Pacific Forest Alliance Limited

April Salumei CCB Monitoring Plan

April Salumei Rainforest Preservation Project
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Project Overview

Background

The April Salumei Sustainable Forest Management Project is located within the district of Ambunti in the province of East Sepik, Papua New Guinea (Figure 1 and 2). The Project Area is currently subject to a Forestry Management Agreement (FMA). The FMA is a legal agreement between the landowners and the government and gives the government, through the PNG Forest Authority, the right to identify a project partner to harvest timber contained in the project area. The Forest Management Agreement (FMA) encompasses a total area of 521,000ha, with a production area of 177,200ha for designated logging and a net production area of 150,620ha.

The project achieved validation against the Climate, Community and Biodiversity standard on 12th June 2011. This document represents the monitoring plan to demonstrate the net climate, community and biodiversity aspects of the project.

Monitoring Plan Purpose

The purpose of the CCB monitoring plan is to demonstrate that the project is delivering its objectives to achieve net benefits to the climate, community and biodiversity of the region as a result of the project activities (Table 1). Monitoring the project implementation will enable the objective assessment of project components success and the identification of gaps and inefficiencies. This information can then be used to improve implementation, monitoring and management of the project in subsequent years.

Monitoring Approach

Monitoring of Climate, Community and Biodiversity indicators in this plan are conducted through both Top-Down Assessment and Bottom-Up Assessment.

Top-Down Assessment: Remote Sensing

Remote sensing techniques will be employed to assess detectible landscape scale changes in the project area. Both low and high resolution images will be assessed to detect changes in the project region related to indicators such as land cover changes, infrastructure development, fires and leakage. Changes at this scale are most likely detectable over a longer (12 month) temporal scale and as such this analysis will take place annually with the results being collated into a 5 yearly CCB monitoring report.

Bottom-Up Assessment: Ground Surveys

Ground surveys will be conducted to gather information from both the forest areas and the communities. Ground surveys may fall under the following categories:

- Routine Field Patrol
- Incident Based Non-Routine Patrol
- Annual Field Monitoring Event

Each field patrol requires completion of a field sheet or survey. Routine field patrols will be conducted by the Climate, Community and Biodiversity Stewards and reported to the Superintendent. Incident based non-routine patrols will be also be completed by the stewards, however the reporting will instigate the adaptive management procedures.

The superintendent will combine both the routine and incident reports with the annual monitoring events to develop the annual report. Finally these annual reports will be compiled into the 5 yearly report to the CCB.

**Monitoring Frequency**

The monitoring of indicators for net climate, community and biodiversity benefits is an ongoing and permanent job for the Climate, Community and Biodiversity Stewards. Whilst the monitoring is designed to report net benefits of the project activities to the CCB on a 5 yearly reporting schedule; the monitoring is designed to assist in day to day and annual operational activities of the Project. As such the following reporting types are relevant to this plan.

**Immediate Reporting**
- Any conflict arising directly from the project activities.
- Any significant hardship caused to community group as a result of the project activities.
- Any damage to a culturally significant site.

**Annual Reporting.**
- Comprehensive report of all Indicators that is used to report to upper management and inform annual project planning.

**5 Yearly Report**
- Comprehensive report of all Indicators that is prepared and delivered for third party verification by a CCB verifier.

The likely/required reporting frequency is specified in the Monitoring Component Tables presented below for CCB Stewards (i.e. Climate Steward – Table 2, Community Steward – Table 3, Biodiversity Steward – Table 4).
<table>
<thead>
<tr>
<th>Focus</th>
<th>Objectives</th>
<th>Indicators</th>
<th>Fieldwork /Remote Sensing/ Survey/ Project Records</th>
<th>Monitoring Plan Section</th>
</tr>
</thead>
<tbody>
<tr>
<td>Climate</td>
<td>Carbon</td>
<td>CL1 Forest Cover</td>
<td>Field Work/Remote Sensing</td>
<td>Section 4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CL2 Forest Health</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>CL3 Leakage</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Social</td>
<td>CO1 Strength of working networks in communities</td>
<td>Survey</td>
<td>Section 5</td>
</tr>
<tr>
<td></td>
<td></td>
<td>CO2 Rights of men, women and youths</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>CO3 Relationships between communities and clans</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Human</td>
<td>CO4 Level of education</td>
<td>Survey/Project Records</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>CO5 Level of health services</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>CO6 Maintenance of community rights</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>CO7 Population</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>CO8 External Stakeholder Engagement</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Development</td>
<td>CO9 Infrastructure</td>
<td>Remote Sensing/Survey</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Financial</td>
<td>CO10 Level of business/employment</td>
<td>Survey</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>CO11 Income source</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>CO12 Asset ownership</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Natural</td>
<td>CO13 Food security</td>
<td>Survey</td>
<td></td>
</tr>
<tr>
<td>Biodiversity</td>
<td>Flora and Fauna</td>
<td>B1 Availability of natural resources</td>
<td>Survey</td>
<td>Section 6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>B2 Maintenance of ecosystem services</td>
<td>Field Work/Survey</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>B3 Integrity of natural communities</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>B4 Use and consumption of biodiversity</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>B5 Pressures and threats</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Table 1: Objectives and Indicators for the April Salumei Project*
Monitoring of Climate Aspect

Approach

A key feature of the April Salumei Climate Monitoring Plan is to employ spatial data and tools to systematically monitor land cover change in the project area and project buffer. Detection of change will trigger a land use change assessment and increased patrols in the vulnerable areas aimed at reducing impact on affected areas and identify at risk areas for more intense patrols.

Monitoring Components

There are two major indicators of climate monitoring: Forest Cover (CL1) and Forest Health (CL2) which are made up of eight components (Table 2).
<table>
<thead>
<tr>
<th>Indicator</th>
<th>Monitoring Component</th>
<th>Activity</th>
<th>Monitoring Frequency</th>
<th>Reporting Frequency</th>
<th>Fieldwork/Remote Sensing/Survey/Project or National Records</th>
<th>Resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>CL1</td>
<td>Boundary</td>
<td>Detect integrity of Project Boundary</td>
<td>Annually</td>
<td>5 yearly</td>
<td>Remote Sensing</td>
<td>ALOS 50m or Landsat 30m</td>
</tr>
<tr>
<td>CL1</td>
<td>Stratification</td>
<td>Land Cover classification</td>
<td>Annually</td>
<td>5 yearly</td>
<td>Remote Sensing</td>
<td>ALOS 50m or Landsat 30m + field data</td>
</tr>
<tr>
<td>CL2</td>
<td>Land change</td>
<td>Detection and area calculation of deforestation</td>
<td>Annually</td>
<td>5 yearly</td>
<td>Remote Sensing</td>
<td>Landsat 30m for detection plus targeted high resolution imagery (aerial or satellite with 1-5m resolution) as needed to support analysis and field surveys</td>
</tr>
<tr>
<td>CL2</td>
<td>Logging</td>
<td>Detection and area calculation of deforestation from by illegal logging</td>
<td>Continual</td>
<td>Immediate/5 yearly</td>
<td>Fieldwork/Remote Sensing</td>
<td>High Resolution Imagery (5m satellite)</td>
</tr>
<tr>
<td>CL2</td>
<td>Fire</td>
<td>Detection of fire ignitions, calculation of burn areas (deforestation associated with fire)</td>
<td>Continual</td>
<td>5 yearly</td>
<td>Fieldwork/Remote Sensing</td>
<td>MODIS imagery (1 km thermal band detects fires as small as 100m² and imagery is collected and posted daily)</td>
</tr>
<tr>
<td>CL2</td>
<td>Forest Carbon Stock</td>
<td>Field measurement of biomass indicators (i.e. species, height, DBH)</td>
<td>10 yearly</td>
<td>10 yearly</td>
<td>Fieldwork</td>
<td>Project Field Inventory Guide and Data Sheets</td>
</tr>
<tr>
<td>CL3</td>
<td>Leakage</td>
<td>New logging or land conversion permit activity within region of project</td>
<td>Annually</td>
<td>5 yearly</td>
<td>Fieldwork/Remote Sensing/National Records</td>
<td>Landsat 30m for detection plus targeted high resolution imagery (aerial or satellite with 1-5m resolution)</td>
</tr>
</tbody>
</table>
Monitoring of Community Aspect

