Participatory Monitoring, Measuring and Reporting (MMR) Guidelines, 2015

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Monitoring, Measuring and Reporting Guidelines for REDD+ Activities, 2015

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Abbreviation and acronyms

ACOFUN	Association of Collaborative Forest Users of Nepal
ANSAB	Asia Network for Sustainable Agriculture and Bioresources
BZ	Buffer Zone
CBFM	Community-Based Forest Management
CF/CFUGs	Community Forest/Community Forest User Groups
CIAA	Commission for the investigation of Abuses of Authority
CSO	Civil Society Organizations
DADO	District Agriculture Development Office
DBH	Diameter at Breast Height (i.e. 1.3 m from ground)
DDC	District Development Committee
DFO	District Forest Office/r
DFRS	Department of Forest Research and Survey
DLSO	District Livestock Service Office
DSCO	District Soil Conservation Office
FAO	Food and Agriculture Organization of the United Nations
FCPF	Forest Carbon Partnership Facility
FECOFUN	Federation of Community Forestry Users Nepal
FEPFOS	Federation of Private Forest Stakeholder Nepal
FGD	Focus Group Discussion
FNCCI	Federation of Nepalese Chamber of Commerce and Industries
FPIC	Free and Prior Informed Consent
FRA	Forest Resource Assessment
GHG	Green House Gas
HIMAWANTI	Himalayan Grassroots Women's Natural Resource Management Association
ICIMOD	International Centre for Integrated Mountain Development
I/NGO	International/Non-governmental Organization
IPCC	Intergovernmental Panel on Climate Change
IPO	Indigenous Peoples' Organizations
LFG	Leasehold Forestry Group
LFUG	Local Forestry User Group
MMR	Monitoring, Measuring and Reporting
M and MRV	Measuring and Monitoring, Reporting and Verification
MFSC	Ministry of Forest and Soil Conservation
MPFS	Master Plan for the Forestry Sector
NAFAN	National Forum for Advocacy *Nepal*
NBS	Nepal Biodiversity Strategy
NBSAP	National Biodiversity Strategy and Action Plan

NEFIN	Nepal Federation of Indigenous Nationalities
NEFUG	Nepalese Federation of Forest Resource User Group
NFA	Nepal Foresters' Association
NFMS	National Forest Management System
NTFP/NWFP	Non Timber Forest Products/Non Wood Forest Products
PA	Protected Area
PES	Payments for Ecosystem Services
PRA/RRA	Participatory Rural Appraisal/Rapid Rural Appraisal
RDF	Rural Development Foundation
REDD+	Reducing Emissions from Deforestation and Forest Degradation and the role of Conservation, Sustainable Management of Forests and Enhancement of Forest Carbon Stocks in developing countries
REDD-IC	REDD-Implementation Centre
RL/REL	Reference Level/Reference Emission Level
R-PP	Readiness Preparation Plan
SESA	Social and Environmental Safeguard Assessment
SFM	Sustainable Forest Management
SIS	Safeguard Information System
UNFCC	United Nations Framework Convention on Climate Change
UN-REDD	United Nations collaborative initiative on Reducing Emissions from Deforestation and forest Degradation
USD	United States Dollar
VDC	Village Development Committee
WWF	World Wide Fund for Nature

Definitions

Air Dry Density

The density of timber and other related materials which is measured by bringing the moisture contents of the materials, such as timber, in equilibrium with local atmospheric conditions. It depends on the local climate, weather, season of the year and the timber species. It is the intermediate stage of drying. However, oven dry density is the ration of oven dry weight and volume of the wood. Oven dry weight is computed by drying the wood in about 100° to 105° temperature for 48 hours to 72 hours until it achieves constant weight.

Benefit Sharing Mechanism

The mechanism devised for the sharing of benefits, among various stakeholders, generated from the implementation of the REDD+ program. Two types of benefits can be garnered from REDD+ program.

- **Carbon benefits:** the benefits generated from the sale of verified carbon emission reductions.
- **Non-carbon benefits:** the benefits other than carbon storage or sequestration, broadly grouped into social, environmental and governance related benefits, for example biodiversity conservation, provision of ecosystem services, employment opportunities, equity and good governance etc.

Biodiversity

The variability of the life forms in definite spaces. Variability of lives incorporates from the genetic diversity to species and ecosystem diversity.

Biomass

It is the total amount of living organic matter in trees/vegetation expressed as oven-dry tons per unit area. It includes leaves, twigs, branches, main bole, bark and roots also. It is broadly divided into aboveground biomass and below ground biomass.

Evaluation

It is an exercise attempting systematically and objectively to assess the progress and achievement of an activity, project or programme. It can be done at different stages such as mid-term evaluation or end evaluation. The REDD+ activities, project or programme is evaluated based on its relevance, effectiveness, efficiency, impact and sustainability. .

Forest

It is the area over 0.5 ha in a place, covered predominantly with trees with the minimum canopy cover of 10%, with the minimum width of 20 m and tree height of 5 m at maturity (FAO, 2012). It does not include land that is predominantly under agricultural or urban land use.

Community Forest: whole or part of the national forests, legally handed over to the communities for the conservation, management and utilization.

Collaborative Forest: whole or part of the national forest being managed by in collaboration/partnership with the department of forest, local users and local government where the benefits accrued will be shared at the proportion of 50:50. The CFM is concentrated only in the tropical forests of Terai region of Nepal.

Leasehold Forest: degraded forests (<20% crown cover) handed over for the maximum period of 80 years to the people below the poverty line for the poverty reduction and environmental amelioration.

Forest Reference Levels (FRL)

This is the baseline information for the comparison of the impact of REDD+ implementation in reducing carbon emissions from deforestation, forest degradation, conservation of forests, sustainable forest management and enhancement of forest carbon stock. This is used as the benchmark for the estimation of the payment for participating countries, sub-national units or projects for their contribution in the reductions of emissions.

Green House Gases (GHG)

This is the group of gases that traps the heat in the atmosphere. There are six GHGs under Kyoto Protocol i.e. carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O) and (natural occurrence) and Hydro fluorocarbons (HFCs), per fluorocarbons (PFCs), sulfur hexafluoride (SF_6: artificial or synthetic). Carbon dioxide is the most significant GHGs, BLAMED for global temperature increase, and targeted to reduce emissions under REDD+ mechanism.

Growing Stock (GS)

Growing stock is the sum-total of all trees, by number or volume or biomass, growing within a particular area of interest. In the case of carbon assessment, it includes volume or biomass of all living plants including herbs, shrubs, seedlings, poles and trees.

Leakage/Displaced Emissions

The protection or conservation of the carbon stock in one area after implementation of the program which may leads to the deforestation/forest degradation in another area is considered as the leakage or displaced emissions.

Measuring, Reporting and Verification (MRV)

It is series of the procedures from measurement to communication and verification of emissions through quantification of anthropogenic forest-related emissions and sinks, forest carbon stocks and changes upon from REDD+ implementation; communicating to international community through standardized reports; and checking the accuracy of the estimation by independent third parties designated by UNFCCC.

Monitoring

It is systematic, regular and purposeful observation or measurement of the processes and various variables in order to assess the progress of the REDD+ implementation and ensure better performance towards obtaining project goal and objectives. It assesses the effectiveness and efficiency of the program at implementation stage.

Reducing Emission from Deforestation and Forest Degradation (REDD)+

The UNFCCC in its decision 1/CP.13 of Bali Action Plan legally defined REDD+ as "*policy approaches and positive incentives on issues relating to reducing emissions from deforestation and forest degradation in developing countries".* It is a financial compensation mechanism for which funds are supposed to be mobilized from the developed countries to the developing nations for performance based emission reduction through avoiding or controlling deforestation and forest degradation, conservation of forests, sustainable forest management and carbon enhancement.

Deforestation is the permanent conversion of the forest into non-forest land use system such as agriculture, road, settlement etc. It decreases the forest area.

Forest Degradation is defined as the negative changes in forest structure, dynamics and functions of the forests as the result of tremendous and unplanned harvesting, forest fire, uncontrolled grazing, illicit felling etc. It is the decrease in the capacity of a forest to provide goods and services but not the forest area.

Conservation of Forests includes the protection, management and utilization aspects of the forests: protection from forest fire, encroachment, grazing, illicit felling and other biotic and abiotic elements; management increases the productivity and ensures continuous flow; and utilization ensures proper uses of forest products and forests including planned and regulated harvesting of the trees.

Sustainable Forest Management (SFM) is the management of the forests that ensures the continuous flow of desired products and services from the forests without undue reduction of its inherent values and future productivity and damages to the physical and social environment (ITTO, 2005). It is environmentally appropriate, socially beneficial and economically viable means of forests management for both present and future generations.

Forest Carbon Enhancement is to increase the stocking of carbon inside forests e.g. through reforestation, re-vegetation and quality enrichment.

Reforestation

It is the artificial conversion of non-forest lands into the forest lands. Both reforestation and afforestation are included into the broader definition of reforestation in this guideline. Afforestation includes the establishment of a forest by artificial means on an area where forest

vegetation has been long absent e.g. plantation in barren or agricultural land, seeding along landslide areas etc. Reforestation is restocking the felled areas.

Social and Environmental Standards (SES)

The REDD+ SES is a social and environmental standard, for all forms of fund-based or market-based financing. The primary role of REDD+ SES is to provide a mechanism for country-led, multi-stakeholder social and environmental performance assessments of REDD+ program design, implementation and outcomes, and to enable countries to show how internationally- and nationally-defined safeguards are being addressed and respected. The standard covers all social and environmental elements of the "safeguards" agreed under the UNFCCC COP-16 decision (Cancun), and is intended to complement other social and environmental approaches, such as the World Bank Strategic Environmental and Social Assessment (SESA) and UN-REDD tools.

Strategic Environmental and Social Assessment (SESA)

SESA is an instrument to ensure the integration of environmental and social considerations during the formulation and implementation of national REDD+ strategy; and that REDD+ readiness activities under the FCPF comply with all applicable safeguards. SESA connects the different components, actions and activities necessary to formulate a comprehensive and coherent REDD+ strategy during the implementation of R-PP.

Safeguard Information System (SIS)

It is a system for providing information of how REDD+ safeguards (i.e. seven safeguard principles of the Cancun Agreement) are addressed and respected throughout the implementation of REDD+ activities. SIS is one of the four elements required for REDD+ under the "Warsaw Framework for REDD+", including National Strategy or Action Plan, National Forest Reference Level and National Forest Monitoring System.

Verification

It is the independent assessment of the actual emissions reductions and co-benefits of particular mitigation activity by third party designated from UNFCC.

Chapter 1: Introduction

1.1 Background

Nepal has been working on REDD+ readiness since 2008. It is one of the most prioritized forestry programs in Nepal as it is expected to generate enormous economic, social and environmental benefits. A very rough estimate indicated that Nepal is able to draw USD 20-86 million per year after full-fledged REDD+ implementation (UN-REDD and REDD Cell, 2014). Besides, it generates various non-carbon benefits such as biodiversity conservation, management of essential ecosystem services, and promotes livelihoods and human rights of forest dependent, marginalized and indigenous communities.

Nepal is the country with the high rate of deforestation. Average annual deforestation rate was estimated to be 1.7% in Nepal which is significantly higher than global (0.14%) and Asian (1%) averages (DFRS, 1999; FAO, 2012). Over 100,000 hectares forests have already been encroached in last two decades (MFSC, 2015). Aggravating the situation, about 28% of the total forests in Nepal has been badly degraded (DFRS, 2008). The deforestation and degradation of the forests significantly contribute in the carbon emissions. One hectare deforestation of Nepalese forest contributes about 57-85 tons emissions from above ground biomass (Oli and Shrestha, 2009; DFRS/FRA, 2015 unpublished) and loses the carbon sequestration capacity by 1.93 tons/year in the hills (Karky, 2008). However, the rate of deforestation has been slowed down in last decades (~0.4% per year in Terai and Siwalik regions; FRA 2014a, FRA, 2014b) mainly due to the successful community forestry program.

Nepal has endeavored to control the deforestation and forest degradation for more than 60 years. In line with national policy, the REDD+ framework also aims to control deforestation and forest degradation by addressing their various proximate and underlying drivers. Moreover, it acts in the forest conservation, sustainable management and forest carbon enhancement. All these are the regular activities and obligatory mandates of the Ministry of Forest and Soil Conservation (MFSC) and its departments.

Additionally, the large networks of the community based forest management regimes such as community forestry, collaborative forestry, BZ community forestry, leasehold forestry etc. have been in actions for controlling the deforestation and degradation as well as the conservation of forests, sustainable forest management and enhancement of carbon stocks in their forests. Over 19,000 Community Forest User Groups (CFUGs), including 2.4 million households, have been managing over 1.8 million ha of national forests (DoF, 2015 [Unpublished]). Over 54,072 ha of national forests have been managing through 23 collaborative forests in the lowland Terai (DoF, unpublished). A total of 75,021 poor households are managing 42,835 ha of degraded forests as the pro-poor leasehold forests (Oli, 2014; DoF. 2015 unpublished). All of them are directly or indirectly contributing to achieve the similar goals and targets set by the REDD+. Therefore, the

implementation of the REDD+ will benefit the community based forest management systems of Nepal and entire nation by providing the performance based financial compensation.

Successful implementation of REDD+ mechanism needs meaningful participation of all relevant stakeholders throughout the process. A broad and inclusive participation of stakeholders can assist to ensure the sharing of responsibilities and benefits, in addition to strengthening ownership on REDD+ implementation and monitoring. Various stakeholders including national and sub-national government institutions, local communities, women and indigenous population each have particular roles to play and contribute to the REDD+ process, including development of reference levels (RL/REL) and a robust and transparent national forest monitoring system (NFMS) to support Monitoring, Reporting and Verification (MRV). Community Based Forest Management (CBFM) practitioners and particularly the CFUGs have evolved as robust institutions with institutional arrangements and accumulated experiences of managing and monitoring forests. With realization of forest user groups' stake and potential role in REDD+, Nepal's R-PP has already highlighted the need of local involvement in the REDD+ process including the establishment of an inclusive and participatory MRV system. This justifies the need for all concerned CBFM practitioners to undertake REDD+ initiatives and regular/periodic carbon monitoring with capacity and technical support from local forest authorities. It is essential to establish an appropriate mechanism for Measuring, Monitoring and Reporting (MMR) and ensure that environmental and social safeguards of local communities are addressed and respected. Participatory MMR is understood as an approach to improve the vertical and horizontal institutional integration of different stakeholders for assessing performance of REDD+ programs including safeguard compliance and carbon accounting.

The Ministry of Forest and Soil Conservation and its underneath agencies such as Department of Forest and REDD-IC as well as many other I/NGOs have also produced and promulgated various guidelines for forest inventory, biomass and carbon measurement as well as its reporting. The ministry approved guidelines are mostly mandatory whereas I/NGOs prepared guidelines are mainly meant for technical support and programme facilitation hence voluntary in nature. None of other guidelines provisions for the measurement and reporting for non-carbon and safeguards measurement. This is the impetus behind the preparation of the participatory MMR guidelines which measures all carbon, non-carbon and biomass measurement and reporting of the REDD+ activities as indicated in the table 1.

Table 1: Comparative matrix of major inventory and community development guidelines in Nepal

SN	Guidelines	Publisher	Main Agency		Measurement parameters					Reporting	Implementation status
			DFO/ Professional	Communities	GS	Biomass	Carbon	Non-carbon	Safeguards		
1.	CF Inventory Guidelines 2004	MFSC/DoF	☑☑☑	☑	☑	☑	☒	☒	☒	**NA**	**M**
2.	Forest Carbon Assessment Guidelines, 2010	MFSC/REDD-Cell	☑	☑	☑	☑	☑	☒	☒	☒	**M &V**
3.	Guidelines for Measuring Carbon Stocks in Community Managed Forests, 2011	ANSAB/ICIMOD/FECOFUN	☑	☑☑	☑	☑	☑	☒	☒	☒	**V**
4.	CF Development Guidelines 2014	MFSC/DoF	☑	☑	☒	☒	☒	☒	☒	☑	**M**
5.	Participatory MMR Guidelines 2015	MFSC/REDD-IC/ICIMOD	☑	☑☑☑	☑	☑	☑	☑	☑	☑☑	**M &V**

GS: Growing stock; M: Mandatory by Law; V: Voluntary; M & V: Mandatory by Law when measurement occurs, but voluntary to participate in the programme. ☑: Yes and ☒: No. Number of symbol demonstrates its relative strength

This guideline provides a basic framework of stakeholders' participation in MMR process and supports enhancing the local communities' and REDD+ practitioners' capacity in undertaking MMR of REDD+ activities. Against the costly, expert led conventional monitoring process, the local/community based monitoring is proposed as it enhances the local ownership and responsibility, larger cultural relevance, lower cost, more sustainable and better institutional strength at the local levels without compromising the required precision of the results. Doing so, the local communities will find the solutions of any problems emerged during program implementation.

The guidelines will support greater participation and use of locally available instruments and resources wherever possible. It will also strengthen local participation in the resource management, promote equity and good governance. The community based MMR could supplement and feed into the national MRV system. The guideline will support the local communities and relevant stakeholders for more autonomous, participatory, precise and authenticated MMR process at the local level.

1.2 Objectives of the guidelines

The main objective of the guideline is to support local communities and REDD+ practitioners at local level (up to district level) in undertaking REDD+ interventions effectively by enhancing their capacities to monitor, measure and report to the relevant authorities about their natural

resources and its changes over time, implementation status of REDD+ activities, benefit sharing and its social and environmental impacts etc. Specific objectives of this guideline are to:

- Encourage and facilitate local people in undertaking MMR process of REDD+ activities.
- Provide a detail of steps, processes and activities of MMR process at local level.
- Promote transparency, governance, equity and local ownership on REDD+ activities.
- Support for MMR process to be cheap, reliable and consistent with MRV framework ; and also consistent with CFUG monitoring and evaluation procedures/guidelines
- Respect and strengthen traditional ways of forest management in rural Nepal.

1.3 Users of the guidelines

These guidelines have been prepared to facilitate the local level MMR process therefore the main targeted beneficiaries (users) of the guidelines include:

- **Local government**

  District Development Committees (DDC), Metropolitan / Sub-Metropolitan / Municipalities, Village Development Committee (VDCs), District Forest Sector Coordination Committee (DFSCC) etc.

- **District level governmental line agencies**

  Forestry organizations: District Forest Offices (DFOs), District Soil Conservation Offices (DSCOs), District Plant Resource Offices (DPRO), respective offices of Protected Areas (National Park, Wildlife/Hunting Reserve, Conservation Areas) etc.

  Other government organizations: District Agriculture Development Offices (DADO), District Livestock Services Offices (DLSO), District Cottage and Small Industries Office (DCSIO), Irrigation Development Division (IDD), Divisional Road Office (DRO), District Administration Office (DAO), Women Development Office etc.

- **Local forestry groups**

  Community Forestry User Group (CFUG), Leasehold Forestry Group (LFG), Religious Forestry Group (RFG), Collaborative Forests Management Committee (CFMC), Buffer Zone Management Committee (BZMC), Buffer Zone-Community Forestry User Groups (BZ-CFUG), Conservation Development Committee (CDC) etc.

- **Civil society organizations**

  Network of local forestry user groups (e.g. FECOFUN, NEFUG, ACOFUN, Leasehold Forestry Federation), Federation of Private Forests Stakeholders (FEPFOS), Nepal Federation of Indigenous Nationalities (NEFIN), Federation of Dalit People (e.g. Dalit Alliances for Natural Resources), District branches of FNNCI, related Non-Government Organizations (NGOs), Federation of journalists, local media etc.

- **Private sectors**

Forest based entrepreneurs, owner of sawmills, furniture, NTFP entrepreneurs.

- **Political parties**
  District branches of national and regional level political parties.

- **Academia**
  University faculties, graduates and students may use the guideline for academic purposes.

1.4 Materials and methods

The build-on approach has been used to prepare the guidelines. Building the guidelines, aimed to use and strengthen the various existing guidelines, directives and institutions and ongoing practices. The guidelines attempted to make it as simpler as possible without losing the essence of technical worth. Further, it endeavored to minimize the workload and extra burden through its implementation. It highly honors the traditional knowledge, skills and practices of the local communities and indigenous communities in the protection, conservation and management of the forests. Therefore, aims to utilize the motivation, skills and knowledge of the local people in the MMR processes of the REDD+ activities.

The guideline has been prepared based on existing community forestry processes and systems in Nepal. It aims not to drastically propose new actions and activities, rather it desires to strengthen, improve and simplify ongoing guidelines, exercise and practices for MMR process of the REDD+ activities.

The guideline is developed with the participation of major REDD+ stakeholders that aims to promote transparency, consistency, accessibility, and flexibility in MMR process of the REDD+ activities. It is developed through the stakeholder consultation process ensuring the participation of poor, disadvantaged, deprived, women and forest dependent communities, indigenous peoples and their federations. The preparation of the guideline followed the procedures as shown in Figure 1 adopting the following consecutive steps of literature review and consultations:

Figure 1: MMR preparation procedures

Extensive review of the forestry and REDD+ related documents

- ☑ Various legal documents such as forestry laws (acts, regulations), guidelines, directives etc.
- ☑ Other relevant policies and strategies such as Forest Policy 2015, NBSAP, 2014-2020, Land Use Policy, 2012, Nepal Climate Change Policy, 2011, Wetland Policy, 2009, Herbs and NTFP Development Policy 2004, Forest Encroachment Control Strategy, 2012, Scientific Forest Management Working Procedures, 2014 etc.
- ☑ The national and international documents, peer reviewed journals on climate change and REDD+ mechanism.
- ☑ Major documents and reports prepared or produced by REDD-IC (previously REDD-Cell).
- ☑ Various publications and guidelines on carbon assessment and participatory monitoring– prepared by the REDD-IC, ANSAB-ICIMOD-FECOFUN, WWF, CIFOR, IPCC and UNFCC.
- ☑ A sourcebook of methods and procedures for monitoring and reporting anthropogenic GHG emissions and removals associated with deforestation, gains and losses of carbon stocks in forests remaining forests, and forestation (by GOFC-GOLD, 2003), Good Practice Guidance on Land Use, Land-Use Change and Forestry (IPCC, 2003).

Stakeholder consultations

- ☑ Stakeholder consultations were made by organizing three district level workshops one at each Chitwan, Gorkha and Dolakha districts.
- ☑ The date, venue and participants for the consultation workshop were set 2 weeks earlier in extensive consultation with major stakeholders such as District Forest Officer, FECOFUN and project staffs.
- ☑ Altogether 85 participants from three districts were consulted either through personal meeting or by organizing district level workshop. A total of 16 participants were women and 25 were indigenous people.
- ☑ A central level consultation workshop was conducted to share the draft of the guidelines requesting for the suggestions and feedback.
- ☑ Prepared draft guideline was shared to the members of REDD+ multi-stakeholders forum and REDD+ working group. The draft was revised as per the suggestions, feedbacks and comments received from the experts.
- ☑ A total of 34 forestry, REDD+ and environment experts from different key stakeholders such as MFSC, REDD-IC, DoF, DFRS, GIZ, FECOFUN, NEFIN, HIMAWANTI, RECOFTC, Forest Action etc. actively participated in the central level sharing workshop and provided their feedbacks and comments on the draft.

1.5 Organization of the guidelines

The guidelines are organized into five chapters. Each of the chapter deals with different activities of MMR process including: background (Chapter one), preparation and planning (Chapter two), monitoring (Chapter three), measurement (Chapter four) and reporting (Chapter five). Consecutive organization of the guideline and its respective chapters is illustrated in Figure 2.

Figure 2: Outlines of the different chapters of the MMR guideline

Chapter 2: Preparation and planning

2.1 Introduction

The firmed, participatory and detail planning is very important for the successful execution of the monitoring, measurement and reporting (MMR) of the REDD+ activities. As it requires the human and financial resources for conducting participatory MMR, it is suggested to include MMR process and allocate necessary budgets through annual plans and budgets. It should be the part of the REDD+ planning at the district level.

