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This publication was printed with FSC certified paper and vegetable-based ink.
Publishing plan registration number: 1497-2013/CXB/11-164/LĐ
Publishing permit number: 589/QĐLK-LĐ
ISBN: 978-604-59-0547-0

Participatory Carbon Monitoring: Operational Guidance for National REDD+ Carbon Accounting

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Version 1.0 - September 2013

Supported by:
Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

Acknowledgements

This guidance document is an output of the project *'Delivering Multiple Benefits from REDD+ in Southeast Asia'* (MB-REDD), implemented by SNV – The Netherlands Development Organisation in collaboration with the *'Lowering Emissions in Asia's Forests'* (LEAF) project. The MB-REDD project is part of the International Climate Initiative. The German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety supports this initiative on the basis of a decision adopted by the German Bundestag. LEAF is a five-year cooperative agreement, funded by the United States Agency for International Development's (USAID) Regional Development Mission for Asia (RDMA). LEAF is being implemented by Winrock International (Winrock), in partnership with SNV, Climate Focus and The Center for People and Forests (RECOFTC).

The operational guidance presented here draws on an unpublished technical background paper prepared by Patrick van Laake for the SNV project *'Harnessing Carbon Finance to Arrest Deforestation and Forest Degradation, and Conserve Biological Diversity'*, funded by the Darwin Initiative of The United Kingdom government's Department for Environment, Food & Rural Affairs.

The work of Winrock International, both as a LEAF implementing partner and as a global leader in forest carbon measuring and monitoring is acknowledged.

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Cite report as:
Casarim, F.M., Walker, S.M., Swan, S.R, Sharma, B.D., Grais, A., and Stephen, P. 2013. *Participatory Carbon Monitoring: Operational Guidance for National REDD+ Carbon Accounting*. SNV - The Netherlands Development Organisation, REDD+ Programme, Ho Chi Minh City.

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Abbreviations

AD	activity data
AFOLU	agriculture, forestry and other land use
CO_2	carbon dioxide
COP	Conference of Parties
EF/RF	emission/removal factor
GHG	greenhouse gas
GIS	geographic information system
IPCC	Intergovernmental Panel on Climate Change
LEDP	low emissions development planning
MRV	measurement, reporting, and verification
NFI	national forest inventory
NFMS	national forest monitoring system
PCM	participatory carbon monitoring
PFM	participatory forest monitoring
PLR	policies, laws and regulations
QA/QC	quality assurance and quality control
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
RL/REL	reference levels/reference emissions levels
UNFCCC	United Nations Framework Convention on Climate Change

Icons


National government institutions


Subnational government institutions


Local stakeholders (including local and communities)


