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REDD and Climate Change Cell**

**REDD-Forestry and Climate Change Cell**

**Development of a Measurement, Reporting and  
Verification (MRV) System for Emissions and  
Removals**

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**Nepal's MRV System Management Architecture: Structure,  
Functions, Human Resources and Capacities**

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## **Acronyms and Abbreviations**

AFO:	Assistant Forest Officer
ANSAB	Asia Network for Sustainable Agriculture and Bio resources
BAU	Business as Usual Baseline
BZCFUGs:	Buffer Zone Community Forest User Groups
CBFM:	Community Based Forest Management
CBFMUGs:	Community Based Forest Management Users Groups
CCB	Country Capacity Building
CF:	Community Forest
CFI	Continuous Forest Inventory
CFOP:	Community Forest Operational Plan
CFUGs:	Community Forest User Groups
CoFM:	Collaborative Forest Management
COPs	Conference of Parties
CSO:	Civil Society Organization
DBH	Diameter at Breast Height
DBMS	Database Management System
DDC:	District Development Committee
DFO:	District Forest Office/Officer
DFRS	Department of Forests Research and Survey
DOF	Department of Forests
ESMF	Environmental and Social Management Framework
ESS	Environmental and Social and Safeguards System (ESS)
FAO	Food and Agricultural Organization of the United Nations
FAO FP	FAO Forestry Paper
FCPF	Forest Carbon Partnership Facility
DSCO:	District Soil Conservation Officer
FECOFUN:	Federation of Community Forest Users Nepal
FGD:	Focus Group Discussion
FMU:	Forest Management Unit
FRA	Forest Resources Assessment of Nepal Project
GHG	Greenhouse Gas Emissions
GIS	Geographic Information System
GLCN	FAO/UNEP Global Land Cover Network
GPG	International Panel on Climate Change: Good Practice Guidance
GPS:	Geographic Positioning System
ICIMOD:	International Center for Integrated Mountain Development
IPs:	Indigenous Peoples
IPCC	Intergovernmental Panel on Climate Change
LCCS	Land Cover Classification System
LhFUGs:	Leasehold Forest User Groups
M and MRV:	Measurement and Monitoring, Reporting and Verification
MIS	Management Information System
MRV	Measuring, Reporting and Verifying
NAFIMS	National Forestry Information Management System
NFCAG	National Forest Carbon Action Group
NEFIN:	Nepal Federation of Indigenous Nationalities
NGO:	Non-Government Organization
NORAD:	Norwegian Agency for Development Cooperation

PSP	Permanent Sample Plots
REDD	Reducing emissions from deforestation and forest degradation
REDD+	The REDD"+" is more than just avoided deforestation. It is tied to measurable and verifiable reduction of emissions from deforestation and forest degradation as well as sustainable management of forests, conservation of forest carbon stocks and enhancement of carbon stock
RL/REL	Reference Emission Level
R-PP:	Readiness Preparation Proposal
SLMS	Satellite Land Monitoring System
UNFCCC	United Nations Framework Convention on Climate Change
WISDOM	Wood fuel Integrated Supply and Demand Overview Mapping
WWF	World Wildlife Fund

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## INTRODUCTION

Measurement and MRV forms one out of four key functions within the national REDD+ architecture (Vatn and Angelsen, 2009). Establishing and operationalizing a national MRV system needs to build on the link between the country's REDD+ policy and the forest carbon MRV (Herold and Skutsch, 2009). This link between national REDD+ policy and the forest carbon MRV provides the basis for:

- Developing protocols and operationalizing technical units to gather/acquire and analyze the data related to forest carbon at national, sub-national and local levels (measurement and monitoring)
- Establishing and operationalizing a unit responsible for collection of relevant data in central database for national estimates and international reporting as specified in IPCC GPG including uncertainty assessment and improvement plans (reporting);
- Detailing out the measurement parameters for co-benefits, social and environmental safeguards and other monitoring parameters including roles and responsibilities at different levels of the system;
- Establishing an independent framework for verifying the long-term effectiveness of REDD+ actions at multiple levels and by different actors (verification);

The four major functions of a national MRV system are:

1. Measuring the changes in forest carbon stock at national level;
2. Evaluating the progress/performance of the country's national REDD+ strategy
3. Monitoring the periodic change in forest carbon stock and reporting; and
4. Monitoring the changes in forest carbon stock at a scale equivalent to where the payment is liable (e.g., payment at sub-national/project level and/or to a community engaged in REDD+ strategy implementation)

Vatn and Angelsen (2009) provide an indicative list of such tasks as follows:

- 1) Development of national standards in line with international protocols and GPG to measure changes in forest carbon;
- 2) Establishment of an independent national organization with required capacity to monitor and verify information;
- 3) Establishment of non-carbon MRV systems, including social and environmental safeguards;
- 4) Coordination and harmonization of carbon accounting and MRV systems across sectors and scales;

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- 5) Establishment of transparent and coordinated systems for managing information, and ensuring their availability in public domain for all stakeholders;
- 6) Reporting to the relevant national and international agencies and providing relevant information to actors in carbon market as appropriate;

The Department of Forest Research and Survey (DFRS) of the Government of Nepal (GoN) has been identified as the national implementing agency for MRV system in Nepal's R-PP. As envisaged, the prime responsibilities of DFRS will be:

1. Periodic execution of forest assessments for deforestation and degradation monitoring,
2. Design, maintain and operate National Forest Information Management System (NAFIMS),
3. Coordinate the collection of sub-national level information, and
4. Disseminate NAFIMS and MRV deliverables through a web portal.

DFRS will house the MRV institution of National REDD+ architecture and therefore, will need to build its institutional as well as technical capacities to manage, maintain and update the NAFIMS and MRV system in an effective, efficient and transparent manner.

## **1. PURPOSE**

This working paper has three-fold objectives:

- 1) Review the objectives, functions, organizational structure and staffing of the DFRS;
- 2) Propose refinements deemed necessary in the existing operational manual of DFRS;
- 3) Propose an appropriate MRV system management architecture from central down to district/local forestry governance unit level that provides an indication of structure, functions and functional relationships, human resources and capacities at each functional level.

## **2. DFRS OPERATIONAL MANUAL: EXISTING MANDATE, ORGANIZATIONAL FRAMEWORK AND HUMAN RESOURCES**

### ***2.1 Mandate***

As indicated in the operational manual 2004 of the DFRS, the **four main objectives** of DFRS to i) develop new technologies based on studies and research on issues related to forestry sector, ii) undertake inventories of national forests and maintain updated record, iii) provide forestry related studies and research services and iv) coordinate with relevant agencies. Accordingly, its **four major functions** are:

- 1) Updating and maintenance of forest inventory data for sustainable forest management;
- 2) Development and extension of appropriate technology for enhancement of the productivity of forests (both natural and plantation)
- 3) Development and extension of appropriate technologies for conservation, management and utilization of forest, wildlife and soil and watersheds
- 4) Communicating the results of studies and research in an effective manner to the target audience.

### ***2.2 Organizational Framework***

Led by a Director General (gazetted first class technical), DFRS has two divisions, i) Forest Research and ii) Forest Survey. Each division is led by one deputy director general (gazetted first class technical). The DFRS operational manual provides the objectives and key functions of all sections mentioned in the organizational structure. Terms of reference of all professionals from the director general down to the section heads of all sections in two divisions is elaborated in this manual.

**Forest Survey Division** is responsible for undertaking forest survey and inventory at national level once in 10 years. It is also responsible for forest inventory at district level for which it uses aerial photos, images obtained from remote sensing and field inventory approaches. It has six sections e.g., 1) (Cartography) Mapping, 2) Aerial photography, 3) Forest inventory, 4) Remote sensing, 5) Forest utilization and 6) Biometry. The former four sections are each led by one senior forestry professional (gazetted second class) and assisted by one junior forestry professional (one gazetted third class). Each section has two or more rangers (senior forestry technicians) as appropriate. The last two sections are each led by one junior forestry professional (gazetted third class and one ranger. Subject specific expertise is mandatory for staff in all sections.