During the preparation phase, either the REDD+ Working Group or District Forest Office (DFO) needs to organize targeted awareness programs about REDD+ and participatory MMR activities for the local stakeholders. At least one participatory consultation meeting should be organized prior to the execution of MMR. This chapter describes procedural details about preparation and planning for the MMR process of REDD+ activities.

2.2 Initiation of the work

The REDD+ desk officer coordinates and facilitates the startup activities for the MMR. In case of the districts where REDD+ desk is not formed, DFO should nominate a forest officer to take care of REDD+ process in the district. The REDD+ desk will prepare and distribute various extension materials related the importance and procedures of the REDD+ mechanisms and MMR activities to initiate this process.

2.3 Preparation

2.3.1 Consultation

A consultation workshop should be organized by involving key REDD+ stakeholders at the district. The REDD+ desk officer may utilize the REDD+ stakeholders/expert roster available at the district for selecting the key stakeholders and persons for the consultation workshop. District level governmental line agencies; REDD+ working group members, forestry user groups and their federations/networks, key environmental NGOs need to participate in the workshop. Related agendas should be conveyed to the participants at least three days ahead of the workshop. The agenda can be:

- ☑ Discuss and agree upon the needs of the REDD+ monitoring at local level.
- ☑ Make consensus on the goal and objectives of the participatory MMR process.
- ☑ Prepare roster of active and potential Local Forestry User Groups (LFUGs) and REDD+ experts/LRPs available at district.
- ☑ Divide the constituencies for the identified REDD+ experts and local resource persons (LRPs).
- ☑ Allocation or division of the rights, responsibilities and resources to the various persons (technical and community members) to execute MMR.

- ☑ Identification and management of the essential equipment and tools, skills and knowledge.
- ☑ Formation of the MMR team at District, Sector[1] and local level.
- ☑ Selection of the LFUG[2].
- ☑ Preparation of activity calendar.
- ☑ Consensus on the broader working procedures.
- ☑ Alignment of the MMR activities in line with DFO program/activities.
- ☑ Miscellaneous.

2.3.2 Collective decision

The REDD+ stakeholders take combined decision about the execution of the MMR in their respective areas. Decisions on participation of local communities will be taken freely by providing sufficient information to them about the advantages and disadvantages of MMR execution. Possible costs, planned procedures and intended outcomes of the MMR should be discussed in detail. Decisions about formulation of the various teams at the multiple levels to facilitate the MMR should be undertaken. The inclusion of the members should be decided as per unanimous consensus. A four tier working teams should be established at every district by involving key stakeholders as shown in Figure 3.

Figure 3: Four tier institutional arrangement for MMR at district level

A) District REDD+ working group

Chair: DDC member (Agriculture, Forestry and Environmental)

Members: District Forest Office, District Agriculture Office, District Livestock Services Office, DDC Office, District Soil Conservation Office, National Park/Wildlife

[1] Sector indicates the Sector Forest Office or Ilaka forest office in the district where there is no Sector forest office
[2] LFUGs: Local Forestry User Groups. It includes all existing community based forest management regimes in Nepal

Reserve/Hunting Reserve/Conservation Area, District Women Development Office, FECOFUN, ACOFUN, NEFIN, Buffer Zone Management Committee, Dalit Organization, Women's Organization, Private Forestry Network, District NGO Federation.

Member secretary: Forest officer

Minimum capacity for civilian members

SLC, training on their respective sector, fair knowledge on national/international policy on REDD+, climate change, carbon rights/carbon trade, benefit sharing mechanism and forestry sector policy of Nepal.

Responsibilities

- ☑ Overall planning, implementation, monitoring and evaluation of the REDD+ activities in the district.
- ☑ Horizontal and vertical coordination and collaboration with other stakeholders.
- ☑ Provide proactive ideas and instructions for MMR team.

B) Sector level MMR team

Coordinator: Head of sector forest office

Members: FECOFUN, ACOFUN, Woman CF member, Dalit, LRP

Member secretary: AFO of respective sector forest office

Minimum capacity for members

SLC, REDD+ orientation training, understanding MRV, MMR, carbon assessment, SESA, SIS, PES; fair knowledge on national/international REDD+ policy, climate change, carbon rights/carbon trade, benefit sharing mechanism and forestry sector of Nepal.

Responsibilities

- ☑ Plan MMR activities at sector forest office jurisdiction.
- ☑ Select the Ilaka to implement MMR activities.
- ☑ Coordination and collaboration on successful MMR.
- ☑ Supervise, monitor and evaluate the work.
- ☑ Identify the carbon leakage and displacement areas.

C) Ilaka level MMR team

Coordinator: to be decided with the unanimous consensus of members

Members: FECOFUN, ACOFUN, Woman CF member, Dalit, LRP

Member secretary: AFO/Ranger of respective Ilaka forest office

Minimum capacity for members

SLC, REDD+ orientation training, understanding MRV, MMR, carbon assessment, SESA, SIS, PES; fair knowledge on national/international REDD+ policy, climate change, carbon rights/carbon trade, benefit sharing mechanism and forestry sector of Nepal.

Responsibilities

- ☑ Plan MMR activities at Ilaka level.
- ☑ Select the LFUGs to implement MMR activities.
- ☑ Coordination and collaboration on successful MMR.
- ☑ Supervise, monitor and evaluate the work.

D) Community level MMR team

Coordinator: Chairperson of respective LFUG

Member: One staff from Ilaka, 2 LRPs, 3-5 active members of LFUG

Member secretary: Secretary of the respective LFUG

Minimum capacity for members:

Middle secondary education, basic idea on the concept of participatory resource management, community forestry, other participatory forestry program, understanding of forest inventory, boundary survey, simple mathematics, REDD+, carbon value, non-carbon value, governance system and equity etc.

Box 1: Instruction for community level MMR team

At least one member from the targeted group will be added in the MMR team. For example, a woman representative would be added to the team if the women focus program is to be monitored. Similarly, the additional representation of the indigenous member is sought for the monitoring of indigenous communities targeted program.

Responsibilities

- ☑ Overall execution of the MMR of the REDD+ activities at local level under the direct supervision of the executive committee of respective user group
- ☑ Carbon and non-carbon measurement, analysis and presentation to the LFUGs
- ☑ Preparation of the report.

Note: Different task specific small team can be formed by including particular expert and other relevant people to facilitate community level MM R team.

2.4 Execution of the planned activities

Once the collective decisions are made and decided to execute the MMR activities, the implementation of the various activities should be made systematically together with DFO staffs and local communities.

Chapter 3: Monitoring of REDD+ activities

3.1 Introduction

The systematic recording and periodic analysis of the information during the project implementation mainly by insiders (project beneficiaries and implementers) is considered as the participatory monitoring (Davis-Case, 1990). Participatory monitoring is simply the active involvement of local people in all stages of the monitoring activities. It is a regular and continuous process that attempts to keep the project on track by providing regular feedback and early indications of progress or failure.

The main objective of the participatory monitoring is to assess the progress or weakness/deviation of the works (e.g. inputs, process) during the project period against the expected results or set targets so that the necessary adjustments or corrective measures can be made in time to ensure the project achievements. The timely solutions of the identified problems keep the project in right track to succeed maintaining the good quality and standards. Participatory monitoring ensures the most effective and efficient use of available human, financial and physical resources.

Figure 4: monitoring is like the fuel meter of the vehicle which indicates about the fuel available in the vehicle and distance to be travelled

This is a tool to fully immerse the local beneficiaries in the project activities, support them to identify various actions and their own indicators and finally empower them with the widened knowledge-base about the ongoing project and its actual status. It contributes in building social capital and improving rural livelihoods. Consequently, it develops and strengthens local ownership over project ensuring the project success and future sustainability.

It further supports for the success of project by ensuring accountability to the relevant stakeholders and taking timely decisions and promoting adaptive management. Active participation of the targeted beneficiaries in the monitoring of the project activities facilitates to obtain comments and suggestion for corrective actions; and increases the reliability and the validity of the REDD+ project.

3.2 Types of monitoring

There are various methods and criteria to categorize the monitoring into different groups. Very general and simplified categorization of the monitoring is based on its focus or attentions towards which stages of the project and things have been monitored. The figure 5 depicts the various monitoring types made at different stages of the project.

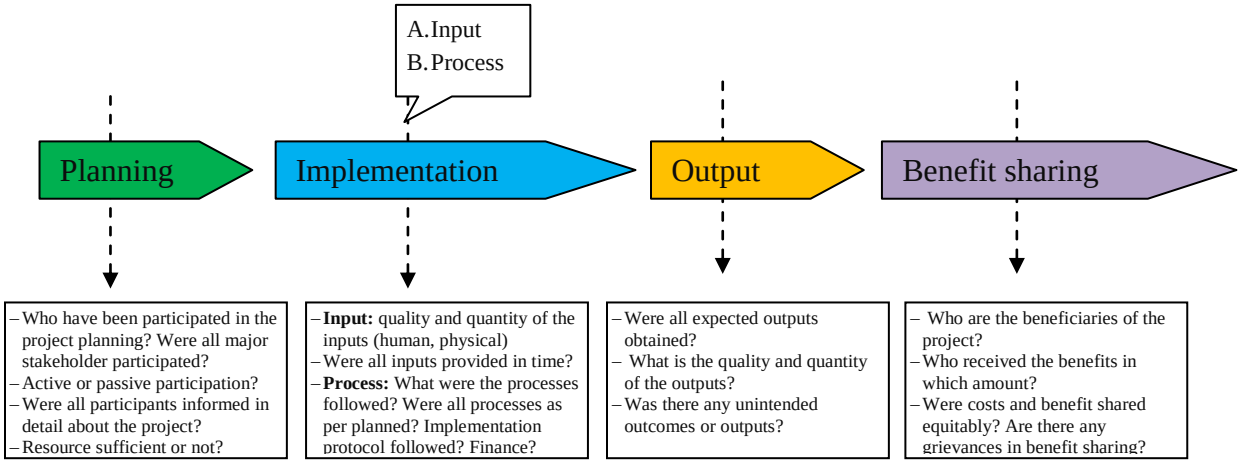

Figure 5: Monitoring activities at various stages of the project. Monitoring questions are given in the boxes.

3.2.1 Input monitoring

Input monitoring analyzes various resources (human and materials) being used in the project/ program against that was envisioned in the project document. How far the quality and quantity of the inputs met? Who are involved / included in the project implementation?

3.2.2 Process monitoring

Process monitoring basically monitors about the work procedures and methods used for the planning and execution of the activities. Process monitoring provides answers whether all the process mentioned in the project documents being thoroughly followed or not. It seeks appropriate order and sequences of the activities being implemented, fiduciary risks minimized or not, governance improved or not.

This can be done through direct observation, reviewing meeting minutes and financial report, consultation with beneficiaries and focus group discussion.

Box 2: An example of participatory monitoring

Manakamana CFUG, Sarlahi, Nepal, conducting participatory monitoring of a plantation site in 2006.

Manakamana CFUG formed 7 member plantation monitoring team, comprised of 3 male and 3 female users; including Dalit and Ethnic communities. One forestry staff from the Ilaka forest Office was involved in the team.

The team first looked up for the operational plan and the decisions related to the plantation activities. The monitoring team analyzed the methods of species selection, process followed to purchase seedlings and cost incurred. It further checked the sizes and quality of seedlings, size of the pits, spacing, applied planting techniques, species composition, number of seedlings and area of the plantation.

They also looked at likely risk/challenges for the plantation protection including the fencing systems, grazing conditions and local involvement, survival rate, and symptoms of other destruction. Finally, the team prepared the monitoring report and submitted to the executive committee.

That monitoring report was considered as one of the best participatory monitoring report of that year in the district.

3.2.3 Output monitoring

Output monitoring examines conditions and qualities of the outputs being generated as the result of activities implemented. This monitoring process considers whether expected outputs are

achieved meeting the required qualities and quantities. Output monitoring also includes reviewing the project document, annual plans, progress report in consultation with beneficiaries and key stakeholders. Direct observation is also considered one of the effective means of output monitoring.

3.2.4 Benefit sharing monitoring

Monitoring of benefit sharing process seeks answers the questions including: How many people (men, women, Dalit, Indigenous communities) benefitted from the project? Have the benefits shared equitably among all stakeholders? Do elites capture most or share equally to poorer sections of the society? Is it shared in cash or kind? Does the benefit delivered to targeted group or needy people on time? Is there any conflicts/grievances? Gender balanced?

This can be done through reviewing the project document, periodic progress report and discussing with the beneficiaries.

3.3 Participatory monitoring of REDD+ activities

REDD+ is the performance based policy intervention agreed under the United Nations Framework Convention on Climate Change (UNFCCC), aiming to reduce atmospheric carbon dioxide emissions through halting deforestation and forest degradation in developing countries, as well as fostering sustainable management of forests, forest carbon enhancement and conservation of forests. The country receives the monetary benefits only for the proven amount of the reduction in carbon emission. It further aims to contribute in the biodiversity conservation and livelihood enhancement of the people.

The proper assessment of the progress in controlling carbon emissions at the national level needs to be done prior to claiming for carbon fund. Only the verified amount of the emission reductions in comparison to the reference level is eligible for obtaining compensation. There are several high-tech, sophisticated and costlier methods for the National Forest Inventories (NFI) and forest resource assessment. Various remote sensing data and techniques are available and

Box 3: Key guiding questions for 'carbon assessment' monitoring

Let's take an example of a carbon assessment process done by a community forestry user group. While doing carbon assessment monitoring, the monitoring team closely observes all activities from planning to analysis and interpretation of the result. The monitoring team should answer the following key questions:

How has the team formed for the carbon assessment? Are there sufficiently qualified persons in the team? Who are the people included from the local communities? How are they selected? Have all the team members sufficiently trained for the carbon measurement? How are they oriented for the tasks?

What is the protocol followed for the carbon measurements? What is the intensity of the sampling? How are the plots laid out in the field? What are the instruments being used for the measurement? Which are the parameters (variables) recorded? Are the diameter measured at breast height or in convenient place? How has been the height measured? Have all equipment (e.g. diameter tape, abney's level, clinometer, GPS etc.) rightly used? How is the data recorded? Are there any weaknesses/errors in data entry? How has been the collected data analyzed? Is there any possibility for personal biasness and manipulation?

being implemented to estimate the forest area, growing stocks and deforestation rate. It requires relatively sophisticated technologies, skilled professionals and larger investment.

The participatory monitoring of the deforestation, forest degradation and other components of REDD+ mechanism provides ample opportunity to the local people to learn new techniques and better understand their forest conditions and challenges. It creates the huge awareness about their forestry resources; practically knowing the existing strengths, weaknesses, challenges and opportunities at the implementation level. This will increase the confidence of the local people upon their knowledge and skills. Their participation in the forest monitoring will capacitate them to take immediate decisions/actions to improve any observed weaknesses or errors. The level of the participation, transparency in resource mobilization and decision making, governance conditions and equity in cost and benefit sharing will be enhanced through community based monitoring.

With the opportunities to participate in all stages of the program implementation and monitoring, the local ownership on the REDD+ activities will be increased. This will significantly improve the REDD+ implementation standards at the local level. Further, it will support to defend and aligning local interests with REDD+ activities. The participatory identified carbon savings at the local level is considered more reliable and authentic than remotely sensed data. Therefore, it can be used as the fundamental basis to verify the remotely sensed data and to pay the local communities for their efforts of carbon savings.

3.3.1 Linkage between participatory MMR and MRV

The national Monitoring as well as Measurement, Reporting and Verification (MRV) system is developed at the central level which is authenticated and responsible for international reporting. The Department of Forest Research and Survey has been identified and authenticated to work as MRV entity for Nepal. The national MRV system will be established at the broader scale mainly based on remote sensing and national forest inventory data. It will report the effectiveness of the REDD+ activities to reduce the carbon emissions from various efforts made by the nation.

MRV system provides required framework to the local level stakeholders to conduct community based monitoring. For example, the central agencies direct the local stakeholders about the national priorities and REDD+ strategies. It provides various datasets needed for local community (such as average forest area, deforestation rate, above ground biomass etc.) at national, regional and local levels. They further assist the local communities by organizing various capacity development activities such as practical and theoretical training, study visits, on-job training. The financial support for the community based monitoring can be sought from the center. In addition, the central MRV system supports the local community level monitoring by providing access to central data and assisting them through supervision of their work in order to maintain the required quality and standards of the local measurement.

Similarly, the local MMR supports the central MRV system by providing more precise, regular and real time data, forest change events such as deforestation and degradation. At central level, precise monitoring of the forest degradation is more difficult and costlier by using remote sensing data. The real time recording of the deforestation, degradation and forest enhancement at local level can assist to check and improve the quality of the data at central MRV system. Further, the real time information about the people participation and gender and social inclusions (GESI) and other environmental and social safeguards could be helpful to central MRV. The functional relationship of the MRV and community based MMR is depicted in Figure 6 and table 1.

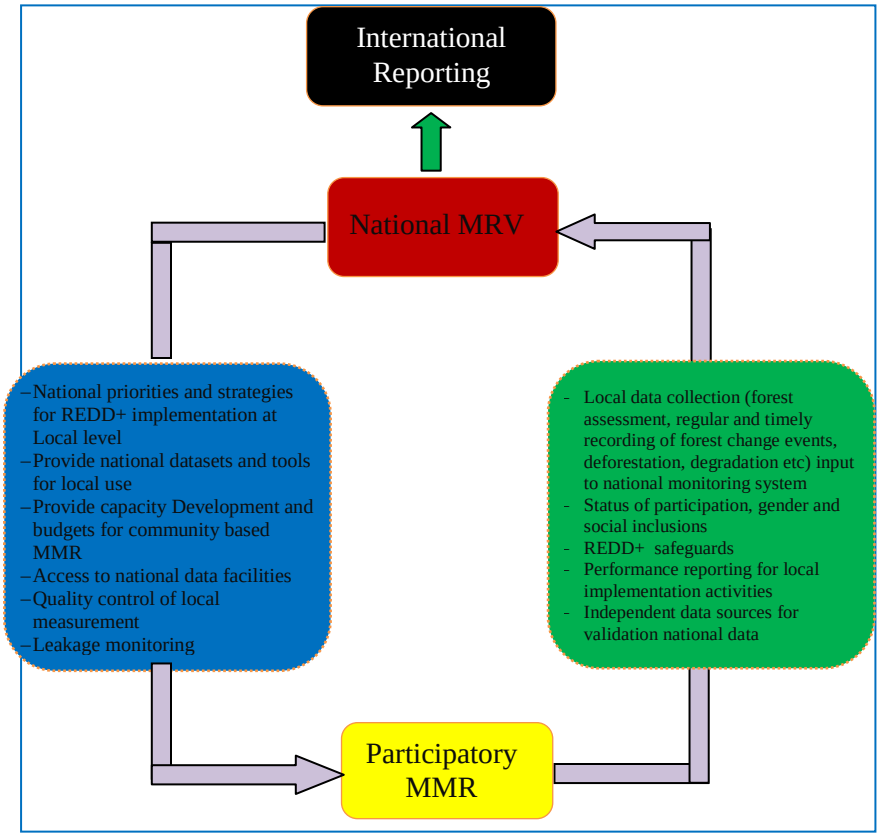

Figure 6: The functional linkages of national MRV and participatory MMR (modified from Herold and Pratihast, 2011; World Bank workshop, 12-14. September, 2011, Mexico City Mexico).

Table 2: Role of participatory MMR in national MRV (modified from Herold, M. & Pratihast, A. 2011)

Activities	Major indicators	MRV options	
		National Level	Local level (participatory MMR)
1. Deforestation	– Location and aerial extent of forest change – Forest area loss (in ha)	Remote sensing, NFI	– Acquiring information about the location, area, time, intensity of changes, lost forest types and species, reasons, responsible agents – Actual measurement at the field (measurement of plot, growing stock, fallen trees, stumps, leaf litter, pest damages, area damages due to insects, pests, flood, landslides etc.)
2. Forest degradation	– Quality of the forest, stand structure, crown cover, growing stock per hectare, availability of important tree species	Remote sensing, NFI	
– Forest fire	– Damaged area (ha), intensity and frequency of forest fire, duration of forest fire, loss of standing tree and harvested timber	Remote sensing, NFI	
– Uncontrolled grazing	– Grazing area, number of livestock (animal unit) per hectare, period of free grazing,	Difficult to estimate	
– Illicit-felling, Illegal logging,	– Number of tree illegally felled, number of theft events, number of tree stumps,	Remote sensing, NFI,	

charcoal burning, fuelwood collection, selective logging	volume of illegally logged timber, number of people involved in illegal activities in local area, number of legal actions taken by the group and DFO, – amount of the timber and fuelwood collected legally and illegally, annual harvesting of timber and other forest products, – Charcoal burning areas, production of the charcoal (quantity) etc	governmental reports; difficult to get precise information through RS	
– Other biotic /abiotic damage (insects / pests / disease, drought, landslide, flood)	– Incident of insect/pests outbreak, area infested by pests and disease, mortality rate of tree, – Drought period (months), tree mortality due to drought – Number of landslides, area damaged – Number of flood events, area damaged	Remote Sensing, NFI, thematic report, damages due to insects/pests is difficult	
3. Forest carbon enhancement (e.g. reforestation, revegetation, regrowth rate)	– Increase in the forest area, – Increase in the growing stock (biomass) – Regrowth period between two harvesting intervals – Number of plants/ seedlings planted – New area (in hectares) brought under plantation.	Remote sensing, NFI, plantation reports	– Measure plantation area, direct measurement of the survival/mortality rate – Direct measurement of annual increment of growing stock, yield and harvesting, biodiversity conservation – Direct measurement of seedlings planted. – Measurement of the timber extracted (under SFM) – Directly assessing species composition to check for being indigenous or exotic origin (under SFM).
4. Forest conservation	– Increase in the forest area, increase in the growing stock (biomass)	Remote sensing, NFI	
5. Sustainable forest management	– Degree of people participation in forest management, extent of the area under management (natural, plantation), existence of procedures to control illegal activities, flow of forest products (quantity), estimate of wood/non-wood harvests, forest management plans, investment in SFM activities – Comparing the felled growing stock/ timber extracted against the (annual?) increment.	Remote sensing, NFI	
6. Social parameters (participation, governance, equity) and safeguards	– Participation of people in planning to implementation and M&E – Participation of poor, disadvantaged, ethnic communities, Dalit and Women in all stages of the project – Rule of law – Incidence of fund misappropriation – Equity in benefit sharing etc.	Thematic reports, annual report of the department and other institutions (e.g. Transparency international, CIAA etc.)	– Meeting minutes, audit report, book keeping, record of distribution of timber, fuelwood and other items, receipts etc.

3.3.2 Procedures for participatory monitoring of the REDD+ activities at local level

The four tiers MMR team arrangement (district, sector, ilaka [area] and community) as discussed in previous chapter (Chapter 2) undertake monitoring activities at district level. However, they may invite/involve some more members for performing some specific activities that require expertise, knowledge and skills like GIS/RS experts for change detection and trend analysis.

Basically, participatory monitoring begins from community level. The community level MMR team develops a framework for regular monitoring and reporting system. One of the MMR team members representing executive committee of the local forest user group (i.e. CFUG, LFUG, and BFUG) coordinates monitoring activities. Community level monitoring team includes forest watchers, people living near the forests, livestock herders and firewood/NTFP collectors. Team members are responsible for regular monitoring of their respective constituency and keep reporting to the team leader. The team leader keeps records of monitoring reports from the team members in a standard format as highlighted in Box 4 (detail MMR format is given in Appendix 4). The monitoring team leader presents his/her reports at the regular meeting of his team to be held once in a month. Monitoring team members representing respective Ilaka Forest Office must take part in the regular meeting and take necessary action if unintended activities like illegal cutting, encroachment and fire events are reported.

