Terms of Reference

For

Preparing a Report of National Forest Inventory 2006 and Report of Permanent Sample Plot Measurements

1. Background

Fiji is implementing a series of activities as stipulated in the Readiness Preparation Proposal (R-PP) to prepare itself for the REDD+ (Reducing Emissions from Deforestation and Forest Degradation and forest conservation, sustainable management of forests and carbon stock enhancement) mechanism to harness potential benefits of REDD+ implementation in future. It has been envisioned that REDD+ implementation has the prospect to contribute to sustainable forest management including improvement of forest governance.

The Forest Carbon Partnership Facility (FCPF) is supporting Fiji to enable the country to participate in REDD+ processes and to harness benefits of the result-based payments (RBP) for REDD+. In order to implement REDD+, Fiji required to establish measurement, reporting and verification (MRV) within the existing National Forest Monitoring System (NFMS) that provide national estimates of changes in emissions and removals from forest resources that can be reported biennially. Forest resource inventory is an important basis for the design and implementation of NFMS.

In Fiji, three National Forest Inventories (NFIs) were conducted in the past. Assessing timber stock in the forest for logging was the main aim of the inventories. The most recent NFI was conducted in 2006. Analysis of NFI data is necessary to have detailed understanding of the forest dynamics and to serve the needs of forest monitoring system. However, analysis of NFI data was not completed for the NFI conducted in 2006. Therefore, preparation of a report presenting the analysis of NFI 2006 data is a priority.

Permanent sample plots (PSPs) provide data on forest growth and forest dynamics (status, condition, and trends). Fiji has established 84 PSPs in the forest area. The PSP were periodically measured (2010, 2012, 2014, 2016, and 2018) to record changes in the specified stand and tree attributes. All data collected are available in the database established at the Ministry of Forestry. However, analysis of the PSP measurements and estimation of biomass that meets precision and confidence interval requirements were not conducted. Therefore, analysis of the PSP measurement data is essential to understand forest growth dynamics and to support forest management initiatives.

2. Objectives

The objective of this assignment is to analyze the NFI 2006 and PSP measurement data ((2010, 2012, 2014, 2016, and 2018); and to prepare reports with the analysis of NFI and PSP data reflecting the status of Fiji forest resources.

3. Brief description of the NFI and PSP data

3.1 National Forest Inventory

For the NFI 2006, a sampling unit consisting of a cluster with 5 concentric plots was used. Each plot has three concentric circular plots with radius of 11.28 m, 5.64 m, and 1.78 m. The sample plots were not permanently marked so that they cannot be used for repeated measurements. A total of 1023 clusters were assessed. The main forest attributes recorded in the NFI 2006 were forest types (open and closed), forest function, district, province, beat, spatial location of a plot, diameter at the breast height (DBH), and tree commercial height. All trees having DBH ≥5 cm were recorded. A standard Operating Procedure of NFI is available at http://www.forestry.gov.fj/.

3.2 Permanent Sample Plots

The outermost plot has a size of 50 m x 50 m, DBH [cm], total tree height [m] and species are recorded on all living trees with DBH ≥ 25 cm. Two subplots having size 20 m x 20 m are placed at the east and west corner of the outmost square plot. On the two 20 m x 20 m subplots, DBH [cm], total tree height [m] and species were recorded on all living trees ≥ 5 cm and < 25 cm DBH. The plots are permanently marked so that repeated recordings at successive occasions are possible. A total of 84 PSPs were established in 2010. Five measurements (2010, 2012, 2014, 2016, and 2018) have been done until 2018. The data are recorded in MS Access format.

4. Methodology

Standard Operating Procedures exist for both NFI and PSP measurements. The consultant is expected to review the documents related to NFI and PSP prior to conducting analysis of NFI and PSP measurement data. The consultant is expected to use open source software for conducting statistical analysis of the data.

5. Scope of work and main responsibilities

The consultant will analyze the NFI and PSP data, and prepare reports. The consultant work program will include the following tasks.

Task 1. Analysis of data
The consultant will liaise with the REDD+ Unit and the Ministry of Forestry (MoF) to get access to the data. The consultant should share the data analysis to REDD+ Unit and the Ministry of Forestry to validate the analysis before writing the reports. Checks on data quality needs to performed to detect and correct errors in data.