Approach

The community benefits derived from the Project’s development objectives and goals are set to improve livelihood within the community. For this monitoring plan indicators shown in Table 3 will be monitored on an annual basis through a survey conducted by the Community Stewards in each village in the last quarter of each year. A report will be produced by the Project Superintendent every year and submitted to the Board to ensure consistency and transparency of the project.

Monitoring Components

There are thirteen major indicators of Community monitoring: Strength of working networks in communities (CO1), Rights of men, women and youth (CO2), Relationships between communities and clans (CO3), Level of Education (CO4), Level of health services (CO5), Maintenance of Community Rights (CO6), Population (CO7), External Stakeholder Engagement (CO8), Infrastructure (CO9), Level of business/employment (CO10), Income Source (CO11), Asset Ownership (CO12) and Food Security (CO13).
<table>
<thead>
<tr>
<th>Indicator</th>
<th>Monitoring Component</th>
<th>Activity</th>
<th>Monitoring Frequency</th>
<th>Reporting Frequency</th>
<th>Fieldwork/Remote Sensing/Survey/Project or National Records</th>
<th>Resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1</td>
<td>Strength of working networks in communities</td>
<td>Amount of travel to other villages</td>
<td>Annually</td>
<td>Annually / yearly</td>
<td>Survey</td>
<td>Individual Survey</td>
</tr>
<tr>
<td>CO2</td>
<td>Rights of men, women and youth</td>
<td>Fair contribution of work and involvement of women in commercial activities</td>
<td>Annually</td>
<td>Annually / yearly</td>
<td>Survey</td>
<td>Survey conducted by Community Steward</td>
</tr>
<tr>
<td>CO3</td>
<td>Relationships between communities and clans</td>
<td>Increase/decrease of Land disputes and relationship with neighbouring villages</td>
<td>Annually</td>
<td>Annually / yearly</td>
<td>Survey</td>
<td>Individual Survey</td>
</tr>
<tr>
<td>CO4</td>
<td>Level of Education</td>
<td>Increase in education level and attendance in school</td>
<td>Annually</td>
<td>Annually / yearly</td>
<td>Survey</td>
<td>Individual Survey</td>
</tr>
<tr>
<td>CO5</td>
<td>Level of Health Services</td>
<td>Increase in health and decrease in travel to health service provider</td>
<td>Annually</td>
<td>Annually / yearly</td>
<td>Survey</td>
<td>Individual Survey</td>
</tr>
<tr>
<td>CO6</td>
<td>Maintenance of community rights</td>
<td>Rights and position of village compared to other villages in project area</td>
<td>Annually</td>
<td>Annually / yearly</td>
<td>Survey</td>
<td>Individual Survey</td>
</tr>
<tr>
<td>CO7</td>
<td>Population</td>
<td>Monitoring of birth and death rates</td>
<td>Annually</td>
<td>Annually / yearly</td>
<td>Survey</td>
<td>Individual Survey</td>
</tr>
<tr>
<td>Indicator</td>
<td>Monitoring Component</td>
<td>Activity</td>
<td>Monitoring Frequency</td>
<td>Reporting Frequency</td>
<td>Fieldwork/Remote Sensing/Survey/Project or National Records</td>
<td>Resources</td>
</tr>
<tr>
<td>-----------</td>
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<td>----------------------------------------------------------</td>
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</tr>
<tr>
<td>CO8</td>
<td>External Stakeholder Engagement</td>
<td>Amount of research conducted and increase in capacity building and tourist activities in the area</td>
<td>Annually</td>
<td>Annually / yearly</td>
<td>5 Report</td>
<td>Pacific Forest Alliance report</td>
</tr>
<tr>
<td>CO9</td>
<td>Infrastructure</td>
<td>Road expansion and new settlements</td>
<td>Annually</td>
<td>Annually / yearly</td>
<td>5 Survey</td>
<td>Community Survey</td>
</tr>
<tr>
<td>CO10</td>
<td>Level of business/employment</td>
<td>Increase in business activities and income</td>
<td>Annually</td>
<td>Annually / yearly</td>
<td>5 Survey</td>
<td>Community Survey</td>
</tr>
<tr>
<td>CO11</td>
<td>Income source</td>
<td>New income sources since project start</td>
<td>Annually</td>
<td>Annually / yearly</td>
<td>5 Survey</td>
<td>Community Survey</td>
</tr>
<tr>
<td>CO12</td>
<td>Asset ownership</td>
<td>Increase in assets owned by village/families</td>
<td>Annually</td>
<td>Annually / yearly</td>
<td>5 Survey</td>
<td>Individual Survey</td>
</tr>
<tr>
<td>CO13</td>
<td>Food security</td>
<td>Increase in meals and changes in food supply</td>
<td>Annually</td>
<td>Annually / yearly</td>
<td>5 Survey</td>
<td>Individual Survey</td>
</tr>
</tbody>
</table>
Monitoring of Biodiversity Aspect

Approach

This project aims to have overall positive impacts on the high conservation values of forests. Project activities will eliminate logging and will protect and conserve the natural habitats and the flora and fauna they harbour, particularly the endemic species. Any degree of habitat degradation or fragmentation could result in a significant loss of endemic species or distinct species populations.

A biodiversity monitoring programme will be implemented, which will include regular data collections, assessments of existing and new threats to biodiversity and the local communities living within the Project area or nearby areas.