Non-governmental institutions and private sector

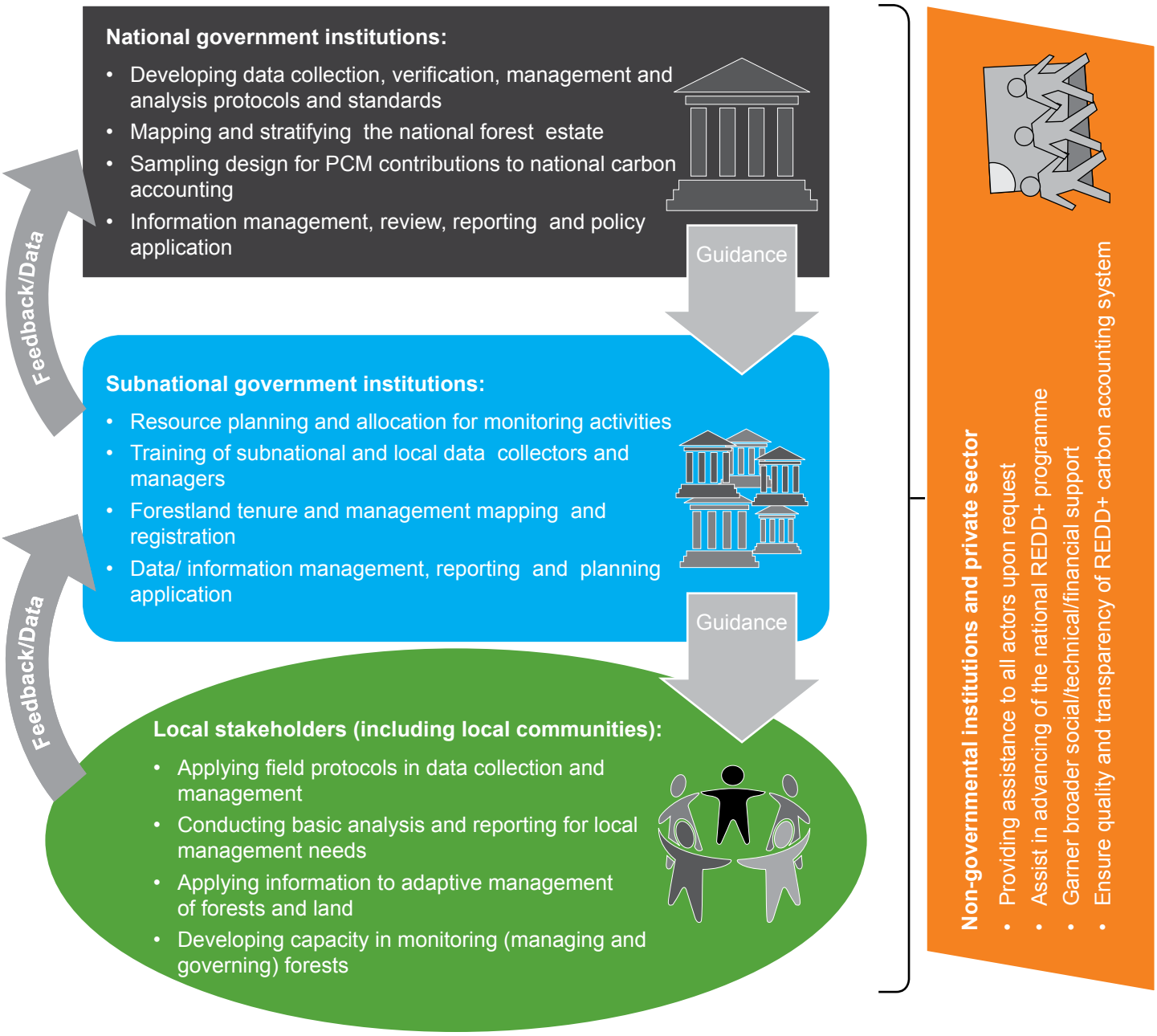
Executive summary

The United Nations Framework Convention on Climate Change calls for a phased approach to REDD+ at the national level, with subnational elements, and the participation of all relevant stakeholders in the development and implementation of national strategies and action plans. A broad and inclusive participation of stakeholders in national REDD+ programmes can help to ensure the sharing of responsibilities and benefits, in addition to strengthening ownership of implementing and monitoring REDD+ actions.

The various stakeholders can each contribute to the development of reference levels (RL/REL) and a robust and transparent national forest monitoring system (NFMS) to support measurement, reporting and verification (MRV) of greenhouse gas emission reductions and enhanced removals from forests and land use change. The national and subnational government institutions as well as local stakeholders, including local communities, each have particular roles to play in these carbon accounting requirements of national REDD+ programmes.

Participatory carbon monitoring (PCM) is presented here as an approach to improve the vertical and horizontal institutional integration of different stakeholders for carbon accounting within a country's national REDD+ programme. This document aims to guide national stakeholders involved in the REDD+ readiness process in understanding: a) what a PCM approach is, and what are potential and limitations involved (Section 1); and b) how to organise stakeholders and operationalize carbon accounting within a PCM approach for national REDD+ programmes (Section 2). PCM applications for REDD+ other than carbon accounting – safeguard compliance; low-emissions development planning; benefit sharing; and monitoring REDD+ policies and measures - are also introduced but not elaborated on in this document.

The document describes roles and key functional tasks for a PCM approach to four distinct stakeholder groups: national government institutions, subnational government institutions, local stakeholders (including local communities), and non-government institutions and private sector. Development of data standards and protocols, together with sampling strategy design and information management and reporting (as part of a NFMS) is the purview of national government institutions. Subnational government institutions are responsible for subnational resource planning and allocation to PCM activities to on-the-ground, local stakeholder capacity development, and data management, and aggregation and submission of data and information to the NFMS. Local stakeholders, be they local community, forest owners, managers or users of forest resources, can contribute by applying national protocols in collecting and managing field data, together with subsequent basic analysis and application of information for adaptive management at the site-based level. Non-governmental institutions or private sector may play a critical role in providing technical assistance to any of these stakeholder groups in performing their functional tasks for PCM.



Key stakeholder categories and their primary participatory carbon monitoring functions

Integration of a PCM approach into NFMS is outlined with simple flow diagrams and accompanying text including step-by-step procedures for participatory generation of the activity data, emission/removal factors necessary to establish reference levels and a subsequent MRV system of the national REDD+ programme's performance. Complementary technical resources for a PCM approach are listed in an annex.

The audience of this operational guidance document is primarily those government agencies responsible for coordinating REDD+ readiness and implementation activities (e.g. REDD+ taskforce and the like), as well those agencies with historical responsibilities for forest inventory and monitoring. Although this document focuses on national REDD+ programmes, the guidance is equally applicable to other, subnational scales of programmatic REDD+.

It is hoped that REDD+ countries and their development partners take both technical and operational PCM guidance to the field and test the methods and systems in 'real world' application. From these practical experiences second generation guidance, together with more interactive decision support tools, can be developed to foster more cost-effective monitoring, not just for REDD+ but multiple management interventions and policy approaches for tropical forests that need good data to ensure and assure impact.