**Forest Research Division** was established for research on i) enhancing forest productivity, ii) managing natural and man-made forests, iii) developing propagation technologies of multi-purpose and fast growing species and iv) site – species matching including v) socio-economic impacts on forests. It has six sections and five field units, one in each development region of Nepal's MRV System Management Architecture: Structure, Functions, Human Resources and Capacities

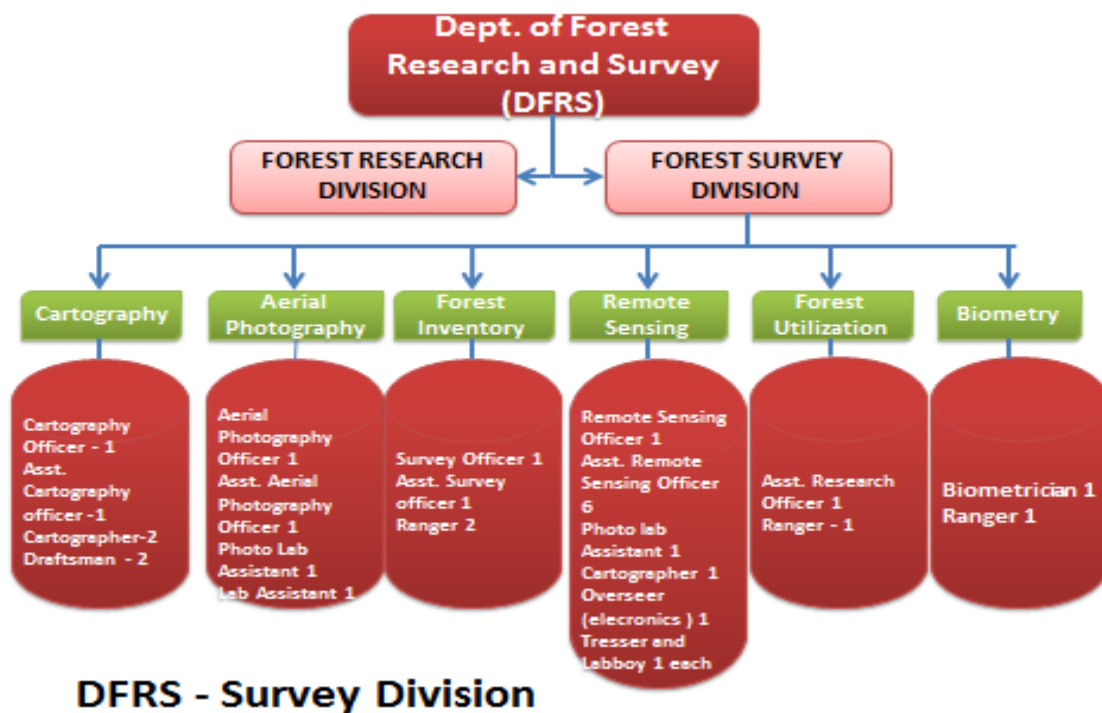


Nepal. The six sections are: 1) Plantation, 2) natural forest, 3) Agro-forestry, 4) Tree Improvement, 5) Soil and 6) Socio-economic. A senior forestry professional (gazetted 2<sup>nd</sup> class technical) leads each of these sections assisted by one junior professional (gazette 3<sup>rd</sup> class technical). Plantation and natural forest section has 2 and 3 rangers respectively and remaining sections except for soil section has one ranger each. Soil section has two lab boys. Each of the field units are led by one ranger (senior forestry technician) with one forest guard.

### 2.3 Existing Human Resources

Excluding the drivers and orderlies (5+4), the department has a staffing of 70, comprising 31 professionals and 39 mid-level technicians. Given Survey division will have to play the key role in operationalizing and maintaining the NAFMIS and MRV this working paper focuses on the Survey Division only.

The Survey Division has 16 professionals and 15 technicians including rangers. The chart below provides the type and number of human resources in different sections of the survey division.



### **3. REFINEMENTS DEEMED NECESSARY IN OBJECTIVES, FUNCTIONS AND OPERATIONAL MODALITIES OF DFRS AND SURVEY DIVISION**

Following refinements are deemed necessary in the DFRS Operational Manual:

#### ***Objective of the DFRS (1.2):***

- Refine the objective's bullet 2 and add: Periodic inventory of forest resources (using both remote sensing/GIS data and field validation) and maintenance, management and updating of NAFMIS
- Add one bullet - Maintenance, management and operationalization of the MRV system including planned gradual strengthening of the system based on procurement of improved technology, software and capacity.