Monitoring Components

There are five major indicators of Biodiversity monitoring: Availability of natural resources (B1), Maintenance of ecosystem services (B2), Integrity of natural communities (B3), Use and consumption biodiversity (B4), Pressures and Threats (B5).
<table>
<thead>
<tr>
<th>Indicator</th>
<th>Monitoring Component</th>
<th>Activity</th>
<th>Monitoring Frequency</th>
<th>Reporting Frequency</th>
<th>Source of Information</th>
<th>Resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>B1</td>
<td>Availability of natural resources</td>
<td>Main food supply and location of required food</td>
<td>Annually</td>
<td>Annually</td>
<td>Survey</td>
<td>Individual Survey</td>
</tr>
<tr>
<td>B2</td>
<td>Water quality</td>
<td>Water chemistry</td>
<td>Monthly / Annually</td>
<td>Immediately / 5 yearly</td>
<td>Fieldwork</td>
<td>Water sampling and analysis kits</td>
</tr>
<tr>
<td>B2</td>
<td>Ecosystem disruption</td>
<td>(CL2 - Fire) Detection of fire ignitions, calculation of burn areas (deforestation associated with fire)</td>
<td>Immediately / Annually</td>
<td>Annually / 5 yearly</td>
<td>Field Patrols / Remote Sensing</td>
<td>Field patrols / MODIS</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(CL 2 – Logging) Detection and area calculation of deforestation from by illegal logging</td>
<td>Immediately / Annually</td>
<td>Annually / 5 yearly</td>
<td>Field Patrols / Remote Sensing</td>
<td>Landsat 30m for detection plus targeted high resolution imagery (aerial or satellite with 1-5m resolution) as needed to support analysis and field surveys</td>
</tr>
<tr>
<td>B3</td>
<td>Contiguous Forest Cover</td>
<td>(CL 2 – Land Change) Detection and area calculation of deforestation</td>
<td>Immediately / Annually</td>
<td>Annually / 5 yearly</td>
<td>Field Patrols / Remote Sensing</td>
<td>Landsat 30m for detection</td>
</tr>
<tr>
<td>B3</td>
<td>Exotic weed and pest dominance</td>
<td>Distribution and abundance of weeds and pests considered a threat</td>
<td>Annually / 5 yearly</td>
<td>Annually / 5 yearly</td>
<td>Fieldwork</td>
<td>Biodiversity Field Patrols</td>
</tr>
<tr>
<td>B3</td>
<td>Bird Species Abundance</td>
<td>Number of birds sited</td>
<td>Immediately / Annually</td>
<td>Annually / 5 yearly</td>
<td>Fieldwork</td>
<td>Biodiversity Field Patrols</td>
</tr>
<tr>
<td>Indicator</td>
<td>Monitoring Component</td>
<td>Activity</td>
<td>Monitoring Frequency</td>
<td>Reporting Frequency</td>
<td>Source of Information</td>
<td>Resources</td>
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<td>--------------------------------------------------------------------------</td>
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<td>-------------------------------</td>
<td>------------------------------------</td>
</tr>
<tr>
<td>B3</td>
<td>Mammal Species Abundance</td>
<td>Number of mammals sited</td>
<td>Immediately / Annually</td>
<td>Annually / 5 yearly</td>
<td>Fieldwork</td>
<td>Biodiversity Field Patrols</td>
</tr>
<tr>
<td>B4</td>
<td>Use and consumption of biodiversity</td>
<td>Hunting and fishing practices. Collection of forest for village use</td>
<td>Annually</td>
<td>Annually / 5 yearly</td>
<td>Survey</td>
<td>Individual Survey</td>
</tr>
<tr>
<td>B5</td>
<td>Infrastructure Development</td>
<td>New Roads/Ports/Villages</td>
<td>Annually</td>
<td>Annually / 5 yearly</td>
<td>Remote Sensing/Survey</td>
<td>Landsat 30m for detection Community Survey District Plans and Permit allocation</td>
</tr>
<tr>
<td>B5</td>
<td>Spatial Planning</td>
<td>New logging or land conversion permit activity within region of project</td>
<td>Annually</td>
<td>Annually / 5 yearly</td>
<td>Remote Sensing/National Records</td>
<td>Landsat 30m for detection Community Survey District Plans and Permit allocation</td>
</tr>
</tbody>
</table>
Reporting Project Implementation Performance

Monitoring and Reporting within the Project is based on a two Tier approach. The Project Superintendent is responsible for the immediate and annual reporting. Rainforest Project Management Limited will be responsible for collating all the data collected in the 5 yearly reports to the CCB standard. This operational structure is presented in Figure 1.

![Figure 1: Operational Monitoring and Reporting Delivery Structure](image)

Figure 1: Operational Monitoring and Reporting Delivery Structure
Adaptive Management

Monitoring of Climate, Community and Biodiversity aspects of this project are subject to an adaptive management process as described in Figure 2.

Figure 2: Control Plan for the April Salumei Project

In this system, monitoring activities are organized into two classes: Major Threats (Deforestation) and Moderate/Minimal Threats (Degradation). Firstly the monitoring of climate, community and biodiversity aspects is completed via remote sensing, surveys or patrols. The outcomes of these activities are formally reported by the Stewards to the Superintendent. A failure modes & effects analysis (FMEA) is conducted based on the monitoring reports and a resulting Risk Assessment Index is assigned to each possible “Failure Mode” (i.e. Fire, Logging, Agricultural Conversion, Reduction in health facilities etc.).

In response to a potential failure mode, corrective action plans (CAPs) are created between the superintendent and the stewards. These CAPs inform ant necessary revision of the field standard operating procedures (SOPs), thereby closing the loop and implementing a system of continuous improvement through a “learn by doing” adaptive management process.

If the monitoring and reporting process identifies indicators experiencing a net loss in the project area, then the following decision tree (Figure 3) is to be used to provide support in finding solutions to the issue.
The Board of Trustees and Rainforest Project Management are committed to working together to investigate issues and find appropriate solutions.
Appendix 1 – Remote Sensing Guide

This procedure outlines the approach for monitoring the following parameters:

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Monitoring Component</th>
</tr>
</thead>
<tbody>
<tr>
<td>CL1</td>
<td>Boundary</td>
</tr>
<tr>
<td>CL1</td>
<td>Stratification</td>
</tr>
<tr>
<td>CL2 / B3</td>
<td>Land change</td>
</tr>
<tr>
<td>CL2 / B2</td>
<td>Logging</td>
</tr>
<tr>
<td>CL2 / B2</td>
<td>Fire</td>
</tr>
<tr>
<td>CL3 / B2</td>
<td>Leakage</td>
</tr>
</tbody>
</table>

Monitoring can be completed by applying the following 3 steps:

STEP 1. Selection and analyses of sources of land-use and land-cover (LU/LC) change data
STEP 2. Interpretation and analyses
STEP 3. Documentation

STEP 1: Selection and analyses of sources of land-use and land-cover (LU/LC) change data
Medium resolution remotely sensed spatial data shall be used (30m x 30m resolution or less, such as Landsat, Resourcesat-1 or Spot sensor data). In general, the same source of remotely sensed data and data analysis techniques must be used. If remotely sensed data has become available from new and higher resolution sources (e.g. from a different sensor system) between monitoring periods then it is possible to change the source of the remotely sensed data. Equally if the same source is no longer available (e.g. due to satellites or sensors going out of service) an alternate source may be used. A change in source data may only occur if the images based on interpretation of the new data overlap the images based on interpretation of the old data by at least 1 year and they cross calibrate to acceptable levels based on commonly used methods in the remote sensing community.

The data collected and analysed must cover:

- The entire project area: data shall be available for the year in which monitoring and verification is occurring
- The entire leakage belt, where required: data shall be available for the year in which monitoring and verification is occurring

Processing LU/LC Change Data
The remotely sensed data collected must be prepared for analysis. Minimum pre-processing involves geometric correction and geo-referencing and cloud and shadow detection and removal.
Guidance for interpretation of remote sensing imagery is given in the GOFC-GOLD 2008 Sourcebook for REDD and shall be followed as appropriate.

