tp/01.pdf
2. GOFC-GOLD REDD technical sourcebook, updated version published in July 2009 (3-4 printed should be available to key technical people): http://www.gofc-gold.uni-jena.de/redd/sourcebook/Sourcebook_Version_July_2009_cop14-2.pdf
3. UNFCCC SBSTA 30 decision and draft text for Copenhagen negotiated in June 2009 (should be available to workshop participants): http://unfccc.int/resource/docs/2009/sbsta/eng/l09.pdf

The technical experts participating in the workshop are encouraged to consider the recent guidelines and guidance

- Guidelines (2003) on Land Use Land Use Change and Forestry (LULUCF), focus on chapters 2 and 3: http://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf.html
- Guidance on Agriculture Forestry and other Land Uses (AFOLU), focus on chapters 1-4: http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol4.html

3.3 NATIONAL FOREST MONITORING FOR REDD

A national forest monitoring system for REDD is a fundamental requirement for participation in the REDD process. Despite the broader benefits of monitoring national forest resources per se, there is a set of specific requirements for establishing a national forest carbon monitoring system for REDD:

- The considerations of a national REDD implementation strategy (requires a coordinating national/international process – ongoing for Fiji);
- Systematic and repeated measurements of all relevant forest-related carbon stock changes. Robust and cost-effective methodologies for such purpose already exist (see UNFCCC workshop in REDD monitoring methods: report and presentations under: http://unfccc.int/methods_and_science/lulucf/items/4289.php);
- The estimation and reporting of carbon emissions and removals on the national level using the IPCC Good Practice Guidelines on Land Use Land Use Change and Forestry (LULUCF) given the related requirements for transparency, consistency, comparability, completeness, and accuracy;
- Independent review of national forest carbon monitoring systems.

The development of a national monitoring system for REDD is a process and several requirements need to be considered to implement a national monitoring system. The first component – *forest area change monitoring* – needs to deliver forest area and spatially explicit forest area change, corresponding to approach 3 of IPCC guidelines for LULUCF and AFOLU. It therefore requires the application of transparent and consistent datasets. The use of remote sensing technologies is considered a suitable approach for most developing countries to assess historical and future deforestation rates. The application of remote sensing techniques requires technical resources, infrastructure and human capacity for data acquisition, storage, processing and analysis and needs to consider the national circumstances. For the second component - *carbon stock and carbon stock change estimation* – the IPCC GPG provides different tiers regarding the level of detail and accuracy.

Tier	Details
Tier 1	IPCC methods and IPCC default values (no data collection needed)
Tier 2	IPCC methods and country specific data for key factors (including more detailed country specific strata)
Tier 3	Country specific methods or models, national inventory of key carbon stocks, repeated measurements of permanent plots to directly measure changes in forest biomass

The application of Tier 2 requires technical resources, infrastructure and human capacity for forest inventory estimations. For Tier 3, detailed measurements of carbon stock changes need to be provided for different carbon pools (e.g. through permanent field plots).

Table 1 lists the key components and required capacities for establishing a national monitoring system for estimating emissions and removals from forests. The first section of planning and design should specify the monitoring objectives and implementation framework based on the understanding of:

- the status of international UNFCCC decisions and related guidance for monitoring and implementation;
- the national REDD implementation strategy and objectives;
- knowledge in the application of IPCC LULUCF good practice guidelines;
- existing national forest monitoring capabilities;
- expertise in estimating terrestrial carbon dynamics and related human-induced changes;
- the consideration of different requirements for monitoring forest changes in the historical (reference period) and for the future (accounting period);

The planning and design phase should result in a national REDD monitoring framework (incl. definitions, monitoring variables, institutional setting etc.), and a plan for capacity development and long-term improvement and the estimation of anticipated costs.

Table 2: Components and required capacities for establishing a national monitoring system for estimating emissions and removals from forests.

Phase	Component	Capacities required
Planning & design	1. Need for establishing a forest monitoring system as part of a national REDD implementation activity	• Knowledge on international UNFCCC decisions and SBSTA guidance for monitoring and implementation • Knowledge of national REDD implementation strategy and objectives
	2. Assessment of existing national forest monitoring framework and capacities, and identification of gaps in the existing data sources	• Understanding of IPCC LULUCF estimation and reporting requirements • Synthesis of previous national and international reporting (i.e. UNFCCC national communications & FAO Forest Resources Assessment) • Expertise in estimating terrestrial carbon dynamics, related human-induced changes and monitoring approaches • Expertise to assess usefulness and reliability of existing capacities, data sources and information
	3. Design of forest monitoring system driven by UNFCCC reporting requirements with objectives for historical period and future monitoring	• Detailed knowledge in application of IPCC LULUCF good practice guidelines • Agreement on definitions, reference units, and monitoring variables and framework • Institutional framework specifying roles and responsibilities • Capacity development and long-term improvement planning • Cost estimation for establishing and strengthening institutional framework, capacity development and actual operations and budget planning
Monitoring	4. Forest area change assessment (activity data)	• Review, consolidate and integrate the existing data and information • Understanding of deforestation drivers and factors • If historical data record insufficient – use of remote sensing: o Expertise and human resources in accessing, processing, and interpretation of multi-date remote sensing imagery for forest changes o Technical resources (Hard/Software, Internet, image database) o Approaches for dealing with technical challenges (i.e. cloud cover, missing data)

	5. Changes in carbon stocks	• Understanding of processes influencing terrestrial carbon stocks • Consolidation and integration of existing observations and information, i.e. national forest inventory or permanent sample plots: o National coverage and carbon density stratification o Conversion to carbon stocks and change estimates • Technical expertise and resources to monitor carbon stock changes: o In-situ data collection of all the required parameters and data processing o Human resources and equipment to carry out field work (vehicles, maps of appropriate scale, GPS, measurements units) o National inventory/permanent sampling (sample design, plot configuration) o Detailed inventory in areas of forest change or "REDD action" o Use of remote sensing (stratification, biomass estimation) • Estimation at sufficient IPCC Tier level for: o Estimation of carbon stock changes due to land use change o Estimation of changes in forest areas remaining forests o Consideration of impact on five different carbon pools
	6. Emissions from biomass burning	• Understanding of national fire regime and fire ecology, and related emission for different greenhouse gases • Understanding of slash and burn cultivation practice and knowledge of the areas where being practiced • Fire monitoring capabilities to estimate fire effected area and emission factors: o Use of satellite data and products for active fire and burned area o Continuous in-situ measurements (particular emission factors)
	7. Accuracy assessment and verification	• Understanding of error sources and uncertainties in the assessment process • Knowledge on the application of best efforts using appropriate design, accurate data collection, processing techniques, and consistent and transparent data interpretation and analysis • Expertise on the application of statistical methods to quantify, report and analyze uncertainties for all relevant information (i.e. area change, change in carbon stocks etc.) using, ideally, a sample of higher quality information

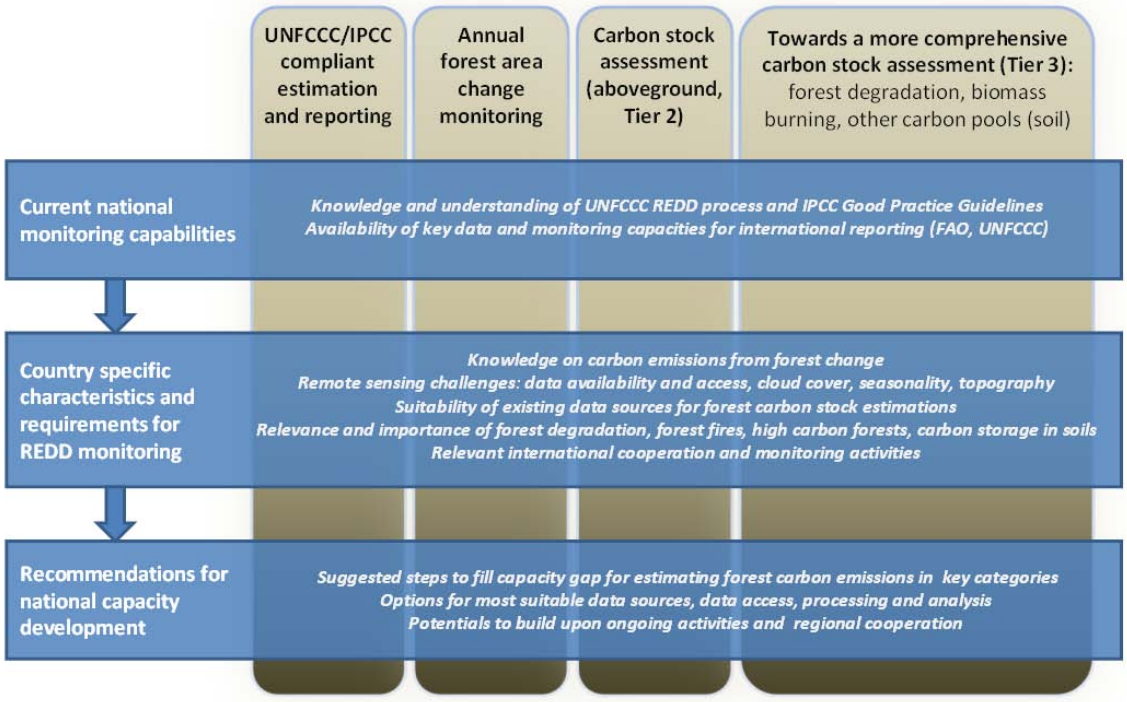
Analysis & reporting	8. National GHG information system	• Knowledge on techniques to gather, store, and analyze forest and other data, with emphasis on carbon emissions from LULUCF • Data infrastructure, information technology (suitable hard/software) and human resources to maintain and exchange data and quality control
	9. Analysis of drivers and factors of forest change	• Understanding and availability of data for spatio-temporal processes affecting forest change, socio-economic drivers, spatial factors, forest management and land use practices, and spatial planning • Expertise in spatial and temporal analysis and use of modelling tools
	10. Establishment of reference emission level and regular updating	• Data and knowledge on deforestation and forest degradation processes, associated GHG emissions, drivers and expected future developments • Expertise in spatial and temporal analysis and modelling tools • Specifications for a national REDD implementation framework
	11. National and international reporting	• Expertise in accounting and reporting procedures for LULUCF using the IPCC GPG • Consideration of uncertainties and understanding procedures for independent international review

Implementing measurement and monitoring procedures to obtain basic information to estimate GHG emissions and removals requires capabilities for data collection for a number of variables. Carbon data derived from national forest inventories and permanent plot measurements, and remote sensing-based monitoring (primarily to estimate activity data) are most commonly used. In addition, information from the compilations of forest management plans, independent reports, and case studies and/or models have provided useful forest data for national monitoring purposes. Irrespective of the choice of method, the uncertainty of all results and estimates need to be quantified and reduced as far as practicable. A key step to reduce uncertainties is the application of best efforts using suitable data source, appropriate data acquisition and processing techniques, and consistent and transparent data interpretation and analysis. Expertise is needed for the application of statistical methods to quantify, report, and analyze uncertainties, the understanding and handling of error sources, and approaches for a continuous improvement of the monitoring system both in terms of increasing certainty for estimates (i.e. move from Tier 2 to Tier 3) or for a more complete estimation (include additional carbon pools).

All relevant data and information should be stored, updated, and made available through a common data infrastructure, i.e. as part of national GHG information system. The information system should provide the basis for the transparent estimation of emissions and removals of greenhouse gases. It should also help in analysis of the data (i.e. determining the drivers and factors

of forest change), support for national and international reporting using a common format of IPCC GPG 'reporting tables', and in the implementation of quality assurance and quality control procedures, perhaps followed by an expert peer review.

Figure 5: Conceptual framework to derive recommendations for national capacity development for REDD.



As exemplified in Figure 5, the evaluation of country capacities and REDD specific characteristics provides the basis to specify the recommendations and next steps for Fiji. Starting with an assessment of current capacities, additional information on country-specific characteristics and requirements for REDD will need to be analyzed. The components listed in Table 2 help to define the requirements that a monitoring system should include and deliver, following the requirements outlined in the IPCC GPG. The difference between the current status and the requirements provides information on the capacity gap.

Uncertain input data (i.e. on forest area change and C stock change) is a common phenomenon among non-Annex I countries but adequate methods exist to improve monitoring capacities. A starting point is to critically analyze existing forest data and monitoring capabilities for the purpose of systematic estimation and reporting using the IPCC LULUCF GPG. Table 3 lists several key existing data sources that are commonly considered useful.

Table 3: Examples of important existing data sources useful for establishing national REDD monitoring

Variable	Focus	Existing records	Existing information
Area changes (activity data)	Deforestation	*Archived satellite data & airphotos*	*Maps & rates of deforestation and /or forest regrowth*
	Forest regrowth	*Field surveys and forest cover maps*	*Land use change maps*
		Maps of forest use and human infrastructures	*National statistical data*
Changes in carbon stocks / emission factors	Land use change (deforestation)	*Forest inventory, site measurements*	*Carbon stock change and emission/ha estimates*
	Changes in areas remaining forests	*Permanent sample plots, research sites*	*Long-term measurements of human induced carbon stock changes*
	Different C-pools (i.e. soils)	*Forest/ecosystem stratifications*	
		Forest concessions/harvest estimates	
		Volume to carbon conversion factors	
		Regional carbon stock data/maps	
Biomass burning	Emissions of several GHG	*Records of fire events (in-situ)*	*Burnt area map products*
		Satellite data	*Fire regime, area, frequency & emissions*
		Emission factor measurements	
		Records of areas under slash and burn cultivation	
Ancillary (spatial) data	Drivers & factors of forest changes	*Topographic maps*	*GIS-datasets on population, roads, land use, planning, topography, settlements*
		Field surveys	
		Census data	

Some of the common gaps in current national monitoring capacities can be summarized by considering the five IPCC GPG estimation and reporting principles:

- **Consistency:** Reporting by many countries are based either on single-date measurements or on integrating different heterogeneous data sources rather than using a systematic and consistent monitoring;

- **Transparency:** Expert opinions, independent assessments or model estimations are commonly used as information source for forest carbon data; often causing a lack of transparency in the methods used;
- **Comparability:** Few countries have experience in using the IPCC GPG as common estimation and reporting format among Parties;
- **Completeness:** The lack of suitable forest resource data in many non-Annex countries is evident for both area change and changes carbon stocks. Carbon stock data for aboveground and belowground carbon are often based on estimations or conversions using IPCC default data and very few countries are able to provide information on all five carbon pools.
- **Accuracy:** There is limited information on error sources and uncertainties of the estimates and reliability levels by countries and approaches to analyze, reduce, and deal with them for international reporting and for implementation of carbon crediting procedures.