Box 4: Framework for REDD+ project monitoring report

1. **Reporter:** name, sex, age, address, engagement
2. **Monitoring type**: regular, casual, other
3. **Deforestation**: yes/no, new/old, location, scale, main reason, extent of loss, involvement, intension
4. **Degradation**: yes/no, new/old, location, scale, main reason, extent of loss, involvement, intension
5. **Fire**: observed/no, type, cause, duration, extent of loss, how did it extinguished, was it new/normal
6. **Other evidences**: excessive grazing, fire wood collection, NTFPs collection, poaching, other
7. **Activities implementation**: name of the activity, budget, duration, approach, progress (physical, financial), involvement, beneficiaries, grievances
8. **Safeguards**: stakeholders' participation in policy planning and decision making, transparency, roles and responsibilities of women, IPs and marginalized groups, capacity building, access to benefits, process of regular meetings, grievance redress mechanism, use of local skills and knowledge, respect to the local customary rules and traditional practices, promotion of natural regeneration, ecological restoration, choice of species etc.
9. **Other issues:** changes in protection system that might have hampered local communities, poor and marginalized in particular, leakage, migration, trend of fuel wood consumption etc.

(Please see appendix 4 for standard MMR *format. This box only highlights points related to monitoring)*

Second tier of the district REDD+ monitoring arrangement covers area of corresponding Ilaka Forest Office. Forest Officer of the corresponding Ilaka Forest Office coordinates monitoring team of several members representing each LFUG operational under the Ilaka. Size of the team varies from five to several based on LFUG numbers and other related stakeholders as discussed in the previous chapter. Monitoring team meets once in a month and assesses monitoring reports from first tier (community level) MMR team. Ilaka level monitoring team develops monitoring plans, provides trainings and equipment to the community level monitoring team. Forest officer coordinating Ilaka level monitoring team keeps record of all monitoring reports from community level and maintains monthly summary report.

Third tier of the local level monitoring arrangement covers areas under Sector forest authorities. This level of monitoring team becomes district level if there is only one sector office in the district. The sector forest officer coordinates sector level monitoring team comprising of team

members from Ilaka Forest Officers, representation from civil society, women groups, federation of LFUGs, related line agencies and other local authorities like VDCs (Chapter Two for detail). Similarly as in Ilaka level, Sector level monitoring team also follows similar approach that Ilaka level team follows. Sector Forest Officer makes sure that each Ilaka team reports their monitoring report of required standard (Appendix 4) regularly and timely. In addition to rely monitoring report from Ilaka team, Sector level monitoring team undertakes regular monitoring activities like patrolling hot spots, establish regular communication with local communities, civil society organizations and networking. Sector level team not only monitors implemented REDD+ activities but also reports displacement and safeguard related issues.

The fourth and last tier of local level REDD+ monitoring arrangement is district level. The district MMR team nominates one of its team members, preferably REDD desk officer, as the district REDD+ activities monitoring coordinator. Like other monitoring teams discussed above, district monitoring team also consists of five to seven members including representation from key stakeholders like district FECOFUN, ACOFUN, HIMAWANTI, NEFIN and representative from the NGO federation. Team members can be more than seven in some districts based on the local context. The District level monitoring team will be responsible for monitoring of the REDD+ activities throughout the district in coordination with Sector, Ilaka and Community level monitoring teams. Each member of the monitoring team must be aware of REDD+ activities implemented. They must also know basic theory and principles of REDD+, monitoring tools and techniques. District monitoring team coordinating with Sector monitoring teams develops annual monitoring plan including progress monitoring (progress of implemented activities), damage monitoring (deforestation, forest degradation, illegal cutting, fire and other illegal activities) and safeguard monitoring (based on social safeguard indicators).

District level monitoring applies the use of both RS/GIS data and reporting system. Freely available images/maps like Google and Landsat could be useful and reliable data to be used for local level monitoring of REDD+ activities and related issues. For example, Google images can be used to detect deforestation activities like illegal timber harvesting, encroachment for agricultural expansion, fire damage, landslides etc timely and in a regular basis from the desk of monitoring officer. In addition to monitor activity data (i.e. land use), RS and GIS data can also be used to identify and monitor hotspots of carbon displacement, fire and other activities like expansion of urban areas. Further, district monitoring team must be aware of social aspects of REDD+ implementation. Monitoring report must explicitly describe the social, environmental and economical outcomes and likely implications of REDD+. Monitoring reporting format highlighted in Box 4 (detail in Appendix 4) shows some major safeguard criteria/indicators to be reported in the monitoring report.

In order to make the reporting system effective and efficient, each district can be divided into different constituencies based on local context including institutional arrangements, biophysical conditions, accessibility and management regimes. For example if the district is divided into

several Sectors and Ilakas, monitoring network and reporting system should also be networked accordingly. In case of districts with more than one management regimes like protected areas system, scientific management of forests, collaborative, leasehold and community forests, for example, each of the management regime can be considered as a constituency so one of the monitoring team members can be assigned as the responsible person to take care of the monitoring and reporting system of the assigned constituency.

Overall, this section has described five major steps for monitoring REDD+ activities starting from monitoring team establishment, monitoring plan preparation, information collection, analysis and suggest corrective measures. Figure 7 illustrates the linkage these consecutive steps.

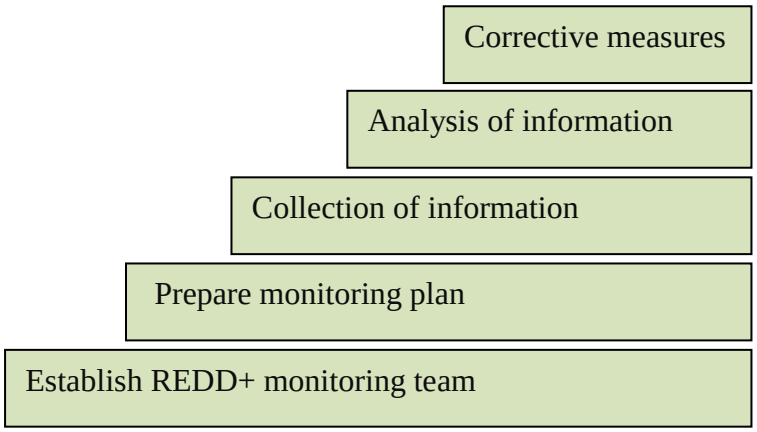

Figure 7: Procedures for community based monitoring of REDD+

3.4 Monitoring tools and techniques

3.4.1 Monitoring tools

There are various monitoring tools and techniques being used in many projects including REDD+. The selection of the appropriate tools depends on the technical capacity of the people, available budgets and purpose of the monitoring. The selection of the monitoring tools and their preferences at four different tires are given in the table 2:

Table 3: the selection of monitoring tools at four different tiers of MMR team

Monitoring tools	MMR team				Remarks
	District	Sector	Ilaka	Community	
Logical framework	☑☑	☑☑	☑	☒	
Project documents	☑☑	☑☑	☑	☑	
Periodic/annual plans and budgets	☑	☑	☑☑	☑☑	
Performance indicators	☑	☑	☑	☑☑	
Images (Satellite images)	☑☑	☑	☒	☒	
Maps		☑	☑☑	☑	
GPS, Digital camera (with high pixel resolution) units (e.g. Garmin) and software	☒	☒	☑☑	☑☑	
Other measuring instruments	☒	☒	☒	☑☑	
Different forms (such as site information form, data collection forms, vegetation information forms)	☒	☒	☒	☑☑	
Note: ☑☑= Highly useful, ☑= useful, ☒= Not any serious use					

3.4.2 Monitoring methods/technique

- ☑ Direct observations
- ☑ Photo point comparison
- ☑ Carbon assessment
- ☑ Forest inventory
- ☑ Remote sensing
- ☑ GIS/GPS
- ☑ Biodiversity assessment and profiling
- ☑ Participatory Rural Appraisal (PRA)
- ☑ Rapid Rural Appraisal (RRA)
- ☑ Focus Group Discussion (FGD)/ Interest Group Meeting
- ☑ Formal surveys: structured, semi-structured survey, checklist survey
- ☑ User satisfaction survey

Chapter 4: Measurement of REDD+ outcomes

4.1 Introducion

Preformance measurement of REDD+ activities has been considered as the most important step of REDD+ implementation. Mesurement report prescribes possible revenue to be generated from the implementation of REDD+ activities. Skills and approaches applied for performance mearurement determine acuracy and realiebility of the measurement hence influence motivation and involvement of the local people in REDD+ program. Measurement process involves different steps including time series recording of different variables in the field, analysis of colected data and interpretation of the result by involving different tools and techniques like analysis of remotely sensed data, use of professional skills and local communities knowledge. The participatory measurement done by the local community is comparatively cheaper, faster and more reliable than the measurement by external experts (Danielsen *et al.*, 2011; Skutsch *et al.*, 2009). Transparent, consistent and cost-effective data collection empower local communities and boost-up their confidence on REDD+ implmentation. If local people are properly trained on the basics theoretical and practical concepts of forest measurements, use of measuring tools and techniques, and supported by simple protocols/guideline for the measurement; they can produce the necessary information required for the implementation of REDD+ program.

4.2 Parameters to be measured

Broadly, REDD+ benefits are categorised into carbon and non carbon benefits. Possible amount of these benefits are determined by measuring several parameters related to status and impact of the REDD+ implementation. Figure 8 shows major parameters to be measured for assessing REDD+ performance.

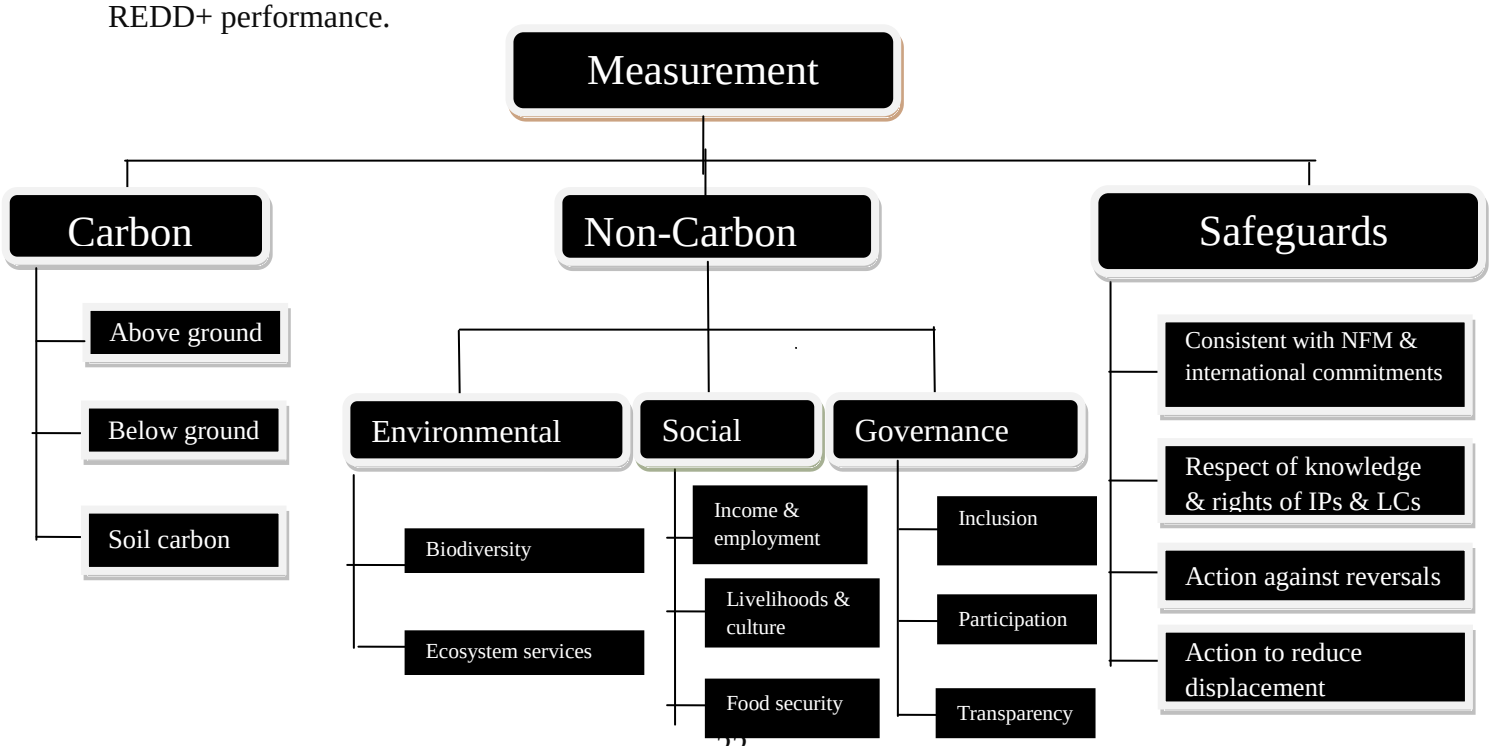

Figure 8: Different parameters to be measured under REDD+ at local level (NFM: National Forest Management; IPs: Indigenous people; LC: Local communities)

4.3 Processes and procedures for participatory measurement of REDD+ activities

4.3.1 Establishment of measurement team

The four tiers MMR team arrangement (district, sector, ilaka [area] and community) as described previously in Chapter 2 undertake measurement of REDD+ activities at local level. However, they may invite/involve some more members for performing some specific measurement that require expertise knowledge and skills like calculation of Activity Data (AD) using RS/GIS data, calculation of Emission Factors (EF) using inventory data.

As shown in Figure 8, there are different parameters to be measured. Different parameters require measurement teams of different skills and with different approaches. Based on carbon and non carbon outcomes, two types of measurement teams can be established

(i) Carbon Team: Carbon measurement team includes more technical matters and handling of measuring equipment therefore the members of this group should be able to properly handle simple tools and equipment. Forest Officer/Ranger of respective Ilaka forest office, a Local Resource Person (LRP), 3 members from CFUGs including women, Dalit[3] and indigenous people are suggested team members for carbon measurement at community level. The representative members will be selected by the group with extensive consultation and consensus. If the group is homogenous and there is not availability of other caste and indigenous communities, then the group selects the team members by keeping gender and wealth class of the members in mind. The team may hire or include additional 3-5 members to assist the team in field works if the size of the forests is very huge (or larger than 100 ha). The respective tasks for the team members are briefly described here:

Forest technician (AFO/Ranger): functions as the crew leader responsible for the overall technical precision of the measurement; GPS handling, sampling design, mapping, location of the plots, fixing the plots, height measurement and analysis, fixing relevant wood density and allometric equations for biomass estimation etc.

Local resource person (LRP): supports AFO/Ranger in conducting all abovementioned activities, diameter measurements, recording the measurement, mobilizing CFUGs members, data entry and analysis etc.

CFUG members: supports in plot layout, diameter measurement, clipping of the saplings, green weight measurement, packaging in the plastics, labeling, safety of the collected materials etc.

[3] Dalit: members of so called lower/untouchable caste in Hindu caste systems

(ii) **Non-carbon and safeguard team:** The team comprises a LRP, two from CFUG executive committee, one from women group and one representing indigenous groups. Forest technician may be desirable but not compulsory.

4.3.2 Basic training requirement for the team members

All team members should be trained on the theoretical and practical aspects of the carbon and non-carbon measurement. Set objectives, methods, tools, technique and procedures of the measurement should be clearly provided to the participants. Possible sources of errors and its effects in the interpretation should be described to them during the training. They should be clearly instructed about the existing mechanism for the data verification and validation.

The DFO in collaboration and cooperation with FECOFUN, NEFIN and other environment related NGOs should provide training before the actual measurement starts up. Two to five days long intensive training may be needed to train the team. Training should focus on following areas:

- ☑ Sampling techniques, plot layout, measurement methods and slope correction.
- ☑ Use of the forestry tools and equipment (e.g. GPS, base map, diameter tape, ordinary tape, Suunto Clinometer etc.).
- ☑ Measuring individual trees, shrubs, litters and soil organic carbon.
- ☑ Direct and proxy measurement methods for non-carbons and safeguards.
- ☑ Error sources and their types (cumulative or compensating errors).
- ☑ Simple tools and techniques for error minimization.
- ☑ Accurate recording of the measurement.
- ☑ Simple data analysis methods and their interpretation.
- ☑ Data validation and verification methods.

Box 6: Useful forest inventory and carbon measurement guidelines

- **DoF, 2004.** Community forestry inventory guideline, 2061
- **Pearson, T. R. H., Brown, S. L., Birdsey, R. A., 2007.** Measurement guidelines for the sequestration of forest carbon. USDA, the USA
- **MFSC, 2010.** Forest carbon measurement guideline, 2067
- DFRS/FRA, 2010. FRA field manual
- **ANSAB, FECOFUN, ICIMOD, 2011.** Guidelines for measuring carbon stocks in community managed forests
- **DoF, 2012.** NTFP inventory guideline, 2069
- **DoF, 2015.** Community forestry development guideline, 2071
- **GOFC-GOLD, 2012.** A sourcebook of methods and procedures for monitoring and reporting anthropogenic greenhouse gas emissions and removals associated with deforestation, gains and losses of carbon stocks in forests, remaining forests, and forestation

Box 7: Errors in measurement

Systematic/cumulative errors: adding up errors that may largely deviate the results from truth. It may be due to wrong calibration of the instruments and faulty personal vision of the individuals. Wrongly placed tape (i.e. is not complete horizontal) in the breast height always provide over estimation of the diameter of the tree. It is very serious problems if undetected on time.

Compensating errors: errors occur in both directions (+ or -), more or less compensating the results. Occur mainly due to carelessness, wrong measurement, vibrating the ocular instruments such as Suunto Clinometer etc.

4.4 Biomass/carbon measuring equipment

Following equipment or instruments can be used for participatory measurement of carbon and other non-carbon activities:

Table 4: Measuring tools/equipments and their uses

SN	Particulars	Tools/equipment	Use/purpose
1	Area measurement	Base map	Plot navigation and stratification
		Global Positioning System (GPS)	Area navigation, fixing point coordinates, boundary survey, locating plots
		GIS software (e.g. ArcView, ArcGIS, MapSource etc.)	Preparing the necessary maps and area estimation
		Computer	Preparing maps and area estimation
		Sylva compass	Measuring bearing and angles
		Linear tape	Measuring horizontal distances
		Ropes	Fixing the sample plots
		Iron or wooden peg	Fixing plot center or corners
		Cement pillar	
		Machete	Bush/shrub/climber cutting/cleaning
2	Diameter measurement	Diameter tape	Measure diameters at breast height
		Caliper	
		Enamel, Brush	Mark the plot or tree
		Recording sheet	To record the data obtained
		Pocket calculator	For computation of the data
3	Height measurement	Suunto Clinometer	Measuring angle of elevation or depression
		Abney's level	
		Vertex and Transponder	Measuring tree height, distance, angle
		Linear tape	Measuring horizontal distance
		Recording sheet	Record the data obtained
4	Volume/Biomass estimation	Volume table	Estimating volumes
		Biomass table	Estimating biomass
		Scissor/Knife	Cutting the herbs/grasses
		Weighting machine	To weigh the sample dishes, soil etc.
5	Soil sampling	Soil Corer	Collecting the samples from different layers
		Spade	To dig out the soil
		Trowel	
		Plastic bag & labels	To bring the soil to the laboratory
		Metal ruler	Measuring thickness of the soil layer

4.5 Details of carbon measurements

4.5.1 Forest carbon pools

Living biomass

Sum value of all living plant biomass measured above the soil including stems, stumps, branches, bark, seeds, and foliage is understood as the above ground carbon pool. Below ground living biomass is the live roots of plants which are generally above 2 mm diameter (IPCC, 2003).

Dead biomass

It includes dead wood and litters. Dead wood is all non-living woody biomass either standing or lying on the ground or in the soil. Litters are the small sized non-living biomass lying dead above the soil.

Soil

Soil organic matter (SOM) includes the organic carbon that lies in the soil to the depth of 30 cm from the ground surface (IPCC, 2006; MFSC/REDD-Cell, 2010).

4.5.2 Procedures for carbon estimation

The detail procedure for carbon estimation is given in Forest Carbon Measurement Guidelines, prepared by MFSC/REDD-Cell (now REDD-IC) in 2010. Similarly, ANSAB/ICIMOD/FECOFUN has also published the guidelines for measuring carbon stock in community managed forests in 2011.

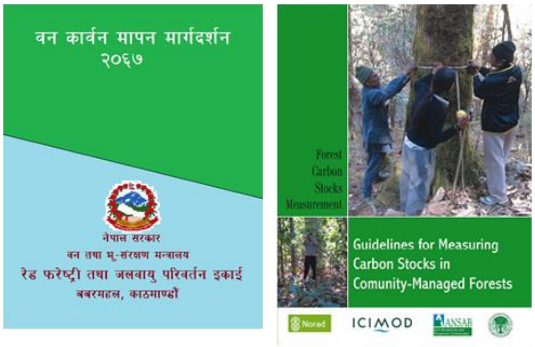

Figure 8: Carbon Inventory Guidelines prepared by REDD-IC and ANSAB/ICIMOD/FECOFUN

These guidelines in the following section briefly describe procedures to be followed while undertaking participatory carbon measurement at local level.

Determination of the forest boundary

Community managed forests varies largely in sizes, stand structure, composition, growing stock and geography. The average size of the CF is about 95 hectare in Nepal. However, the CF sizes range from mere few hectares (<1ha) to over 3,000 hectare. Dumling Conservation Community Forest has an area of 5,698 ha under Appi Nappa Conservation Area at Darchula district of Nepal. Many handed over community forests are continuous in distribution but some scattered and fragmented forests are also handed over as the community forests.

Therefore, it is very important to precisely identify and delineate the boundary of the forests. In general, most of the community forests and other types of the ongoing community based forest

management system in Nepal incorporate the precise boundary delineation on the forest map. If there is the GPS based map, it is necessary to check the precisions of the some boundary points (coordinates) or offsets by using GPS. If the previous map points or offsets are found precisely recorded, it is not necessary to do resurvey and delineate the boundary to prepare the map. In the case, there is any significant discrepancy or error noticed in the coordinate of the earlier map, the boundary survey needs to be done to prepare new map. The same will be done if there is not any map or precise map prepared in the CF Operational plan. For this, the team needs to consult with the respective District Forest Office requesting for their permission and support.

If there is not any inclusion or exclusion of the forest area, the previous map from CF operational plan could be used as the base map. Changes in forest area and its boundary if occurred must be documented, mapped out with greater precision to assess changes in emissions and the stock of carbon in the area (pool). The detail methods about recording coordinates, fixing boundaries and preparing maps by using GPS is elaborated in Forest Carbon Measurement Guideline, 2010 (MFSC/REDD Cell, 2010).

Mapping of reforestation, revegetation and deforestation areas

Existing base map can be revisited for the purpose of mapping changes in land use and forest composition. The reforested/revegetated or deforested areas after last measurement should be found out and located in the base map with the participation of local people. The identified locations of the changed forest areas or patches should be surveyed, delineated and mapped by using GPS. This map shows how much land have been reforested or deforested during stipulated time interval.

Sampling design

Complete enumeration is very expensive and time consuming; therefore it is not preferred technique in forestry. There are several sampling methods being implemented for inventorying forests in Nepal. Some of the important methods are: systematic sampling, random sampling and stratified sampling. There are advantages and disadvantages of all sampling methods which can be thoroughly studied in any book of forest inventory including "Forest Mensuration and Biometry" by Chaturvedi and Khanna, 2000.

For the more precise information collection, stratified random sampling is suggested for biomass estimation in the community forests of Nepal.

Stratified random sampling

Random sampling inside homogenous strata is called stratified random sampling. The major advantage of the stratified random sampling is to reduce the sampling bias and minimize the probable over or under representation of any part of forests.

If the random sampling is done in heterogeneous forest without making it to the homogenous strata, there is a chance to have disproportionately large number of plots in one part than others. Insufficiently sampled parts of the forests may lose much important information regarding the forest carbon.