**Post-processing and accuracy assessment**

Post-processing is required to:

- Map area change detected in the imagery.
- Calculate the area of each category of change within the project area and, where required, the leakage belt.

For the calculation of each category of change:

a) At the end of each monitoring period:

Calculate the area of each category within the project area and, where required, the leakage belt. Update the Forest Cover Maps for the project area and leakage belt.

b) Estimating land-use and land-cover (LU/LC) change data in cloud-obscured areas:

Calculating the rate of deforestation when maps have gaps due to cloud cover is a challenge. Multi-date images must be used to reduce cloud cover to no more than 10% of any image. If the areas with 10% cloud cover in either date in question do not overlap exactly, then the rate should come from areas that were cloud free in both dates in question. This should be estimated in % per year. Then, a maximum possible forest cover map should be made for the most recent time period. The historical rate in % should be multiplied by the maximum forest cover area at the start of the period for estimating the total area of deforestation during the period. The overall classification accuracy of the outcome of the previous steps must be 90% or more.

**STEP 2: Interpretation and analyses**

**Monitoring deforestation**

This step will produce an estimate of the emissions resulting from any deforestation that occurs within the project area and leakage belt.

Many methods exist to detect and map deforestation using remotely sensed data. The method selected must be based on common good practice in the remote sensing field and will depend on available resources and the availability of image processing software. The same method should be used for the entire monitoring period. The key is that the method of analysis results in estimates of any deforestation that may occur in the project and leakage areas. See IPCC 2006 GL AFOLU, Chapter 3A.2.4 and the GOFC-GOLD 2008 Sourcebook for REDD for additional guidance.

The net carbon stock change as a result of deforestation is equal to the area deforested multiplied by the emission per unit area.

**Monitoring degradation**

As remote methods for monitoring degradation are not available at the time of methodology approval, the following ground-based methods must be used.
For the project area, the net greenhouse gas emissions resulting from degradation is equal to the sum of stock changes due to degradation through extraction of trees for illegal timber or fuelwood and charcoal, and extraction of trees for selective logging from forest management areas.

**Monitoring areas undergoing natural disturbance**

Fire monitoring frequency will be determined by the season and conditions of the Project Area. Both remote sensing and field patrol techniques will be employed. The Fire Information for Resource Management System (FIRMS) delivery of MODISA satellite maps will be monitored weekly in the wet seasons and daily in the dry seasons.

If burned areas are detected in the forest strata within the project boundary in the monitoring year, ge-referenced, high resolution aerial imagery or geo-referenced ground measurements will be collected and analysed over the burnt areas to record and calculate the area of fire scars. If these burnt areas were forest areas previously, this will result in a reduction of VCUs, if it was grassland or other non-forest land no deduction would be necessary.

Where natural disturbances occur in the project area, such as fire, that results in a degradation of forest carbon stocks, the area disturbed shall be delineated and the resulting emissions estimated.

The net carbon stock change as a result of the disturbance is equal to the area disturbed multiplied by the emission per unit area. In situations where the impact of disturbances on forest carbon stocks in a stratum varies spatially, the stratum may be further stratified based on post-natural disturbance carbon stocks.

For degradation through firewood/charcoal extraction only a proportion of baseline carbon stocks are removed from the forest in the baseline. The impact of the project on emissions from subsequent disturbance is therefore equal to the difference in stocks between the baseline before and after fuelwood harvest. Thus the delineated area of the sum of disturbance shall be proportionally reduced to reflect the less than complete impact of the baseline activity on available stocks to be disturbed in the baseline case.

**Monitoring Infrastructure Expansion**

This step will produce an estimate of the emissions resulting from any deforestation that occurs within the project area and leakage belt.

The net carbon stock change as a result of deforestation from infrastructure expansion is equal to the area deforested multiplied by the emission per unit area.

**STEP 3: Documentation**

A consistent time-series of data on land use-change, and emissions and removals of CO2 must emerge from periodic monitoring. This is only possible if a consistent methodology is applied over time.

The methodological procedures used in steps 1-2 above must be documented. In particular, the following information must be provided when remotely sensed data are used:

**Data sources and pre-processing**
Type, resolution, source and acquisition date of the remotely sensed data (and other data) used; geometric, radiometric and other corrections performed, if any; spectral bands and indexes used (such as NDVI); projection and parameters used to geo-reference the images; error estimate of the geometric correction; software and software version used to perform tasks; etc.

Data classification
Definition of the classes and categories; classification approach and classification algorithms; coordinates and description of the ground-truth data collected for training purposes; ancillary data used in the classification, if any; software and software version used to perform the classification; additional spatial data and analysis used for post-classification analysis, including class subdivisions using non-spectral criteria, if any; etc.

Classification accuracy assessment
Accuracy assessment technique used; coordinates and description of the ground-truth data collected for classification accuracy assessment; and final classification accuracy assessment.

Changes in Data sources and pre-processing / Data classification
If in subsequent periods changes will be made to the original data or use of data:
Each change and its justification should be explained and recorded; and
When data from new satellites are used documentation must follow a) to c) above
Appendix 2 - Biomass Field Inventory Approach

Purpose
The aim of this document is to outline Standard Operating Procedures (SOPs) for assessment of aboveground tree biomass, aboveground non-tree biomass and dead wood in tropical forests, for the purposes of estimating current forest carbon stock to be used as the basis of forecasting baseline and project carbon stock changes for REDD and IFM projects.

This document is to be used to ensure consistent measurement techniques for all EAS field staff and consultants. The document should be used for inducting new staff to the field team, and for existing EAS field staff to ensure they are applying the correct procedures.

Field Team
The field team for aboveground tree and non-tree biomass and dead wood sampling should be comprised of members that fall into two categories: the field measurement team and the advance trail slashing team. The field team positions for each crew and their responsibilities and required training are outlined in Table 4.

Table 3: Field team positions, responsibilities and required training

<table>
<thead>
<tr>
<th>Position</th>
<th>Preferred qualifications and training</th>
<th>Main tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field measurement team</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Team leader (x1 per crew)</td>
<td>Degree in forestry (or equivalent), and/or more than 2 years experience in implementation of forest inventory</td>
<td>Design of field inventory, coordinate logistics, check GPS coordinates of plot locations, direct transect location and trail cutting, supervise plot establishment and measurement, forest classification, train others in plot layout and field measurements</td>
</tr>
<tr>
<td>Forester/botanist (x 1 per crew)</td>
<td>Degree in botany or forestry (complete or near completion), prior training in forest inventory</td>
<td>Check GPS coordinates of plot locations, assist team leader in plot establishment, DBH, tree height and basal diameter forest inventory measurement, identification of tree species. More experienced field team members may also supervise local field crew</td>
</tr>
<tr>
<td>Local field crew (x 2)</td>
<td>On-the-job training, natural passion for field work but no prior qualifications required</td>
<td>Follow instructions from field team leader in plot establishment, DBH measurement, sample collection, establishment of campsites, transport of equipment</td>
</tr>
</tbody>
</table>
**Advance trail slashing team**
Local field crew (x2) | On-the-job training, no prior qualifications required | Cut trail along appropriate bearing, following team leader, tie flagging tape every 500m along the trail at each waypoint, establishment of campsites

**Camp Leader**
Local (x1) | On-the-job training, no prior qualifications required | Assist with setting up of camp, responsible for cooking and cleaning.