In case there are no consistent times series of historical forest area change data, the country should consider using archived satellite data and establish the required monitoring capacities. Forest inventory data are currently the most common data source for the estimation of changes in forest carbon stocks. However most of the existing and traditional forest inventories have not been designed for carbon stock assessments and have limited use for this purpose. Ideally and in some contrast to traditional inventories, the design for national carbon stock inventory should consider the following requirements:

- **Stratification of forest area:** by carbon density classes and relevant human activities effecting forest carbon stocks;
- **Coverage:** full national coverage with most detail and accuracy required in areas of "REDD relevant activities";
- **Site measurements:** emphasize on measuring carbon stocks, potentially in all carbon pools;
- **Time:** consistent and recurring measurements of carbon stock change, i.e. for deforestation and in areas remaining as forests (i.e. degradation);
- **Uncertainties:** verification and considerations for independent international review.

The investments and priority setting for monitoring carbon stock changes related to forests, in all carbon pools (i.e. soils, biomass burning) may depend on how significant the related human-induced changes are for the overall carbon budget and the national REDD implementation strategy are. For example, if the country has no fire regime and no significant emission from biomass burning it is not necessary to develop a related monitoring. The monitoring of carbon changes in forests remaining as forests (both increase and decrease) is generally less efficient than for the case deforestation, i.e. lower carbon stock changes per ha versus higher monitoring costs and, usually, lower accuracies. On the other hand, monitoring of forest degradation is important since the cumulative emission can be significant and updated data are required to avoid displacement of emissions from reduced deforestation.

A country should have understanding and regularly monitor the human processes causing loss or increases in forest carbon stocks, i.e. through a recurring assessment of degraded forest area. However, the level of detail and accuracy for actual carbon stock changes should be higher for countries interested in claiming credits for their activities (i.e. reducing emissions from forest degradation). In this case, the establishing the REDD monitoring system should put particular emphasis in building the required capacities that usually require long-term, ground-based measurements. A similar procedure maybe suggested for the monitoring of changes in other carbon pools.

To date, very few developing countries report data on soil carbon, even though emissions maybe significant, i.e. emissions from deforested or degraded peatlands. If the soil carbon pool is to be included in country strategy to receive credits for reducing emissions from forest land, the related monitoring component should be established from the beginning to provide the required accuracy for estimation and reporting. For other countries, the monitoring of emissions and removals from all carbon pools and all categories is certainly encouraged in the longer-term but maybe of lower priority and require smaller amount of resources in the readiness phase. This approach is supported the current IPCC guidance which already allow a cost-efficient use of available resources, e.g. the concept of key categories[4] indicate that priority should be given to the most relevant categories and/or carbon pools. This flexibility can be further expanded by the concept of conservativeness[5]".

The analysis and use of existing data is most important for the estimation of historical changes and for the establishment of the reference emission levels. Limitations of existing data and information may constrain the accuracy and completeness of the LULUCF inventory for historical periods, i.e. for lack of ground data. In case of uncertain or incomplete data, the estimates should follow, as much as possible, the IPCC reporting principles and should be treated conservatively with motivation to improve the monitoring over time. The monitoring and estimation activities for the historical period should include a process for building the required capacities within the country to establish the monitoring, estimation and reporting procedures as long-term term system. Consistency between the estimates for the historical period and future monitoring is essential. The existing gaps and known uncertainties of the historical data should be addressed in future monitoring efforts as part of a continuous improvement and training programme.

[4] Key categories are sources of emissions/removals that contribute substantially to the overall national inventory (in terms of absolute level and/or trend). According to the IPCC-GPG, key categories should be estimated higher Tiers (2 or 3), which means that Tier 1 is allowed for non-key categories.

[5] Conservativeness is a concept used by the provisions of the Kyoto Protocol. In the REDD context, conservativeness may mean that - when completeness or accuracy of estimates cannot be achieved - the reduction of emissions should not be overestimated, or at least the risk of overestimation should be minimized.

3.4 TRAINING SESSION NOTES

During the national consultation and training workshop, a number of presentation and lectures have been prepared and presented by the remote sensing expert. The presentations included both plenary talks, breakout groups and technical training sessions:

1. Forest monitoring capabilities for REDD participation: Background and requirements for building an MRV system in Fiji (workshop day 1)
2. Background on IPCC Good Practice Guidelines on Land Use Land Use Change and Forestry (LULUCF) and Guidance on Agriculture Forestry and other Land Uses (AFOLU) (workshop day 2)
3. Monitoring Emissions from Deforestation and Degradation: A Remote Sensing Introduction (workshop day 3)
4. Discussions on existing capacities and gap filling opportunities (workshop day 3)
5. Report from monitoring stream, technical training and capacity development plan

The following aspects have been covered in the context of the technical training on REDD MRV:

a. Measuring terrestrial carbon in forests
b. Foundations of national carbon inventory
c. Basic requirement and procedures for IPCC Good Practice Guidelines
d. Remote sensing and monitoring of forest area changes
e. Estimation of carbon emissions from deforestation and forest degradation

3.5 DATA FOR FIJI'S INTERNATIONAL REPORTING

All forest related national monitoring is done by the Forestry department. NFI's for forest land conducted for 1991 and 2006. A remote sensing based forest cover map exists for the year 2002. Fiji's forestry department prepares the country reports for FAO's global forest resources assessment.

Fiji regularly reports to the FAO FRA. According to FRA2005 and the draft report for 2010 the area of natural und semi-natural forests is stable since 1990 (Figure 6). However, the expansion of agriculture and infrastructure are not systematically measured with existing inventory methods and constitutes an existing data gap. Thus, the amount of natural forest has consistently declined of the recent years with the actual area being unknown at this point.

Figure 6: Forest area changes reported for FAO FRA 2005

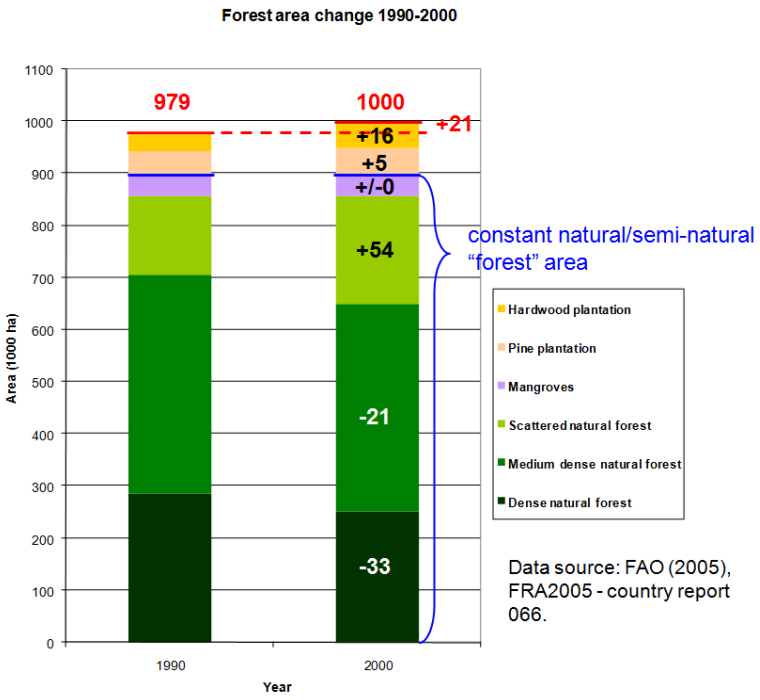
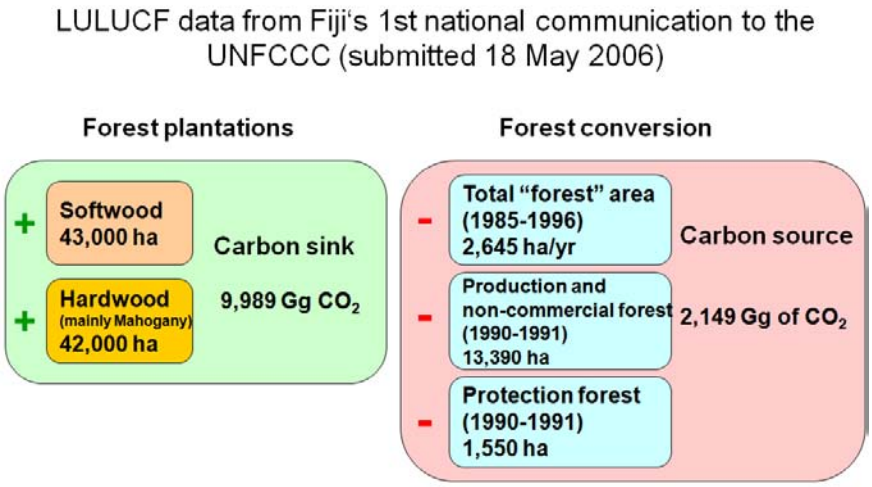


Figure 6 also highlights the increase of forest land due to plantations, and forest degradation due to commercial logging and clearing for plantations are reported. This general trend is further confirmed in the draft report of Fiji for FRA 2010.

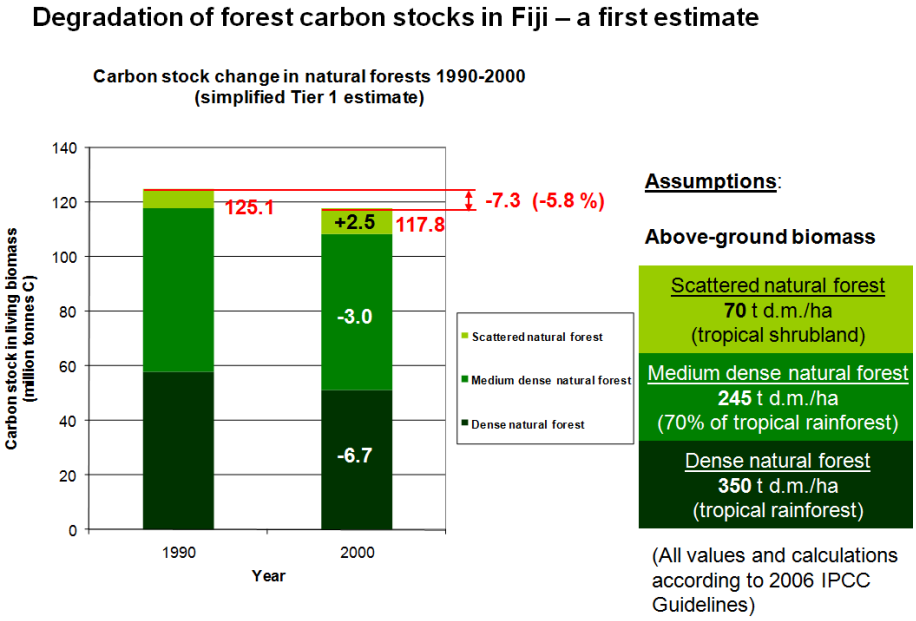
The 1st national communication to the UNFCCC contains some related estimates (Figure 7). Both sinks (forest plantations) and sources (forest conversion) are reported with the carbon sink outweighing the sources. The 2nd national communication of Fiji is currently under development.

Figure 7: Summary of forest related carbon sinks and sources reported in Fiji's 1st National communication to the UNFCCC



Besides sinks and sources from plantations and forest conversions, the reporting for FRA 2005 indicated a significant source of carbon due to forest degradation due to loss of dense and medium dense forest towards more open forests (Figure 6). The reported changes in area can used to provide some first-cut estimates using Tier 1 default data and procedures in the IPCC AFOLU GPG. Figure 8 indicates that, although being a rough estimation, the loss of carbon stocks due to forest degradation is significant.

Figure 8: Tier 1 estimate of carbon stock change due to forest degradation based on FAO FRA 2005 changes in area for different forest classes.



3.6 CAPACITY GAP ANALYSIS

3.6.1 International Requirements: IPCC GPG

The major sources are summarized and published in the FAO FRA 2005/2010 country report. The most important data sources include two national forest inventories conducted in 1991 and 2006. A forest cover map has been derived for the year 2002 and used to stratify the most recent NFI. In addition, commercial forestry activities (i.e. logging, plantations, harvest estimates) are commonly recorded by relevant government agencies (i.e. the forestry department) and forestry companies.

Considering the data requirements posed by the IPCC LULUCF and AFOLU GPG, Fiji has undertaken an assessment on existing datasets and data gaps that are summarized in Table 4.

Table 4: Comparison of IPCC monitoring requirements with existing data sources and data gaps

Variable	Focus	Existing information/data	Missing data and gaps
Area changes (activity data)	Deforestation/ reforestation	Some data from NFI's 91/06, forest plantations and land allocations and leases	No consistent national data on historical land use changes for multiple times, particular agriculture and infrastructure expansion
	Degradation	Logging concession areas	Data on areas affected (concessions, others) need to be integrated Some degradation processes not monitored
Changes in carbon stocks / emission factors	Land use change	Existing NFI estimates of volume, some data from permanent sample plots Data on plantation harvests and growth	No data on actual carbon stocks, emission factors Carbon conversion procedures needed Suitable national forest stratification?
	Degradation	Logging concession areas/harvest estimates, permanent plots	Limited availability of emission factors and net-carbon changes for different degradation processes
	Other pools (i.e. soils)	Available soil database	No national soil carbon change dynamics model and database

Biomass burning	Emissions of several GHG	Some data for fire in pine concessions	No consistent national data
Ancillary (spatial) data	Factors of forest changes	FLIS, other land databases, Land leases, Land use planning and concessions	Consistent national database integrating relevant data is missing

3.6.2 National Requirements: Assessment of Drivers

During a national consultation process, the participants from Fiji have assessed its recent and active drivers and processes impacting forest carbon on the national level including the type of activity, the important actor, and some qualitative estimation of its carbon impact. The results are shown in Table 5.