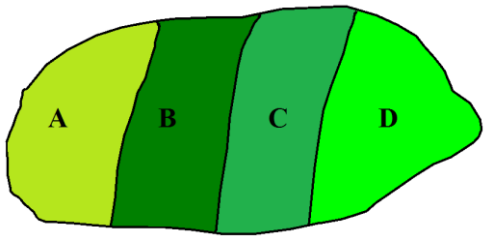

Figure 9: simple stratification of the forest based on tree species and conditions of the forests

Stratification is the process of dividing the forests into more or less homogenous strata. Therefore, there are more similarities within strata and larger variations between strata. The remote sensing images, aerial photographs, topographical maps etc. can be used to stratify the heterogeneous forest into various strata. Equally important is participatory stratification, which can be done by directly observing the differences in forest types, dominant tree species, stand ages (tree, pole, sapling, regeneration etc.), density of the trees, slope and aspects of the sites etc. Based on the characteristics of the forests, the size of the strata may differ.

For the participatory stratification, the team comprised of local community members visits the forests together and does boundary survey. The distinguished features such as variations in forest types, tree species, density, stand ages, slope or aspects etc need to be noticed. Based on the conditions of the forests, they themselves decide the criteria for stratification and divide the forests into 3-5 strata. The clearly visible and distinguishable boundary such as river, mountain ridges, roads etc. will be taken whenever possible to divide the forests into strata. The boundary survey with the GPS will be conducted to fix the size and shape of each stratum.

Box 9: Steps for participatory stratification

i. Participatory observation or reconnaissance survey.
ii. Identify visible differences among forest patches.
iii. Unanimously decide upon forest stratification into 3-5 strata.
iv. Consensus upon the boundary of each stratum.
v. Survey and prepare map of the forests with all strata.

If the CF blocks were rightly laid out and there is the availability of the good quality map of the forest precisely displaying the size and shape of the block, these blocks can be used as the strata for the purpose of carbon measurement.

Sampling intensity

Sampling intensity is simply the ration of the sampled units with the whole population which is generally shown in the percent. There are two different approaches in practice to decide the sampling intensity for the forest inventory. The first one is the fixing sampling intensity following the thumb rule (e.g. CF inventory guidelines, 2004). The second is to decide the optimal sampling intensity based on desired level of accuracy that considers the variability of the forests.

Sampling intensity fixed by thumb rule

The community forestry inventory guideline, 2061 proposes the sampling intensity to be in the range of 0.2 to 1.5% of the population for the estimation of the growing stock. The sampling intensity will gradually decrease as the size of the forest increases (see Table 3). Total number of sample plots will be proportionately distributed among the strata based on their individual sizes. If the area of the strata is 50 ha, the sampling intensity will be fixed at 1.5% (i.e. 15 plots of $20\times25m^2$). It is fixed at 1% for the 100 ha sized strata (or 20 plots of $20\times25m^2$) for tree measurement.

It is recommended to include additional 10% sample plots measurement upon the estimated number of plots as prescribed by Table 3. It works as buffer to minimize any discrepancies generated due to not including the variability of the strata into calculation of the number of plots by thumb rule.

Table 5: Sampling intensity as prescribed by the community forest inventory guideline, 2004

Area of Stratum (ha)	Sampling intensity (%)		
	Timber	Pole	Regeneration
Below 50	1.50	0.50	0.300
50.1 to 100	1.00	0.40	0.200
100.1 to 500	0.50	0.20	0.100
5000.1 to 1000	0.30	0.15	0.075
Above 1000	0.20	0.10	0.050
Plot size	**$20\times25m^2$ (0.05 ha)**	**$10\times10m^2$ (0.01 ha)**	**$5\times5m^2$ (0.0025 ha)**

Composite sample plots of various sizes need to be prepared for the measurement of the timber, poles, regeneration and sampling as shown in Figure 10. This is comparatively easier and more practical to fix the sampling intensity and sizes of plots. However, it does not consider the within stratum variations in fixing the intensity. The revised CF inventory guideline, 2016 (in preparation) has considered that the variance estimation is an essential item to be done prior to calculating the sampling intensity and plot numbers in order to reduce the errors.

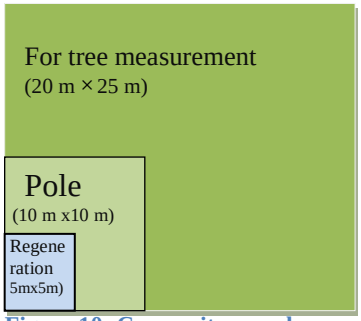

Figure 10: Composite sample plots for forest inventory

Fixing optimal sampling intensity

This will incorporate the variability of the sampling strata to allocate the number of plots. The variability of the measurement is calculated by estimating variance (σ^2) or standard deviation. Standard deviation (SD or σ) is the measure of the dispersion of a set of data from its mean. A greater number of plots will be allocated to the strata that have

greater variability (i.e. larger standard deviation) so that maximum variations within stratum could be captured.

The ANSAB, FECOFUN, ICIMOD (2011) prescribed the following procedures to calculate the number of required plots for above ground biomass measurements:

Step 1: Determine the level of precision required. Generally, the precision level is fixed at 10% of the mean in 95% (half tailed) confidence interval.

Step 2: Select randomly 10 to 15 preliminary sample plots per stratum.

Step3: Take biomass measurement in the plots. Estimate carbon stock per tree, per plot and mean carbon stock per ha for each of the preliminary sampling plots.

Step 4: Compute standard deviation of carbon (Mg C ha^{-1})* for all the plots.

Step 5: Calculate the maximum number of potential plots (or population frame) possible to make in the whole forest (N) and individual stratums (N_i) by dividing their respective area by the size of plot

Step 6: The total number of sample plots (n) in all strata will be measured by using following equation

$$n = \frac{(\sum_{i=1}^{L} N_i * S_i)^2}{\frac{N^2 * E^2}{t^2} + (\sum_{I=1}^{L} N_i * S_i^2)} \quad \text{.....equation (i)}$$

Then the distribution of the sample plots in each individual stratum is done by using following equation

$$n_i = n * \frac{N_i * S_i}{(\sum_{i=1}^{L} N_i * S_i)^2} \quad \text{.....equation (ii)}$$

Where,

n= total number of required sample plots

n_i= total number of required sample plots in strata (i)

i= project strata number 1 to L

L= total number of strata

N_i= maximum possible number of sample plots in stratum (i)

N= maximum number of sample plots in the project area

E= desired level of precision

t= sample statistic from the t-distribution for the 95% confidence interval

S_i= standard deviation for stratum (i).

Step 7: Visit the field to measure the biomass on the number of sample plots derived at step 6 (above).

*Mg C is the carbon measurement units which stands for Mega gram i.e. 1,000,000 grams which is equivalent to 1 ton

Step 8: Calculate the precision level for each stratum at the true relative half width of the confidence interval and compare these to the required precision values of 10% (Equation i). If the precision level is poorer than expected 10%, it is suggested to adjust the number of sample plots (increase) based on the standard deviation from all the sampling plots.

Step 9: It is suggested to repeat steps from 6 to 8 until the required precision is attained.

Shape and size of the plots

Plot design is very important for obtaining precise information. The quadrate (rectangular/square) and circular plots are most commonly used shape of the plots in forest inventory. Both types of the plot have particular advantages and disadvantages. Circular plot is easier to establish because one can easily make it sitting in the plot center and measuring the radius. However, it is very difficult to fix/mark the circular boundary permanently in the field as it has the circular or curved circumference. The rectangular plots are also easier to establish and permanently lay out on the ground.

Box 10: Deciding plot size and shape

- ☑ Use either circular or quadrate plots
- ☑ Circular plot is easier to establish as it can be drawn by fixing only the plot radius
- ☑ Make permanent and fixed plots for the consecutive measurements of the data for change detection
- ☑ Capture within plot variability to the maximum
- ☑ Use larger plots for sparsely dispersed trees and smaller plots for the dense and homogenous forests
- ☑ For the biomass measurement in Community Forests of Nepal, the plot size of 250 m^2 (plot radius 8.92 m) is recommended.

Guiding principle while designing/establishing sample plots is to capture the maximum variability within the designed plots. Capturing the high variability within the plot means that the differences between plot values become smaller that leads to minimize the standard error. Comparatively, the rectangular plots capture more variability within plots as compared to the circular plots.

Measurement teams are free to use either of these two (rectangular or circular) plot types (shape) considering available time, human resources and instructions if any. Most important thing is to follow process/procedures very precisely and consistently.

It is suggested to use the permanent plots for biomass/carbon measurement. Permanent plots are generally used for change assessment in the given time period. It should be established in such a way that the plot should be identified easily in the future. The plot center (for circular plots) and plot corners (for quadrate plots) should be marked with the wooden/cemented or iron peg. Permanent plots provide the opportunity to measure each variable very precisely and compare the results with baseline information to detect the changes. However, sometimes it is found that the due attentions are being paid to the permanent plots compared to surrounding areas that may provide the bias (one-sided) information. Likewise, it has been difficult to locate the permanent plots if the measuring interval is very long and poor marking is done.

The size of the plots largely depends on the homogeneity or variability of the strata. Larger plots yield more precise results as it collects more information. If the trees are consistently sparsely

distributed or widely spaced, then larger plot size is required. If the stand is dense and full of trees, even the smaller plots could provide required information. The size of the fixed plot depends on the variability of the plots, average measuring time per plot and average travelling time between neighboring plots (McDicken, 1997). The plot size should be fixed based on the conditions of the forests. McDicken, 1997 has suggested to use the plot sizes ranged from 100 m^2 (plot radius 5.64 m) for dense forests to 1,000 m^2 (plot radius 17.84 m) for very sparsely wooded vegetation. The default value of 250 m^2 (plot radius 8.92 m) is recommended for the biomass measurement of the community forests of Nepal (McDicken, 1997; ANSAB, FECOFUN, ICIMOD, 2011).

Table 6: Decision on appropriate size and shape of the plots based on the conditions of the forests

Plot size (m^2)	Quadrate plot	Circular plot (radius)	Area per tree (m^2 per tree)	Forest conditions
100	10×10 m^2	5.64 m	0-15	Very dense vegetation, stands with large number of small diameter stems, uniform distribution of larger stems
250	15.81×15.81 m^2	8.92 m	15-40	Moderately dense woody vegetation
500	20×25 m^2	12.62 m	40-70	Moderately sparse woody vegetation
666.7	25.82×25.82 m^2	14.56 m	70-100	Sparse woody vegetation
1,000	25×40 m^2	17.84 m	>100	Very sparse woody vegetation
				Adapted from MacDicken, 1997

Nested circular plots should be arranged within the large circle to measure poles, saplings, regeneration and leaf litters. Subplots of 5.64 m and 1.0 m radii should be established for measuring poles and regenerations respectively. Similarly, a subplot should be established with a 0.56 m radius (i.e. area: 1.0 m^2) for sampling leaf litters, herbs, grass and soils (ANSAB, FECOFUN, ICIMOD, 2011).

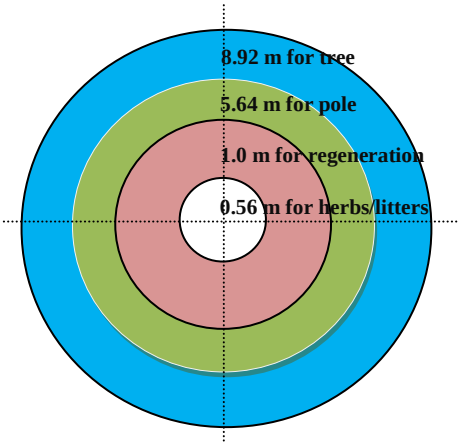

Figure 11: Nested circular sample plots for the biomass measurement

- **Slope correction**

The horizontal distance needs to be calculated before the actual measurement to lay out the plots. In the sloping field, the actual sloping distance should be measured based on the slope angle and horizontal distance.

Slope can be measured by Abney's level or Clinometer and linear tape. The surveyor should stand in the lower

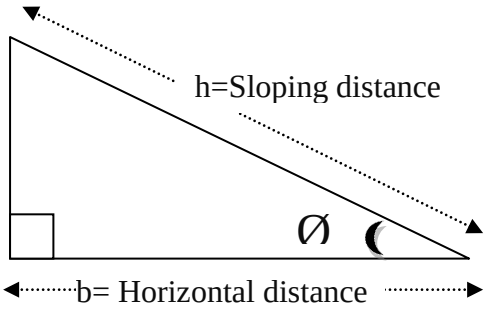

Figure 12: Converting sloping distance into the horizontal distance

side of the field and looked into the stand of his eye height fixed at the uphill side of the slope. The Suunto Clinometer or Abney's level or any other angle measuring instruments provides the sloping angle of the field. The surveyor precisely measures the angle of sight through Suunto Clinometer (or other angle measuring instrument) by sighting the vertical staff or stick of his/her eye height erected at another side of the slope and notes the angle of elevation. The sloping distance can be converted to the horizontal distance by using trigonometric formula. The formula for the conversion of the sloping distance into horizontal distance is as follows:

$$Horizontal\ distance(b) = sloping\ distance(h) \times Cos\emptyset \ldots\ldots\ldots\ldots\ldots\text{equation (iii)}$$

$$Sloping\ distance(h) = \frac{horizontaldistance(b)}{Cos\emptyset} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\text{equation (iv)}$$

For example, let's suppose the angle (Ø) of the slope is 30°, then the horizontal distance 8.92 m would be the 10.30 m sloping distance (Cos 30°=0.866). Therefore, the radius of the circle needs to keep 10.30 m instead of 8.92m in sloping directions for measuring the biomass.

Plot layout

Plot layout in the map

After deciding the total number of plots, their size and shape, it is very important to distribute the plots into the map. There is various GIS based software to lay-out or distribute the random sample plots within each stratum such as Hawth's analysis tool for ArcGIS. It can be downloaded from http://www.spatialecology.com/htools/

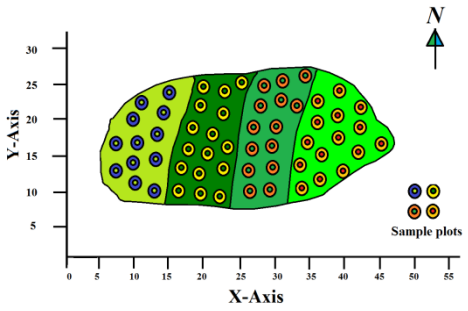

Figure 13: Sample plots distributed among forest strata in the map

It can also be done manually. Steps for manual distribution of the plots in map and in forest are as follows:

- ☑ Coordinates for the forest and strata should be fixed first.
- ☑ The minimum and maximum coordinates (X and Y) of the each stratum should be identified.
- ☑ These coordinates can be identified by using GPS.
- ☑ The X and Y coordinates of each random plot will be fixed by generating random number in the calculator or computer.
- ☑ Find out the random number for each individual plots and find out the coordinates of the plot center (if circular plot) for all plots by using following formula:

$$\mathbf{X = x\ minimum + (x\ maximum - x\ minimum) \times Random\ Number}$$
$$\mathbf{Y = y\ minimum + (y\ maximum - y\ minimum) \times Random\ Number}$$

Where,

x-maximum/minimum: maximum/minimum X coordinates of the respective stratum

y-maximum/minimum: maximum/or minimum Y coordinate of the respective stratum

- ☑ Random number generated ranges from 0 to 1. It can be generated by using the random number generating functions of calculator or computer
- ☑ Calculated plot coordinates are either depicted in the map or uploaded into GPS. Accurate and well labeled maps are important for finding the permanent plots for the subsequent measurement in future.

Plot distribution in the field

- ☑ The X and Y coordinates uploaded into the GPS needs to be distributed in the field.
- ☑ The center point of the each circular plot (and corner point of the quadrate plot) should be navigated with GPS in each stratum.
- ☑ The precision of the plot center located with the GPS depends on the quality of the instruments, overgrown vegetations and weather conditions. If the GPS signal is not strong and disturbed by the trees and bushes, the exact location of the plots may be shifted by few meters (~5m).
- ☑ In the case of GPS unavailability or very dense vegetations disturbing to obtain good quality satellite signals, the compass can be used to take the bearing. The distance will be measured by tape. This compass bearing and distance method is also useful and easy to operate.
- ☑ Permanent sample plots will be fixed by marking the center with metal or wooden pegs, tags or Enamel.

4.6 Measurement of carbon

After establishing the permanent plots in each stratum; the crew may start the above ground and below ground biomass measurement from one corner of the strata. The biomass then converted into the carbon storage or sequestration into the forests by using the conversion factor (specific density) or allometric equations.

4.6.1 Biomass measurement

There are different carbon pools in the forest as mentioned in chapter 4.5.1. Most of the carbon is retained as the plant biomass in the forests. These includes: tree biomass, biomass of sapling, poles, regeneration, shrubs and herbs. They are measured in the respective plots by following methods:

Estimation of the growing stock of the trees and poles

The total growing stock of the forest is estimated by measuring the diameter at breast height and total height of the trees and poles. Trees have the DBH over 30 cm and the poles in the ranges of 10 cm to 29.9 cm (MFSC, 2015; CFD guidelines). However, most of the carbon measurement guidelines recommend measuring the biomass of all trees above 5 cm dbh. For the precise volume estimation, the form factor of the tree (i.e. 0.5 in general) can be frequently used in the equation.

The team should start diameter and tree height measurement from one side of the plot. The name of the species, DBH and tree height should be recorded in the data sheet. Each measured tree

should be marked with enamel to control duplication in measurement. All the trees inside the plot over 5 cm DBH should be measured and recorded.

Diameter measurement

The diameter of the tree is measured at the breast height. The 1.3 m from the ground surface is considered as the standard breast height for diameter measurement. A straight stick marked with 1.3 m can be locally prepared for faster and easier measurement of the breast height for diameter measurement.

- ☑ Measure the DBH with either Diameter tape or Caliper.
- ☑ If there is not the diameter tape, then the DBH can be measured with linear tape. As it measures the circumference of the stem, it should be converted into diameter by dividing with 3.1416 (i.e. the value of Π)
- ☑ Measure the over bark diameter of the bole to the precision of 0.1 cm (metric system).
- ☑ The tape should be kept horizontal across the stem so that the precision could be improved.
- ☑ There are several methods for the measurement of the diameter in special cases
- ☑ For the inclined tree, measure the height (1.3 m) from the inclined side
- ☑ For the tree in slope land, the dbh should be measured at 1.3 from uphill side
- ☑ If the fork is above 1.3 m, the diameter will be measured below the fork considering the tree as the single tree.
- ☑ If the fork is below the 1.3 m, the bifurcated branches will be separately measured at 1.3 meter, and the dbh is estimated by following formula

Figure 14: Diameter measurement of the forked tree

$$dbh = \sqrt{a^2 + b^2} \quad \text{.....equation (v)}$$

Where, a and b are the diameter of bifurcated stems 1 and 2 respectively.

- ☑ If the stem is swollen at the height of 1.3 m, the diameter will be measured just below the swollen stem.
- ☑ If the stem is buttressed up to 1.3 height, the diameter should be measured on the stem just above the buttresses

Figure 15: Laser Range Finder (up) and Transponder (down)

Tree height measurement

After diameter, the height of the tree is the second most important variable for volume/biomass calculation. Height measurement is a time consuming and expensive process. There are some optical instruments that can measure the height of the tree and provide direct

measurement. The trigonometric calculations program is inbuilt in these instruments. Vertex with Transponder, TruPulse 360° Laser Range Finder (see figure.) can be used for the direct measurement of the tree height. However, they are more expensive instruments and slightly difficult to handle by local people with limited skills.

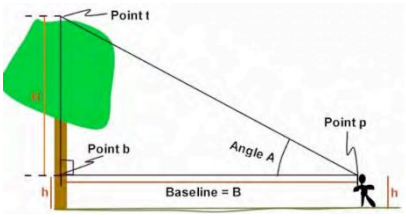

Figure 9: Height measurement

Simple instruments such as the Suunto Clinometer or Abney's Level can be used to measure the angle of elevation or angle of depression formed while sighting the tip of the tree. After measuring the angle of elevation (Figure 16) and horizontal distance between observer and tree, the total height of the tree can be computed by simple trigonometric calculation.

$$TanA = \frac{p}{b} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{equation (vi)}$$

Where,

p= perpendicular (height of the tree above eye height of the observer (H) i.e. b × TanA)
b= base (the horizontal distance between observer and tree)
∠A= angle of elevation
h= eye height of the observer
Total height of the tree= H + h

Process

- ☑ Carefully check the instruments and confirm whether it is in good or damaged.
- ☑ Find out the place from where the tip of the crown and bottom of the tree can be easily seen.
- ☑ Mark the tree at his/her eye height.
- ☑ Sight the tip of the crown through Suunto Clinometer or Abney's Level.
- ☑ Sight the eye height marked on the tree stem.
- ☑ Note both angles on the diary.
- ☑ Measure the horizontal distance between tree and observer.
- ☑ If the tree is on slope, the slope distance should be converted into horizontal distance.
- ☑ In slope areas, observer measures either both angles of elevation (tree standing on uphill side) or angle of depression if the tree is standing on downhill side.
- ☑ If the tree is inclined, it should be measured differently (see Chaturvedi and Khanna, 2000)
- ☑ Record all measurements very precisely and carefully in the field book. The condition of the tree is used to categorize the quality of trees into three different categories as suggested in Annex 7 of the Forest Regulation, 1995.

All the trees above 11 inches diameter at the breast height except Khair (*Acacia catechu*) should be categorized into three classes:

Class I: clear and firmed bole without any scar due to decay and wound.

Class II: partly damaged with decay and wound therefore part of the timber is lost from the gross volume, at least 2 logs over six feet length or a log over 10 feet log will be obtained up to 8" top diameter.

Class III: those trees not covered by class I or II.

Biomass measurement of tree

In Nepal, there are two methods in general practice for the estimation of forest tree biomass. First, the growing stock by volume of the existing trees is estimated by using volume table (Sharma and Pukala, 1990). This estimated amount of the volume is later converted into the biomass by multiplying with the density[4] of the wood. The branch-to-stem and foliage-to-stem biomass ratio will be taken from the MPFS, 1988 to estimate the branch and foliage biomass.
The biomass of the stem is

$$\text{Biomass} = \text{Volume (in m}^3\text{)} \times \text{Density of the wood (in kg per m}^3\text{)} \quad \text{..... equation (vii)}$$

Air dry density is always larger than oven dry density of the wood. When we measure the air dry density of the wood (i.e. mostly density table are given in air dry density as mentioned here in the guidelines). This air dry density needs to convert into oven dry density to estimate the carbon. The air dry to oven dry density conversion factor is taken as 0.9 (FRA, 2014).

The second method is to use the biomass table (and equation) directly based on the measurement of the DBH. The Tree Improvement and Silviculture Component under the MFSC (2000) published the biomass table for 34 timber species including Sal (*Shorea robusta*), Khair (*Acacia catechu*), Uttis (*Alnus nepalensis*), Sisoo (*Dalbergia sissoo*), Eucalytus (*Eucalyptus camaldulensis*), Lankuri (*Fraxinus floribunda*), Angeri (*Lyonia ovalifolia*), Kafal(*Myrica esculenta*), Chir pine (*Pinus roxburghii*), Blue pine (*Pinus wallichiana*), Banjh (*Quercus leucotrichophora*) etc. The diameter measurement at the breast height (i.e. 1.3 m) can be converted into the green biomass of the tree by using the biomass table or equation given in the HMG/TISC, 2000. HMG/TISC/MFSC, (2000) produced the allometric equations to estimate the biomass for various species. These equations can be used to estimate total biomass from foliage, branch and stem of the trees.