### Field Equipment
The field equipment listed in Table 5 is required:

Table 4: Field Equipment Checklist for each crew

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Purpose</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>3m Diameter tape (x 3)</td>
<td>Measurement of tree diameter (large trees)</td>
<td>Yamayo 3m Fibreglass Diameter Tree Tape</td>
</tr>
<tr>
<td>Measuring tape (x 1)</td>
<td>Measurement of plot boundaries</td>
<td>Komelon Fiberglass 50m measurement tape</td>
</tr>
<tr>
<td>Compass (x1)</td>
<td>Plot establishment</td>
<td>SILA</td>
</tr>
<tr>
<td>GPS (x 1)</td>
<td>Location of plots</td>
<td>GPS Garmin 62s</td>
</tr>
<tr>
<td>Satellite phone (x1)</td>
<td>Safety and communications</td>
<td></td>
</tr>
<tr>
<td>Laser distance meter (x1)</td>
<td>Measurement of tree height</td>
<td>Nikon Pro Laser</td>
</tr>
<tr>
<td>Camera (x1)</td>
<td>Photography</td>
<td>Nikon</td>
</tr>
<tr>
<td>Machete (x2)</td>
<td>Cutting of trail, testing of dead wood samples</td>
<td></td>
</tr>
<tr>
<td>First aid kit (x1)</td>
<td>Large Tropical Specific First Aid Kit</td>
<td></td>
</tr>
</tbody>
</table>

### Type of Sampling
The plots will be established along a straight line transect, targeting the measurement of carbon stocks in the identified forest strata.

Temporary plots are initially established, i.e. they are not designed to be re-measured as part of the long term monitoring program, although some may be targeted later for re-measurement.

A sufficient number of plots should be established to aim for an aboveground biomass estimate to be within 15% of the mean at the 95% confidence interval. The number of plots required per strata to target this confidence level should be determined using the Winrock Terrestrial Sampling Calculator\(^1\) combined with experience or expert opinion of the likely carbon stock and variance. This is the responsibility of the Team Leader.

### Determination of Plot Location

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\(^1\) Available at: [www.winrock.org/ecosystems/files/Winrock_Sampling_Calculator.xls](http://www.winrock.org/ecosystems/files/Winrock_Sampling_Calculator.xls)
Biomass plots should be located at 1km intervals along the transect. The location of the plots should be determined by the team leader and established on a map prior to commencing fieldwork. The GPS co-ordinates of each plot and the plot identification number should be established on field sheets prior to commencing fieldwork.

The plots should be established to the left of the transect line, using the transect line as one side of the plot.

If the plot cannot be measured, another plot located to the right of the transect line should be established. If the plot is located to the right it should be noted on the field sheet and the reason for the relocation noted.

Reasons for relocation include:

- Slope of the plot is greater than 30 degrees
- Plot extends into a water coarse
- Plot covers more than one forest strata
- Plot covers forest and non-forest land cover classes

If neither the left nor the right of the transect line is suitable then a new plot shall be established in the same forest type at either end of the transect.

**Loading Plots into the GPS**

The transect locations should be uploaded in the GPS, using the projection layer Geographic WGS 84. A plot location should be positioned every 1000m. The latitude and longitude of each plot should then be uploaded to the GPS and saved as a waypoint. For details on manual entry of waypoints to the GPS, and/or connecting the GPS to the computer, refer to the user manual for the Garmin GPSMAP 62s, page 5.

**Collection of Non-Forest Ground Truth Plots**

On route to the start of the transect, field team members should collect ground truth points for non-forest land uses that they are passing by, such as agriculture, grasslands, or plantations. These ground truth points will be supplied to the remote sensing consultant to help improve the land use classification. To take a ground truth point, walk approximately 200 metres into the land use, such that the surrounding land is homogenous for approximately 200m in each direction.

Observations to be recorded at each ground truth point include:

- GPS coordinates;
- Photograph of the vegetation (horizontal and crown cover), show GPS coordinates on photograph
- Vegetation classification
- Disturbance status (i.e. logged, primary, burnt etc); and
- Any other information worth noting (presence of roads, etc).
Locating Plots in the Field

The advance slashing team should cut a trail along the appropriate bearing in accordance with the transect locations pre-loaded to the GPS. A field crew member trained in use of the GPS should lead the slashing team to ensure the trail is cut along the correct bearing. At each waypoint (i.e. at each 1000m interval along the transect) the lead field crew member should place a piece of flagging tape on a stick to mark the location of the biomass plot.

Once the transect has been cut, the field measurement team should then be able to locate each plot by looking for the flagging tape. The field measurement team should also carry a GPS to check that the flagging tape is located in the appropriate location.

Plot Establishment

At each 1000m location the flagging tape should signal the location of the biomass plot. At this point a plot 20x20m in size will be established and all trees with DBH >10cm (10cm or greater) will be measured.

Upon reaching the plot location (indicated by the flagging tape), the field measurement team should undertake the following steps to establish the plot:

1. Using a compass, one field team member should sight a bearing that is 90 degrees perpendicular to the left of the transect.

2. Using a measuring tape, another field team member should walk a distance of 10 m along the 90 degree bearing from the transect line, and put a piece of flagging tape at the point. This will become one edge of the centreline of the plot.

3. Using the compass and measuring tape, measure out a further 10 metres from the marked centre line of the plot to create a plot ‘baseline’ (red arrow in Figure 4) of 20 m in length. Mark the plot corners with flagging tape. The transect line itself will make up one edge of the plot.

4. At the corner furthest from the transect line, measure 20 metres from the baseline at a bearing 90 degrees perpendicular to the baseline (green arrow in Figure 4) (or parallel to the transect line).

5. Put flagging tape at the 20 m point. Repeat this process at 90 degree angles to return to the transect line (blue arrow in Figure 4) to create a 20m x 20m square plot.
Figure 4: Design of Biomass Plot

Accuracy Requirements: The length of each side should be accurate to 0.5m.

Plot Measurements – Biomass Plots
The following measurements should be taken in the biomass plots.

Forest classification – ground truth point
The field team leader should identify the vegetation class that dominates the area around the plot location using the forest classification system for the location of the fieldwork.

OPTIONAL
The field team should also calculate the percentage canopy cover in the plot, in order to assess the disturbance class of the vegetation. This is done using the densitometer. Densitometer measurements should be taken by applying the following steps:

1. Look through the viewfinder of the densitometer and use the spirit level to make sure it is level;
2. Look at the proportion of light relative to leaves and branches shown in the viewfinder. To assist, the viewfinder is divided into quadrants.
3. Estimate the proportion of the viewfinder (%) that is taken up by leaves and branches. The guide below can be used to assist in canopy cover estimation.
Figure 5: Guide for estimation of forest canopy cover

A total of three canopy density measurements should be taken along the centreline of the plot, at the zero, 10m and 20m points, and the average canopy density of these three measurements will be used to allocate the forest to one of three disturbance classes:

1. Pristine forest (greater than 65% canopy cover)
2. Open forest (between 15 – 65% canopy cover)
3. Sparse forest (less than 15% canopy cover)

Diameter at Breast Height

All trees with a diameter at breast height (DBH) of 10cm or greater should be measured using a diameter tape. DBH is defined as 1.3 m from the base of the tree. A stick should be marked at 1.3m until the field crew is confident of measuring at 1.3m. Use Figures 6 and 7 as guides for correct tree measurement of DBH.