Table 5: Assessment of current processes and drivers active in Fiji.

Current Drivers of Forest Carbon Change in Fiji				
Processes that effect forest carbon stocks	**Who is doing it and for what purpose (historical, current, future)**	**Effects on the forest (carbon) in the short and long-term**	**How important is the process nationally (area affected)?**	**carbon impact**
Forest conversion for expansion of agriculture (or biofuels)	Landowners or lessees of land	Source (large)	Large	Very high (+)
Conversion of forest for settlement(squatters)/ tourism – especially in mangroves and including illegal settlements	Developers and squatters	Source (medium)	Large	High (+)
Plantation clear-fell harvesting & replanting	Government owned Forestry companies	Sink, if not replacing native forest (medium)	Large	High (-)
High intensity selective logging of native forests → remains native	Contractors commissioned by the forest owners or local communities – driven	Generally a source but sustainable forest management	Low – SFM Low – for local use	Medium (+)

	by market demand and/or local need for wood in village	would help to minimise the carbon impact (1-2)	Medium - commercial	
Accidental burning that gets out of control & into forest	Farmers & arsonists	Source (2)	Low to medium – mainly in the dry western zones –	Medium (+)
Forest clear-fell for mining prospects	Mining companies	Source (3)	Low	Medium (+)
Protecting native forest for ecosystem services, etc. e.g. Sovi Basin	Forest resource owners and Environment NGOs, drivers of eco-tourism	Neutral, avoided emissions (2)	Medium	Medium (+/-)
Shifting cultivation – slash & burn – especially in dry areas	Local communities, increasing due to population growth and cash crops	Source (2)	Low – more in isolated rural areas	Some (+)
Afforestation of talasiga land →pine forest for wood/chip production	Government initiative to benefit people	Sink (2)	Low	Some (-)
Afforestation with teak	Private forest company, landowners/lessees planting an investment	Sink (2)	Low	Some (-)
Natural regeneration of expired agriculturally leased land	Landowner leaving land idle/fallow	Sink as long as the trees stand (2)	Low	Some (-)
Increased vulnerability to cyclone damage/ fires/landslides of degraded natural wet forest	Quasi-natural process	Source (1)	Low	Low (+)

The table emphasizes that many drivers are active in Fiji and should be potentially addressed (encouraged or discouraged) by REDD actions. Data and information of the activities are varying and limited for most of the processes. From a carbon impact point of view, the land use changes resulting in the removal of native forests causing most of current emissions. Plantations on non-forest land are the largest component increasing the terrestrial forest carbon sink.

Depending on the driver, deforestation and forest degradation are located along the remaining forest areas and forest edges in different part of the country. Most of Fiji's forests have been subject to human intervention of some kind in the past. Considering areas most affected for the most recent:

- The majority of logging and most commercial activities in the Forestry sector are happening on the 2 big Fiji islands Vanua Levu and Viti Levu.
- On smaller islands, most activities impacting forest carbon are related to subsistence land use. However, some commercial agriculture on Taveuni and Kadavu have been encouraged and driven by the national government. Some recent agriculture expansion has happened on Waibau. Parts of Kabara Island are used for logging of Vesi for handicrafts for commercial purposes.
- Vanua Levu, Seaqaqa, and Ra and western Viti Levu have been the most important areas for sugarcane production; an effort that has declined in area and intensity over the recent years.
- Settlement and infrastructure expansion into forest areas is focused on coastal and lowland forest areas

All forest types in Fiji are under particular pressure for human intervention and deforestation or degradation. Some processes are focused on specific forest types. Mangrove and lowland forests are particularly subject to conversion for expansion of settlements, infrastructure and tourism purposes (i.e. resorts). The cloud mountain forests, that contain most of the remaining intact forests, are under increasing pressure for the construction dams, for mining and increasingly from logging.

Given the capacity gap assessment, Fiji currently does not have sufficient data to develop a historical reference level. However, basic steps have been taken to assess the full range of drivers and identifying a set of data analysis exercises that would need to be performed by providing comprehensive data to quantify historical sinks and sources (Table 3). Based on this improved base of historical data, Fiji will explore options to develop a reference level based on international guidance and REDD objectives and opportunities that have been identified in the National REDD strategy.

3.7 ADDRESSING DRIVERS

REDD implementation and monitoring will need to be closely linked in the process to fill existing capacity gaps. The national system will be a systematic one building upon area change assessments using remote sensing data, permanent sample plots and NFI data, and data acquired by several government agencies in forest concessions and land leases etc. In addition, the current plan is to

stratify the country according to REDD activities. Most detail and accuracy is required for specific activities or projects that will be monitored through targeted surveys.

Gaps exist for monitoring the carbon emissions and removals exist for all drivers activities in Fiji (Appendix 9a). However, a solid base of data and capacities exists, as well as, suggested near-term activities to fill existing gaps were developed by workshop participants in consultation with international experts (Appendix 9b).

3.8 SUGGESTED TIMELINE FOR CAPACITY DEVELOPMENT

The development of a national MRV system has started with a process that assesses current gaps and a plan to fill them and continuously improve the MRV system over time. A roadmap defines the current steps to establish the MRV system:

Key MRV related activities:

1. Acquire all data & information needed for national policy strategy and action plan:
   - Evaluate and integrate existing data sources
   - Acquire additional data if needed
2. Develop capacities data for a Tier 2 national forest carbon monitoring and reference level
   - Focus on building baseline datasets
   - Capacity building
   - Reference level
   - Pilot projects
3. Establish operational MRV system and IPCC reporting:
   - Consistent and continuous monitoring and estimation
   - IPCC reporting and GHG inventory
   - MRV support for REDD actions (i.e. projects) and national policy

A set of different MRV objectives are anticipated The next phase for Fiji is to develop the national REDD Strategic Action Plan. The monitoring objective is to acquire all data and information needed for national policy strategy and action plan.

Three major activities have been scoped and are expected to start in the near-term:

Objective of MRV action	Key steps	Key actors
Gather and evaluate all existing and relevant data in Fiji	1. Collect data from agencies and companies 2. Integration to common format (GIS) 3. Evaluation and comparison	Forestry Dep., Lands Dep., NLTB, Land use etc. with international support
Take essential steps to convert existing forest data into carbon stocks	1. Evaluate NFI/plot data and harvest estimates 2. Select and implement procedures for carbon conversion	Forestry Department, Ian Payton/Landcare
Complete a national forest area change assessment for most recent years	1. Gather and process suitable multi-temporal datasets 2. Interpretation and analysis	Forestry Department, SOPAC, CI, Martin Herold/FSU

After the development of the Strategic Action Plan (R-PLAN), the objective with respect to building a national MRV system is to conduct capacity building and foster the implementation of a Tier 2 (minimum) national forest carbon monitoring and establish historical reference level by 2012. Anticipated activities include:

1. Developing baseline datasets for national Tier 2 assessment using IPCC GPG
2. Provide all data to establish a reference level
3. Conduct a series of national capacity building activities including regional cooperation
4. MRV for pilot projects
5. Uncertainty analysis and improvement plan
6. Engage in post-graduate exchange and research

The goal is to develop a fundamental data bases within Fiji so MRV could move towards operational mode. Thus, beyond 2012, the activities will establish an operational and sustained MRV and IPCC reporting system. This includes the continuous monitoring and IPCC reporting of all relevant forest change processes on national and sub-national level and the preparing for an independent international review.

3.9 NEXT STEPS

3.9.1 Detailed Plan for Utilizing National Datasets

The capacity assessment has highlighted that a suitable datasets are available with a number of different actors in Fiji. These forest and land change data are very useful for REDD monitoring and include:

- Forestry department (concessions, harvest estimates, forest maps, NFI, etc.)
- Other government agencies (Lands Dep.-FLIS, NLTB) on land use, conversions and leases
- Companies (Fiji Pine, Sugar, Fiji Hardwood)

Fiji should initiate a mechanism to engage these different national actors to make these datasets useful for the national REDD program. All datasets need to be gathered in a common format (GIS) and evaluated (i.e. through international experts). This effort would be considered as an essential next step since existing national data is fundamental to supporting any new data to be derived (i.e. remote sensing forest change assessment).

This should be initiated and, perhaps, completed during the time that additional datasets are being acquired using remote sensing and carbon measurements/conversions.

3.9.2 Detailed Plan for Area Change Assessment

The completion of a historical forest area change assessment is suggested as one key activity for Fiji to fill the capacity gap. The key issue for such an activity is to consistently track forest changes over time. The map products to be derived should provide spatial data and area estimates on key processes such as the forest loss due to agriculture, clearing and infrastructure, the forest area increase due to plantation activities. Given the range of current capacities in Fiji and the region, progress can be achieved in short period and first cut forest area change analysis to be completed for development of the National REDD Strategic Action Plan.

The suggested process is to establish an ad hoc technical task team involving key actors to compile change map within next year. The composition of the technical team should be driven by currently existing remote sensing and forest area change assessment capabilities. A suggested set of actors would include the Department of Forestry (coordinator), SOPAC/SPC (W. Forstreuther), Conservation international, GTZ, international experts and other related agencies.

The following activities are proposed:

1. The first step would include the assessment and utilization of archived remote sensing data given the following requirements:
    - Ideally several time steps from 2000 until today, maybe back to 1990, more recent times are most important
    - Data availability: some (almost) free satellite data (Landsat, ASTER), some archived data in Fiji (i.e. SOPAC), some data may need to be purchased
    - Conduct an assessment of available archived data and their suitability:
        a. Existing data in Fiji (1991, 1995/96, 2002)
        b. Archived Landsat data (free)
        c. ASTER data (80 US$ scene)
        d. SPOT data or others (more expensive)
2. Data pre-processing (lead: SOPAC/SPC):
    - Challenges with pre-processing and analysis (clouds, topography, seasonality, ATCOR 3 + DEM available)
    - Geo-rectification
    - Build national satellite data archive
3. Data interpretation (lead Forestry/SOPAC):
    - Use simple but defendable and transparent methods
    - National forest area change monitoring has not been implemented in the region (starting activities within CI)
    - Utilize existing national, non-remote sensing on forest changes (FLIS, concessions, etc.)
    - Use existing field plots for accuracy assessment (i.e. NFI locations, permanent sample plots etc.)

This activity is an exercise in filling a data gap and should use existing capacities rather than allocating resources to developing new ones (at least not initially). The technical task team would act as a platform to exchange experiences and capacities and assist in case any problems occur. The interaction with international experts can be minimal given current expertise, data and information.

There is a need to establish formal steps to start this process. The Forestry Department should coordinate the activity in association with partner agencies. For example, the national representative of Fiji to SOPAC should endorse this activity for the GIS and RS service unit to contribute. There also needs to be a mechanism to engage other technical experts if needed (i.e. from USP, Conservation International and international technical experts).

Part 4: Forest Carbon Inventory

4.1 INTERNATIONAL REPORTING REQUIREMENTS

Greenhouse gas (GHG) emissions (sources) or removals (sinks) from the forestry sector fall into one of three categories:

- ***Forest land converted to other (non-forest) land***. This is deforestation, and is always a source of emissions.
- ***Forest land remaining forest land***. This may be a source or a sink. Forests set aside for conservation purposes are likely to be sinks, at least until they reach an old growth stage where emissions balance removals. Forests managed for timber production may be sources or sinks, depending on the stage of the forest management cycle and the level of harvesting. Similarly, forest degradation will be a source of emissions while the forest continues to be degraded, but may become a sink where degraded forests are allowed to regenerate.
- ***Other (non forest) land converted to forest land***. These are new forests, which act as sinks by removing GHG's from the atmosphere.

The definition of forest land is country-specific, but within guidelines provided by the Intergovernmental Panel on Climate Change (IPCC).

Inventories to determine whether forestry sector activities are GHG sources or sinks are required to take account of carbon stocks in five broad pools. These are:

- ***Above-ground live*** – trees and shrubs
- ***Below ground*** – root biomass
- ***Dead wood*** – logs and fallen branches
- ***Litter*** – fine woody debris, dead leaves and humus
- ***Soil organic matter*** – carbon that has been incorporated into the mineral soil.

The IPCC guidelines outline three methodological tiers for estimating and reporting on GHG emissions and removals. The tiers correspond to a progression from simple equations using default data to country-specific data in more complex national systems.

> **Tier 1**, which uses methods and default values outlined in the IPCC guidelines, is appropriate for countries where inventory data are scarce or absent.
>
> **Tier 2** uses a similar methodological approach, but with emissions factors (carbon stock estimates) and activity data (area change) which are more appropriate for the climatic regions and land-use systems of the country.
>
> **Tier 3** reporting is based on higher order methods including models and inventory measurement systems tailored to address national circumstances, repeated over time, and driven by high resolution activity (area change) data. Tier 3 methods result in a higher level of certainty than that of lower tiers, and have the ability to track changes in land use over time.

It is good practice to use methods that provide the highest level of certainty within the limits of the resources that are available.

In addition, carbon inventory methodologies are required to be:

- **Adequate** – capable of representing carbon stock changes and greenhouse gas emissions and removals and the relations between these and land use and land-use changes.
- **Consistent** – capable of representing management and land-use change consistently over time, without being unduly affected either by artificial discontinuities in time series data or by effects due to interference of sampling data with rotational or cyclic patterns of land use.
- **Complete** – all land should be included, with increases in some areas balanced by decreases in others where this occurs in reality.
- **Transparent** – data sources, definitions, methodologies and assumptions should be clearly documented and available for external peer review.