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[4]**Air dry density of wood**:
Rajbriksha: 970 kg/m^3, Khair: 960 kg/m^3, Asna: 950 kg/m^3, Harro: 920 kg/m^3, Banjhi: 900kg/m^3, Sal: 880 kg/m^3, Khasru: 860 kg/m^3, Bot Dhagero: 850 kg/m^3, Amala: 840 kg/m^3, Gayo: 830 kg/m^3, Satisal: 820 kg/m^3, Sissoo: 780 kg/m^3, Barro: 770 kg/m^3, Jamun: 770 kg/m^3, Kafal: 750 kg/m^3, Teak: 720 kg/m^3, Painyu: 720 kg/m^3, Khari: 720 kg/m^3, Birch: 700 kg/m^3, Chilaune: 690 kg/m^3, Haldu/Karma: 670 kg/m^3, Khote Sallo: 650 kg/m^3, Bhojpatra: 650 kg/m^3, Lali Gurans: 640 kg/m^3, Dabdabe: 640 kg/m^3, Kutmero: 610 kg/m^3, Kadam: 600 kg/m^3, Deodar: 560 kg/m^3, Rudraksha: 500 kg/m^3, Champ: 497 kg/m^3, Gobre Sallo: 480 kg/m^3, Tooni: 480 kg/m^3, Thingre Sallo: 480 kg/m^3, Kavro: 460 kg/m^3, Uttis:390 kg/m^3, Simal: 368 kg/m^3, Gutel: 352 kg/m^3, Uttis: 320-370 kg/m^3, Phaledo: 300 kg/m^3 (MPFS, 1988; Sharma and Pukala, 1990; Jackson, 1994).

This green biomass can be converted into the oven dry biomass by using conversion factor. The conversion factor can be derived by oven drying the part of timber.

$$Conversion\ Factor = \frac{Green\ Biomass\ in\ kg}{Oven\ Dry\ Biomass\ in\ kg} \ldots\ldots\ldots\ldots\ldots\ldots \text{ equation (viii)}$$

The total biomass of the individual tree can be estimated by summing up the stem biomass, branch biomass and foliage biomass.

Biomass estimation of saplings, shrub and regeneration

Besides trees, the forests in general are full of the poles, sapling, regenerations, shrubs and herbs. Generally, the number of the plants in the high forest forms the inverse 'J' shapes. Forests in general represent extremely large number of the seedlings (i.e. regeneration) that gradually drops down to few large trees as it grow. All plant less than 1 cm dbh is considered as the regenerations. Saplings are the plants which is 1 cm to 5 cm in diameter at breast height. All of these plants need to be measured in the plots of their respective sizes (Table: 5; Figure: 9).

- ☑ Measure the DBH of all saplings in the plots.
- ☑ Make a frequency table for counted saplings. This can be made into four classes.
- ☑ Class I (DBH 1 to 2 cm), Class II (DBH 2 to 3 cm), Class III (DBH 3 to 4 cm) and Class IV (DBH 4 to 5 cm).
- ☑ Count the number of regenerations which is less than 1 cm DBH.
- ☑ Harvest all parts of five saplings per plot. It can be harvested up to 3 plots per stratum. It is done to reduce the damages to the growing poles as the biomass estimation for the poles follows destructive methods.
- ☑ The harvested parts should be chopped into small pieces so that it can be packed into the small plastic bag.
- ☑ Weigh the freshly harvested plants (Green or fresh weight).
- ☑ Pack the chopped parts and send it to the laboratory for measuring the oven dry weight.
- ☑ Produce the correlation coefficient of the green and oven dry weight of the poles.
- ☑ Produce the correlation coefficient of the sizes of the poles and oven dry weight.
- ☑ Multiply the number of poles in each size class with the average oven dry weight of the poles of that size class.

Box 11: Correlation coefficient (r)

It indicates the linear relationship between 2 or more interdependent variables. It ranges from -1 to +1. It can be estimated by calculating:

$$\mathbf{r} = \frac{\mathbf{n}(\sum \mathbf{xy}) - (\sum \mathbf{x})(\sum \mathbf{y})}{\sqrt{[\mathbf{n}\sum \mathbf{x^2} - (\sum \mathbf{x})^2\,] - [\mathbf{n}\sum \mathbf{y^2} - (\sum \mathbf{y})^2]}}$$

Where,

x=measurement of variable x (such as green weight in kg)

y= measurement of variable y (such as oven dry weight in kg)

Likewise, correlation coefficient (r) can be established between pole sizes and oven dry biomass

Biomass estimation of grasses and herbs

Grass and herbs are relatively smaller in the plots. They are harvested from 1 m radius plots (area: 3.14 m^2) and weighed to estimate the green weight. Later on, these harvested grasses are sent to laboratory to dry and get the oven dry biomass.

Biomass estimation of leaf litters

Similarly all the dry and fallen leaves, small twigs (less than 2 cm diameter) and such parts are collected from the central circular plot of 0.56 m radium (1 m^2) and weighed. Then, the well mixed composite sample of about 100 grams is prepared and brought to the laboratory to measure the oven dry biomass. Later the total biomass of the leaf litter, twigs, grasses and other herbs is estimated by using the unitary system of the arithmetic.

Biomass measurement of the dead wood, stumps and logged trees

All of the standing dead trees, fallen trees (dead or green) and fallen branches over 5 cm DBH are measured in the whole plots of 250 m^2 (radius 8.92 m). Branches less than 5 cm diameters are measured at subplot of 100 m^2 (radius 5.64 m).

Volume of the standing dead trees is estimated as in the case of standing live tree by measuring DBH and height of the tree (Chapter 4.6.1)

Stump is the part of tree bole containing best quality timber. It is strong, denser and more resistant to biotic/abiotic infestation compared to other parts of the log. The diameter at the mid-length of the stump and its length (height) should be measured. The volume can be measured by using quarter girth formula. For the broken tree whose height is over 1.3 m, the DBH and height of the broken point of the tree is measured. The volume is estimated by using volume table as in Chapter 4.6.1.

The volume of the fallen branches/stems should be obtained by measuring the mid-diameter and length. The stem or branch of the tree is sectioned into straight sizes of possible length (i.e. 1 m to 4 m). The mid diameter of the log is then to be measured. For the easy reason, quarter girth formula is used to estimate the volume. We need to add the 21.5% of the estimated volume as quarter girth formula provides the lower estimate by the 21.5%.

Calculated volume should be converted into the oven dry biomass by multiplying with the density of the respective tree species.

Underground carbon estimation

There are mainly two components that comprised underground carbon. The first one is the dead or living roots of all plants and the second one is the carbon contains in the soil. They should be measured as follows:

Carbon estimation of the underground roots

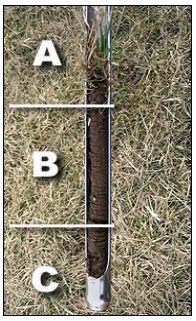


Figure 10: Excavated soils for 3 different layers in the Soil Corer

Biomass estimation of the underground roots is very difficult, time consuming, much expensive and challenging tasks. The digging of vertical and horizontal spreads roots is almost impossible for larger areas. Therefore, it is suggested to use the root to shoot biomass ratio published earlier.

MacDicken 1997 has suggested using 10-20% of the above ground biomass as a conservative estimate for the estimation of underground biomass. However, general practice in Nepal is 20% shoot to root ratio as suggested by the carbon inventory guidelines (MFSC/REDD Cell, 2010; ANSAB/ICIMOD/FECOFUN, 2011). But, we recommend to use the conversion factor for shoot to root ratio of 0.25 as it is reasonably close to IPCC default value of major forest types of Nepal and also used by the Forest Resource Assessment Project of Nepal (FRA, 2014).

Soil organic carbon measurement

Soil organic carbon is derived from living tissues such as leaves, twigs and roots, sap and exudates, microbes, fungi, and animals, mostly as the result of decay processes and microbial metabolisms.

The soil organic carbon is analyzed to the depth of 30 cm from the ground surface (IPCC, 2006).A pit of 30 cm depth will be dug near to the center of all plots considering the aspect, slope, vegetation types and geological structures. The Soil Corer (see figure 16) will be inserted into the soil to obtain the soil mass from different depth layers (0-10 cm, 10-20 cm and 20-30 cm). The soil at all three different depth layers should be collected and kept into different plastic bags and sent to laboratory for further analysis. One composite soil sample is collected by mixing the all soils from three soil layers. Around 100 grams of the composite soil is suggested for the further analysis.

Bulk density, dry weight per unit volume of the undisturbed soil, needs to be estimated to calculate the soil organic carbon. It can be estimated by dividing the dry weight of the soils (after drying in the lab) by the volume of the undisturbed soils. The soil volume can be obtained by multiplying the inner area of the Soil Corer by the length of the excavated soil obtained in the Corer. For more precision, the length of the soils can be averaged after collecting four samples at a plot.

$$\textbf{Bulk density (D)} = \frac{\textbf{Ovendryweightofthesoilsamples (W)}}{\textbf{Volumeofundisturbedsoil (V)}} \quad \text{..... equation (ix)}$$

Where, $\textbf{Soil volume} = \frac{\Pi d^2}{4} \times \textbf{L}$ ..... equation (x)

d=Inner diameter of the Soil corer (in cm)

L=Length of the excavated soil in the Soil Corer (in cm)

4.7 Data analysis

All collected data need to be properly analyzed to draw inferences about the quantity of the carbon stored/sequestered in the forests. The carbon sequestered in all carbon pools must be clearly computed and added up. There should not be anything left out for expert guesses, rather should be justified in the light of scientific bases.

4.7.1 Aboveground biomass

Aboveground tree biomass

Looking upon the larger portion of the carbon storage in the tree biomass at forests, it is considered as one of the important carbon pools. It is better to start the biomass estimation soon after the completion of the field measurement. Following steps are suggested:

- ☑ Enter all required data fairly into the data recording format.
- ☑ Clean the data if needed, correct the units of the measurement and any errors occurred during field work.
- ☑ Establish an excel sheet on Microsoft office or database register.
- ☑ Enter the data into the Excel sheet.
- ☑ Decide upon the use of appropriate methods for the data analysis.
- ☑ Decide on the application of which of the volume table or biomass table used for the data analysis.
- ☑ Decide on the use of allometric equation to estimate volume or biomass. Allometric equation for estimating biomass depends on DBH, tree height and specific gravity (density) of the wood.
- ☑ If volume table is decided to use, obtain the appropriate volume table from recognized sources of targeted species. Sharma and Pukala, 1990 has generally been recommended volume table for many species in Nepal.
- ☑ The volume of the tree can be converted into the biomass by multiplying with the oven dry density of the species. There are the density of many timber species in HMG/TISC, 2000 and Jackson, 1994 publications. The synthesis of the species wise density of major timber species of Nepal has been provided in the Carbon Inventory Guidelines; MFSC/REDD-Cell, 2010.
- ☑ The biomass of the branches and foliage should be estimated by branch-to-stem and foliage-to-stem ratio prescribed by MPFS, 1998 (for detail see Table 6).
- ☑ If it is decided to use the biomass table, then it is suggested to obtain the appropriate biomass table for selected species. The HMG/TISC has produced a good quality biomass table in 2000 AD for many timber species. Either the biomass table or the allometric biomass equations can be used for the estimation of fresh biomass.
- ☑ This fresh biomass can be converted to the oven dry biomass in kg (kilogram).

- ☑ Based on the specific gravity (density) of the species, the oven dry biomass is converted into the carbon content of the tree by multiplying with the default conversion factor 0.47 for tropical and subtropical regions (IPCC, 2006).
- ☑ Compute the carbon storage in all plots and estimate the average carbon storage per square meter of forest area. It can be later converted to the unit of ton carbon per hectare.

Table 7: Branch-to-stem and foliage-to-stem biomass ratio (R)

SN	Species		Branch to stem			Foliage to stem		
	Local name	Botanical name	Small	Medium	Large	Small	Medium	Large
1.	Birch	*Betula spp.*	0.511	0.383	0.300	0.277	0.173	0.123
2.	Banjh	*Quercus sp.*	0.747	0.960	1.060	0.229	0.215	0.202
3.	Oak	*Quercus lanata*	0.747	0.960	1.060	0.229	0.215	0.202
4.	Lali Gurans	*Rhododendron arboreum*	0.544	0.910	1.135	0.277	0.225	0.212
5.	Chilaune	*Schima wallichii*	0.520	0.186	0.168	0.064	0.035	0.033
6.	Kafal	*Myrica esculenta*	0.524	0.590	0.605	0.170	0.160	0.155
7.		*Engelhardtia spicata*	0.925	1.410	1.685	0.316	0.225	0.202
8.	Uttis	*Alnus nepalensis*	0.803	1.226	1.510	0.169	0.089	0.060
9.	Paingyu	*Pyrus pashia*	1.595	2.680	3.220	0.186	0.172	0.169
10.	Angeri	*Lyonia ovalifolia*	0.879	0.709	0.670	0.506	0.714	0.850
11.	Katus	*Castanopsis indica*	0.398	0.915	1.496	0.053	0.048	0.042
12.	Chir pine	*Pinus roxburghii*	0.189	0.256	0.300	0.101	0.046	0.033
13.		*Rhus wallichii*	0.601	0.630	0.640	0.143	0.083	0.080
14.	Blue pine	*Pinus wallichiana*	0.689	0.488	0.410	0.403	0.238	0.180
15.	Sal	*Shorea robusta*	0.055	0.341	0.357	0.062	0.067	0.067
16.	Sissoo	*Dalbergia sissoo*	0.684	0.684	0.684	0.010	0.010	0.010
17.	Amala	*Phyllanthus emblica*	0.645	0.725	0.750	0.125	0.079	0.067

Maturity Class: Small: regeneration and pole size (<28 cm dbh); medium: immature or small timber sized trees (28 cm to 53 cm dbh); Large: matured to over matured trees (over 53 cm dbh).

(Adapted from MPFS, 1988)

Sharma and Pukkala (1990) have also proposed various allometric equations to find out the branches and foliage biomass based on the stem biomass. They have categorized the tree into four major groups: **s**mall (<10 cm dbh), **m**edium (10-40 cm dbh), **b**ig (40-70cm dbh) and **o**ver sized (>70 cm dbh). This formula can also be used to assess the 'Air Dry' biomass of the branches and foliages based on the stem biomass of the respective sized tree.

For the small trees with less than 10 cm dbh

$$\boldsymbol{R = s}$$

For the medium sized trees at range of 10 to 40 cm dbh

$$\boldsymbol{R = ([(dbh - 10)m + (40 - dbh)s])/30}$$

For the big sized trees at range of 40 to 70 cm dbh

$$R = ([(dbh - 40)b + (70 - dbh)m])/30$$

For the over sized trees over 70 cm dbh

$$R = o$$

Where,

R: ratio
s: stem biomass of the small sized tree (i.e. less than 10 cm dbh)
m: stem biomass of the medium sized tree (10-40cm dbh)
b: stem biomass of the big sized tree (40-70dbh)
o: stem biomass of the over sized tree (> 70 cm dbh)

4.7.1.2 Aboveground sapling biomass

The above ground sapling biomass can be computed with the biomass table or equation produced by HMG/TISC 2000. This book produced the biomass tables for several tree species which are commonly found in the CF of Nepal. It is suggested to use the value of the similar species if the information about particular species is missing in this publication. The biomass equation is prescribed as

$$\log B = a + b \log D \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{equation (xi)}$$

Where,

log= natural logarithm (dimensionless)
B= above ground sapling biomass (green weight in kg)
a= intercept for allometric relationship (dimensionless) and value given in the HMG/TISC, 2000
b= slope for allometric relationship (dimensionless) and value given in the HMG/TISC, 2000
D= over bark diameter at breast height (in cm)

Thus calculated green biomass should be converted into the oven dry biomass by multiplying with conversion factor (i.e. Oven Dry to Wet Mass). The conversion factor can be estimated by drying the sampled dishes. The conversion factor (F) is estimated by computing the oven dry weight percentage of the sampled dishes from saplings:

$$DWR = \frac{DW}{GW} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \textit{equation } (xii)$$

Where,

DWR= Oven dry to wet mass ratio (%)
DW= Oven dry weight (in kg)
GW= Green weight (in kg)

Thus, estimated oven dry biomass is converted into carbon biomass by multiplying with IPCC default value of 0.47.

Carbon estimation from leaf litter, herbs and grass

The oven dry biomass of the collected leaf litter, herbs and grasses are computed by multiplying their wet masses by DWR as in equation xii. The biomass is converted into carbon content by multiplying with IPCC default value of 0.47.

4.7.2 Belowground biomass

As the computation of the below ground biomass is difficult to estimate, the default shoot to root ratio of 0.2 is used to convert aboveground biomass to the below ground biomass.

4.7.3 Soil Organic Carbon (SOC)

The soil organic carbon is measured in the laboratory. The participatory team will assist in the precise collection of the soil samples and sending them to the laboratory. The carbon content per unit of soil volume is converted to the total carbon content in the forest stratum and forest area.

4.8 Total carbon stock density

Total carbon stock of the stratum is the sum of the carbon stock densities of all individual carbon pools of that particular stratum. Carbon stock density of a stratum is computed as:

$$\mathbf{TCD = A + B + C + D + E + SOC} \quad \text{equation (xiii)}$$

Where,

TCD= Carbon stock density for a land use category (Mg C ha^{-1})
A= Carbon stock in above ground tree biomass (Mg C ha^{-1})
B= Carbon stock in above ground sapling biomass (Mg C ha^{-1})
C= Carbon in below ground biomass (Mg C ha^{-1})
D= Carbon in litter, herb and grass (Mg C ha^{-1})
E= Carbon in the deadwood and stumps (Mg C ha^{-1})
SOC= Soil Organic Carbon (Mg C ha^{-1})

The total carbon storage of the respective forest stratum is calculated by multiplying the total carbon density by area of the stratum and forests. The total carbon storage of the forests is then need to converted into the tons of CO_2 equivalent by multiplying with 3.67.

Thus the total carbon storage inside the forests estimated.

4.9 Measurement of non-carbon outcomes

Non carbon benefits of REDD+ implementation include social, environmental and governance enhancement. REDD+ may have both positive and negative outcomes to the society, culture, and environment and livelihoods in the area of intervention. Non-carbon outcomes measurement is therefore considered as an important part of the REDD+ implementation process. Measurement of non-carbon outcomes of REDD+ implementation include following activities:

4.9.1 Biodiversity assessment

Biodiversity refers to the variability of the life forms that includes genetic, species and ecosystem diversities in the particular area. The biodiversity conservation is one of the major achievements obtained from community forests in Nepal. The impacts of the REDD+ activities in the conservation of local biodiversity need to be assessed and reported.

The detail biodiversity assessment is difficult and much demanding for special tools, technique, knowledge and skills. Various scientific methods and measuring indices are available for biodiversity assessment. Some basic tools and methods for estimating biodiversity at the species level of important flora and fauna are described in this guideline.

It is recommended to use the same plot design and sample size for biodiversity measurement that was designed to measure biomass. As discussed in previous section, tree species diversity and other plants/NTFPs should be recorded from the plot of 250 m^2 (i.e. radius: 8.92 m) and 3.14 m^2 (i.e. 1 m radius) respectively. Some major steps are:

- ☑ Directly observe the species, take the photographs and specimen if possible.
- ☑ Identify the number of tree/plant/wildlife species with support from the local people and expert.
- ☑ Take the herbarium specimen and clear photographs for important/endemic plant or wildlife species; unknown (unidentified) and rare species.
- ☑ Record the number of the species in the field book.
- ☑ Identify the non-timber forest products, their abundance and importance.
- ☑ Assess the importance and ethno botanical use of the NTFPs consultation with local people and published literatures.
- ☑ Record the number of epiphytes (e.g. orchids), parasites, climbers (e.g. Bhorla, Kukur Daino[5] etc.) and their host species.
- ☑ List out the number of all species such as tree species, shrub species, climbers, grasses, birds, mammals, reptiles etc.
- ☑ Record the number of water bodies, their sizes, pastures lands (range land) area.

Box 12: Species identification

Identification of the local species, mainly plant species is difficult for outsiders. The participatory identification is more convenient than the species identification based on the taxonomical studies by experts (botanists or taxonomists). Therefore, local name of the major plant species will be identified by asking with the local people, women, indigenous and old people. There are over 380 tree species found in Nepal (MFSC, 2012). Over 90% of the plant species including trees and shrubs can be identified by local name with local people consultation in Nepal. The local name will be cross checked with the botanical name of the species afterward by either LRP or forest technician. All locally and commercially important species should be correctly identified.

[5]Kukur Daino (*Smilax perfolata*)

- ☑ Wildlife number can be estimated by transect survey. Several transects at the fixed intervals can be made and the number of the wild animals and birds seen and their distance should be measured from the transect line.
- ☑ Identify and recognize the animal voice, sounds.
- ☑ Record the sounds of different wildlife and birds if possible.
- ☑ Observe the pugmarks (foot prints), droppings (scats, dung, pellet etc.), marking (urinating, digging, scraping, claw marks on tree etc.), carcasses (skull, stomach contents, bones of the prey species) and trophies (antler etc.)
- ☑ Record the any threats for biodiversity (e.g. events of the grazing, forest fire, illicit felling, lopping, hunting, encroachment etc).

Based on this information following biodiversity indices can be calculated. Major biodiversity indices to be estimated are:

Species richness (S): is the total number of different species present in the particular area which does not consider the proportion and distribution of each species within the community

$$S = \frac{\sum_{i=1}^{n} X_i}{Area} \quad \text{..... equation (xiv)}$$

Alpha (α) and Beta (β) diversity: Alfa diversity is the measures of species diversity (or richness) of a local community or habitat whereas the Beta diversity is the difference in diversity associated with differences in habitats or relatively larger spatial scale. It can be estimated as

$$\alpha = \frac{S_n}{P_n} \text{.....} \quad \text{..... equation (xv)}$$

$$\beta = \frac{S_n}{\alpha} - 1 \quad \text{..... equation (xvi)}$$

Where,

α=Alpha diversity
β=Beta diversity
S_n= Total number of all species found in plots
P_n= Total number of plots

Shannon Index: is the measure of the biodiversity that takes into account of the species richness and proportion of each species within that community. It is also called Shannon-Weaver diversity index and can be estimated by.

$$\bar{H} = \sum_{i=1}^{n} p_i \times \ln p_i \quad \text{..... equation (xvii)}$$

Where, p_i=Proportion of total number of individual species i (i.e. n/N)
n= Total number of individual species
n_i=Number of individual species i rangingfrom 1 to n
N=Total number of all existing species
ln=Natural logarithm

Ecosystem services

Forest provides not only the goods but various ecosystem services which are pivotal for the sustenance of the human beings and the environment. These services can be grouped into provisioning (food, fiber, timber, fuelwood, NTFP, fodder etc.), regulating (water regulation, air purification, carbon sequestration, soil conservation, climate regulation, disease-pest regulations, pollination, seed dispersal), cultural services (aesthetic, spiritual, educational and recreational) and supporting services (primary production, provision of habitat, nutrient cycling, soil formation, water cycling etc.

In addition to the detail of participatory measurement of carbon sequestration and biodiversity described in previous section, it is suggested to record the following items:

Harvesting of forestry goods: information about extraction of various forestry products (timber, non-timber), their distributions, sale, processing and value addition. It is also necessary to understand people's perception on provisioning services of forests including trend (increased or decreased) after implementation of REDD+ project. It can be done by reviewing the forestry records of CFUGs, DFOs, focus group discussion and consultation with local entrepreneurs.

Events of landslides and soil erosion: the size and shape of the landslides, loss of the forests, agriculture land and settlement, date of the landslides etc need to be collected and reported.

Water regulation and recharge: water resources such as river, streams, ponds, lakes and water holes available in the forests should be recorded. At least number and tentative size of the water resources, contemporary uses should also be listed.

Disease-pest infestation: events and symptoms of diseases and pest infestation and scale of damages in the forests should be recorded and reported.

Cultural services: uses of the forests for the fulfillment of cultural needs should be recorded and reported. For example, the events of "Kulpuja (Ancestral worship)", burial of the corpses of some indigenous communities, area covered by these events and any positive and negative impacts upon forests should be recorded.