If trees are leaning, 1.3 m measurement should be taken from the underside of the tree (Figure 7a).

If the tree forks well below 1.3 m, both stems should be measured separately at 1.3 m (Figure 7b).

If the tree forks at 1.2 m or above, the tree should only be measured as one stem, below the fork (Figure 7c).

If the tree has buttresses or tree roots, the diameter should be measured at the point where the bole of the tree becomes cylindrical (typically around 50cm above the buttress or root). Note the measurement of tree buttresses may require climbing the tree.
Trees should be measured using a diameter tape only, not a measuring tape. This is done by encircling the tree with the tape, taking care to ensure the tape is horizontal all the way around the tree. Caution should be taken when measuring using the provided diameter tapes, as these tapes measure diameter on one side (i.e. the red number side) and metric length on the other (i.e. the black number side).

The field team should ensure they are measuring diameter using the RED number side. Care should also be taken to read the diameter measurements from the zero point of the tape, NOT from the metal loophole at the end.

Two field team members should be responsible for tree measurement; one team member should be responsible for recording the measurements. To minimise transcription errors, the person recording the data should repeat the diameter measurement aloud before noting it down. The person measuring the tree should then correct them if the measurement was not heard correctly.

Trees should be measured in a systematic manner, moving from one side of the plot to the other. The person recording the data should keep track of which trees have already been measured, to avoid trees being missed or measured twice. Where the forest is particularly dense, trees may to be flagged with flagging tape following measurement to denote that the tree has been measured.

Towards the edge of the plot boundary, it may not always be clear whether trees are ‘in’ or ‘out’. When in doubt, the team leader should use the laser distance finder from a marked plot edge,
perpendicular to the tree in question to determine whether it is in or out of the 20m plot. A tree is considered 'in' the plot if at least half of its trunk is inside the plot.  

**Accuracy Requirements:** DBH should be measured to 1 decimal place (i.e. 23.6 cm) and should be repeatable to within 0.5cm.

**Species identification**
Species of each tree above 10cm DBH must be identified by a trained botanist. If the botanist does not immediately know the genus and species of the tree, then foliage, bud and bark resin samples can be collected to facilitate identification of the species at a later date.

The species should be called out with the DBH measurement to the recorder and the recorder should repeat to ensure that it is correctly noted.

The sample should be bagged and labelled with the plot ID, field sheet tree number and DBH to facilitate completion of the field sheet once the species has been identified.

**Tree Height**
The height of each tree should be taken using the laser distance meter. The height of the tree should be taken by a person experienced in the use of the laser distance meter. Care should be taken that the heights are recorded correctly against the species and DBH measurements taken by other field crew members.

![Figure 8: Tree height establishment](image.png)
References


CDM Executive Board, A/R Methodological Tool “Estimation of carbon stocks and change in carbon stocks of trees and shrubs in A/R CDM project activities(Version 02.0.0)

VCS Approved Methodology VM0004. "Methodology for Conservation Projects that Avoid Planned Land Use Conversion in Peat Swamp Forests". Version 1.0


# Appendix 3 – Biomass Fieldwork Sheet

(Office Use: Name (person entering data)):

<table>
<thead>
<tr>
<th>Field team:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date of measurement:</td>
</tr>
<tr>
<td>Date of data entry:</td>
</tr>
<tr>
<td>GPS coordinates:</td>
</tr>
<tr>
<td>Name of strata:</td>
</tr>
<tr>
<td>Plot ID</td>
</tr>
<tr>
<td>Vegetation class/forest type:</td>
</tr>
<tr>
<td>Disturbance status:</td>
</tr>
<tr>
<td>Fire history:</td>
</tr>
<tr>
<td>Additional notes: Only standing trees will be measured</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Growth Stage A/D</th>
<th>Tree No.</th>
<th>Local name/species</th>
<th>DBH (cm)</th>
<th>Height (m)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Appendix 4 – Individual Questionnaire

### Individual CCB-Monitoring Survey

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Questions</th>
<th>Answers</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>C01</strong></td>
<td>How often do you travel to another village?</td>
<td>Less than 1x per month</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1x per month</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2-3x per month</td>
</tr>
<tr>
<td></td>
<td></td>
<td>More than 4x per month</td>
</tr>
<tr>
<td></td>
<td>What are the reasons?</td>
<td>Food</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Business</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Education</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Social</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Heath</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Other</td>
</tr>
<tr>
<td></td>
<td>How far on average do you travel to the next village?</td>
<td>½ day or less</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 day</td>
</tr>
<tr>
<td></td>
<td></td>
<td>More than 1 day</td>
</tr>
<tr>
<td><strong>CO2</strong></td>
<td>Do you consider your personal rights in your village as adequate/fair?</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>What would you change?</td>
<td>Explain</td>
</tr>
<tr>
<td></td>
<td>What share does the woman/man in the household contribute to family life?</td>
<td>Women%</td>
</tr>
<tr>
<td></td>
<td>W/M ration (e.g. 60%/40%)</td>
<td>Men %</td>
</tr>
<tr>
<td><strong>CO3</strong></td>
<td>How would you describe your relationship with the neighboring village?</td>
<td>Very Good</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Average</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Not good</td>
</tr>
<tr>
<td></td>
<td>Are you aware of any land disputes in your area? No/Yes</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>What do you think is the cause/s of these disputes?</td>
<td>Please explain:</td>
</tr>
<tr>
<td></td>
<td>Has the community changed over the last five years?</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>No</td>
</tr>
<tr>
<td></td>
<td></td>
<td>If yes, please explain</td>
</tr>
<tr>
<td><strong>CO4</strong></td>
<td>How often do you attend school per week?</td>
<td>1x per week</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2-3x per week</td>
</tr>
<tr>
<td></td>
<td></td>
<td>More than 3x per week</td>
</tr>
<tr>
<td></td>
<td>What’s your education level now?</td>
<td>None</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Primary</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Secondary</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Tertiary</td>
</tr>
<tr>
<td><strong>CO5</strong> Level of Health Services</td>
<td><strong>CO6</strong> Maintenance of community rights</td>
<td><strong>CO11</strong> Income Source</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>----------------------------------------</td>
<td>------------------------</td>
</tr>
<tr>
<td><strong>What level would you like to achieve?</strong></td>
<td><strong>How would you describe your current health?</strong></td>
<td><strong>What do you generate income from?</strong></td>
</tr>
<tr>
<td>None</td>
<td>Poor</td>
<td>Own business</td>
</tr>
<tr>
<td>Primary</td>
<td>Average</td>
<td>Trade</td>
</tr>
<tr>
<td>Secondary</td>
<td>Healthy</td>
<td>Employment</td>
</tr>
<tr>
<td>Tertiary</td>
<td>Other</td>
<td>Carbon Project</td>
</tr>
<tr>
<td><strong>What is stopping you from achieving your education?</strong></td>
<td><strong>What are your main health concerns/ diseases affecting you and your family?</strong></td>
<td><strong>How long does it take you to get to your nearest health center from your home?</strong></td>
</tr>
<tr>
<td>Money</td>
<td>Please explain</td>
<td>less than ½ day</td>
</tr>
<tr>
<td>Time</td>
<td></td>
<td>½ day</td>
</tr>
<tr>
<td>Opportunity</td>
<td></td>
<td>1 day</td>
</tr>
<tr>
<td>Motivation</td>
<td></td>
<td>more than 1 day</td>
</tr>
<tr>
<td><strong>How long does it take you to get to your nearest health center from your home?</strong></td>
<td><strong>How often do you visit a health practitioner?</strong></td>
<td><strong>Is your village 'better off' since the project commenced?</strong></td>
</tr>
<tr>
<td>less than ½ day</td>
<td>1x per month</td>
<td>Yes</td>
</tr>
<tr>
<td>½ day</td>
<td>2x per year</td>
<td>No</td>
</tr>
<tr>
<td>1 day</td>
<td>1x per year</td>
<td>Please explain</td>
</tr>
<tr>
<td>more than 1 day</td>
<td>never</td>
<td></td>
</tr>
<tr>
<td>B1 Availability of natural resources</td>
<td>Does your main food supply come from the immediate area?</td>
<td>Yes</td>
</tr>
<tr>
<td>-------------------------------------</td>
<td>--------------------------------------------------------</td>
<td>-----</td>
</tr>
<tr>
<td>Do you grow/collect your own food or do you buy it? (please show in % if necessary, e.g. 60% grown/40% bought)</td>
<td>Grow</td>
<td>Buy</td>
</tr>
<tr>
<td>What are the three main foods that you eat?</td>
<td>1.</td>
<td>2.</td>
</tr>
<tr>
<td>How much fish/meat do you eat per week?</td>
<td>1x per day / / / 1x per month</td>
<td>2-3x per week</td>
</tr>
<tr>
<td>B4 Use and consumption of biodiversity</td>
<td>What items do you collect from the forest?</td>
<td>Fire wood / or boats</td>
</tr>
<tr>
<td>Has this changed over the last five years?</td>
<td>Please explain</td>
<td></td>
</tr>
<tr>
<td>Do you hunt/fish for your food supply?</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Which types of animal do you hunt/fish for your food supply?</td>
<td>Please list</td>
<td></td>
</tr>
<tr>
<td>How often? (please fill in separate for fishing and hunting if necessary)</td>
<td>1x per day / / / 2-5x per week</td>
<td>1x per week</td>
</tr>
<tr>
<td>How far do you have to travel to hunt/fish?</td>
<td>½ day</td>
<td>1 day</td>
</tr>
<tr>
<td>Has the radius of your hunting/fishing area increased in the last 5 years?</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>
## Appendix 5 – Community Level Questionnaire