4.2 GROUND-BASED CARBON INVENTORY METHODS

Carbon stock estimation requires a knowledge of the size of the area that is being assessed, and the average carbon stock (t/ha) for that area. Area is normally determined from maps, aerial photos or satellite images. Average carbon stocks are typically determined from plot-based measurements.

4.2.1 Sample Plots

Sample plots should be established throughout the area being assessed on an objective (usually random or systematic) basis. Where change is to be assessed by repeat measurement, permanent plots are the preferred option because they factor out spatial variability that would otherwise mask temporal changes. They also allow for verification of field measurements, something that is difficult when plots are not relocatable.

The number of plots required depends on the desired level of precision, with higher levels requiring more resource and therefore cost. Costs will also increase where:

- Carbon stocks are more variable
- More carbon pools are measured
- The frequency of monitoring increases, and
- The monitoring methods become more complex

Stratification is a means of reducing the variability of carbon stocks within individual sampling units or strata. It should only be used where it reduces the number of plots required to achieve the desired level of precision.

Plot size should be sufficient to capture the variability at the site, but not so large as to require more effort (and therefore cost) to measure than is necessary. This is usually achieved using nested quadrates, with large trees being measured over the whole plot, smaller trees over part of the plot area, and understorey vegetation over a still smaller area.

Plots should be either circular or square. Circular plots minimise what is termed the edge effect (i.e. minimise the boundary for a given area)), but the inability to lay out boundary tapes can cause difficulties for understorey measurement. Square plots overcome this problem. Circular plots are a good option when only trees are being measured.

4.2.2 Measuring Carbon Stocks

Plant biomass is approximately 50% carbon. Five pools are recognised for carbon accounting purposes. These are above-ground live (trees, shrubs, understorey vegetation), below ground (roots), dead wood (logs), litter (small branches, twigs, fallen leaves, ferment and humus), and soil organic matter. Change is usually greatest in the above-ground live pool, although soil carbon stocks can show substantial changes where there has been a land-use change.

Carbon stocks in trees (above-ground live) are estimated from diameter and height measurements. These are converted to biomass (and therefore carbon) estimates using allometric relationships which incorporate a species-specific density term. In forests, large trees sequester the bulk of the carbon stock. Shrub and understorey vegetation is assessed from height and cover measurements, with the resulting volume converted to a mass

Roots (below-ground) are typically estimated as a percentage of the above-ground live pool, with figures obtained from experimental studies.

Dead wood (also termed Coarse Woody Debris) is estimated from length and diameter measurements. These are used to derive a volume which is converted to a mass using a species-specific density factor and a decay-stage modifier. The latter discounts the carbon remaining in the log, based on the stage of decay.

Litter is sampled using quadrate harvests. Where litter volumes are high or remote locations create handling difficulties, subsampling can be used to reduce the need to transport and process large quantities of leaf and twig material.

Soil carbon is assessed by determining the carbon content of a known volume of soil. Samples are collected for bulk density assessment and for carbon analysis. Soil carbon cannot be assumed to be a set percentage of the dry mass.

4.2.3 Carbon Stock Estimates

Carbon stock estimates are calculated on a plot-by-plot basis, expressed as tonnes/ha or tonnes CO_2e/ha, and slope corrected. The latter procedure ensures that all results are expressed on a horizontal area basis (i.e. the same basis as the mapped area). The average carbon stock for all plots multiplied by the area is the carbon stock for the sample area.

Carbon stock change (i.e. the amount of carbon sequestered) is typically assessed by remeasuring plots, and calculating the difference between the initial and final stock estimates.

4.2.4 Sources Of Error In Carbon Stock Estimates

There are three main sources of error associated with carbon stock estimates:

- Sampling error – the number and selection of plots used to sample the area of interest.

- Measurement error – errors associated with field measurements (e.g. stem diameters and heights), or laboratory analyses (e.g., soil carbon analysis).
- Regression error – errors associated with the allometric equations used to convert the field measurements to biomass (and therefore carbon).

Each of these sources of error can be quantified.

4.2.5 Quality Assurance And Quality Control

Quality control (QC) refers to the set of procedures you put in place to ensure a robust inventory. Quality assurance (QA) is the system a third party uses to ensure the delivery of a quality result.

All inventory programmes should have a QA/QC plan. This should cover:

- Collecting reliable field measurements
- Verifying the methods used to collect field data
- Laboratory measurements
- Data entry and archiving
- Analysis procedures

This is usually best achieved by developing a set of Standard Operating Procedures (SOPs), which set out how each task is to be done, the standards that are expected, and the checks that will be done to ensure those standards are met.

4.3 FOREST CARBON INVENTORY CALCULATIONS FOR FIJI

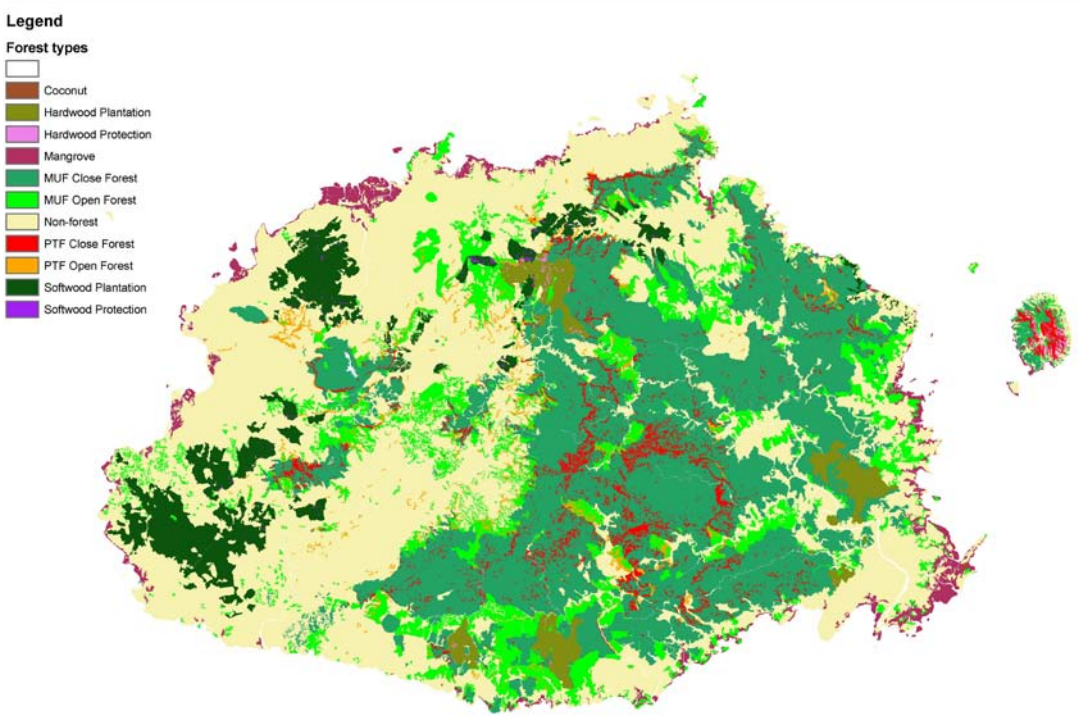
Carbon inventory requires the assessment of stocks and stock change in five broad pools. These are above-ground live, below ground, dead wood, litter and soil organic matter.

4.3.1 Existing Datasets For Forest Carbon Inventory Calculations

Existing datasets held by the Fijian Forestry Department, Fiji Hardwood, and Fiji Pine are sufficient to calculate average carbon stock values for the above-ground live and below ground pools of the main forest classes (indigenous forests, mahogany and pine). When combined with area data from

the most recent forest inventories (Fig. 9) this will allow us to calculate an initial estimate of carbon stocks in these pools. There do not appear to be existing data that would allow the calculation of carbon estimates for the dead wood or litter pools. Forest inventory in Fiji has not included sampling or analysis of soil properties. However, soil surveys carried out by the New Zealand Soil Bureau (now part of Landcare Research) in the 1970s and 1980s do provide data that would appear to offer the opportunity of developing a soil carbon model along the lines of that used by New Zealand government agencies for UNFCCC and Kyoto Protocol reporting.

Figure 9. Present day forest cover on Viti Levu.



4.3.2 Indigenous Forests

The primary datasets are the 1991 and 2006/07 National Forest Inventories. They are held by the Forestry Department and available in electronic format and hardcopy. Wood density data are available for commercially harvested species.

To calculate a carbon stock estimate from these data we will need to:

- Identify an appropriate allometric relationship to convert diameter and height measurements to a biomass (and therefore carbon) estimate.

- Develop a height:diameter relationship to estimate the height of trees without a height measurement[6].
- Determine an appropriate wood density value for all tree species in the dataset.
- Calculate above-ground live estimates for each plot, and apply an appropriate multiplier to obtain an estimate of the below ground pool.
- Use these estimates to calculate an average carbon stock for the above-ground live and below ground pools.
- Multiply the average carbon stock values by the mapped area to produce a carbon stock estimate for the indigenous forest estate.

4.3.3 Hardwood Plantations

The primary datasets are held by Fiji Hardwood Corporation Ltd (FHCL). They consist of inventory plots measured between 1990 and 2005, and spanning an age range of 5-61 years. The summary datasheet indicates there are data from 385 sites, spread across 13 locations, and that four regional groupings are recognized. There are two inventory methods. Both provide data on stem diameter and height. Recent area data are available for all sites/species/age-classes both as spreadsheet summaries and mapped areas. FHCL has c. 41,700 ha currently planted in mahogany, and c. 10,500 ha in other species, including *Pinus carribea*.

To calculate a carbon stock estimate from these data we will need to:

- Identify the most appropriate allometric relationship to convert diameter and height measurements to a biomass (and therefore carbon) estimate.
- Calculate a carbon estimate for the above-ground live and below ground pools for each of the plots, and an average carbon stock value for each of the sites.
- Either, combine the site estimates with the area data to produce a carbon stock estimate for each site, or use the site-level carbon estimates to produce a carbon stock:stand age curve and use this to estimate carbon stocks and predict carbon stock change[7].

[6] Total tree height was measured in the 1991 survey, but in 2006/07 this was replaced by measurements of merchantable timber height.

[7] The absence of thinning and pruning regimes in both hardwood and pine plantations in Fiji removes the complication of accounting for carbon losses from these sources. The extent to which cyclone damage is reflected in the datasets is unclear at this stage.

4.3.4 Pine Plantations

The primary datasets are held by Fiji Pine Ltd. Discussions with the Chief Executive (Ilaisa Tulele) and Inventory Officer (Rafaele Raboiliku) indicate that there are Permanent Sample Plot (PSP) data for a range of age classes, and that there are area data for all stands. I do not yet know the details of these datasets, and have thus far not been able to access the data.

To calculate a carbon stock estimate from these data we will need to:

- Identify the most appropriate allometric relationship to convert diameter and height measurements to a biomass (and therefore carbon) estimate.
- Calculate a carbon estimate for the above-ground live and below ground pools for each of the PSP plots.
- Use these data to produce a carbon stock: stand age curve and use this to estimate carbon stocks and predict carbon stock change[8].

4.3.5 Other Species

Discussions with staff from Fiji Hardwood and Future Forests Fiji (Paul and Roderic Evers) point to the existence of other hardwood plantation species (e.g., Cadaba, Cordia, Maesopsis, teak) in Fiji. There will be data that would allow us to estimate above-ground live and below ground carbon stocks for at least some of these.

[8] The absence of thinning and pruning regimes in both hardwood and pine plantations in Fiji removes the complication of accounting for carbon losses from these sources. The extent to which cyclone damage is reflected in the datasets is unclear at this stage.

4.4 DATA GAPS FOR FIJI FOREST CARBON INVENTORY

This section deals only with issues relating to the measurement and calculation of carbon estimates.

4.4.1 Indigenous Forests

(a) Sampling regime

This needs to shift from the unmarked National Forest Inventory plots, to the Permanent Sample Plot network that is currently being established in indigenous forests. The methodology for this inventory will ideally be modified to allow the dead wood and litter pools to be assessed on some or all of the plots.

(b) Wood density

- The methodology for the current data needs to documented, and additional data collected for non-commercial tree species.
- Tree species for which wood density data are not available should be allocated to a density 'group' and assigned an average value for that 'group'.
- Within-species variability in wood density should be examined for tree species contributing the bulk of the biomass (and therefore carbon) in indigenous forests.
- Carbon estimation of dead wood (logs) requires the development of decay-stage modifiers to take account of carbon loss as logs decay. These modifiers should be determined for the dominant species, and include the establishment of trial plots.

(c) Allometry

Initial carbon stock estimates will use a generic allometric relationship for tropical forests that includes a wood density term. This will ideally be replaced by Fiji-specific allometry for indigenous forests.

4.4.2 Hardwood Plantations

(a) Sampling regime

It is not possible to assess what needs to be done until we are able to access and analyze the existing datasets.

(b) Wood density

Initial discussions with staff from Fiji Hardwood indicate that they recognize growth rate differences across their forest estate. If this is the case, and we can't be certain until we have completed the initial carbon stock analyses, within-species differences in wood density may need to be examined.

(c) Allometry

There is no reason to suspect that the existing allometry used to estimate the biomass (and therefore carbon) in mahogany isn't a good fit for Fijian stands. As in the indigenous forests, logging operations provide an opportunity to gather data on above-ground biomass, and these data could be used to verify the performance of the existing allometry, and if necessary develop a Fiji-specific equation.

4.4.3 Pine Plantations

(a) Sampling regime

It is not possible to assess what needs to be done until we are able to access and analyze the existing datasets.

(b) Wood density

We expect there are existing data on the wood density of Fijian-grown *Pinus carribea*. We don't know if these data provide a measure of the variability in wood density across *P. carribea* stands. Additional sampling to establish this would be a useful refinement, but not a high initial priority.

(c) Allometry

There is no reason to suspect that the existing allometry used to estimate the biomass (and therefore carbon) in *Pinus carribea* is not a good fit for Fijian stands. As in the indigenous

forests, logging operations provide an opportunity to gather data on above-ground biomass, and these data could be used to verify the performance of the existing allometry, and if necessary develop a Fiji-specific equation. This would be a useful refinement, but is not a high initial priority.