4.10 Measurement of social outcomes

4.10.1 Income and employment of local people

Forests play significant role in promoting income and employment opportunities to the rural people. People go to forests to collect timber, non timber and other forestry products. Over 65% of Nepalese people use firewood for cooking their foods. Over 40% of the livestock feeds come from the forests. Forests significantly contribute in maintaining the productivity of agriculture through nutrient recycling. Huge number of poor, women and disadvantaged people work in forests as the daily wage laborers. All these need to be assessed and evaluated for the successful

implementation of REDD+ mechanism. REDD projects are supposed to increase local income and offer employment opportunities for the sustainability of the project. Income and employment related outcomes/impacts are measured as follows:

Box 13: Methods/tools for measuring social impacts of REDD+ project

- Participatory Rural Appraisal
- Review Audit Report of CFUGs
- Consultation with committee, local entrepreneurs
- Review the CF records and register about the production of the timber and NTFPs
- Review the wealth ranking of the CFUG
- Focus Group Discussions
- Household survey

- ☑ Assess trend (increased or decreased) of income and employment and identify how REDD+ has contributed.
- ☑ Assess number of forestry activities directly linked to income and employment to local people through Participatory Rural Appraisal (PRA).
- ☑ Identify and measure the number of people employed in different forestry activities (i.e. nursery, thinning, cleaning, harvesting, logging, forest road construction and maintenance, protection, fire fighting) in consultation with local people.
- ☑ Assess the disaggregate data for income and employment from REDD project (gender, social class, IPs).
- ☑ Identify and record the period of local employments.
- ☑ Identify and measure the labour and non-labour income; small enterprise development, processing and value addition.
- ☑ Identify rate of daily wages and average income from various forest based economic activities
- ☑ Assess the annual and monthly productions of timber, non-timber and other forestry products (e.g. harvesting and sell of timber, fuelwood, MAPs, ecotourism)
- ☑ Identify the annual income and expenditure of the CFUGs by reviewing audit report
- ☑ Assess the number of forest based enterprises involved in the areas, number of the people involved in the forestry enterprises, their economic incentives (e.g. saw mill, handicrafts, cottage industry, NTFP processing industries, tourist guide, home stay, small hotel and restaurants
- ☑ Identify the distribution of the income and benefits to different individuals, groups and communities

4.10.2 Livelihoods and culture

The income and employment is the principal but not sole agent for rural livelihoods. Livelihood comprises the capabilities, assets (stores, resources, claims and access) and activities required for a means of living. The REDD activities are supposed to build local capacity to enhance assets and provide sustainable livelihoods for future generations.

Livelihood assets comprise five capitals including human, physical, financial, social and natural capitals.

Human capital: Health, nutrition, education, knowledge and skills, capacity to work and adapt

Natural capital: forests, trees and forest products, land and produce, water and rangeland resources, wildlife, wild food and fibers, biodiversity, ecosystem services

Physical capital: iinfrastructure (roads, trails), shelter & buildings, water supply & sanitation, energy, communications, tools and equipment for production, seed, fertiliser, pesticides.

Social capital: social relation, trust and norms,formal and informal groups, cultures and practice, social institutions and networks, social norms and values, cutomary practices, traditional and indigenous knowledge, leadership, collective representationnetworks and connections.

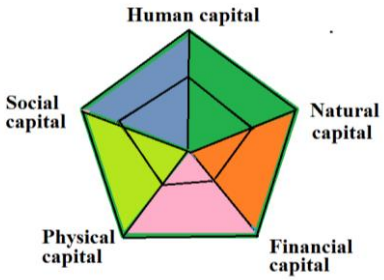


Figure 11: livelihood pentagons

Financial capital: Bank and cooperatives, saving, credit/debt, remittances, pensions, wages.

4.10.3 Food security

REDD+ implementation should not have disturbed or challenged the food security of the community rather it should promote the physical and economic access to sufficient, safe and nutritious foods to meet the dietary needs and preference.

- ☑ Food production and crop diversity, availability and loss of agricultural lands, year round cultivation area, production of cereal crops, vegetable and fruits
- ☑ Availability and flow of NTFPs i.e. mushroom, wild vegetable etc. to the society,
- ☑ Percent of food expenditure to the total household expenditure
- ☑ Degree of access to water, health and sanitation
- ☑ Stability of food price and supply
- ☑ Numbers of meals per day
- ☑ Number of undernourished people, dietary energy requirements and supply, vitamin A deficiency, number of stunted growth

4.11 Measurement of impact on forest governance

Governance is simply the art of governing that in very general term is the process of decision making and its rightful implementation. It is the cross-cutting topics largely involved various sectors and disciplines in a board. Transparency, accountability, participation and predictability are considered four pillars of the good governance (World Bank). Additionally, consensus orientation, participation, rule of law, effectiveness and efficiency, accountability, transparency, responsiveness, equity and inclusiveness are simply considered as the measures of governance system in any places or organization.

The deforestation and degradation of the forests in many developing countries are directly linked to the poor forest governance. Therefore, it is considered as one of the important factors for

controlling deforestation and degradation, enhancing sustainable forest management, eradicating poverty, promoting sustainable livelihoods and overall development of the forest dependent people and communities in Nepal and anywhere.

The non-carbon measurement team conducts the focused group discussion, observes the monthly and general assembly, scrutinizes the CF documents on production, sale and distribution of the forest products, review audit reports, conducts survey to the poor, marginalized and Dalit households about their participation in decision making and implementation, know about their concerns are whether considered or not.

Table 8: Methods/tools for the measurement of the forest governance in REDD+ project

SN	Particulars	Measures	How
1.	Public consensus	How the decisions are being taken in major issues? Is it taken by unanimous decision or with majority? Authoritarian or democratic? Is it Free, Prior and Informed consent? Respect on traditional knowledge and cultural practices	Observe monthly and annual meeting, review the decisions made
2.	Rule of law	Whether the provisions of the forestry laws and regulations have been followed? Does community follow the provisions of CF constitution and OPs? Access to justice and effective remedies?	Consultation with the committee members and DFO staffs
3.	Participation	What is the participation level of people in forest management, decision taking and monitoring? How the people are mobilized for different activities?	Focus group meeting, Household survey
4.	Effectiveness and efficiency	How far the committee able to implement the provisions of constitution and OPs? Have all decision taken gone into action? Timeliness and frequencies of the actions?	Annual report of CFUG, focus group meeting
5.	Responsibility and accountability	How much the organization and its executive team are committed to accountability? How much the team keeps their actions as per their commitments or voice? What are the existing system and mechanism for internal and external oversights and verification? What are the levels of the transparency on various actions and activities?	Focus group meeting, key informant survey, annual report, audit report
6.	Transparency	Real time public dissemination of financial and decisions, unbiased, undistorted, complete and accurate information, understanding levels of different people, accessibility of information	Focus group meeting, annual report, HH survey, field observation
7.	Responsiveness	What are the grief redress mechanisms? How does the executive committee respond to any suggestion, comments and feedback by CFUG members? What is the level of managerial flexibilities in executive members?	Consultation with CFUG and committee, review decisions made and implemented
8.	Equity and inclusiveness	Representation of poor, dalit and disadvantaged groups in the committee and other groups; equitable, non-discriminatory and transparent benefit sharing; fulfillment of the forestry needs to of poor, dalit and disadvantaged groups; gender equality, gender equity and women's empowerment; special attentions to most vulnerable people and communities	Review the representation level of CFUG in different committees, HH survey, focus group meeting

4.12 Measuring REDD+ safeguards

UNFCCC on its 16th Conference of Parties (COP) held in Cancun formally endorsed REDD+ safeguards by adapting seven safeguard principles (Table 7). Parties implementing REDD should

develop REDD+ Safeguards Information System (SIS) for providing information on how safeguards are being addressed and respected. Earlier, the World Bank's FCPF introduced Strategic Environmental and Social Assessment (SESA) and Environmental and Social Management Framework (ESMF). REDD+ Social and Environmental Standards (SES) were developed by Community Carbon and Biodiversity Alliance (CCBA) and CARE International. REDD+ safeguards are developed to make sure that REDD+ actions do not cause negative social or environmental impacts. It has been the major areas of the concern since REDD+ was developed, particularly after 2009. REDD+ safeguards identify potential negative impacts of REDD+ activities and suggest actions to mitigate negative impacts.

Table 9: Cancun principles of REDD+ safeguards

SN	Principles
1	These actions complement or are consistent with the objectives of national forest programs and relevant international conventions and agreements.
2	Transparent and effective national forest governance structures, taking into account national legislation and sovereignty.
3	Respect for the knowledge and rights of indigenous peoples and members of local communities, by taking into account relevant international obligations, national circumstances and laws, and noting that the United Nations General Assembly has adopted the United Nations Declaration on the Rights of Indigenous Peoples.
4	The full and effective participation of relevant stakeholders, in particular indigenous peoples and local communities, in the actions referred to in paragraphs 70 and 72 of this decision.
5	These actions are consistent with the conservation of natural forests and biological diversity, and to enhance other social and environmental benefits.
6	Actions to address the risks of reversals.
7	Actions to reduce displacement of emissions.

UN-REDD program in 2012 presented 7 principles and 24 criteria to assess REDD+ safeguards, which are given in box 14. Most of the criteria related to carbon and biodiversity are measured as described in previous sections and governance indicators as described in table 4.Other criteria such as the need of consistency of national forestry program and other international commitment made by Nepal should be collected by consulting with local communities and their federations/networks (FECOFUN, NEFIN) etc.

Livelihood implications of REDD+ activities like increased work load for women, poor, Dalit, other vulnerable and marginalized communities should be assessed with the consultation of their respective groups. Some important questions however could be: have the REDD+ actions decreased resources supply including fuel wood, fodder and forage? Have the blacksmith/goldsmith and such other occupational groups been regularly obtaining charcoal and firewood from the forests?

Because of lacking local interpretation of Cancun safeguard principles and REDD+ SIS in Nepal this edition of MMR guideline provides very limited steps of safeguard measurement. As SIS will be developed in near future and further progress will be achieved on implementing REDD+ safeguards this guideline should be updated.

Box 14: Principle and criteria of REDD+ safeguards (UN-REDD Program, 2012)

Principle 1: Democratic governance accorded with national commitments and multilateral agreements

C1.1: Transparency and accountability of fiduciary and fund management
C1.2: Legitimacy and accountability of all bodies
C1.3: Transparency and accessibility of information related to REDD+
C1.4: Full and effective participation of relevant stakeholders with particular attention to indigenous peoples, local communities and marginalized groups
C 1.5: Coordination, efficiency and effectiveness among all agencies
C 1.6: Rule of law, access to justice and effective remedies

Principle 2: Stakeholder rights in accordance with international obligations

C 2.1: Recognition and implementation of the rights of indigenous peoples, local communities and marginalized groups to land, territories and resources, including carbon
C 2.2: Gender equality, gender equity and women's empowerment
C 2.3: Free, prior and informed consent of indigenous peoples
C 2.4: No involuntary resettlement as a result of REDD+
C 2.5: Protection to traditional knowledge, cultural heritage and practices

Principle 3: Sustainable livelihoods and poverty reduction

C 3.1: Non-discriminatory and transparent benefit sharing
C 3.2: Economic and social well-being of relevant stakeholders

Principle 4: Low-carbon, climate-resilient sustainable development policy, consistent with national development strategies, national forestry program (NFP) and international commitments

C 4.1: Consistency with and contribution to national climate policy objectives, mitigation and adaptation strategies and international commitments on climate
C 4.2: Address the risk of reversals of REDD+ achievements, including potential future risks to forest carbon stocks and other benefits
C 4.3: Consistency with and contribution to national poverty reduction strategies and other sustainable development goals including alignment with national strategies and plans
C 4.5: Ensure consistency with and contribution to national biodiversity conservation policies, other environmental and natural resource management policy objectives, NFP and international commitments on the environment

Principle 5: Protect natural forest from degradation and/or conversion

C 5.1: No conversion of natural forests
C 5.2: Reduce degradation of natural forests
C 5.3: Reduce indirect land-use change impacts of REDD+ activities on forest carbon stocks, biodiversity and other ecosystem services

Principle 6: Promote multiple functions of forest including biodiversity conservation and ecosystem services

C 6.1: Land-use planning for REDD+ explicitly takes account of potential synergies and trade-offs between the multiple functions of forest and the benefits they provide respecting local and other stakeholders' values
C 6.2: Planted and natural forest managed to maintain and enhance important ecosystem services and biodiversity

Principle 7: Reduction on adverse impacts on non-forest ecosystem services and biodiversity

C 7.1: Reduce adverse impacts on carbon stocks, other ecosystem services and biodiversity
C 7.2: Reduce adverse impacts on carbon stocks, other ecosystem services and biodiversity resulting indirectly from REDD+ activities (including those of indirect land-use change impacts and intensification of land use)

Chapter 5: Reporting of REDD+ outcomes

5.1 Introduction

In the context of this guideline, reporting is understood as a process of presenting real and unbiased information obtained from monitoring and or measuring of REDD+ activities in a standardized format and procedures. Reporting is the final stage of MMR process based on which performance of REDD+ activities is claimed by host countries and verified by third parties. In order to receive incentives (e.g. carbon revenue) for REDD+ interventions (i.e. emissions reduction and carbon enhancement), performance reporting system must be complete, consistent, credible, accurate, transparent and verified.

Box 15: Qualities of good report

- ☑ Comprehensive and complete
- ☑ Readable (professional language, simple words and phrases)
- ☑ Informative and factual
- ☑ Accuracy
- ☑ Clearly organized
- ☑ Formally structured
- ☑ Logical sequence
- ☑ Offer concrete recommendation

The report should incorporate the amount of CO2 emission reduced as a result of decreased deforestation and forest degradation, as well as increased carbon storage/sequestration through improved conservation efforts and sustainable management of forests. It should include the methodological information, description of data sets, models, various conversion factors and assumptions used during the measurement and monitoring of the REDD+ project/activities reported

5.2 Principles of reporting under UNFCC

There are five general principles under the UNFCC reporting framework which should be duly considered for the estimation and the reporting of carbon emissions and removals (GOFC-GOLD, 2012). Those guiding principles are:

Transparency: All methodologies, materials and assumptions used for the carbon inventory and other relevant measurements and their analysis should be appropriately documented and clearly explained in order to ascertain the correctness and verify the information provided in the report. Most relevant background data needs to be provided in the report which will assist to verify the underlying calculation and validation of the key results.

Consistency: The consistent definitions and methodologies should be used throughout the report along different time so that the reports could be compared regularly.

Comparability: The report should follow the standard formats and methodologies so that the reports across different communities could be compared.

Completeness: The estimates and reports should include all agreed categories and carbon pools.

Accuracy: All the measurements and reporting should be accurate and follow the standard methodologies in accordance with the IPCC to reduce and quantify the uncertainties.

5.3 Participatory reporting

The REDD+ emphasizes the participatory reporting of the carbon and non-carbon impacts of the REDD+ project. Participatory reporting encourages the active participation of the key stakeholders including the members of the CFUG in the organization and preparation of the report. Group representatives and the forest technician are involved in the designing, implementing, measuring and reporting of the REDD+ activities, achievements and constraints.

Participatory reporting is very crucial to inform the decision makers about the achievements and constraints faced by the community from the implementation of the REDD+ activities. The benefits of the participatory reporting are:

- ☑ Educates the local communities about the REDD+ concepts, progress and obstacles faced by the community during implementation
- ☑ Verifies/validates the actual status of the REDD+ program components such as the reduction/increase in deforestation, forest degradation, forest carbon enhancement, forest conservation, SFM and impacts on socio-economic, environmental and local traditions
- ☑ Supports the local communities to own and internalize the REDD+ project
- ☑ Builds confidence and strengthen the people's motivation to participate REDD+ project
- ☑ Increases transparency, accountability and responsibility in overall REDD+ implementation
- ☑ Enhances the reliability and credibility of the report.

5.3.1 Steps for participatory reporting

Step 1: Formation of reporting team

- ☑ Formation of the report preparation team lead by the team members of measurement
- ☑ The team will work under the overall management of the participatory MMR team developed under chapter 1. It also works under the direct coordination and linkage with carbon and non-carbon measurement teams
- ☑ At least two members of the measurement team should be the part of reporting team
- ☑ 2-3 more members can be added by the CFUGs, as it requires the report preparation and write up, it is needed to be at least bachelor passed person with writing skills
- ☑ Introduce team members about the objectives and methods of the report preparation, dissemination and publication

Step 2: Division of work and finalization of the contents of the report

- ☑ Meeting with the CFUG committee, other key members and relevant stakeholders
- ☑ Discuss about the potential contents/parts/areas of the report

- ☑ Finalize the areas to be covered by report, deadline and timeframe for different activities
- ☑ Finalize the resource requirements and its delivery to the team (allowances, stationery, remuneration etc.)
- ☑ Divide the work load and responsibilities among team members (report write up, data gathering and analysis, conducting public hearing on report etc.)

Step 3: Compilation of the data and relevant information

- ☑ Compile carbon and non carbon data and information
- ☑ Compile secondary information if any published upon about their CFUGs and related work
- ☑ Develop and/or maintain community level baseline database on REDD+ activities and outcomes (deforestation/reforestation; forest degradation/improvement, forest conservation, SFM, carbon enhancement, non-carbon benefits, REDD+ safeguards etc.)
- ☑ Prepare the draft report including key areas of REDD+ implementation, carbon sequestration and socio-economic and cultural outcomes in standard format

Step 4:Sharing with the key stakeholders and CF committee

- ☑ Share the draft to the key stakeholders such as CFUG, DFO, DSCO, PAs, FECOFUN, NEFUG, HIMAWANTI, ACOFUN, NEFIN, VDC and all related organizations
- ☑ The sharing can be done by organizing a half day workshop where the team presents the major outcomes of REDD+ project and the areas covered by the report
- ☑ Collect feedback, comments and suggestions
- ☑ Obtain permission to publish the report for public scrutiny after incorporating their feedback
- ☑ Improve the report by incorporating their comments

Step 5: Publish for public scrutiny

- ☑ Publish the report for the public scrutiny and collecting their feedbacks
- ☑ Put few copies of the report in VDC office and other governmental organization for those people who want to review the report and provide their comments/feedbacks
- ☑ Provide 15 days to period to provide their comments/suggestions and necessary feedback on the report
- ☑ Prepare and publish the notice/appeal in CFUG office board. Send this notice to local offices (such as post office, health post, VDC/municipality, DDC, schools etc.) for publishing onto their notice boards. It can be fixed in such other public places like "Chautara", public stadium and tea shops.
- ☑ If require obtain receipts from the offices to whom the notice was sent for the mass publication on their notice board.
- ☑ Incorporate any suggestions, comments and feedback received by the people.
- ☑ Submit final report to the CFUG

Step 6: Endorsement of the report and submission

- ☑ The executive committee discusses about the overall content of the report
- ☑ Take any corrective measures by themselves if needed and suggested by the report
- ☑ Endorses the report
- ☑ Submit officially the report to their networks and Ilaka/Sector/DFO offices for final approval
- ☑ DFOs/REDD desk review, verify and validate the report. DFO takes the corrective measures and provides technical and financial supports to the CFUGs if it finds any problems shown by the report related to control deforestation and degradation.
- ☑ DFO submits the report to the upper relevant organizations or REDD+ institution for the final approval of the report. The DFO will recommend/request for the compensation to the CFUGs for their contribution to avoid emission (controlling deforestation and degradation) and promoting carbon storage (through, forest conservation, SFM and carbon enhancement).

5.3.2 Channel and reporting period

Reporting system of REDD+ performance is a part of MRV system hence must comply with national forest monitoring system. However, it does not mean reporting system of the REDD+ activities should not exert much burdens to local communities. Mostly, executive committee and other key members of the CFUGs work voluntarily in the community. Therefore, it is not recommended to overload the committee with the extra burden which will perturb their routine works and daily livelihoods.

Participatory reporting system should follow the timeline and procedures of preparing and submission of the CF report. Forest Act, 1993 provisions compulsory mandate to prepare and submit financial and community forestry reports to the district forest office (DFO) within a month from the end of every fiscal year. The DFO may provide comments and feedback to the respective CFUGs based on their reports. REDD+ MMR system should tie up with reporting system in practice.

5.3.3 Timeline for reporting

S.N.	Particulars	Period	Remarks
1.	Preparation of MMR team	January	
2.	Monitoring	Regular	
3.	Measurement of carbon and non-carbon benefits	May-June	Carbon measurement biennial
4.	Analysis of the data	July	
5.	Sharing of analyzed data and outputs and draft report within CFUGs	Mid-July	
6.	Publication of data for public scrutiny	Third week of July	
7.	Finalization of the report and submission	Mid August	

References

Chaturvedi, A. N. and Khanna, L. S., 2000. Forest Mensuration and Biometry, 3rd edition., Khanna Bandhu, Dehra Dun, India, 364p.

Danielsen, F., Burgess, N. D., Balmford, A., 2005. Monitoring Matters: Examining the Potential of Locally-Based Approaches. Biodiversity and Conservation 14, 2507–2542.

Danielsen, F., Skutsch, M. M., Burgess, N. D., Jensen, P.M., Andrianandrasana, H., Karky, B. S., Lewis, R., Lovett, J. C., Massao, J., Ngaga, Y., Phartiyal, P., Poulsen, M. K., Singh, S. P., Solis, S., Sorensen, M., Tewari, A., Young, R. and Zahabu, E.,2011. At the Heart of REDD+: a Role for Local People in Monitoring Forests? Conservation Letters.

Davis-Case, D. J., 1990. The Community's Toolbox: the Idea, Methods and Tools for Participatory Assessment, Monitoring and Evaluation in Community Forestry. Food and Agriculture Organization, Bangkok, Thailand.

DFRS, 1999. Forest Resource of Nepal (1987-1998). Department of Forest Resource and Survey Publication No. 74, Kathmandu, Nepal.

DFRS/FRA, 2010. Forest Resource Assessment in Nepal, Field Manual.

FAO, 2012. FRA 2015: Terms and Definitions. Forest Resources Assessment- Working Paper 180. Food and Agriculture Organization of the United Nations, Rome, Italy.

FRA/DFRS, 2014a. Terai Forests of Nepal (2010-2012). Babarmahal, Kathmandu: Forest Resource Assessment Nepal Project / Department of Forest Research and Survey.

FRA/DFRS, 2014b. Churia Forests of Nepal (2011-2013). Babarmahal, Kathmandu: Forest Resource Assessment Nepal Project / Department of Forest Research and Survey.

Hawthorne S. D. and Boissière M., 2014. Literature Review of Participatory Measurement, Reporting and Verification (PMRV). Working Paper 152. Bogor, Indonesia: CIFOR.

Herold, M. & Pratihast, A. 2011. Linking the National to the Local. World Bank workshop, 12-14. September, 2011, Mexico City Mexico.

HMGN/MFSC, 1988. Master Plan for the Forestry Sector of Nepal. Forest Resources Information Status and Development Plan.

HMG/Nepal, 2000. Biomass and Volume Tables with Species Description for Community Forest Management. TISC Technical paper series no. 101 (90 pp).

ITTO, 2005. Revised ITTO Criteria and Indicators for Sustainable Management of Tropical Forests Including Reporting Format.

K.C., Rajendra, 2014. Prominent Non-wood Forest Products of Terai and Siwalik Regions of Nepal. Food and Agriculture Organization, Kathmandu, Nepal.

Karky, B.S., 2008. The Economics of Reducing Emissions from Community Managed Forests in Nepal Himalaya. Ph.D. Thesis Submitted to University of Twente, Enschede-the Netherlands.

MacDicken, K.G., 1997. A Guide to Monitoring Carbon Storage in Forestry and Agroforestry Projects Arlington (VA), Forest Carbon Monitoring Program, Winrock International Institute for Agriculture Development.

MFSC, 1988. Master Plan for the Forestry Sector in Nepal. Kathmandu, Nepal.

MFSC, 2015. Forest Policy. Singha Durbar, Kathmandu, Nepal.

Oli, B. N., 2014. Pro-poor Leasehold Forestry in Nepal: A New Dimension on Livelihoods, in K.C., Rajendra, Baral, J.C. and Kafley, G. Edited Workshop Proceedings of the Regional Workshop on Pro-poor Leasehold Forestry Held at Kathmandu, 11-14 June, 2014.