The statistical analysis of data should cover plot and stratum level descriptive statistics of the inventory, diameter- height relationships, basal area, growing stock, increment, site index and other relevant inventory metrics

Task 2. Result report
The consultant is expected to prepare - Report on the NFI and PSP measurements.

(i) NFI 2006 Data Analysis Report

The reports should contain annexes which explain the software used, scripts used to analyze the data, and equations used to estimate volume and biomass. A detailed description of the methods and estimation procedures should be presented to ensure replication of the results of analysis. The consultant is expected to use open source statistical software as far as possible for the data analysis. The report or analysis should include maps, graphs, tables, and other illustrations to communicate the results of analysis in an effective way and to support the analysis.

The NFI report should include the following analysis;

- Historical background of Fiji's forest
- Description of the previous National Forest Inventories or assessments
- Description of sampling approach, sample frame and sample plot designs of NFI2006
- Description of method used for NFI data collection and sampling design of the NF
- Tree count by diameter classes, merchantable height classes, and tree species
- Forest attributes such as forest cover, basal area, volume, tree counts by strata District, Province, and Division
- Volume and biomass of upland and lowland forests differentiated with data from using Digital Elevation Model (DEM) as well as distinguishing the closed and open forests based on basal area/canopy cover measures.
- The growing stock in terms of volume and biomass should be presented with uncertainty estimates.
- Volume by diameter class, by merchantable height class, and by major tree species
- Gaps in the design and implementation of 2006 NFI recommendations for improving the design of future National Forest Inventory and data collection.

The consultant can consult the NFI 2006 team which is still working under the Ministry of Forestry for greater details if documented information related to NFI is not sufficiently available.

(ii) PSP Data Analysis Report
The PSP report should cover at least the following aspects;
- Background to the PSP Program
- Features of PSP measurements campaigns (2010, 2012, 2014, 2016, 2018) – common and consistent features of PSP measurement campaigns
- Description of sampling approach, sample frame and sample plot designs of PSP
- Data collected and methods used for data collection on PSP at measurement campaigns

- Descriptive statistics of sample plot measurement attributes
- Diameter-height relationships by tree species
- Volume and biomass increments measured at each measurement campaigns
- Gaps in the PSP sample plots framework and gaps in the data of measurement campaigns
- Recommendation to improve the design of PSPs
- Scope for integrating PSP sample frame with the REDD+ requirement

(iii) Capacity building of government Staff and other Stakeholders

The consultant will visit Suva and conduct a training to the government staff and other REDD+ relevant stakeholder on NFI and PSP data analysis and result. This will enable the government staff to produce similar kind of report in the future. The period of training will be a maximum of 5 days. The Ministry of Forestry will bear the cost of the training.

6. Time required

The estimated number of days required to complete the work is 42 days and the contract period is 10 weeks.

7. Deliverables

- Analysis and report on the National Forestry Inventory 2006. The report should be well referenced.
- Analysis and report on the Permanent Sample Plot Measurement. The report should be well referenced.
- Dataset of 2006 NFI used for statistical analysis.
- Datasets of PSP measurement 2010, 22012, 2014, 2016, and 2018 used for statistical analysis.

8. Payment schedule

SN	Deliverable	Percentage of total payment (%)	Payment (USD)
1	Draft report on NFI and PSP	50	
2	Final report on NFI and PSP and completion of the training	50	

9. Reporting arrangements

The consultant will report to Fiji REDD+ Unit and addresses to Mr. Viliame Rabici (viliamerabici@gmail.com), Dr. Narendra Chand (narendrachand@gmail.com), and Mr. Viliame Tupua (vtupua@gmail.com).

10. Consultant qualifications

The consultant will have the following qualifications;
- Advanced Degree in Forest Inventory, Forest Biometrics, Forest Science, Biology, Natural Resources or equivalent

- More than 5 years of experience in forest inventory and permanent sample plots
- Demonstrated knowledge and experience in forest statistics
- Strong skills on using statistical software packages
- Experience of working in the South Pacific Region specifically having knowledge of the vegetation of the region, previous work experience in the Fiji forestry sector is an advantage.
- Experience of writing such reports is an advantage

11.Selection procedure

A consultant will be selected using the World Bank's Selection of Individual Consultant method. For further details refer to the World Bank's <u>Guidelines: Selection and Employment of Consultants under IBRD Loans and IDA Credits & Grants by World Bank Borrowers</u>, January 2011 (Revised July 2014).

12. Contact

For further information on these terms of reference please contact:
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