4.4.4 Soil Carbon

For reasons explained earlier, most of the data that would be required to develop a soil carbon model are already available. The advantages of choosing this approach to estimating soil carbon stocks are:

- The type of model proposed is being used by New Zealand to report soil carbon stocks and stock change, is peer reviewed and internationally published.
- It avoids the need for an expensive sampling programme, although some additional sampling may required to fill data gaps and refine estimates of changes to soil carbon resulting from land-use change.
- It allows soil carbon stocks and stock-change to be estimated across all land cover classes.

4.5 INITIAL CARBON STOCK ESTIMATE FOR FIJI FORESTS

Getting the data required to calculate a carbon stock estimate for Fiji forests is proving to be a challenging task. The Forestry Department has provided data from the 1991 and 2006-07 national forest inventories (over 35,000 records) which will allow us to calculate an initial carbon stock estimate for indigenous forests. Staff at Fiji Hardwood and Fiji Pine have expressed their willingness to provide the data we need, but we have yet to see these data.

The data summary from Fiji Hardwood indicates there is a large quantity of Permanent Sample Plot (PSP) data, but until we see these data it is not possible to say what will be required to turn them into a carbon stock estimate. The key issue is whether the dataset is representative of the hardwood plantation estate. If it isn't, and this is very likely to be the case, the fall-back position is to derive a carbon stock: stand-age curve, and calculate carbon estimates for each age class within the plantations.

We have yet to see any data from Fiji Pine. Indications are that PSP data are available for most age classes within the pine plantations. As for the hardwood plantations, the key issue is whether these are representative of the total pine plantation estate.

Ideally, all the necessary data will be forwarded to Ian Payton in New Zealand, he will determine how best to use them to produce a carbon stock estimate, and then work with in-country staff to 'crunch the numbers' and produce the estimate. This scenario is contingent on staff from Fiji Hardwood and Fiji Pine delivering the necessary datasets, and any help that can be provided to facilitate this would be much appreciated. The fall-back position is to carry out these tasks on-site (i.e. at the offices of Fiji Pine and Fiji Hardwood) rather than at the end of an email connection.

The other factor to be considered is the development of capability for carbon stock assessment within Fiji, which is a high priority for the project. We suggest that the most efficient way to develop this capability is to identify the people who will form the core of a Fiji carbon inventory group, and for Ian to work with them to understand the data needed for carbon calculations, and to calculate the initial carbon stock estimate for Fiji forests. The key skills required are the ability to understand and manipulate large datasets within a database environment. If, during this process, we are able to identify staff from Fiji Pine or Fiji Hardwood with an interest in and an aptitude for carbon stock assessment, this will assist buy-in to the process.

4.5.1 Proposal

- Forestry Department to identify the staff that will form the core of a carbon inventory group. This core group should initially consist of no more than 2-3 people.
- Ian Payton to work directly with these people to:

(a) Obtain the datasets required from the offices of Fiji Hardwood and Fiji Pine, should this prove necessary.

(b) Calculate a carbon stock estimate for the above-ground live and below ground pools in Fiji forests.

Resources required

The table below lists the tasks and estimated time required to complete them. There will also be travel and accommodation costs for the period that Ian Payton is in Fiji.

Task	Time	Persons	Place
1. Collate datasets, and determine the best means of using them to derive a carbon stock estimate	2 weeks	1 (Ian Payton)	New Zealand
2. Calculate a carbon stock estimate for indigenous forests, hardwood and pine plantations	3 weeks	1 (Ian Payton)	Fiji
	1 week	1 (biometrician)	New Zealand
	3 weeks	2-3 (forestry staff)	Fiji
3. Prepare a report that specifies the datasets obtained, the methods used, and the results produced.	2 weeks	1 (Ian Payton)	New Zealand

4.6 NATIONAL CARBON INVENTORY FOR FIJI FORESTS

This section lists the tasks that are required to build and refine the carbon stock assessment part of a national carbon inventory system for Fiji, and to underpin project-scale monitoring, reporting and verification. It is divided into two parts (indigenous forests, plantations) for the above ground live, below-ground, dead wood and litter pools. Carbon stocks in soil organic matter are discussed separately. Tasks are prioritized according to their importance to the inventory.

4.6.1 Indigenous forests

1. Sampling regime

- Ensure that the proposed PSP plot network provides adequate, objective coverage of the whole of the indigenous forest estate. This should include mangrove forests, which are not part of the current forest inventory. **[high priority]**
- Include the measurements required for dead wood and litter estimates in the PSP methodology. If this is not possible, devise another way of obtaining default values for these carbon pools. **[high priority]**
- Investigate the option of measuring the plot network on a 5 or 10 year cycle, with 10 or 20% percent of the plot network being measured each year. **[medium priority]**

- Document the plot methodology to be used for the national carbon inventory, including the processes to ensure quality data collection, and the archiving of the datasets. **[high priority]**

2. Wood density

- Develop a wood density database that includes density estimates for species contributing ≥ 5% of woody biomass in Fiji's indigenous forests. **[high priority]**

- Determine within-species variability in wood density for tree species contributing the bulk of the biomass (and therefore carbon) in indigenous forests. **[medium priority]**
- Document the methodology used to collect and analyze wood density samples, including the processes to ensure quality data collection, and the archiving of the data. **[high priority]**
- Develop decay-stage modifiers, to estimate carbon loss in decaying logs, for dominant tree species in indigenous forests. **[high priority]**
- Establish a series of trial plots to determine rates of decay in logs of dominant tree species. **[medium priority]**

3. Allometry

Develop Fiji-specific allometry for carbon estimation in indigenous forests. Ideally this will produce a generic allometric equation that can be used for indigenous forests. The fall-back position is an expansion factor[9]. **[medium priority]**

- Data for larger trees may be able to be sourced from a proposed forestry project that looks at what is removed and what remains after logging operations.
- Additional sampling would be required to ensure the allometry is applicable for smaller trees – i.e. stem sizes below the threshold for harvesting.
- Document (and preferably publish) allometry developed for Fiji's indigenous forests.

Establish an above:below-ground ratio for tree species in Fiji's indigenous forests. This requires the extraction and weighing of trees (including root systems) for a range of tree species and size-classes. On its own this piece of work would be an expensive exercise. In conjunction with other activities (e.g. road construction, removal of mining overburden) the increased accuracy this provides the national inventory may well justify the additional expenditure.
[lower priority]

[9] An expansion factor allows the use of a measured variable (e.g. log weight) to estimate a related but unmeasured variable (e.g. total above-ground biomass).

4.6.2 Hardwood and Pine Plantations

1. Sampling regime

- Establish a PSP network that provides adequate, objective coverage of the whole of the plantation estate. As far as possible, this should make use of existing plots. **[high priority]**
- Include the measurements required for dead wood and litter estimates in the PSP methodology. If this is not possible, devise another way of obtaining default values for these carbon pools. **[high priority]**
- Document the plot methodology to be used for the national carbon inventory, including the processes to ensure quality data collection, and the archiving of the datasets. **[high priority]**

2. Wood density

- Tasks and priorities as for indigenous forests.

3. Allometry

As previous stated, there is no reason to suspect that the existing allometry used to estimate biomass (and therefore carbon) in the main plantation species (mahogany, pine) isn't a good fit for Fijian stands. It would however be good practice to verify that this is the case. **[lower priority]**

- As for indigenous forests, data would ideally be sourced from logging operations, or perhaps from the salvage of cyclone-damaged stands.
- Additional sampling would likely be required to ensure the allometry is applicable for smaller trees – i.e. stem sizes below the threshold for harvesting.
- Document (and preferably publish) the verification of allometry used to estimate carbon stocks in Fijian plantations.

Establish an above:below-ground ratio for timber species in Fiji's hardwood and pine plantations. Tasks and priorities as for indigenous forests.

4.6.3 Soil Carbon

The detailed requirements for developing a New Zealand-type soil carbon model are discussed by Baisden et al. 2006[10]. The model is based on the IPCC default methodology[11] for estimating soil carbon stocks and change. However, consistent with good practice, the model uses country-specific data to estimate both carbon stocks at a given time (baseline soil carbon) and changes in carbon stocks resulting from major changes in land use. The system is based on the well-established paradigm[12] that there are known key factors (e.g. land use, climate, soil class) that together regulate carbon stocks.

The model calculates soil carbon stocks by estimating the land area and the average soil carbon stock associated with each combination (henceforth termed a 'cell') of soil, climate, land use, and topography. The land area associated with each cell is obtained by overlaying national spatial datasets of soil, climate, land use and topography (Fig. 10). The estimation of soil carbon values is obtained from a mathematical relationship between measured site-level soil carbon and the variables that define each of the cell types.

The model can be considered to consist of four key components:

- A calibration dataset that comprises representative sampled values of quasi-equilibrium soil carbon together with variables that determine soil carbon stocks – typically climate, topography, soil type and land use.
- A (regression) model that is able to describe the soil carbon values in the calibration dataset in terms of the variables that determine soil carbon stocks.
- Methods to extrapolate the resultant model across the landscape to regional and national scales, based on the model and spatial datasets used in the model, typically using a raster- or vector-based geographic information system (GIS).
- Independent datasets to validate the model, and its estimates of soil carbon.

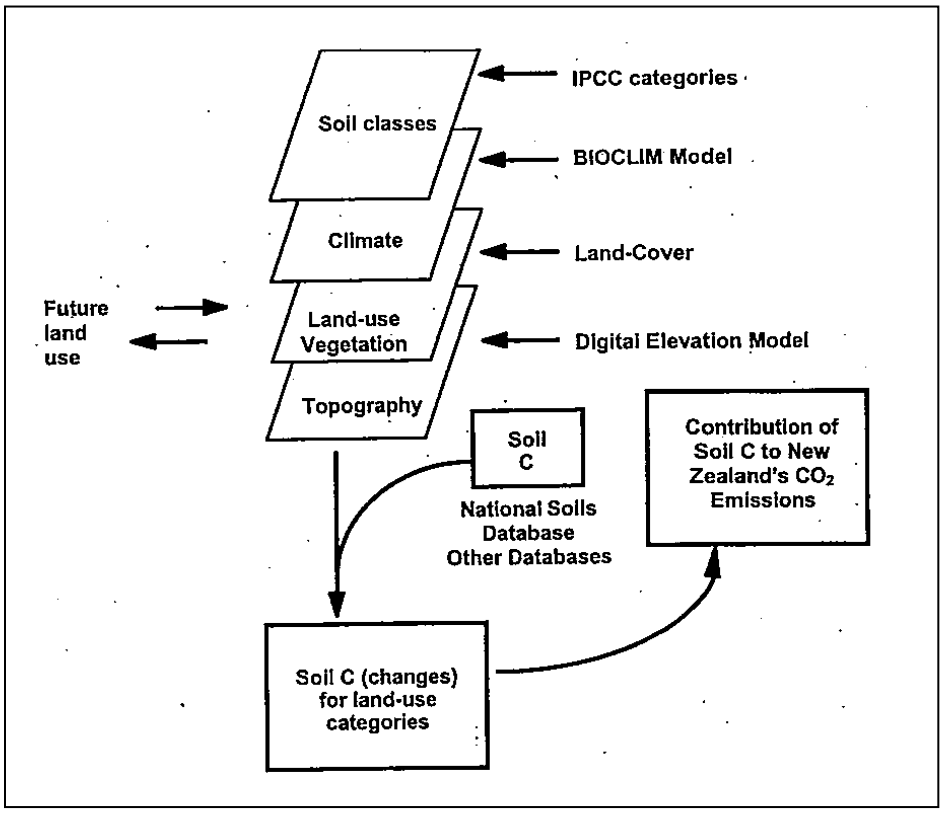
[10] Baisden, W.T., Wilde, R.H., Arnold, G., Trotter, C.M. 2006. Operating the New Zealand Soil Carbon Monitoring System. Landcare Research Contract Report LC0506/107, prepared for the New Zealand Ministry for the Environment, Wellington. 45 p.

[11] Intergovernmental Panel on Climate Change 2003. Good practice guidance for land-use change and forestry. IPCC Greenhouse Gas Inventories Programme: Hayama, Japan.

[12] An example is Parton, W.J., Schimel, D.S., Cole, C.V., Ojima, C.S. 1987. Analysis of factors controlling organic matter levels in Great Plains grasslands. Journal of the Soil Science Society of America 51: 1173 –1179.

In principle the process is very simple. In practice, there are a number of challenges. The chiefly relate to the lack of adequate national-scale datasets. For Fiji, the soil class, land use (i.e. vegetation cover) and topographic layers are available in a form that could be used to develop a soil carbon model. We have yet to determine whether sufficient data exist to derive a sufficiently robust climate layer. Data on carbon content are available for most soil types, but at this stage it is not possible to say how representative these are at a regional or national scale.

Figure 10. Conceptual approach used to estimate soil carbon stocks and changes in soil carbon resulting from land use change.



If it is decided to develop a soil carbon model for Fiji along the lines of the system used for national reporting in New Zealand, the first step would be to do a detailed analysis of what data are available, the additional data would need to be obtained, and the processes that will be used to develop, operate, and validate the model.

4.6.4 Frequency of National Forest Inventory

The National Forest Inventory currently recurs approximately every 15 years. A national forest carbon monitoring reporting and verification system will benefit from a more frequent national forest monitoring cycle. One way of approaching this is to establish a rolling inventory process where some work is being undertaken every year rather than the current process of undertaking a major forest inventory exercise every 15 years. An on-going (rolling) inventory has several advantages over periodic and widely spaced national forest inventories. These advantages include:

1. Constant maintenance of a skilled forest inventory human resource pool rather than training an inventory team every 15 years, undertaking an inventory, losing skills over time, and having to retrain for the next inventory
2. A rolling inventory process is often easier on funding streams as the costs are spread more evenly through time, rather than requiring a major funding injection every 15 years
3. A rolling inventory enables a constant (annual) updating of the national carbon stock calculation rather than having to wait a decade for the next update.