Oli, B.N., and Shrestha, K., 2009. Carbon Status in Forests of Nepal: An Overview, Journal of Forest and Livelihood, Vol.8 (1), pp 63-67.

REDD+ Safeguards Working Group, 2014. REDD+ Safeguards Information System (SIS) What Should Further Guidance Deliver?

Sharma, E.R. and Pukkala, T., 1990. Volume Equations and Biomass Prediction of Forest Trees of Nepal; Publication 47. Forest Survey and Statistics Division of Ministry of Forest and Soil Conservation, Babarmahal, Kathmandu.

Skutsch, M.M., van Laake, P.E., Zahabu, E., Karky, B. S., Phartiyal, P., 2009. Community Monitoring in REDD+. In: Angelsen, A. (Ed.), Realising REDD+: National Strategy and Policy Options. CIFOR, p. 101.

Shrestha, H. L., Dhital, K. R., Bajracharya, R. M., Sitaula, B.K., 2015 (in press). Mapping Ecosystem Services in Community Forestry in Nepal, in the proceedings of the National Workshop on Mainstreaming Biodiversity and Ecosystem Services in Community Forests of Nepal, Bird Conservation Nepal

UN-REDD, 2012. Guidelines on Stakeholder Engagement in REDD+ Readiness Questionnaire, Table, Flow Charts etc.

UN-REDD, 2013. National Forest Monitoring Systems: Monitoring and Measurement, Reporting And Verification (M & MRV).

UN-REDD and REDD Cell, 2014. Understanding Drivers and Causes of Deforestation and Forest Degradation in Nepal: Potential Policies and Measures for REDD+.

http://www.dof.gov.np

http://www.partnerships.org.uk/guide/frame.htm

http://lithgow-schmidt.dk/sherry-arnstein/ladder-of-citizen-participation.html

http://www.un-redd.org/Multiple_Benefits_SEPC/tabid/54130/Default.aspx

Appendices

Annex 1: Locating permanent plots for measurement and remeasurement

……..……..……..

Name of forest:

Address:

Plot shape: ☐ Circular ☐ Square ☐ Rectangle **Plot size**:……. m^2

Plot size:……m radius (for circular)**, Length:**…m; **Breadth**:……m (for quadrate plot)

Signpost for Plot: ☐ Iron peg ☐ Wooden peg ☐ Cemented pillar ☐ others

Recorders:

- Name of team leader:
- Team members:

……..……

Stratum Name	Plot number	Forest types (Sp, cond^n)[6]	X-coordinate	Y-coordinate	Altitude (m)	Aspect	Slope (°)	Nearby offsets		
								Object	Bearing (°)	Distance (m)
A	A_1									
A	A_2									
A	A_3									
A	A_4									
A	A_5									
A	A_6									
A	A_n									
B	B_1									
B	B_2									
B	B_3									
B	B_4									
B	B_n									
C	C_1									
C	C_2									
C	C_n									
D	D_1									
D	D_2									
D	D_n									
E	E_1									
E	E_2									
E	E_n									

[6] Species: dominant species in short form, e.g. S for Sal, K for Khair; condition: very dense (>70% crown cover), dense (40-70%) sparse (10-40%) and rare (<10%)

Annex 2: Slope correction for sample plot lay-out

Slope (Ø)	Herb/Shrub/ Litter/ Soil	Seedling	Sapling	Tree	Slope (Ø)	Herb/Shrub/ Litter/ Soil	Seedling	Sapling	Tree
	0.56 m	1 m	5.64 m	8.92 m		0.56 m	1 m	5.64 m	8.92 m
0°	0.56	1	5.64	8.92	23°	0.61	1.09	6.13	9.69
1°	0.56	1.00	5.64	8.92	24°	0.61	1.09	6.17	9.76
2°	0.56	1.00	5.64	8.93	25°	0.62	1.10	6.22	9.84
3°	0.56	1.00	5.65	8.93	26°	0.62	1.11	6.28	9.92
4°	0.56	1.00	5.65	8.94	27°	0.63	1.12	6.33	10.01
5°	0.56	1.00	5.66	8.95	28°	0.63	1.13	6.39	10.10
6°	0.56	1.01	5.67	8.97	29°	0.64	1.14	6.45	10.20
7°	0.56	1.01	5.68	8.99	30°	0.65	1.15	6.51	10.30
8°	0.57	1.01	5.70	9.01	31°	0.65	1.17	6.58	10.41
9°	0.57	1.01	5.71	9.03	32°	0.66	1.18	6.65	10.52
10°	0.57	1.02	5.73	9.06	33°	0.67	1.19	6.72	10.64
11°	0.57	1.02	5.75	9.09	34°	0.68	1.21	6.80	10.76
12°	0.57	1.02	5.77	9.12	35°	0.68	1.22	6.89	10.89
13°	0.57	1.03	5.79	9.15	36°	0.69	1.24	6.97	11.03
14°	0.58	1.03	5.81	9.19	37°	0.70	1.25	7.06	11.17
15°	0.58	1.04	5.84	9.23	38°	0.71	1.27	7.16	11.32
16°	0.58	1.04	5.87	9.28	39°	0.72	1.29	7.26	11.48
17°	0.59	1.05	5.90	9.33	40°	0.73	1.31	7.36	11.64
18°	0.59	1.05	5.93	9.38	41°	0.74	1.33	7.47	11.82
19°	0.59	1.06	5.96	9.43	42°	0.75	1.35	7.59	12.00
20°	0.60	1.06	6.00	9.49	43°	0.77	1.37	7.71	12.20
21°	0.60	1.07	6.04	9.55	44°	0.78	1.39	7.84	12.40
22°	0.60	1.08	6.08	9.62	45°	0.79	1.41	7.98	12.61

- The slope distance to lay out the plots in sloping areas will be calculated by using the values given in the table, which is calculated by dividing horizontal distance by the CosØ (where Ø is the slope angle).
- The circular plot becomes the oval shape in general as the horizontal distance remains the same (due to flatness along the contour) and inclination towards the slope.
- Seedling is also considered as the regeneration (<1cm dbh).

Annex 3: Field measurement, recording and simple calculation of biomass and carbon

……

Name of forest:

Stratum/block:

Plot number:

Coordinates of plot: X-coordinate: Y-coordinate:

Slope: ……°; **Aspect:** ☐N ☐S ☐E ☐W ☐NE ☐NW ☐SE ☐SW

Recorders:

Team leader:

Team members:

Date:

……

A. For measurement of tree (tree size: over 30 cm DBH; plot size: 250 m^2; radius of the plot: 8.92 m)

SN	Species	DBH (cm)	[7]Angle of depression or elevation (°)	Slope of the ground (°)	Sloping distance (m)	Horizontal distance between eye and tree (m)	Height of eye (m)	Height above eye (m)	Total tree height (m)	Tree class (I, II, III)	Remarks
A.1	A.2	A.3	A.4	A.5	A.6	A.7	A.8	A.9	A.10	A.11	A.12
1.											
2											
3											
4											
5											
6											
7											
8											
..											
n											

B. For measurement of poles[8] (pole size: 5 to 30 cm DBH; plot size: 100 m^2; radius of circular plot: 5.64 m)

SN	Species	DBH (cm)	Angle of depression or elevation (°)	Slope of the ground (°)	Sloping distance (m)	Horizontal distance from eye (m)	Height of eye (m)	Height of pole above eye (m)	Total pole height (m)	Remarks
B.1	B.2	B.3	B.4	B.5	B.6	B.7	B.8	B.9	B.10	B.11

[7] Angle of depression is indicated with + sign, and angle of depression with - sign

[8] Pole sizes defined by the Forest Product Collection and Distribution Guideline, 2014 of MFSC: 5" (12.7 cm) to 11" (27.9 cm); Guideline for the inventory of Community Forests defines regeneration: up to 9.9 cm dbh (sapling 4 cm to 9.9 cm dbh); Pole tree (10 to 29.9 cm dbh) and Timber trees (above 30 cm dbh). However, in the case of carbon estimation from LFUG, all the plants above 5 cm dbh up to 30 cm is considered here as the pole/

1.										
2										
3										
4										
5										
6										
7										
8										
..										
n										

C. For measurement of sapling (Sapling size: 1-5 cm DBH, plot size: 3.14 m^2, circular plot of 1 m radius)

SN	Species	DBH (cm)	Height (m)	Green weight of up to 5 saplings (kg)	Oven dry weight (kg)	Remarks
C.1	C.2	C.3	C.4	C.5	C.6	C.7
1.						
2						
3						
4						
5						
6						
7						
8						
n						

D. For measurement of regeneration (regeneration size: less than 1 cm DBH, plot size: 3.14 m^2, circular plot of 1 m radius)

SN	Species	Total Number	Average height (m)	Green weight of up to 5 regenerations (kg)	Oven dry weight (kg)	Remarks
D.1	D.2	D.3	D.4	D.5	D.6	D.7
1.						
2						
3						
4						
5						
6						
7						
n						

E. For measurement of grass, herbs and leaf litters (plot size: 1 m^2, circular plot of 0.56 m radius)

SN	Items	Total fresh weight (kg)	Fresh weight of samples (in kg)						Oven dry weight of samples (in kg)						Conversion ratio	Total oven dry biomass (kg)	Remarks
			1	2	3	4	5	Average	1	2	3	4	5	Average			
E.1	E.2	E.3	E.5						E.6						E.7	E.8	E.9
1.	Grass/herbs																
2	Litters																

F. Soil organic carbon

SN	Soil Depth	Sample number	Sample volume (cm^3)	Sample weight (g)	Oven dry weight (g)	Bulk density	Carbon content (g) or %	Remarks
G.1	G.2	G.3	G.4	G.5	G.6	G.7	G.8	G.9
1	0 cm to 10 cm							
2	10 cm to 20 cm							
3	20 cm to 30 cm							
4	**Composite soil**							

G. Measurement of the dead and logged tree

G.1 Measurement of dead but standing trees

SN	Species	DBH (cm)	Height (m)	Volume (m^3)	Decay Class (I, II, III or IV)	Wood density (kgm^{-3})	Biomass (kg)	Remarks
G.1	G.2	G.3	G.4	G.5	G.6	G.7	G.8	G.9
1.								
2								
3.								
4.								
5.								

G.2 Measurement of broken tree

SN	Species	DBH (cm)	Height (m)	Volume (m^3)	Decay class (I, II, III or IV)	Wood density (kgm^{-3})	Biomass (kg)	Remarks
H.1	H.2	H.3	H.4	H.5	H.6	H.7	H.8	H.9
1.								
2.								
3.								
4.								
5.								

G.3 Measurement of the stumps

SN	Species	Stump diameter (cm)	Stump height (m)	Volume (m^3)	Decay class (I, II, III or IV)	Wood density (kgm^{-3})	Biomass (kg)	Remarks
I.1	I.2	I.3	I.4	I.5	I.6	I.7	I.8	I.9
1.								
2.								
3.								
4.								
5.								

Decay classes for logged tree

……

- **Class I:** Sound wood; a machete cannot sink into the wood in a single strike
- **Class II:** Intermediate wood; a machete sinks partly into the piece in a single strike
- **Class III:** Rotten/crumbly wood; a machete cuts through

Decay classes for standing dead wood, down and dead wood

……

- **Class I:** With branches and twigs but without leaves
- **Class II:** With no twigs, but with small and large branches
- **Class III:** With large branches only
- **Class IV**: Bole (trunk) only, no branches

G.4 Plot wise estimation of carbon

Stratum ID	Plot ID	Carbon (t C/ha)	Cluster Average AG Carbon (t C/ha)	Total Area of the stratum (ha)	Total carbon (ton)	Remarks
J.1	J.2	J.3	J.4	J.5	J.6	J.7
Total						

Annex 4: Monitoring format for REDD+ activities

……..
Members of monitoring team: Date:
Team leader:
Team members:
……

1. Introduction of the LFUG

Name:
Area:……ha. Number of users: ……HH
Address: VDC/Municipality Ward number:
Date of hand over:
Date of renew:
Code of LFUG:
……

1.1 Description about the representation in executive committee

SN	Position	Male	Female	Dalit	Ethnic/IPs	BCT	Poor	Others	Remark
1.	Chair person								
2.	Vice-chair person								
3.	Secretary								
4.	Joint-secretary								
5.	Treasurer								
6.	EC[9] members								
7.	Advisors								
Total									

1.2 Description about the involvement of different class people in LFUG

SN	Caste	Number of the different wealth class households				Remarks
		Poor	Medium	Rich	Total households	
1.	Bahun, Chhetri, Thakuri (BCT)					
2.	Ethnic and Indigenous people					
3.	Dalit					
4.	Others					
Total						

1.3 Forest types and condition

SN	Particulars	Unit	Quantity	Remarks
1	Total forest area			
2	Number of strata/block			
2.1	– Area (strata 1)			

[9] EC: executive committee

2.2	– Area (strata 2)			
2.3	– Area (strata 3)			
2.4	– Area (strata 4)			
2.5	– Area (strata 5)			
3	Growing stock per ha			
4	Major forest species			
4.1	– Sal			
4.2	– Khair/ Sissoo			
4.3	– Asna			
4.4	– Khote Sallo			
4.5	– Quercus			
4.6	– Uttis/Chilaune			
4.7	– Rhododendron			
4.8	– Others (specify)			

2. Deforestation

SN	Particulars	Unit	Quantity	Remarks
1.0	Deforestation in general			
1.1	Estimated size of the deforested area (ha):			
1.2	Nature of deforestation (scattered or intact)			
1.2.1	If scattered, in how many places (number) and estimated sizes of scattered deforestation (ha)			
1.3	Place of deforestation			
1.3.1	Block/strata			
1.3.2	Coordinates			
1.3.3	Address (VDC/wards)			
1.4	Date of the deforestation initiated (month/year)			
1.5	Date for deforestation completed (month/year)			
2.0	How was the deforested land before?			
2.1	⮚ Very dense (over 70% crown cover) ⮚ Medium (40-70% cover) ⮚ Poor (10-40%) ⮚ Barren land (~0% coverage)			
2.2	Reasons of the deforestation			
2.2.1	– Settlement			
2.2.2	– Urbanization			
2.2.3	– Agriculture			
2.2.4	– Industry			
2.2.5	– Infrastructure development			
2.2.6	– Others (specify)			
3.0	Legal nature of Deforestation			
3.1	Legal (by government) or illegal			
4.0	Families involved in deforestation (number)			
5.0	Legal actions taken to control deforestation			
5.1	– by LFUGs			
5.2	– by DFO/Park authorities			
5.3	– by local government			

Deforestation in nearby forests [e.g. national forest, protected areas and other community managed forests (area, period, number of families, forest conditions before encroachment/ deforestation, purpose etc)]:
Describe legal actions taken by:

3. Forest degradation

3.1 Illicit timber felling/firewood collection

SN	Illicit timber felling and firewood collection	Unit	Quantity	Remarks
1.	Occurrence of illicit felling (Yes or No)			
2.	Event and frequency of the illicit felling decreased or increased after hand over			
3.	Number of illicit felling/timber poaching events			
4.	Total number of illicitly harvested tree			
4.1	– Total volume of illicitly harvested timber			
4.2	– Illicit firewood collection and disposal			
5.	Illicitly felled tree species and volume			
5.1	– Name of species i:			
5.2	– Name of species ii:			
5.3	– Name of species iii:			
6.	Tentative number of people involved in illicit felling			
7.	Confiscated timber from timber poachers (estimated)			
8.	Action taken against forest offenders			
9.	Revenue from penalties/fines to the offenders			
10.	Revenue generated from the sale of confiscated items			
10.1	– LFUG			
10.2	– Government			

3.2 Unsustainable harvesting of timber

SN	Harvesting	Unit	Quantity	Remarks
1.	Number of harvesting events of timber species in a year			
2.	Provision of harvesting in CF operational plan			
2.1	– Growing stock of the forests			
2.2	– % of the growing stock for estimating AAC			
2.3	– Annual Allowable Cut (in cft or m^3)			
3.	Harvested timber species			
3.1	– Name of species i:			
3.2	– Name of species ii:			

3.3	– Name of species iii:			
3.4	– Period of harvesting (months)			
4.	Distribution of timber harvesting			
4.1	– In which blocks/strata			
4.2	– Congregation in one place or scattered all over the forests			
4.3	– Harvested tree: i) green ii) dead iii) fallen or iv) others			
5.	Harvesting by DFO or LFUG			
6.	Decrease or increase in the unsustainable harvesting of timber from forests			
7	Who participate in harvesting? Local people or outsiders?			
8.	Does LFUG obtain permission for harvesting from DFO/PA authority?			
9	Are there any damages to new regeneration and others to harvest and extract timber from the forests?			
9.1	– How many % of regeneration get damaged			

3.3 Uncontrolled grazing

SN	Grazing	Unit	Quantity	% decreased	% increased	Remarks
1.	**Free grazing events**					
2.	**Grazing intensity**[10]					
2.1	– High					
2.2	– Low					
2.3	– No grazing					
3.	**Livestock types**					
3.1	– Goat/sheep					
3.2	– Cattles (cow, buffalo)					
3.3	– Other species					
3.4	– Livestock from					
3.4.1	➢ Within group members					
3.4.2	➢ Outside group members					
4.	**Damages by free grazing**					
4.1	Tentative area (ha)					
4.2	Name of block/strata					
4.3	Estimated damages (%) of grass, herbs & regeneration					
4.4	Tentative biomass loss (ton)					

[10] Grazing intensity describes how many livestock unit grazes continuously in per unit area. If it is more than the carrying capacity of the forest, it is considered high intensity and below than carrying capacity it is low. Carrying capacity of the forest depends on the quality of the fodder and forages.

3.4 Forest fires

SN	Particulars	Quantity	Remarks
1.	Events and frequency of the forest fires in a year		
2.	Estimated annual increase or decrease in forest fire occurrence (%)		
3.	Period of forest fire events (months)		
4.	Forest damaged by forest fires (ha)		
4.1	– Estimated logs burnt at timber depot (m^3 or ton)		
4.2	– Estimated forest biomass loss from fire (m^3 or ton)		
5.	Major species damaged by fire		
6.	Major wildlife species killed by fire		
7.	Wildlife habitat loss (ha)		
8.	Any other damages		

3.5 Invasion by alien species

SN	Particulars	Statement	Remarks
1.	Major invasive species		
2.	Annual increase or decrease in invasion		
3.	Damages to the forest ecosystem (ha)		
4.	Scale of the damages to the forests		
4.1	– Whole forest area		
4.2	– 50% of the forest area		
4.3	– 25-50% of the forest area		
4.4	– 0-25%		

3.6 Forest carbon enhancement

SN	Particulars	Species	Area (ha)	Remarks
1.	Revegetation of barren lands (naturally)			
2.	Plantation			
3.	Enrichment plantations			
4.	Survival rate (%)			
5.	Tentative growth rate (MAI in m^3/ha)			
6.	Others			
7.	Estimated biomass added into the forest (ton/ha)			

4. Biodiversity conservation, ecosystem services and increase in other benefits

4.1 Forest management and conservation efforts

SN	Forest conservation activities	Self disciplined	Mobilization local users	By forest watchers	External assistance
1.	Control of illegal harvesting and theft				
2.	Controlling forest fire				
3.	Controlling free grazing				
4.	Controlling forest encroachment				

4.2 Forest management and Silviculture operation

SN	Management activities	Block Number	Quantity	Cost/expenditure		External support (Rs.)	Remarks
				LFUG fund (Rs)	User voluntary service (workdays)		
1.	Nursery establishment (number)						
2.	Nursery maintenance (number)						
3.	Seedling productions (tree species)						
4.	Seedling production (NTFP)						
5.	Fencing						
5.1	– Barbed wire fence (m)						
5.2	– Live fence (m)						
6.	Plantation (ha)						
7.	Casualty replacement (number)						
8.	Weeding (ha)						
9.	Cleaning (ha)						
10.	Pruning (ha)						
11.	Thinning (ha)						
12.	Singling (ha)						
13.	Regeneration management (ha)						
14.	Management demonstration plot establishment (ha)						
15.	NTFP cultivation and management (ha)						
16.	Siliviculture system implementation area (ha)						
17.	Forest road construction/ maintenance (km)						
18.	Fire line construction / management (km)						
19.	Soil conservation and landslide treatment						
20.	Wildlife and biodiversity conservation activities						
21.	Others						

5.3 Other impact/effect of forest management activities: (related to REDD+ non-carbon outcomes)

SN	Particulars	Species	% increase	% decrease	Remarks
1.	Floral diversity after REDD+ implementation				
2.	Fauna diversity after REDD+ implementation				
3.	Reemergence of the new or already extinct species from the area				
4.	Availability of commercially important tree species				
4.1	Availability of commercially important NTFP species				
5	**Annual supply of goods**				

5.1	– Timber				
5.2	– Fuelwood				
5.3	– Fodder and forage				
5.4	– NTFPs including MAPs				
6.	**Annual incidence of illegal hunting**				
6.1	Incidence of illegal trade of wildlife trophies				
6.2	Human wildlife conflicts				
6.3	Damages by wildlife				
6.3.1	– Killing of people				
6.3.2	– Killing of livestock				
6.3.3	– Crop depredation				
6.3.4	– Animals killed by people (number)				
6.3.5	– Problematic wildlife species				
7.	**Annual supply of ecosystem services**				
7.1	Water resources				
7.2	Landslides				
7.3	Soil conservation				
7.4	Natural beauty				

6.0 Gender and social inclusion (GESI): (Related to REDD+ safeguards)

SN	Particulars	% increase[11]	% decrease	Remarks
1.	Participation of women in decision making			
2.	Representation of women in committee			
3.	Representation of women in key positions of LFUGs			
4.	Women participation in programme implementation			
5.	Women participation in M& E			
6.	Women's part in benefits sharing			
7.	Women participation in training and capacity building activities			
8.	**Workload of women**			
8.1	– For fodder			
8.2	– For fuelwood			
8.3	– For leaf litters (composting)			
8.4	– For water			
8.5	– For others			
9.	Budget allocation for the women development activities			
10.	Women empowerment program			
11.	Major incidence of violence against women			
12.	Participation of Dalit in decision making			
13.	Representation of Dalit in committee			
14.	Representation of Dalit in key positions of LFUGs			
15.	Dalit participation in programme implementation			
16.	Dalit Participation in M& E			

[11] **Increase or decrease** is calculated by comparing two consecutive reporting periods. For the first reporting period, it is the comparison between before and after REDD+ implementation scenario

17.	Dalit's part in benefits sharing			
18.	Budget allocation for the livelihood and empowerment of Dalit communities			
19.	Increase and decrease in the Dalit discriminating events in the society after REDD+			
20.	Participation of ethnic communities and IPs in decision making			
21.	Representation of ethnic communities and IPs in committee			
22.	Representation of ethnic communities and IPs in key positions of LFUGs			
23.	Ethnic and IPs participation in programme implementation			
24.	Ethnic and IPs participation in M& E			
25.	Ethnic and IPs' part in benefits sharing			
26.	Respect of the customary rights and culture of IPs			

7.0 **Governance:** (Related to REDD+ safeguards)

SN	Particulars	% increase	% decrease	Remarks
1.	Rule of law			
2.	Adherence with the provision of forestry law and regulation			
3.	Adherence with the CF constitution and OP			
4.	Accountability of the governmental staffs			
5.	Accountability of the CF executives			
6.	Transparency in the decision making system			
7.	Transparency in the budget allocation and expenditure			
8.	Equality and equity in benefit sharing			
9.	Corruption and bribery			
10.	Opportunity for people's voice			
11.	People's concerns and grievances redressed mechanism			
12.	Motivation level of local people in REDD+ activities			

Annex 5. Reporting format for REDD+ activities

Report of the implementation of REDD+ activities
Fiscal year: 20..../20…..
Annual/Biennial Report

……..
Report submitted by:
Report submitted to:
Date of submission:
……..
Members of reporting team:
Team leader:
Team members:
……