### Village CCB Monitoring Survey

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Questions and Answers</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CO7</strong> Population and Death</td>
<td>Age in years living</td>
</tr>
<tr>
<td></td>
<td>Age in years at death</td>
</tr>
<tr>
<td></td>
<td>0-1</td>
</tr>
<tr>
<td>Female</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td></td>
</tr>
<tr>
<td><strong>CO9</strong> Infrastructure</td>
<td>Have new roads been built in your area</td>
</tr>
<tr>
<td></td>
<td>since last survey?</td>
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<tr>
<td>Are they paved or non-paved?</td>
<td>Paved</td>
</tr>
<tr>
<td>What are the roads mainly used for?</td>
<td>Timber collection</td>
</tr>
<tr>
<td>How many hectares have been converted to agriculture since last survey?</td>
<td></td>
</tr>
<tr>
<td>Is there a need for more land for agriculture?</td>
<td>Yes</td>
</tr>
<tr>
<td>Has the number of villages in the project area increased/decreased in the last 5 years?</td>
<td>Increased</td>
</tr>
<tr>
<td>Level of business/employment</td>
<td>What are the main productive activities in your village?</td>
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<tr>
<td>----------------------------</td>
<td>------------------------------------------------------</td>
</tr>
<tr>
<td></td>
<td>How many families in the village have been developing new sustainable economic activities since the last survey?</td>
</tr>
<tr>
<td></td>
<td>How many men/women are involved in new sustainable commercial activities?</td>
</tr>
<tr>
<td></td>
<td>How many new community projects have been started since the last survey?</td>
</tr>
<tr>
<td></td>
<td>Have these projects been funded through money received from the April Salumei project?</td>
</tr>
</tbody>
</table>
Appendix 6 – Biodiversity Field Inventory Approach

This procedure outlines the approach for monitoring the following parameters:

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Monitoring Component</th>
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</thead>
<tbody>
<tr>
<td>B2</td>
<td>Water Quality</td>
</tr>
<tr>
<td>B2</td>
<td>Land Change</td>
</tr>
<tr>
<td>B2</td>
<td>Logging</td>
</tr>
<tr>
<td>B2</td>
<td>Fire</td>
</tr>
<tr>
<td>B2</td>
<td>Deforestation</td>
</tr>
<tr>
<td>B3</td>
<td>Exotic weed and pest dominance</td>
</tr>
<tr>
<td>B3</td>
<td>Bird Species Abundance</td>
</tr>
<tr>
<td>B3</td>
<td>Mammal Species Abundance</td>
</tr>
</tbody>
</table>

Monitoring can be completed by applying the following 3 steps:

STEP 1. Conduct regular field patrols and complete field sheets

STEP 2. Assess parameters using remote sensing

STEP 3. Documentation and Report

STEP 1: Conduct regular field patrols and complete field sheets

The following guidance is provided for various monitoring components

Water Quality

Monitoring of water quality is required on a monthly basis. Water quality monitoring should be conducted at strategic locations that can monitor catchment health. Locations will be selected based on risk of contaminants and should be located at the head, mid-point and mouth of tributaries entering the Sepik and April rivers.

Water quality monitoring should take place monthly and should include the following parameters:

- **Bacteria**
- **Biochemical Oxygen Demand**
- **Dissolved Oxygen**
- **pH**
- **Arsenic**
- **Temperature**
- **Total Suspended Solids**

The Water Quality field sheet should be completed, including noting any recent events such as rainfall, landslide, fish kills, or other obvious events that could affect the sample.
Logging
Logging events could be monitored in routine patrols or additionally notice of a logging event (i.e. from communities or remote sensing) could initiate an incident based non-routine field patrol. The logging event field sheet should be completed to estimate the scale of the loss.
The steward should record the location of the logging event (GPS co-ordinates if possible), number of stumps and the diameter and height of the stump that remain and where possible tree species. Additional information such as suspected use for timber, location to access points, proximity to villages, should all be recorded.
A logging event will lead to classification of the area as high risk areas that trigger high frequency patrols to avoid on going forest degradation that could lead to land use conversion.
The information gathered will be used to estimate the carbon lost from the logging event.

Fire
Fire events could be monitored in routine patrols or additionally notice of a fire event (i.e. from communities or remote sensing) could initiate an incident based non-routine field patrol. The fire event field sheet should be completed to estimate the scale of the loss.
The steward should record the location of the fire event (GPS co-ordinates if possible), an estimate of the area burnt, and severity of the fire. Additional information such as suspected source of the fire, location to access points, proximity to villages, should all be recorded.
A fire event will lead to classification of the area as high risk areas that trigger high frequency patrols to
• avoid on-going forest degradation that could lead to land use conversion.
• The information gathered will be used to estimate the carbon lost from the fire event.