4.6.5 Project-Scale Carbon Inventory

The chief difference between project- and national-scale inventory is that the 'rules' are set by a different 'buyer'. Current national-scale inventory needs to adhere to the 'rules' set by the UNFCCC and outlined in the IPCC Good Practice Guidance Manual (IPCC 2003). Project-scale requirements will generally follow these guidelines, but will ultimately be determined by what the buyer requires. The REDD process can be expected to operate along similar lines.

Where forests are regenerating, project-based inventory will normally focus on those carbon pools expected to show most change as the result of a proposed management action. For example, the project-based inventory being developed to allow New Zealand land owners to participate in the carbon market will measure trees and shrubs (above ground live), use a multiplier to estimate the below-ground pool, use default values for dead wood and litter, and ignore changes in soil carbon stocks on the grounds that little change is expected over shorter (i.e. 5-10 year) timeframes.

Where the focus is on protecting existing carbon stocks, project-based inventory can be expected to focus on the carbon pools making the greatest contribution to the total carbon stock, and on those perceived to be most at risk. For mature forests this will normally be the trees.

The key requirement for project-based inventory is that it is compatible with the national inventory. Unless this happens it will not be possible to reconcile national reporting of carbon stocks with project-based units that are being traded in the voluntary or compliance carbon market.

4.6.6 Next Steps

The above Sections outline a series of tasks that are required to calculate an initial carbon estimate for Fiji forests, and to develop a national carbon inventory. As stated earlier, they are ranked (high, medium, lower) according to their importance to the inventory. Each is a discrete piece of work. Some (e.g. development of a soil carbon model) will require specialist expertise which will need to be sourced outside Fiji. Others are potential topics for post-graduate student dissertations.

The next step is to decide which of these tasks we wish to proceed with in the immediate future, develop a detailed work plan and costings for each, and seek out the resources (people, data, finance) needed to successfully complete them.

Part 5: Recommended Next Steps

	Recommended Immediate Next Steps	Lead Agency	Other Stakeholders Involved
1	Finalise and adopt the national REDD Policy	Forestry	GTZ/SPC
2	Undertake high priority institutional strengthening including a. strengthening the DNA by developing a means for Forestry to provide approval for forest sector carbon projects b. strengthening the DNA by requiring all carbon property right transfers to gain DNA approval (i.e. including voluntary carbon market) c. undertaking a carbon finance legal assessment, review and legislative drafting	Environment	Forestry, GTZ/SPC
3	Initiate pilot project/s following strategic cost analysis to identify most cost effective project types	Forestry	GTZ/SPC
4	Complete a national forest carbon data repository that gathers all relevant forest carbon data sets from different agencies into one location in a compatible format (see Section 3.9.1)	Forestry	SPC-SOPAC
5	Undertake forest area change assessment using remote sensing data to complete the national carbon stock and stock change assessment (see Section 3.9.2)	Forestry	SPC-SOPAC
6	Complete national forest carbon stock estimate for above ground live biomass pools in Fiji forests by gathering necessary data from Fiji Pine and Fiji	Forestry	GTZ/SPC

	Hardwood corporation and undertaking the necessary analysis (see Section 4.5)		
7	Submit completed Fiji R-PIN to the World Bank for peer review (minor editing still remaining)	Forestry	GTZ/SPC
8	Finalise governance structure for national REDD programme	Forestry	GTZ/SPC
9	Develop a national REDD communication strategy	Forestry	SPC
10	Make arrangements for Forestry Department representative and technical/policy advisor to attend the UNFCCC COP-15 in Copenhagen, and make improvements to internal government communications to enable Forestry Department participation at UNFCCC and UNFF REDD and forest sector technical and policy meetings	Environment	Forestry, GTZ/SPC
11	Design and begin to implement a Fiji REDD training programme	Forestry	GTZ/SPC, USP
12	Develop Strategic Action Plan complete with multitask project plan and budget for actions listed in this document but not covered by the immediate next steps listed in this table	Forestry	GTZ/SPC

Appendices

APPENDIX 1 CONSULTATION PROGRAMME

Appendix 1a Workshop Programme			
Thursday 27 August 2009 **Plenary**			
8.30	**REGISTRATION**	Secretariat	
9.00	**OPENING SESSION**		
	Opening prayer		
	Opening of Workshop - Permanent Secretary of Fisheries & Forests	Mr Viliame Naupoto	
	Opening remarks – Director, Department of Environment	Mr Epeli Nasome	
	Opening remarks - GTZ Chief Adviser	Dr Hermann Fickinger	
	Opening remarks – SPC Land Use and Resource Policy Adviser	Mr Inoke Ratukalou	
	Program & Introductions	Ms Christine Fung	
9:45-10:30	Morning Tea	Facilitation	
10:30-12:00	Forests, Climate & Carbon: Defining the task for a national REDD+ strategy for Fiji	Dr Sean Weaver	P1
12:00-1:00	Lunch	Facilitation	
1:00-1:45	Forest Monitoring Reporting Verification (MRV) Requirements & Country Capacity Building	Dr Martin Herold	P2
1:45-2:30	Building a Forest Carbon Monitoring Reporting and Verification System: Experiences from Annex 1 – NZ Case Study	Dr Ian Payton	P3
2:30-2:50	Vanuatu Experience	Dr Sean Weaver & Ioan Viji	P4
2:50-3:00	Arrangements for breakout groups	Dr Sean Weaver	
3:00-3:30	Afternoon Tea	Facilitation	
3:30-5:30	Suggested Breakout Groups (R-PIN) 1. National land sector development & environment priorities & challenges (Policy, goals and documentation) 2. Current and future drivers of forest carbon change 3. Who are the key REDD+ stakeholders and how could they be involved in a national REDD+ mechanism?	 Dr Ian Payton Dr Martin Herold Dr Sean Weaver	B1

Friday 28 August 2009 **Plenary / Thematic Sessions**			
	Policy Stream - Plenary venue Forest Carbon Monitoring Stream - Colo-i-Suva		
8:30-10:00	Report Back From Breakout Groups & Discussion	Rapporteurs & Consultants	P5
10:00-10:30	Morning tea	Facilitation	
10:30-11:30	Framing REDD+ Policy Goals: Options & Opportunities	Dr Sean Weaver	P6
11:30-12:00	Plenary Discussion on Fiji REDD+ Policy Goals	Dr Sean Weaver	P7
12:00-1:00	Lunch	Facilitation	
	Thematic Training Workshop Sessions Policy Stream - Plenary venue (a) Forest Carbon Monitoring Stream - Colo-i-Suva (b)		
1:00-2:00	**Policy Stream** REDD+ Policy training 1: Overview of options & issues - Weaver	**Forest Monitoring Stream** Forest carbon monitoring training 1: IPCC GPG & Monitoring Deforestation/Degradation - Herold	B2a B2b
2:00-3:00	**Policy Stream** REDD+ Policy training 2: Forest climate financing instruments - Weaver	**Forest Monitoring Stream** Forest carbon monitoring training 2: Forest inventory for national and project scale assessment - Payton	
3:00-3:30	Afternoon tea		
3:30-5:00	**Policy Stream (R-PIN)** • Current government strategy • Major programs & policies • What is needed to reduce deforestation and degradation in Fiji? • How to address main drivers? • Cross-sectoral components of Fiji REDD+ • Technical assistance already received and planned/proposed	**Forest Monitoring Stream (R-PIN)** • Detailed assessment of all existing national forest data sets for national forest carbon monitoring • Gap Analysis • Identify goals for national forest carbon monitoring, reporting & verification system	B3a B3b
Monday 31 August 2009 **Thematic Training Workshop Sessions**			
	Policy Stream – Studio 6 Forest Carbon Monitoring Stream - Colo-i-Suva		
8:30-9:30	**Policy Stream** Synthesis from Friday & clarification	**Forest Monitoring Stream** Synthesis from Friday & clarification	B4a B4b
9:30-10:30	**Policy Stream (R-PIN)** Stakeholder consultation assessment and strategy	**Forest Monitoring Stream** Forest carbon monitoring training 3: Remote Sensing	
10:30-11:00	Morning tea		

11:00-12:00	**Policy Stream (R-PIN)** Overcoming REDD+ strategy challenges	**Forest Monitoring Stream** Forest carbon monitoring training 4: Measuring forest carbon	B5a B5b
12:00-1:00	Lunch		
1:00-3:00	**Policy Stream** • Additional benefits of potential REDD strategy • Design training components for National REDD+ strategy (link to USP)	**Forest Monitoring Stream** Forest carbon monitoring training 4: Measuring forest carbon (field example)	B6a B6b
3:00-3:30	Afternoon tea		
3:30-5:00	**Policy Stream** • Scoping international policy engagement • Pilot project priorities • Institutional strengthening and program governance requirements	**Forest Monitoring Stream** • Determine strategy, timeline, and budget for achieving forest carbon MRV monitoring upgrade • Design and budget for training component of national forest carbon monitoring program	B7a B7b
Tuesday 1 September 2009 **Plenary**		Facilitation	
8:30-9:45	Report Back Policy & Discussion	Dr Sean Weaver	P7
9:45-10:30	Report Back Monitoring & Discussion	Dr Martin Herold	P8
10:30-11:00	Morning tea	Facilitation	
10:30-12:00	What types of assistance (technical, financial) will Fiji need to implement its REDD+ Strategy? • Stakeholder consultation • Developing reference scenario • REDD+ Program design & implementation • MRV	Weaver, Herold, Payton	P9
12:00-1:00	Lunch	Facilitation	
1:00-3:00	Potential next steps	Weaver, Herold, Payton	P10
3:00	Closing & afternoon tea		

Appendix 1b Consultation Programme		
DATE	**ACTIVITY**	**COMMENTS / TARGET GROUPS**
23/Aug **Sun**	• Arrival of Sean Weaver & Ian Payton • Meeting preparations	
24/Aug **Mon**	Arrival of Martin Herold	Remote sensing expert
	Introduction/briefing of consultancy and finalisation of work programme	• Department of Environment, Forestry Department, GTZ, and SPC • Meeting at national counterpart office
	Consultation meeting with the Forestry Department	Forestry Department HQ and Divisions
	Focussed meeting on carbon inventorying and remote sensing	Forestry Management Services Division (MSD) for remote sensing, Research Division/Timber Utilisation Division for carbon inventory
25/Aug **Tue**	Stakeholder consultation meetings for policy scoping	Forestry Department, Department of Environment, NLTB, USP, Land Use, FAB
	Focussed consultations on remote sensing information with agencies and local experts	MSD, SOPAC, FLIS (Fiji Land Information System), Land Use, CI (Conservation International)
	Focussed consultations on carbon inventory information with agencies and local experts	Forestry Research Division, Timber Utilisation Division, USP Institute of Applied Sciences
26/Aug **Wed**	Continue stakeholder consultations	
	Assessment of resources and information (policy, remote sensing, carbon inventory)	
	Preparation for training workshop	
27/Aug **Thu**	**Scoping workshop on REDD** – remote sensing, carbon inventorying, strategic directions: Introduction to strategic framework components	One combined group

Appendix 1b Consultation Programme		
DATE	**ACTIVITY**	**COMMENTS / TARGET GROUPS**
28/Aug **Fri**	**<u>Thematic training workshop sessions</u>** – and gap analysis • Remote sensing • Carbon inventorying • National REDD Strategy	Expert groups Training locations with GIS facilities and wood measurement & processing (Nasinu utilisation?)
29-30/Aug	Assessment & Reporting & Preparation for training workshop	
31/Aug **Mon**	**<u>Continue training workshop</u>** on remote sensing and carbon inventory & gap analysis • Draft strategic plan for thematic area	Expert groups
	Parallel: Stakeholder consultation on REDD strategic framework	To include carbon trading technical team
01/Sep **Tue**	**<u>Continue REDD scoping workshop</u>** • Consolidation of thematic findings • development of draft strategic framework for REDD	Group recombines
	Departure of Martin Herold	
02/Sep	Follow up consultations and assessment on REDD strategic framework	
03/Sep	Assessment and reporting	
04/Sep **Fri**	Briefing session to national counterparts, SPC, and GTZ – present on preliminary findings; and next steps	Focal agencies: Forestry Department, Department of Environment, NLTB, Carbon trading Technical Team
05/Sep	Departure of Sean Weaver & Ian Payton	

APPENDIX 2 LIST OF PARTICIPANTS

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APPENDIX 3 DEFINITIONS & INTERPRETATIONS