#### ***Terms of Reference (ToR) of DFRS (1.3):***

- In bullet 1, after SFM add “and REDD/REDD+ related MRV purpose”
- Add one bullet “Maintain, manage and improve the MRV system and make it functional at central, sub-national and local government (DFO) level. This shall include enhancing the efficiency through procurement of technology and capacity of human resources.

#### ***3.1 Refinement proposed under Survey Division of DFRS***

- Once the FRA project has phased out, a major task of the DFRS will be to take over the NAFMIS developed by FRA and maintain, manage and upgrade it through procurement of most relevant technology and capacity in a planned manner.
- Another major task of DFRS as foreseen in Nepal's RPP will be to maintain and manage the central level MRV system, improve its efficiency and effectiveness through procurement of relevant technology and enhance of capacity of the human resources involved in a phased and planned manner.
- It should also establish, maintain and make operational the sub-national and local government level MRV system over time linked to the central level MRV system. Improve the efficiency and effectiveness of the sub-national and local government level MRV system through procurement of most relevant technology and enhance of capacity of the human resources involved in managing them at those levels.

Establishment of a Forest Survey and NAFMIS & MRV system Management Division should be considered as deemed appropriate by the MoFSC. In this case, the organization and management

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(O and M) study of this division could be done based on the functions to be performed by this division and accordingly the specific sections and required human resources could be proposed. This will mean that the existing survey division will be restructured to effectively undertake forest survey using both - the remote sensing and GIS technologies and further validation through field surveys and inventories.

#### **4. KEY TASKS FOR EFFECTIVE OPERATIONALIZATION OF MRV SYSTEM – THE MANAGEMENT ARCHITECTURE**

The MRV project’s Working Document No. 4 provides the MRV management architecture and IT platform for the central level. Building on the working paper 4, the structure and functions of central level MRV section under the NAFMIS and MRV division of DFRS is further synthesized in following section. Also the functions, human resources and structure of MRV at sub-national and district/local governance unit level is further elaborated below.

##### ***4.1 The Central level MRV Section<sup>1</sup>***

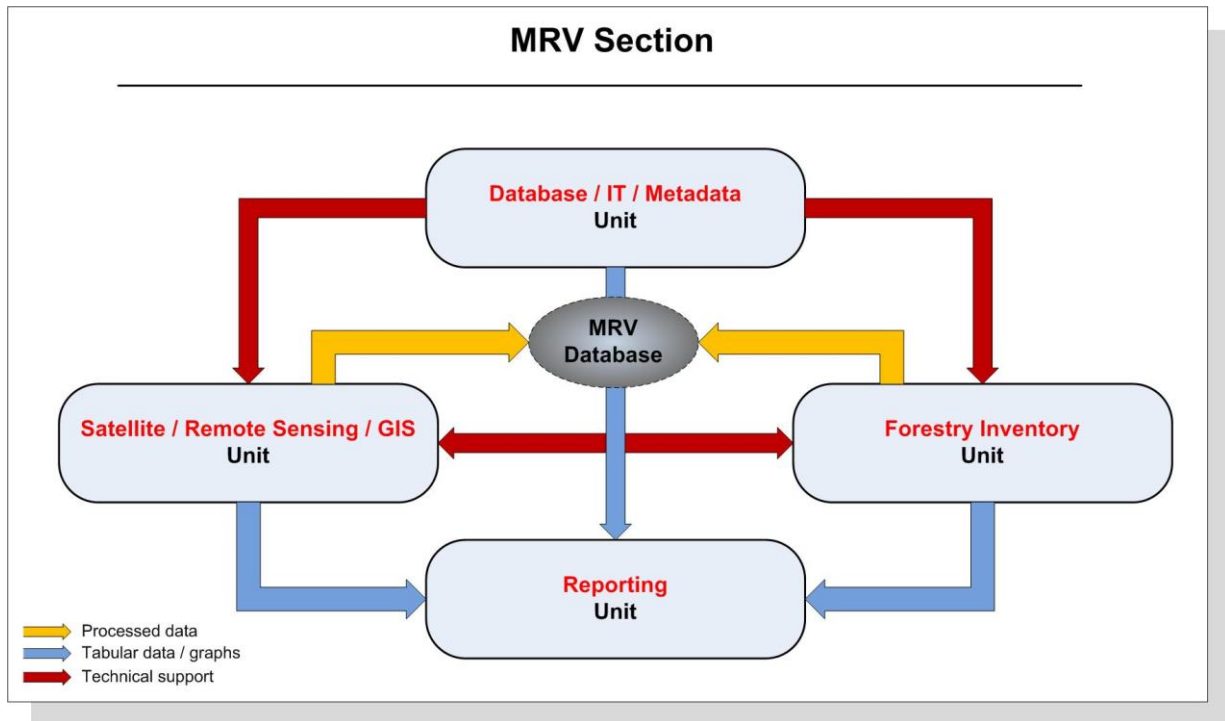
Under the Survey Division (which is most likely to have NAFMIS and MRV operationalization, maintenance and management responsibilities) of DFRS, a MRV section will be responsible for organizing all MRV related functions from national to sub-national and to district/local levels and managing the MRV professionals. This section will be coordinated by a MRV coordinator who will have dual reporting responsibility – reporting to the divisional head in DFRS and also to the REDD division in the MoFSC. MRV section will manage and maintain the MRV system and also promote data dissemination about the project(s).