1.0 Local information		
Name of LFUG:		Sketch map of the forest and LFUG
Address:		
Forest area (in ha):		
Number of households:		
▪ Dalit		
▪ Ethnic		
▪ BCT		
▪ Others		
Date of hand over:		
Date of renew:		
Reporting period:		
Date of report:		
Date of previous report submission:		

1.1 Major objectives of the LFUG
1. 2. 3. 4.

1.2 Major implemented REDD+ activities
1. 2. 3. 4.

1.3 Objectives of the report
1. 2. 3.

2.0 Methodology and materials (brief)
2.1 Carbon measurement:
2.2 Non-carbon outcome measurement:
2.3 Safeguards outcome measurement:

3.0 Overall impacts

3.1 Impact on socio-economic aspects (before-after comparison is the comparison between consecutives reporting periods)

SN	Caste	Number of the different wealth class households						Total household	Remarks
		Poor		Medium		Rich			
		Before	after	Before	after	Before	after		
1.	Bahun, Chhetri, Thakuri (BCT)								
2.	Ethnic and indigenous people								
3.	Dalit								
4.	Others								
	Total								

3.2 Representation in key positions (before-after comparison is the comparison between consecutives reporting periods)

SN	Position	Male		Female		Dalit		Ethnic/IPs		BCT		Poor		Remark
		Before	After	Before	After	Before	After	Before	After	Before	After	Before	After	
1.	Chair person													
2.	Vice-chair person													
3.	Secretary													
4.	Joint-secretary													
5.	Treasurer													
6.	EC Members													
7.	Advisors													
	Total													

3.3 Forest types and condition

SN	Particulars	Unit	Quantity		Remarks
			Before	After	
1.0	Total forest area				
1.1	– Area (stratum 1)	ha			
1.1	– Area (stratum 2)	ha			
1.3	– Area (stratum 3)	ha			
1.4	– Area (stratum 4)	ha			
1.5	– Area (stratum 5)	ha			
2.0	Major forest species				
2.1	– Sal	m^3/ha			
2.2	– Khair/ Sissoo	m^3/ha			
2.3	– Asna	m^3/ha			

2.2	– Khotesallo	m^3/ha			
2.5	– Quercus	m^3/ha			
2.6	– Uttis/Chilaune	m^3/ha			
2.7	– Rhododendron	m^3/ha			
2.8	– Others (specify)	m^3/ha			

4.0 Deforestation

SN	Particulars	Quantity		Remarks
		Before	After	
1.0	Deforestation in general			
1.1	Size of the deforested area (ha)			
1.2	Nature of deforestation (scattered or intact)			
1.3	Block of deforestation, coordinates			
1.4	Address (VDC/municipality, wards)			
2.0	How was the deforested land before?			
2.1	➢ Very dense (over 70% crown cover) ➢ Medium (40-70% cover) ➢ Poor (10-40%) ➢ Barren land (~0% coverage)			
2.2	Reasons of the deforestation			
2.2.1	Settlement (ha)			
2.2.2	Urbanization (ha)			
2.2.3	Agriculture (ha)			
2.2.4	Infrastructure development (ha)			
2.2.5	Others (specify) (ha)			
3.0	Number of families involved in deforestation			

5.0 Forest degradation

5.1 Illicit felling and firewood collection from the forest area

SN	Illicit timber felling and firewood collection	Quantity		Remarks
		Before	After	
1.	Total number of illicitly harvested tree			
2	Total volume of illicitly harvested timber (m^3)			
3.	Illicitly felled tree species and volume			
3.1	Name of species I and volume (m^3)			
3.2	Name of species ii and volume (m^3)			
4	Total biomass of timber (ton)			
5	Total carbon loss (ton)			

5.2 Unsustainable harvesting of timber

SN	Harvesting	Quantity		Remarks
		Before	After	
1.	Annual Allowable Cut (m^3)			
2.	Growing stock of harvested strata (m^3)			
3.	Number of tree harvested			
4.	Harvested timber (m^3)			
5	Disaster induced felling (Earthquake, landslide, storms, floods)			

5.3 Uncontrolled grazing

SN	Grazing	Quantity		Remarks
		Before	After	
1	Area damaged by free grazing (ha)			
2	Level of damage (High, medium, low)			
3	Average biomass damages (ton/ha)			

5.4 Forest fires

SN	Particulars	Quantity		Remarks
		Before	After	
1.	Forest damaged by forest fires (ha)			
2.	Total estimated biomass burnt (ton)			
3.	Total estimated carbon emission (ton)			

6.0 Forest carbon enhancement

SN	Particulars	Species	Area (ha)	Remarks
1.	Revegetation of barren lands (naturally)			
2.	Plantation			
3.	Enrichment plantations			
4.	Survival of the planted species (%)			

7.0 Biodiversity conservation, ecosystem services and increase in other benefits

7.1 Forest management and conservation efforts

SN	Forest conservation activities	Self disciplined	Mobilization local users	By forest watchers	External assistance
1.	Control of illegal harvesting and theft				
2.	Controlling forest fire				
3.	Controlling free grazing				
4.	Controlling forest encroachment				

7.2 Forest management and Silviculture operation

SN	Management activities	Block Number	Quantity	Cost/expenditure		External support	Remarks
				LFUG fund (Rs)	User voluntary service (workdays)		
1.	Nursery establishment (number)						
2.	Nursery maintenance (number)						
3.	Seedling productions (tree species)						
4.	Seedling production (NTFP)						
5.	Fencing						
	Barbed wire fence (m)						
	Live fence (m)						
6.	Plantation (ha)						

7.	Casualty replacement (number)						
8.	Weeding (ha)						
9.	Cleaning (ha)						
10.	Pruning (ha)						
11.	Thinning (ha)						
12.	Singling (ha)						
13.	Regeneration management (ha)						
14.	Management demonstration plot establishment (ha)						
15.	NTFP cultivation and management (ha)						
16.	Siliviculture system implementation area (ha)						
17.	Forest road construction/ maintenance (km)						
18.	Fire line construction / management (km)						
19.	Soil conservation and landslide treatment						
20.	Wildlife and biodiversity conservation activities						
21	Others						

7.3 Production and harvesting of forest products

SN	Activity	Unit	AAC	Production			Revenue (Rs)		Remarks
				Silvicultural operation	Selection harvesting	Confiscated items	Within group	Outside group	
1	Timber	m^3							
1.1	Sal	m^3							
1.2	Salla	m^3							
1.3	Asna	m^3							
1.4	…								
1.5	Others	m^3							
2	Fuelwood	Stack, Bhari							
3	Fodder								
4	Leaf litter								
5	Medicinal plants								
6	Other NTFPs								
7	Resin								
8	Others								

7.4 Income generation activities

SN	Activity	Unit	Quantity	Benefitted households	Total investments (Rs.)	Expenditure (cost)		Remarks
						Group fund (Rs.)	User voluntary (workdays)	
1.	Employment opportunities							

1.1	Wood craft							
1.2	NTFP enterprise							
1.3	Employment at Forest management activities							
1.4	Forest protection							
2.	Income generation activities							
2.1	NTFP cultivation and domestication							
2.2	Livestock							
2.3	Cash crop							
2.4	others							
3.	Other program							

7.5 Capacity Development program

SN	Activity	Unit	Quantity	Benefitted households	Total investments (Rs.)	Expenditure (cost)			Remarks
						Group fund (Rs.)	User voluntary (workdays)	Other NGOs	
1									
2									
3									
4									
5									

7.6 Other impact/effect of forest management activities

SN	Particulars	Major species	% increase	% decrease	Remarks
1.	Floral diversity after hand over				
2.	Wildlife diversity after hand over				
3.	Reemergence of the new or already extinct species from the area				
4.	Availability of number of commercially important tree species				
5.	Increase/decrease in supply of forestry goods				
5.1	– Timber/Fuelwood				
5.2	– Fodder and forage				
5.3	– NTFPs including MAPs				
6.	Number of illegal hunting				
6.1	Illegal trade of wildlife trophies				
6.2	Human wildlife conflicts				
7.	Regular supply of ecosystem services				

7.1	Water resources				
7.2	Landslides prevention				
7.3	Soil conservation				
7.4	Natural beauty				

8.0 Gender and social inclusion (GESI): related to REDD+ safeguards

SN	Particulars	% increase	% decrease	Remarks
1.	Participation of women in decision making			
2.	Representation of women in committee			
3.	Representation of women in key positions of LFUGs			
4.	Women participation in programme implementation			
5.	Women Participation in M& E			
6.	Women's part in benefits sharing			
7.	Women participation in training and capacity building activities			
8.	Increase/decrease in the workload of women			
8.1	– For fodder			
8.2	– For fuelwood			
8.3	– For leaf litters (composting)			
8.4	– For water			
8.5	– For others			
9.	Budget allocation for the women development activities			
10.	Women empowerment program			
11.	Major incidence of violence against women			
12.	Participation of Dalit in decision making			
13.	Representation of Dalit in committee			
14.	Representation of Dalit in key positions of LFUGs			
15.	Dalit participation in programme implementation			
16.	Dalit Participation in M& E			
17.	Dalit's part in benefits sharing			
18.	Budget allocation for the livelihood and empowerment of Dalit communities			
19.	Increase and decrease in the Dalit discriminating events in the society after REDD+			
20.	Participation of ethnic communities and IPs in decision making			
21.	Representation of ethnic communities and IPs in committee			
22.	Representation of ethnic communities and IPs in key positions of LFUGs			
23.	Ethnic communities and IPs participation in programme implementation			
24.	Ethnic communities and IPs Participation in M& E			
25.	Ethnic communities and IPs' part in benefits sharing			
26.	Respect of the customary rights and culture of IPs			

8.1 Governance: related to REDD+ safeguards

SN	Particulars	% increase	% decrease	Remarks
1.	Rule of law			
2.	Adherence with the provision with forestry law and regulation			
3.	Adherence with the CF constitution and OP			
4.	Accountability of the governmental staffs			
5.	Accountability of the CF executives			
6.	Transparency in the decision making system			
7.	Transparency in the budget allocation and expenditure			
8.	Equality and equity in benefit sharing			
9.	Corruption and bribery			
10.	Opportunity for people's voice			
11.	People's concerns and grievances considered seriously			
12.	Motivation level of local people in REDD+ activities			

8.2 Biomass and carbon estimation

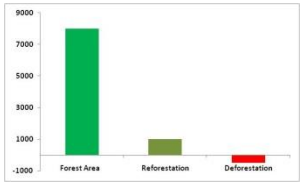
S.N	Activity	Reference level		Average quantity (per unit area) at present	Total	Remarks
		year	Average quantity (per unit area)			
1.0	Total forest area			x		
1.1	Growing stock in forest (m^3/ha)					
1.2	Biomass of forests (ton/ha)					
1.3	Carbon storage in forest (ton/ha)					
2.0	Reforestation/revegetation					
2.1	Reforested or revegetated area (ha)					
2.2	Growing stock of reforested area (m^3/ha)					
2.3	Biomass of reforested area (ton/ha)					
2.4	Carbon stored in reforested area (ton/ha)					
3.0	Deforestation					
3.1	Rate (%)					
3.2	Area (ha)					
3.3	Loss of growing stock (m^3/ha)					
3.4	Biomass loss from deforestation (ton/ha)					
3.5	Carbon loss from deforestation (ton/ha)					
Total (Forest area + reforestation area-deforestation area)						

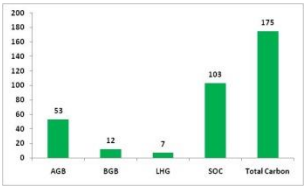
9. Total carbon storage or emission through REDD+ activities

SN	Land use category	Total area (ha)	Reference level Carbon stock per unit area	**Carbon stock in per unit area** (ton/ha)									**Total carbon stock** (ton)								
				Biomass					Dead materials				Biomass		Dead materials						
				Aboveground				Below ground			Soil		Aboveground	Belowground			Soil	Total CO_2 storage	Total CO_2 emission	Remarks
				Tree	Sapling	Regeneration	Grass/Herbs		Dead wood	Litters					Dead wood	Litters					
1	Forest area																				
1.1	Stratum 1																				
1.2	Stratum 2																				
1.1	Stratum 3																				
1.4	Stratum 4																				
1.5	Stratum 5																				
2.	Deforestation area																				
2.1	Change to agriculture land																				
2.2	Change to grass land																				
2.3	Change to settlement																				
3.	Reforestation/revegetation area																				
	Total																				

Graphical representation of carbon storage in the forest and at different carbon pool:

Please include the carbon storage in forest and different carbon pools. If you have the time series data, it is good to show the carbon storage changes in different years. For example





- Graph 1 shows the hypothetical example of 80 ha of CF which has been plantation of 20 hectare and deforestation of 3 hectare.
- Graph 2: true carbon storage example of Chelibeti CF at Kayerkhola Watershed, Chitwan, Nepal (Shrestha et al., 2015).

10. Conclusions (please write short description)

10.1 Communities' impression on the measured REDD+ outcomes.

10.2 Benefits sought and difficulties faced by the communities.

10.3 Total carbon storage/sequestered by the group in their forests.

10.4 Changes in community motivation on REDD+ policy mechanism.

Annex 6: People consulted during MMR preparation

6.1 List of participants of Gorkha (Date: 9 September, 2015)

S.N	Name	Designation	Organization	Telephone	Remark
1.	Jeebanath Paudel	DFO	DFO Gorkha		
2.	Som Bahadur Gurung	Senior Admin. Assistant	NTNC-MCAP		
3.	Er. Kul Raj Lamichhaney	Energy and Environment officer	DDC, Gorkha		
4.	Arun Adhikary	Field Coordinator	Care Nepal/ Hariyo Ban Program		
5.	Ganesh Bdr. Karki	AFO	DFO Gorkha		
6.	Bhuraman Ghimire	Secretary	Ludhikhola REDD+ Network		
7.	Rolak Bahadur Thapa	Coordinator	Ludhikhola REDD+ Network		
8.	Bal Krishna Lamichhane	Dep. Chairperson	Loktrantik NGO Federation,		
9.	Kaji Ram Roka	Chairperson	NFN Gorkha		
10.	Ananda Raj Adhikary	Agriculture Dev. Officer	DSCO		
11.	Indra Bahadur Bhatta	Livestock Dev. Officer	DLSO		
12.	Shyam Bahadur Ramtel	Chairperson	COSDER, Gorkha		
13.	Sangita Gnawali	Member	Community Disaster Management		
14.	Kabita Aryal	Member	HIMAWANTI		
15.	Dipak Devkota	Secretary	Private Forests Network, Gorkha		
16.	Basu Dev Paudel	Technical Assistant	DADO		
17.	Kamal Prasad Lamichhane	Member	FECOFUN		
18.	Tirtha Kumar Shrestha	Senior Agriculture Dev. Officer	DADO		
19.	Shyam Babu Kattel	Chairperson	FECOFUN Gorkha		
20.	Dil Bahadur Purja Pun	AFO	DFO Gorkha		
21.	Ram Chandra Thakur	Ranger	DFO Gorkha		
22.	Meena Adhikary	General Secretary	FECOFUN		
23.	Pampha Tiwari	Chairperson	HIMAWANTI Gorkha		
24.	Janardan Aryal		Private Forest Owner		
25.	Raj Babu Shrestha	Member	Chamber of Commerce		
26.	Moti Lal Thapa	Member	Bhalu Khola CFUG		
27.	Dr. Mohan Prasad Paudel	Under Secretary	REDD-IC		
28.	Kedar Maharjan	Assistant	Rural Dev. Foundation		
29.	Dr. Rajendra K.C.		National Consultant		

6.2 List of participants of Chitwan (Date: 10 September, 2015)

S.N	Name	Designation	Organization	Telephone	Remark
1.	Bishnu Paudel	Under Secretary	CRFD, Hetauda		Meeting held
2.	Sukh Lal Jayasawal	DFO	DFO Chitwan		Meeting held
3.	Shyam Kumar Rimal	AFO	DFO Chitwan	9845048706	shyamrimal2120@gmail.com
4.	Keshav Acharya	Secretary	NGO Federation	9855060199	acharya199@gmailcom
5.	Laxmi Chaudhary	Chairperson	Tharu Welfare Society	9845055942	
6.	Dr. Ram Kumar Karki	Chief	DLSO	9855065179	drrkkarki@gmail.com
7.	Surbir Pokharel	Chairperson	FECOFUN	985505477	surbirpokharel66@gmail.com
8.	Madhav Prasad Upreti	Engineer	DDC	9855056989	
9.	Padam Gurung	Chairperson	NEFIN/DCC	9855058915	pdgurung324@gmail.com
10.	Suraj Shrestha	Secretary	Pragati CFUG	9816245495	
11.	Rajendra Dhungana	Office Secretary	Dharapani CFUG	9855050072	
12.	Lekh Prasad Pokharel	Secretary	Private Forest Network	9845049724	
13.	Bhoj Raj Devkota	Member	NEFUG	9855050062	
14.	Sita Devi Pandey	Member	Community Disaster Management Committee	9845138616	
15.	Swastika Pariyar	Member	Dalit Mahila Jagaran	9855208966	
16.	Bam Dev Dhakal	Officer	DSCO		
17.	Bharat Dhungana	Member	FECOFUN		
18.	Dhan Kumari Thapa	Member	Kalika CFUG	9845198309	
19.	Nar Jung Praja	Chairperson	Singhajebare Diujar	9845149198	
20.	Ramesh Praja	Member	Singhajebare Diujar	9845672318	
21.	Bhim Prasad Bhatta	Junior Staff	DFO Chitwan	9855063715	
22.	Moti Lal Adhikary	Junior Staff	DFO Chitwan	9847157302	
23.	Chandra B. Chowdhary				
24.	Chami K. Rana				
25.	Khil Prasad Regmi				
26.	Rajiv Neupane				
27.	Bishnu Rayamajhi				
28.	Dr. Mohan Prasad Paudel	Under Secretary	REDD-IC		
29.	Kedar Maharjan	Assistant	RDF		
30.	Dr. Rajendra K.C.	Consultant	RDF		

6.3 List of Participants from Dolakha (13 September 2015)

S.N	Name	Designation	Organization	Telephone	Remark
1.	Rabindra Maharjan	DFO	DFO Dolakha		Meeting held
2.	Narayan Basnet	Chairperson	CFUG	9841526239	
3.	Dilip Kumar Subedi		Gaurishankar Conservation Area Project	9741341361	
4.	Bharat Sharma	Program Officer	ANSAB	9860386060	bharatsharma@ansaab.org
5.	Min K. Acharya	Ranger	DFO Dolakha	9855055477	surbirpokharel66@gmail.com
6.	Jagannath Basnet	General Secretary	FECOFUN	9754201327	
7.	Chandra B. Thapa	AFO	DFO Dolakha	9816245495	Jibanyatra37@gmail.com
8.	Raghu Nath Subedi	Chairperson	COFSUN Dolakha	9744045203	
9.	Rajiv Krishna Rajbahak	AFO	DFO Dolakha	9845491177	raghusubedi11@yahoo.com
10.	Gupta Bahadur Basnet	Secretary	Pavati VDC, Dolakha	9844186370	
11.	Lal Kumari Tamang	Treasurer	NEFUG	9844195584	
12.	Kamala Basnet	Chairperson	FECOFUN	9844060271	
13.	Sita K.C.	Chairperson	NEFUG	9844399985	
14.	Harihar Neupane	Member	Simpani CFUG	9844065073	
15.	Rajan Prasad Shivakoti	Secretary	Timber Entrepreneur Association	9841164763	
16.	Mukunda Prasad Adhikary	AFO	DFO Dolakha	9855170229	adhikarimukunda68@yahoo.com
17.	Govinda Dahal	AFO	DFO Dolakha	9855067733	easydahal29@gmail.com
18.	Binod Paudel	Forester	DFO Dolakha		
19.	Dr. Nabin Joshi	Officer	ANSAB	9809403933	nabinjoshi@ansab.org
20.	Sita Ram Subedi	Chairperson	Madhani CFUG	974101954	
21.	Bhagwati Dahal	Member	Hanumanteshwar CFUG		
22.	Malisha Shrestha	Member	Charnawarti CFUG		
23.	Bhima Shrestha	Secretary	Charnawarti CFUG		
24.	Dr. Mohan Prasad Paudel	Under Secretary	REDD-IC		
25.	Kedar Maharjan	Assistant	RDF		
26.	Dr. Rajendra K.C.	National Consultant	RDF		

6.4 Participants in the central level draft sharing workshop at Kathmandu (Date: 29 December 2015)

S.N	Name	Designation	Organization	Telephone	Remark
1.	Dr. Bishwa Nath Oli	Chief	FACD/MFSC		bn_oli@yahoo.co
2.	Man Bahadur Khadka	Chief	REDD-IC	9851211210	mbkhadka@gmail.com
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4.	Kai Windhorst	Chief Technical Advisor	GIZ		kai.windhorst@giz.de
5.	Krishna Man Pradhan	President	RDF	9851033540	kmprdf@mail.com.np
6.	Shekhar K. Yadav	Chairperson	NFA	9851008778	Skyshekhar2003@yahoo.com
7.	Dr. Narendra Chand	Under Secretary	REDD	9843053150	narendrachand@gmail.com
8.	Dr. Mohan P. Poudel	Under Secretary	REDD	9841433332	mohanprasadpoudel@gmail.com
9.	Ishwari P. Poudel	Under secretary	MFSC/FACD	9851164364	poudel.01@gmail.com
10.	Dr. Binod P. Devkota	DFO	DFO Lalitpur	9841234131	binod_devkota@ymail.com
11.	Dr. Indra Sapkota	DFO	DFO Kathmandu	9851193486	isapkota@gmail.com
12.	Surya Kanta Sigdel	DFO	DFO Bhaktapur	9846061045	sigdel57@yahoo.com
13.	Hari P. Pandey	Officer	REDD-IC	9844948989	pandeyhp@hotmail.com
14.	Basant Panta	Program Officer	ICIMOD	9849159294	Basant.pant@icimod.org
15.	Reesha Shrestha			9841517602	reeshas@yahoo.com
16.	Dr. Hari Dhungana	Senior Fellow	SIAS	9851100669	h.dhungana@gmail.com
17.	Dr. Rabindra Roy	REDD+ specialist	Forest Action	9851149635	rabindra@forestaction.org
18.	Dil Raj Khanal	Forest Lawyer		9741217370	dilcommon@gmail.com
19.	Tunga Bhadra Rai	Prog. Officer	NEFIN	9851069918	tungarai@hotmail.
20.	Mana Devi Shrestha	VC	INWYN	9849247017	trilochand@gmail.com
21.	Gyanu Maskey	Research Officer	SIAS	9849684001	gyanu@sias-southasia.org
22.	Bishnu Hari Poudel	Country Prog. Coordinator	RECOFTC	9849532337	bishnu.poudel@recoftc.org
23.	Bhola Bhattarai	Chairperson	NAFAN	9851074770	nafannepal8@gmail.com
24.	Bhola Khatiwada	Chairperson	COFSUN	9851152655	bholacofsun@gmail.com
25.	Rama Ale Magar	Chairperson	HIMAWANTI	9851132808	himawantihimawanti@gmail.com

26.	Sunil K. Pariyar	President	DANAR	9841608949	sunildanar@yahoo.com
27.	Kiran Timalsina		Green Governance Nepal	9851210554	kirantimalsina@hotmail.com
28.	Sambridhi Sharma	GESI	Freelancer		
29.	Bhawani Kayastha		RDF		
30.	Bibek Pradhan		RDF		
31.	Naiel Shrestha		RDF		
32.	Christina Pradhan	GESI	RDF	9860089879	
33.	Chhotelal Chowdhary	Forestry Expert	Free Lancer	9754205113	
34.	Dr. Rajendra K.C.	National Consultant	Free Lancer	9851149420	rkc_nep@yahoo.com

Annex 7: Photo plates from district level consultation workshops

District level stakeholder consultation at Gorkha (9 September, 2015)

District Level Consultation at Chitwan (10 September, 2015)

District level consultation at Charikot, Dolakha (13 September, 2015)

Annex 8: Photo plates from central level stakeholders workshop on draft sharing