Additionality	The requirement that projects under crediting mechanisms such as the CDM would not have just happened anyway – i.e. in the absence of the credits generated by the mechanism (or the existence of the mechanism).
Afforestation (UNFCCC Definition)	"Afforestation" is the direct human-induced conversion of land that has not been forested for a period of at least 50 years to forested land through planting, seeding and/or the human-induced promotion of natural seed sources; See 'reforestation'.
Agroforestry	Agroforestry is a collective name for land use systems and practices in which woody perennials are deliberately integrated with crops and/or animals on the same land management unit. The integration can be either in a spatial mixture or in a temporal sequence. There are normally both ecological and economic interactions between woody and non-woody components in agroforestry"
Allowances	Terms sometimes used to describe *emission units* that are allocated in a *cap-and-trade* emissions trading scheme. Under a cap-and-trade system it is allowances that are traded – not trade in actual emissions.
Annex 1 Countries	Refers to 36 industrialised countries that, under the UNFCCC and similarly the Kyoto Protocol, would take on GHG emission reduction targets, over the period 2008-2012.
Annex B Countries	Refers to 39 industrialised countries that adopted the Kyoto Protocol. Annex B countries all agreed to targets in the first commitment period, 2008-2012. (However the US subsequently did not ratify the KP.).
Baseline	The business-as-usual scenario – i.e. the scenario of emissions or carbon stocks in the absence of an intervention designed to change the rate of emissions or rate of change in carbon stocks. This is commonly understood as the emissions or loss of carbon stocks in the absence of a project or program to reduce emissions.
Cap	The aggregate amount of 'allowed' emissions in a cap-and-trade type emissions trading scheme. This is the set environmental outcome. It often is the sum of the targets for those emitters (countries or firms) covered by the scheme.
Cap and Trade	A type of emissions trading scheme where a cap on emissions is established over a group of emitters, emissions units (sometimes called *allowances* or *certificates*) are issued and allocated, and these units may be traded between emitters.
Carbon	Substance composed of carbon atoms. Not to be confused with carbon dioxide (see 'carbon dioxide').
Carbon Accounting	A system of accounting that monitors carbon units in relation to carbon emissions.
Carbon Balance	The annual sum total of carbon emissions and sequestration within a given area (e.g. a project, sector, country, region, or globally)
Carbon Credits	A generic terms for units that are the result of a project based mechanism that provides 'credits' when emission reduction or sink removal actions result in the beating of a baseline.
Carbon Dioxide	One carbon atom and two oxygen atoms forming the gas CO_2. Carbon markets focus on carbon dioxide and carbon dioxide equivalents. Carbon units therefore are more accurately understood as units of carbon dioxide (allowance, emission avoided or

	sequestered)
Carbon Dioxide Equivalent	A means to compare greenhouse gases on an equivalent basis with carbon dioxide (CO_2).
Carbon Footprint	A measurement of net greenhouse emissions within a defined boundary (e.g. by individuals, firms, organisations, governments) – usually done as part of a *carbon neutral* or *Corporate Social Responsibility (CSR)* program.
Carbon Inventory	A system of measuring and monitoring carbon dioxide emissions and carbon stocks.
Carbon Market	A market instrument used in the context of emissions trading whereby carbon units are traded.
Carbon Neutrality	Where individuals, firms, organisations, governments (even countries) measure their *carbon footprints* (usually before and after taking measures to reduce emissions) and purchase offset credits to neutralise their residual emissions.
Carbon Offsets	A carbon unit that has been purchased to take responsibility for emissions that the buyer has not been able to eliminate from inside their own project boundary. The buyer is usually someone seeking carbon neutrality.
Carbon Pool	A system which has the capacity to accumulate or release carbon. Examples of carbon pools are forest biomass, wood products, soils, and atmosphere. The units are mass (e.g., t C)
Carbon Reservoir	A store of carbon or carbon dioxide somewhere in the Earth System. A standing forest is a carbon reservoir. If the forest is growing (i.e. sub-mature) then it is a carbon reservoir and a carbon sink. If the forest has reached maturity and is not growing then it is a carbon reservoir only. If a forest is degrading then it is a reservoir that is getting smaller and therefore a reservoir and carbon source.
Carbon Sequestration	See carbon sink.
Carbon Sink	The absorption of atmospheric carbon dioxide into a liquid or solid form. This moves the carbon dioxide from the atmospheric carbon pool to another (e.g. to the terrestrial or marine biosphere). Trees grow principally by means of photosynthesis which uses the sun's energy to combine carbon dioxide with water to produce sugar and oxygen. The carbon from the carbon dioxide is sequestered into a liquid form as sugar (sap). This is then either used by the plant in cellular respiration (to release energy for plant growth and development) or stored in the plant in the form of wood. The carbon in wood has come from the air. For this reason forests are able to absorb (sequester) atmospheric carbon dioxide.
Carbon Source	The release of carbon from a reservoir to the atmosphere, commonly in the form of carbon dioxide.
Carbon Stock	The volume of carbon contained in a carbon reservoir (e.g. in a forest or soil).
Carbon Units	A generic term for units that are created and traded in an emissions trading scheme.
CERs	Certified Emissions Reductions, the credits provided through *CDM* projects.
Clean Development Mechanism (CDM)	The mechanism provided by the Kyoto Protocol designed to assist developing countries in achieving sustainable development by permitting industrialized countries to finance projects for reducing greenhouse gas emission in developing countries and receive credits called *CERs* for doing so.

Climate Change Adaptation	Adapting to a changing climate. A necessary step for all countries given that all countries are committed to climate changes in coming decades and centuries irrespective of whether the global community is able to slow or eventually stop global warming.
Climate Change Mitigation	Addressing the cause of human induced climate change, commonly by means of reducing greenhouse gas emissions from sources and enhancing the removal of greenhouse gases by sinks.
Compliance Carbon Market	Carbon market instrument used as part of a regulatory regime where regulations impose binding obligations. The Kyoto Protocol established an intergovernmental compliance carbon market through the intergovernmental cap-and-trade system. Domestic emissions trading schemes have been established in many countries that impose binding obligations on domestic entities.
Deforestation (FAO Definition)	The conversion of forest to another land use or the long-term reduction of the tree canopy cover below the minimum 10 percent threshold.
Deforestation (UNFCCC Definition)	"Deforestation" is the direct human-induced conversion of forested land to non-forested land;
Degradation	The progressive loss of carbon stocks from a forest but not to the point at which it qualifies as 'deforestation.' This can include the removal of 80% of the forest canopy without a permanent change in land use.
Designated National Authority (DNA)	The national focal point for carbon trading through the Clean Development Mechanism. The DNA needs to approve CDM projects prior to approval by the CDM Executive Board. The DNA can also be used to provide a layer of nationally imposed quality assurance for Voluntary Carbon Market transactions if a country chooses to regulate voluntary carbon market activity.
Direct Barter	A form of Payment for Ecosystem Services involving the trade of value between two entities (e.g. two countries). Here the seller offers forest protection in exchange for a combination of values that may or may not include cash (e.g. trade deal, technology transfer, education & training, asset swap).
Drivers	Drivers refers to processes that cause something to occur. A driver of deforestation may be demand for agricultural land. A driver of reforestation might be demand for plantation timber.
Emissions	Greenhouse gas emissions. The principle greenhouse gas in the forest sector is carbon dioxide. Carbon dioxide emissions arise from the burning and decomposition of wood and vegetation.
Emissions Trading	A generic term for the trading of carbon units as part of an instrument designed to reduce carbon (or other greenhouse gas) emissions.
Enhancing Removals by Sinks	Carbon sinks sequester carbon dioxide from the atmosphere. There are many natural carbon sinks. Incentive payments from carbon markets or carbon financing is commonly only eligible for undertaking a management intervention that enhances the removal of atmospheric carbon dioxide by sinks. This is because incentive payments are not required for what nature would do anyway. Accordingly, management interventions seeking incentive payments need to demonstrate that the intervention enhances the rate of carbon sequestration by sinks. Examples of such interventions include a change in land use or a change in management practices.

Forest (UNFCCC Definition)	"Forest" is a minimum area of land of 0.05-1.0 hectares 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 metres 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 metres 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;
Forest Management (UNFCCC Definition)	"Forest management" is a system of practices for stewardship and use of forest land aimed at fulfilling relevant ecological (including biological diversity), economic and social functions of the forest in a sustainable manner;
First Commitment Period	The first management period of the Kyoto Protocol extending for the 5 year period of 1 January 2008 to 31 December 2012.
Greenhouse Gas	Trace gas capable of re-emitting infra red solar radiation, and has the effect of insulating the atmosphere (greenhouse effect). Greenhouse gases are a natural component of the Earth's atmosphere, without which the Earth would not be suitable for life. The addition of greenhouse gases to the atmosphere can amplify the greenhouse effect and contribute to global warming.
IPCC	Intergovernmental Panel on Climate Change. Made up of the world's leading climate scientists who undertake periodic comprehensive reviews of the published scientific literature on climate change in order to generate a scientific consensus view of climate change. The themes covered by the IPCC include the scientific basis of climate change, impacts, vulnerabilities and adaptation, and climate change mitigation (reduction of greenhouse gases).
Kyoto Cap	The collective cap on greenhouse gas emissions taken on by Annex B (developed) countries under the Kyoto Protocol.
Kyoto Protocol	A protocol of the United Nations Framework Convention on Climate Change (UNFCCC). This protocol is designed to reduce greenhouse gas emissions.
Leakage	A situation whereby the reduction of emissions by means of an emission reduction project in one location (e.g. forest protection), leads to the same volume or more emissions in another place (e.g. deforestation elsewhere).
LULUCF	Land Use, Land Use Change, and Forestry – a sector under the UNFCCC and Kyoto Protocol dealing with forestry and agriculture.
MRV	"Measurement, Reporting and Verification" or "Monitoring, Reporting and Verification". A greenhouse gas inventory at a national or project scale that enables an accurate measurement and monitoring of greenhouse gas emissions or carbon stocks and rates of change of these emissions or carbon stocks.
Non-Annex 1 Countries	Countries not listed in Annex 1 of the UNFCCC. This includes the developing nations that ratified the UNFCCC.
New Permanent Forest	Forests established on non-forested lands and maintained as permanent forest into the future. New permanent forest can include plantation forest that is intended for clear felling, provided the forest is replanted after felling and the land is maintained as forest land in perpetuity. Carbon stocks will rise and fall with the growing and harvest cycle and

	will remain higher (on average) than non-forest land that preceded it. Other forms of establishing new permanent forest include the re-establishment of natural forests through rehabilitation, where there is no intention to remove the forest in the future.
Payment for Ecosystem Services	Financial instrument designed to purchase or pay for an outcome that enables the continued production of an ecosystem service by an ecosystem
Permanence	The longevity of a carbon pool and the stability of its stocks, given the management and disturbance environment in which it occurs.
Points of Obligation	Entities that have been given binding obligations under an emissions trading instrument.
Post-2012	This refers to the period following the first commitment period of the Kyoto Protocol.
REDD	Reducing Emissions from Deforestation and Degradation
REDD+	REDD and afforestation/reforestation
Reference Level	The business-as-usual level of emissions or carbon stocks for a country or a project.
Reforestation (UNFCCC Definition)	"Reforestation" is the direct human-induced conversion of non-forested land to forested land through planting, seeding and/or the human-induced promotion of natural seed sources, on land that was forested but that has been converted to non-forested land. For the first commitment period, reforestation activities will be limited to reforestation occurring on those lands that did not contain forest on 31 December 1989;
Sustainable Forest Management (FAO definition)	The stewardship and use of forests and forest lands in a way, and at a rate, that maintains their biodiversity, productivity, regeneration capacity, vitality and their potential to fulfill, now and in the future, relevant ecological, economic and social functions, at local, national, and global levels, and that does not cause damage to other ecosystems.
UNFCCC	United Nations Framework Convention on Climate Change. Came into being in 1992 at the Rio Earth Summit. Ratifying nations meet annually in the Conference of Parties (COP) in December. The third COP was in Kyoto Japan and brought the Kyoto Protocol into being..
Voluntary Carbon Market	A generic term for carbon trading activities not associated with regulatory imposition of binding obligations. The voluntary carbon market focuses principally on carbon neutrality goals (see 'carbon neutrality') as buyers, and voluntary emission reduction or sink removal projects.
Voluntary Standards	Quality assurance standards in the voluntary carbon market. There are many different standards globally, some focusing on different voluntary carbon project types (e.g. Gold Standard focuses only on energy sector emissions reductions whereas the Climate Community and Biodiversity Standard focuses only on forest sector projects that protect biological diversity and local communities).

APPENDIX 5 SCOPING NATIONAL VS PROJECT-BASED APPROACH

	Advantages	Disadvantages	Solutions
National Scale	Technical knowledge and skills not yet sufficient, especially on village level Coordination and focal point at national level easier International standards required Preventing "carbon cowboys" Decrease leakage risk International buyers want national institution involved Drivers can be addressed more efficiently Access to funding Setting of standards and policies Clear policy and legal framework Understanding of international perspective Cost/benefit, economies of scale Security through government involvement National planning and zoning possible Cross sectoral approach possible, e. g. land zoning Lessons can be drawn from Drawa project More opportunity to be strategic in the management of a national programme	Less involvement of landowners So far no focal point Slow processes at national level (lack of institutional memory, staff turnover) Simplification for grass-root level necessary Dependent on good governance Relationship to land owners and local communities challenges Government doesn't have land, need to negotiate with landowners Government institutions "inflate" Overloading of stakeholders Private sector excluded National standards might not be effective, not flexible enough How to get everyone (stakeholders, different landowners) involved? Distribution of benefits difficult How effective are national policies for grassroots level? Stakeholder involvement crucial Landowners might not be happy with legislation/policies	Information sharing with communities essential Close ties with communities Strategy for stakeholder involvement More cross-sectoral consultation, from high level (permanent secretaries) to landowners Hybrid approach that combines advantages of a national approach but enables local participation

Hybrid	National focal point on national level necessary Benefits of national and project scale combined Approving authority necessary Engagement of more people, more participation	Difference in different units/levels of landownership Coordination necessary, no framework in place	Capacity building necessary Establishment of a coordination body Identify SFM projects (like Drawa) for continued cooperation 60% local 40% national
Project Scale	Regulation expensive Quick results Demonstrate that things move fast Ownership of landowners (they are the real decision makers) Project size depends on landownership Project developers come with funding Clear who are you are working with (actors and roles clearer) More flexibility Learning between landowners and project developers	Lack of coordination, reporting back to international level Lack of clear standards Creation of “isolated islands” which are not sustainable People taking advantage of landowners (“carbon cowboys”) How to solve disputes on project level? Alignment with national policies Less opportunity to generate economies of scale	Hybrid that links national approach with project based activities

APPENDIX 6 NATIONAL LAND SECTOR DEVELOPMENT AND ENVIRONMENT PRIORITIES

National land sector development & environment priorities & challenges				
1. Development				
Sector	**Priorities**		**Challenges**	**Documentation**
Forest	Permanent Forest Estates Plantation Forest Estates Forest Conservation (Protected areas) Sustainable supplies of forest services Increased employment		Involvement of stakeholders in implementation of SFM Resources both in capacity and funding	Forest Policy Statement NBSAP EMA
Agriculture	Food security Import substitution Export production & promotion	H3 H2 H1	Lack of land use plan Pest & disease Inconsistency of supplies Funding constraints Land Tenure system Development funds Conflict between traditional & commercial use of land	National rural land use policy of Fiji 2005 Agricultural ministry has annual business plans Agricultural Land & Tenants Act
Water Supply	Quality and quantity for agricultural and rural areas		Inconsistent delivery	Water Policy EMA 2005
Infrastructure	Road Water Ports Sewerage	H2 H1 H3 H3	Maintenance Lack of ports in outer islands Aging septic tanks, systems are very old which cause seepage into the sea, water systems. Lack of sewerage systems in tourism areas	NSDP Ministry of Works/Public Works Department Business Plan

	Bridges	H3	Saline water intrusion	
	Seawall	H3	Coastal erosion	
Tourism	Promotion	H1	Political situation	National Strategic Development Plan
		H2	Non-compliance &lack of enforcement	EMA
	Waste management	H3		
		H2	Insufficient funds	Tourism Master plan
	Diversification of tourism products		Insufficient investment	
			Coastal erosion	
	Increased Capacity/accommodation		Concentration of tourism in certain areas (carrying capacity)	
			Qoli-qoli issue (Fishing rights issue)	
Minerals	Gold	H1	Waste disposal issue (Physical & chemical)	Mining Act
	Water	H2		Environmental Management Act
	Copper	H3	Land and resource ownership	
	Bauxite	H3	Exploration	NLTA
	Manganese	H3	Environmental degradation	
			No legislature in relation to underground water	
Energy	Wind	H2	Increasing energy demand	Department of Energy Policy
	Water	H1	Lack of funding for development of infrastructure	NSDP
	Bio-mass	H1		
	Solar	H2	Lack of capacity	
	Reduce dependency on Fossil fuels	H1	Lack of legislation & policy	
	Decentralization of energy production			
Traditional Land use	Allocation of land		Development finance not available	NLTA
	Land reform		NLTA needs to be reviewed	Fijian Affairs Act

H1 = High priority number 1 ranking

H2 = High priority number 2 ranking etc.