MRV section will require four independent but closely connected units, namely

1. Database/IT/Metadata Unit
2. Satellite/Remote Sensing/GIS Unit
3. Forestry Inventory Unit
4. Reporting Unit.

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<sup>1</sup> Adapted from the working paper 4: MRV Management Architecture and IT Platform



**Figure 1: The MRV Section Management Architecture**

#### 4.1.1 The Database / IT / Unit (DBIT):

This is technically the core unit where 1 (one) System Administrator and 1 (one) DB Expert will work. The DB administrator will be responsible for managing and maintaining the MRV database structure (tables, relationships, keys) and assigning privileges and roles to different kind of users (public, editor, stakeholder, etc.), within the rules and protocols **defined by the MRV Division**. The System Administrator manages and maintains the IT web platform interface, server system, OS, firewalls, web services, connections and software updates as well as the Web Content Management. This DBIT unit provides support for graphs and tabular/aggregated data to Reporting Unit upon request.

#### 4.1.2 The Remote Sensing / GIS Unit (RSGIS)

RSGIS Unit will be responsible for image processing and analysis to produce Land Use/Land Cover classification layers and perform GIS editing and analysis. It will ensure data integrity in MRV database. It will undertake change detection in different forestry classes and categories using Multi-temporal satellite images, DEM and other ancillary data. Once LU/LC layers have been produced (and validated) they will be uploaded into the MRV database. The Unit is also responsible for REL and WISDOM data entry and spatial data integration in the MRV system and should be able to provide tabular data and graphs to Reporting Unit periodically on request.

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This unit will have 6 GIS/remote sensing experts and could also take advantage of technical support from the DBITMET and FORINV Unit for specific tasks.

#### *4.1.3 The Forestry Inventory Unit (FORINV)*

FORINV will be responsible for undertaking forest inventories nationally and coordinating inventories at sub-national district/local governance unit level (also integrated by FRZ data as and where applicable) to estimate GHG emissions using very specific algorithms and models applied to local data collected at district/local governance unit level. Once GHG estimates have been produced (and validated) they will be loaded into the MRV database. It will require 1 – 2 forestry experts for the management of this unit.

The Unit could also take advantage of technical support from the SATRSGIS and DBITMET Unit for specific tasks.

Graphs and tabular/aggregated data should be provided to Reporting Unit upon periodical requests.

#### *4.1.4 The Reporting Unit (REP)*

This Unit provides periodic standard MRV reports (consistent with the reporting requirements outlined in the UNFCCC guidelines<sup>2</sup>) for dissemination of aggregated data and information, collecting the necessary info by the other three Units.

Reporting is a key element of MRV as it provides the means by which, the country's performance is assessed against its commitment or reference scenarios in future REDD+ mechanisms. Hence, it provides the basis for assigning incentives. Human resources needed to manage this Unit is 1 REDD-MRV expert.