Deforestation
Deforestation events could be monitored in routine patrols or additionally notice of a deforestation event (i.e. from communities or remote sensing) could initiate an incident based non-routine field patrol. The deforestation event field sheet should be completed to estimate the scale of the loss.
The steward should record the location of the deforestation event (GPS co-ordinates if possible) and an estimate of the area deforested. Additional information such as whether the deforestation was sanctioned or unsanctioned, known or suspected deforestation agent, purpose for deforestation, location to access points, proximity to villages, should all be recorded.
An unsanctioned deforestation event will lead to classification of the area as high risk areas that trigger high frequency patrols to avoid expansion of the deforestation.
The information gathered will be used to estimate the carbon lost from the fire event.

Exotic Weed and Pest Dominance
Monitoring of exotic weeds or pests will be conducted in routine field patrols. The identification of weeds and pests should be noted on the field patrol sheet. Areas identified as being disturbed (either through logging, fire or deforestation) should be targeted.
**Bird Species Abundance**

Monitoring of bird species will be conducted on routine field patrols. The type of identification (sound or visual) and the location of the identification should be noted on the field patrol sheet.

**Mammal Abundance**

Monitoring of bird species will be conducted on routine field patrols. The type of identification (sound or visual) and the location of the identification should be noted on the field patrol sheet.

**STEP 2: Assess parameters using remote sensing**

In addition to the regular field patrols, the following parameters are monitored using remote sensing techniques described in the Remote Sensing Guide.

- Land Change
- Logging
- Fire
- Deforestation

For guidance on how these aspects are monitored please refer to the Remote Sensing Guide.

The outcomes of the remote sensing are used to determine a net loss of forest cover, frequency of fires, and disturbance from logging to provide an assessment of biodiversity loss.

For land change a conversion of forest land or natural grassland / swampland to agricultural land would be a trigger for potential loss of biodiversity through fragmentation. Monitoring whether this activity is significant and in what pattern it is occurring (frontier or mosaic) should lead the assessment of significance if the activity is a direct threat to biodiversity.

Logging and fire activities should be monitored and reported as legal/illegal or natural events. The scale of these instances should be considered in the context of a biodiversity threat, such as scale, fragmentation potential, percentage loss of habitat, likely longevity of the disturbance.

**STEP 3. Documentation and Report**

The biodiversity stewards should report any disturbance to the Superintendent immediately using the field sheets. A Quarterly report should be developed for the Superintendent. These quarterly reports will be collated as an annual report to the Project Manager Rainforest Management Alliance (RMA), ultimately making an assessment of the threat to biodiversity and the net change in the biodiversity indicators.
## Appendix 7 – Biodiversity Fieldwork Sheets

### Water Quality

(Office Use: Name (person entering data)):

<table>
<thead>
<tr>
<th>Water Quality Patrol</th>
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</thead>
<tbody>
<tr>
<td>Name of Biodiversity Steward:</td>
</tr>
<tr>
<td>Date of Patrol:</td>
</tr>
<tr>
<td>Patrol Location (Water Collection Point)</td>
</tr>
<tr>
<td>GPS coordinates:</td>
</tr>
<tr>
<td>Disturbance status: (Pristine, Slight, Moderate, Severe)</td>
</tr>
<tr>
<td>Cause of Disturbance</td>
</tr>
<tr>
<td>Additional notes:</td>
</tr>
<tr>
<td>Water Parameters Measured (circle)</td>
</tr>
<tr>
<td>Results:</td>
</tr>
</tbody>
</table>


<table>
<thead>
<tr>
<th>Logging Patrol</th>
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<tbody>
<tr>
<td>(Office Use: Name (person entering data)):</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Logging Patrol</th>
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</thead>
<tbody>
<tr>
<td>Name of Biodiversity Steward:</td>
</tr>
<tr>
<td>Date of Patrol:</td>
</tr>
<tr>
<td>Patrol Type (circle)</td>
</tr>
<tr>
<td>GPS coordinates:</td>
</tr>
<tr>
<td>Track Log Number</td>
</tr>
<tr>
<td>Disturbance status</td>
</tr>
<tr>
<td>Likely logging Agent:</td>
</tr>
<tr>
<td>Sanctioned / Unsanctioned:</td>
</tr>
<tr>
<td>Distance to nearest village:</td>
</tr>
<tr>
<td>Distance to nearest access route:</td>
</tr>
<tr>
<td>Logging history:</td>
</tr>
<tr>
<td>Additional notes:</td>
</tr>
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<table>
<thead>
<tr>
<th>Stump No.</th>
<th>Species</th>
<th>Stump Diameter at Base (cm)</th>
<th>Stump diameter at top (cm)</th>
<th>Stump Height (cm)</th>
<th>Comments</th>
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Fire Patrol

(Office Use: Name (person entering data)):

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<td>Date of Patrol:</td>
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<tr>
<td>Patrol Type (circle)</td>
</tr>
<tr>
<td>GPS coordinates:</td>
</tr>
<tr>
<td>Track Log Number</td>
</tr>
<tr>
<td>Disturbance status: (Pristine, Slight, Moderate, Severe)</td>
</tr>
<tr>
<td>Likely Fire Agent:</td>
</tr>
<tr>
<td>Total Area Burnt (ha)</td>
</tr>
<tr>
<td>Distance to nearest village:</td>
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<tr>
<td>Distance to nearest access route:</td>
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<tr>
<td>Fire history:</td>
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Additional notes:

<table>
<thead>
<tr>
<th>Tree Number</th>
<th>Species</th>
<th>Dead / Alive</th>
<th>DBH (cm)</th>
<th>Height (m)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
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<tr>
<td><strong>Deforestation Patrol</strong></td>
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<td><strong>Deforestation Patrol</strong></td>
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<td>Name of Biodiversity Steward:</td>
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<tr>
<td>Date of Patrol:</td>
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<tr>
<td>Patrol Type (circle)</td>
<td>Routine</td>
<td>Incident</td>
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<tr>
<td>GPS coordinates:</td>
<td>Easting</td>
<td>Northing</td>
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<tr>
<td>Track Log Number</td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Disturbance status:</td>
<td>(Pristine, Slight, Moderate, Severe)</td>
<td></td>
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<tr>
<td>Likely Deforestation Agent:</td>
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<tr>
<td>Sanctioned / Unsanctioned:</td>
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<tr>
<td>Area Deforested</td>
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<tr>
<td>Distance to nearest village:</td>
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<tr>
<td>Distance to nearest access route:</td>
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<tr>
<td>Logging history:</td>
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<tr>
<td>Additional notes:</td>
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</tbody>
</table>
**Weed / Bird / Mammal Patrol**

<table>
<thead>
<tr>
<th>Weed / Birds / Mammals</th>
</tr>
</thead>
<tbody>
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<td>Name of Biodiversity Steward:</td>
</tr>
<tr>
<td>Date of Patrol:</td>
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<tr>
<td>Patrol Type (circle)</td>
</tr>
<tr>
<td>GPS coordinates:</td>
</tr>
<tr>
<td>Track Log Number</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Weed/Bird/Mammal</th>
<th>Species</th>
<th>Quantity</th>
<th>Heard, Seen, Track, Scat</th>
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