National land sector development & environment priorities & challenges			
2. Environment			
Sector	**Priorities**	**Challenges**	**Documentation**
Forest	Conservation of forest bio-diversity, water catchment & soil fertility H1	Insufficient resources for enforcement Pressure from resource owners Awareness Antiquated laws	National Forest Policy Statement 2007
Water quality	Protection of catchment areas	Development catchment plans Water pollution (Point & Diffuse)	EMA
Water Supply	Public health	Capacity & Infrastructure	Public health Act National Water Quality Testing Laboratory
CC Adaptation	Changes in coastal processes	Loss of coastal vegetation due to development Increased dry periods Invasive species	EMA National Bio diversity strategic action plan for Fiji
DDR			
Others	Poverty Alleviation		EMA

APPENDIX 7 STAKEHOLDER SCOPING FOR NATIONAL REDD GOVERNANCE

Key REDD Stakeholders & Roles													
Agency	**Role**												
	Funder	Buyer	Regulator/ Policy	Seller/ Beneficiary	Technical capability	Training/ education / awareness	Communication	Quality Assurance	Facilitating participation	REDD Program Governance	Advisory	Affected Party	International relations
Regulatory													
	1	2	3	4	5	6	7	8	9	10	11	12	13
Cabinet													
NEC													
SDC													
Executive													
	1	2	3	4	5	6	7	8	9	10	11	12	13
Environment													
Forestry													
Agriculture (MPI)													
Fisheries (MPI)													
Mineral Resources													
Energy													
Lands													
Education													
T & C Planning													
Tourism													
Indigenous Affairs													
Finance													
Foreign Affairs													
Regional /Provincial													
	1	2	3	4	5	6	7	8	9	10	11	12	13
Tikina/Advisory Cncl													
Village Council													
Statutory bodies													
	1	2	3	4	5	6	7	8	9	10	11	12	13
NLTB													
GCC													
Fiji Trade & (FTIB)													
National Trust													
Tourism Fiji													

FAB													
FEA													
Water Authority													
Housing Authority													
Fiji Pine& Hardwood													
Private Sector													
	1	2	3	4	5	6	7	8	9	10	11	12	13
Fiji Saw Miller Assoc													
Logging Companies													
Carbon Buyers													
Project Developers													
Tourism													
NGOs													
	1	2	3	4	5	6	7	8	9	10	11	12	13
Fiji ENGOs													
Non-Fiji ENGOs													
Social Justice NGOs													
Research Education													
	1	2	3	4	5	6	7	8	9	10	11	12	13
USP													
FIT													
University of Fiji													
Schools													
Internat Uni /Res													
Faith Based Orgs													
	1	2	3	4	5	6	7	8	9	10	11	12	13
Christian Churches													
Hindu													
Muslim													
Other													
Landowners													
	1	2	3	4	5	6	7	8	9	10	11	12	13
Vanua													
Yavusa													
Mataqali													
Tokatoka													
VLRA													
Fiji Mahogany Trust													
Fiji Pine Trust													
Landowner Fore Co.													
Freehold Landowner													
State Land													
Donors													
	1	2	3	4	5	6	7	8	9	10	11	12	13
Multilateral Banks													

Local Donors													
Bilateral Donors													
Consultants													
	1	2	3	4	5	6	7	8	9	10	11	12	13
Local													
International													
Internat. Agencies													
	1	2	3	4	5	6	7	8	9	10	11	12	13
SPC													
(SOPAC)													
SPREP													
PIFS													
PI Private Sector Org													
Pacific Power Assoc													
FAO													
UN Agencies													
Media													
	1	2	3	4	5	6	7	8	9	10	11	12	13
Print													
Radio													
TV													

APPENDIX 8 SCOPING COMMUNICATION STRATEGY & GOVERNANCE STRUCTURE

	What	Who	How
Group 1	Producing CDs with presentations Reach teachers and community groups Radio programme. A national programme capable of explaining the concept of carbon trading in the forest sector and showing how landowners can participate, including what is possible and what is not possible Important to help landowners understand that this is not a carbon gold rush. It is important to clarify legal definitions concerning who is representing landowners and where their mandate comes from. It is important to avoid situations where people claim to represent landowners but who have vested interests, and sometimes do not provide accurate information to landowners. This needs to be better than the minimum legal requirement	Build on Fijian administration conduit: Workshop for Rokotui, they go out to the provinces and disseminate information, district reps bring information to villages Need a secretariat and this needs clarification Resource owners need to be able to participate Need understanding of REDD to flow from the top of government all the way to the grass roots in village communities	Secretariat with government reps. and resource owners and church representatives to implement communication strategy. Need for conceptualization, use the right language and stories. Translation of materials into Fijian. Use Fijian Administration in terms of governance of provincial offices: e.g. 14 Roko Tui to be trained (or assistant trained); then Roko disseminate information to district representatives; village level; return route for information via the same process for information from villages to government. Radio and other media need to be used Once people in villages understand the issue they will be able to participate in and support the national initiative Money need not be the driver of activities in the REDD sector
Group 2	Set of materials (fact sheets, videos) developed by a multi agency group.	Key agency to push REDD process including the communication strategy: Dept of Environment & Dept of	The communication strategy to go through the Fijian Administration all the way to the village level

	Different materials for different target groups (minister of finance, communities…) . Objectives have to be clear to avoid creation of false expectations. Regional perspective on REDD. Need to develop common messages for REDD with accessible materials including fact sheets, audio and video. It is important not to confuse landowners with different messages Start early and get the facts out to landowners early – this will help avoid raising unrealistic expectations among landowners Need a transparent line of communications across different government agencies to enhance integration and avoid policy conflicts & mismatches REDD is in many ways synonymous with a broader definition of sustainable forest management and SFM is already embedded in Fiji forestry policies and infrastructures but needs support for implementation	Forests, DNA, National Trust A multiagency group needs to develop the communication programme Forest Decree, Forestry Policy and REDD programme need to be controlled by the conservator of forests via the Forestry Board and up to the Minister. A communication and governance structure must come through the Conservator of Forests irrespective of what structure is actually adopted Forestry is the channelling body for Ministry of Finance decisions concerning activities and developments in a national REDD programme There needs to be a clear line of communication and governance to the NEC and the Carbon Trading Team It is important to find a way to link the Forestry Board with the National Environment Council in a national REDD programme There may be merit in including the independent services of a management services consultant to assist in the dissemination of information from the policy level to the grass roots	Key stakeholders in the strategy need to take messages to the village in the same team via the Fijian Administration The governance, management and communication components of the national REDD programme can be incorporated into the Corporate Plan for Forestry

Group 3	Focus on REDD+ Effective communications is crucial to good governance of a REDD programme Different messages need to be developed for different audiences in terms of the emphasis and the style of communication It is important for international information and policy developments to find their way to the grass roots in villages to enable villagers and forest owners to be informed of international developments that affect their resources.	DNA with steering committee (NEC could be the steering committee or collaborate closely). Secretariat with forest department. A Steering Committee, and a technical committee Forestry board as legal entity for decisions about forests has a role to play. Technical committee looking at technical issues. Communication and coordination committee for REDD with key stakeholders to ensure one common message.	Advisory council, non-indigenous Fijians have to be informed as well. Use existing structures as much as possible. Existing forestry structures are well suited to incorporating REDD as a policy variant on sustainable forest management and associated consultations and communications. The current forestry route to landowners is via the Fijian Affairs Board and the Native Lands Trust Board.

APPENDIX 9 DRIVERS OF FOREST CARBON CHANGE

Appendix 9a Monitoring Drivers of Forest Carbon Change

1. Monitoring of Forest Impact		
Processes that effect forest carbon stocks	**Current data**	**Suggested activity to fill data gap in the near term**
Forest conversion for expansion of agriculture (or biofuels)	Some data may be available with NLTB, FD & Ministry of Primary Industries, only tracked if commercially logged	1. Remote sensing based area / land use change assessment 2. Conversion of existing inventory data into carbon
Conversion of forest for settlement(squatters)/ tourism – especially in mangroves and including illegal settlements	Some data with Lands Dept & no data for squatters	1. Remote sensing based area / land use change assessment 2. Conversion of existing inventory data into carbon
Plantation clear-fell harvesting & replanting	Data available from forest companies, no government on tracking on when or where	1. Gather data on national level and evaluate data with remote sensing assessment 2. Conversion of existing harvest estimates into carbon
High intensity selective logging of native forests → remains native	SFM: data at GTZ, FD Local use (no data) Commercial use - data from the Forestry Department (spatial data and harvest estimates)	1. Gather data on national level and evaluate data with remote sensing assessment 2. Conversion of existing harvest estimates into carbon 3. Study long-term effects
Accidental burning that gets out of control & into forest	Fiji Pine has fire data for their plantation (pine).	1. Gather data on national level and evaluate data with remote sensing assessment 2. Targeted ground surveys
Forest clear-fell for mining prospects	Mining companies should have data or mineral resources division	1. Gather data on national level and evaluate data with remote sensing assessment
Protecting native forest for ecosystem services, etc. e.g. Sovi Basin	Forestry Dept, National Trust should have some data	1. Gather data on national level
Shifting cultivation – slash & burn – especially in dry areas	No data	1. Gather data on national level and evaluate data with remote sensing assessment 2. Targeted field/project surveys
Afforestation of talasiga land →pine forest for wood/chip production	Some data with Fiji Pine Ltd, future forests & FD	1. Gather data on national level and evaluate data with remote sensing assessment 2. Conversion of existing harvest/growth estimates into carbon
Afforestation with teak	Data with resource owner or future forests, and FD	1. Gather data on national level and evaluate data with remote sensing assessment 2. Conversion of existing harvest/growth

		estimates into carbon
Natural regeneration of expired agriculturally leased land e.g. Northern Division	No data, some data for expired sugar cane leases with Fiji Sugar Corp.	1. Gather data on national level and evaluate data with remote sensing assessment 2. Conversion of existing growth estimates into carbon
Increased vulnerability to cyclone damage/ fires/landslides etc. of degraded natural wet forest	No data	Hard to capture human impact

Shading key: Blue (source); White (sink)

Appendix 9b Drivers of Forest Carbon Change

REDD Response to Drivers				
Processes that effect forest carbon stocks	**Who is doing it and for what purpose**	**REDD Options (activity types)**	**Co-benefits**	**Ease**
Forest conversion for expansion of agriculture (or biofuels)	Landowners or lessees of land	Agroforestry A/R sink program, enhanced agricultural efficiency	High climate change Adaptation	Med
Conversion of forest for settlement(squatters)/ tourism – especially in mangroves and including illegal settlements	Developers and squatters	Potential carbon penalty and/or domestic offset	High climate change Adaptation	Low
Plantation clear-fell harvesting & replanting	Government owned Forestry companies	A/R Expansion & SFM	High timber industry	High
High intensity selective logging of native forests → remains native	Contractors commissioned by the forest owners or local communities – driven by market demand and/or local need for wood in village	Avoided degradation via SFM or forest protection	High biodiversity water	Med
Accidental burning that gets out of control & into forest	Farmers & arsonists	Fire control program	High	Low
Forest clear-fell for mining prospects	Mining companies	Mandatory Site Rehabilitation – potential carbon penalty/ offset	Med biodiversity	Low

Protecting native forest for ecosystem services, etc. e.g. Sovi Basin	Forest resource owners and Environment NGOs, drivers of eco-tourism	Avoided deforestation / degradation linked to sink program	High, water, biodiversity climate change adaptation	Med
Shifting cultivation – slash & burn – especially in dry areas	Local communities, increasing due to population growth and cash crops	Timber cash crops, agricultural efficiency	Med water, biodiversity, biomass energy	Low
Afforestation of talasiga land →pine forest for wood/chip production	Government initiative to benefit people	Sink program	High	High
Afforestation with teak	Private forest company, landowners/lessees planting an investment	A/R carbon project/ program	High economic & REDD link	High
Natural regeneration of expired agriculturally leased land	Landowner leaving land idle/fallow	A/R carbon program	High water, climate change adaptation, biodiversity	Med
Increased vulnerability to cyclone damage/ fires/landslides etc. of degraded natural wet forest	Quasi-natural process	None	n/a	Low

Shading Key: Blue (carbon source); White (carbon sink)

"High ease" is where there are few or no opportunity costs to address, where a program is ongoing (already established).