### **4.2 The Sub-National Level REDD Cell and MRV Section**

Sub-national level institutional and technical arrangements for REDD and MRV is of utmost importance for Nepal given the remarkable diversity in its forest conditions in different physiographic and development regions. Differences in nature, rate and intensity of impact of a range of parameters responsible for deforestation and degradation of forests also demands sub-national level REDD and MRV arrangements and this has been justified by adopting a nested approach for the country.

Under the policy and strategic guidance of the central level REDD division the sub-national MRV will remain integrated with the national MRV system. It will provide policy and

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<sup>2</sup> See the "MRV Manual", by FCMC (October 2013)

operational guidance for the implementation of MRV at CBFMU level and to REDD FMUs other than CBFMUs (e.g., government managed, collaborative, protected and leasehold forests). It will also oversee and guide the capacity building of various stakeholders and beneficiaries of REDD+ engaged in such projects. Its major technical functions will be i) coordination and implementation of forest inventory and field verification of GIS based forest maps produced from central MRV; ii) data processing and reporting to central MRV; iii) technical/capacity and other defined support at local project (FMU) level;

The sub-national level REDD MRV institution (could be called cell, section or unit) located in the sub-national or regional forestry office) will coordinate with and guide the district/local government level forestry institutions and also supervise and monitor their REDD and MRV related activities. It will be managed by a sub-national level REDD and MRV coordinator (a forestry expert) assisted by an IT/monitoring expert skilled at operationalizing the MRV related data base. Institutional and human resources capacity strengthening responsibilities at sub-national level will be taken care of by the relevant the Regional Training Centre and this will be coordinated by the already existing Regional Forestry Director/Directorate. The forest inventory unit of the central MRV will provide technical assistance to the Regional Training Centres to plan and organise the capacity building activities for all districts in sub-national level.

Human Resources requirements for sub-national level REDD and MRV Unit in this case would be limited to maximum 3, - 1sub-national REDD and MRV coordinator, 1 IT/MRV database expert and 1capacity building expert.

#### ***4.3 The District/Local Government Unit Level REDD and MRV Section***

The role of existing DFOs in working as the knowledge centre, official entry point of all sorts of information/data generated in course of REDD+ implementation and facilitating agency for effective REDD+ implementation at local CBFM and other FMU level has been well recognized by all stakeholders from national down to local level. Despite the fact that participatory approach to forest carbon measurement and monitoring is advocated by all stakeholders, the verification and validation of such data will have to be done by DFO prior to their entry into the national MRV database<sup>3</sup>. DFOs have presence down to the range post level and each range posts are responsible to provide forest protection and management services in tentatively 4 to 10 VDCs. Forest technicians located in range posts work closely with local communities promote CBFM as and where applicable.

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<sup>3</sup> DFRS exists at the central level and needs to coordinate with DoF and DFO for forest inventory and forest carbon measurement and recording at sub-national and district level.

At the DFO level therefore, a REDD and MRV section will need to be established with computer and internet based database management arrangements. Forest carbon measurement data from all CBFM units and other FMUs participating in REDD+ will have to be validated by the DFO, refined and entered in the database maintained there. For this purpose it will need a computer operator skilled at data entry, its maintenance and management in DFO. An adequate number of DFO field staff should be trained to work as a facilitator capable of providing technical assistance to local forest managers of CBFM and other FMUs as and when required. They might also need to create awareness and train the local forest managers involved in participatory forest carbon measurement activities.

Human resources required at DFO level will be at least two forestry technicians with additional knowledge and skills of IT and database maintenance/management. For facilitation and capacity building of local forest managers, at least 4 rangers and 8 forest guards should be trained on REDD and MRV related social and technical aspects.

#### ***4.4 Functional Relationships Along the Three Tiers of MRV System Governance Mechanism***

The national/central level MRV Section is overall responsible for all MRV related functions under the policy/strategic guidance of the REDD Division and technical guidance from the Survey Division of the DFRS. It will need to ensure that the sub-national level MRV system is well integrated with the national level. The central level MRV provides all technical/technological support, procures the human resources and builds capacities and infrastructure required for effective management and operationalization of the sub-national MRV. It also steers and supervises the Sub-national level MRV functions.

In addition to performing the MRV functions the sub-national MRV institution also provides the technical oversight, guidance and capacity support to the DFOs for effective and timely forest inventory, participatory forest carbon measurement, data entry and maintenance of database in DFO.