Introduction 1

When forests are cleared or degraded, the carbon stored in the trees, non-tree vegetation, roots, deadwood, litter and soil is released into the atmosphere as carbon dioxide (CO_2), a major greenhouse gas (GHG). In addition, the forest's capacity for additional carbon sequestration is lost or reduced. GHG emissions from deforestation and forest degradation are significant, and have been estimated to account for between 7% and 17% of the total of global anthropogenic CO_2 emissions (Barker et al. 2007, Harris et al. 2012b). A clear need to conserve forests, their ability to sequester CO_2, and enhance or maintain their stored carbon has been identified by the global community as an important element of climate change mitigation.

Under the United Nations Framework Convention on Climate Change (UNFCCC) a climate change mitigation mechanism has been proposed to address GHG fluxes from forestry and other land use sectors - 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). The UNFCCC Cancun Agreement[1] identifies five mitigation actions comprising REDD+:

a) Reducing emission from deforestation;

b) Reducing emissions from forest degradation;

c) Conservation of forest carbon stocks;

d) Sustainable management of forests; and

e) Enhancement of forest carbon stocks.

The UNFCCC supports and provides guidance on developing REDD+, which calls for a phased approach at the national level, with possible supporting sub-national elements, and the development of national strategies and action plans. For a national REDD+ programme to be eligible for results-based financing, the UNFCCC has requested Parties to[2]:

- Identify of drivers of deforestation and forest degradation and means to address them;
- Identify of national REDD+ activities and development of national strategies and actions plans;
- Use the most recent Intergovernmental Panel on Climate Change (IPCC) guidance and guidelines as basis for estimating GHG emissions and removals from forests;
- Establish a national forest monitoring system (NFMS) that combines remote sensing and ground-based techniques for providing estimates that are transparent, consistent, accurate and suitable for review by the Conference of Parties;

1 UNFCCC Decision 1/CP.16

2 UNFCCC Decision 1/CP.16, UNFCCC Decision 1/CP.13, UNFCCC Decision 4/CP.15

- Estimate the national forest reference emission level (REL) or forest reference levels (RL);
- Measure, report and verify (MRV) estimated GHG emissions reduction and removals from forests and land use change; and
- Develop a system for providing information on and ensuring REDD+ safeguards are addressed and respected.

The Cancun Agreement (2010) requests Parties to the UNFCCC to promote and support a number of safeguards when undertaking REDD+ activities, including inter alia, *'the full and effective participation of relevant stakeholders, in particular, indigenous peoples and local communities'*. The benefits of a participatory approach to developing, implementing and monitoring national REDD+ strategies and programmes have been identified to encompass:

- reliable identification of underlying drivers and agents of deforestation and degradation;
- potentially reduced costs of implementation and monitoring of REDD+ activities;
- increased awareness, ownership and motivation for implementing and monitoring REDD+ activities;
- transparent and independent monitoring and enforcement of regulations; and
- monitoring of environmental, social and GHG accounting safeguards.
  (Foti et al., 2008; Daviet, 2011; Mukama et al., 2012)

Participatory carbon monitoring (PCM) presents a tangible and pragmatic opportunity to promote and support the safeguard of *"full and effective participation of relevant stakeholders"* and make potentially cost-effective contributions to a number of essential elements of REDD+ (Box 3), not least of which is GHG accounting.

National and subnational institutions, together with local stakeholders, each have particular roles to play in the development and implementation of national REDD+ programmes[3]; from the development of forestry and related land use mitigation strategies, to implementing and monitoring REDD+ activities. A PCM approach allows REDD+ countries to meet their obligations under the UNFCCC, build a broad and skilled constituency across a number of forest carbon stock monitoring and measuring tasks, and assist in the creation of carbon accounting system(s) that are transparent and accountable to a broad range of stakeholders.

3 This guidance document focuses on national REDD+ programmes, but is equally applicable to other, subnational scales of programmatic REDD+

1.1 Defining participatory carbon monitoring

PCM is defined here as an approach to improve the vertical and horizontal institutional integration of different stakeholders for GHG accounting within a country's national REDD+ programme. A PCM approach can be regarded as one component of participatory forest monitoring (PFM) – a broad approach for multi-stakeholder engagement in monitoring forest resources and services, together with the environmental and social impacts of different management interventions, including REDD+ (Swan, 2012) (see Box 1). Historically, PFM approaches have demonstrated the potential for engaging local stakeholders under a variety of participatory forest management modalities - such as joint forest management, community forest management, collaborative forest management, co-management - and for a variety of purposes and forest management objectives (Evans and Guariguata 2008, Martin-Garcia and Diez 2012).

Box 1: Characteristics of participatory forest monitoring (PFM)

- Engages different stakeholders, performing different functions based on complementary mandates and skills, from national government to the grassroots level.
- Applies local knowledge and capitalises on the different capacities and competencies of local stakeholders, particularly forest managers and local government officers.
- Is not restricted to any particular forest tenure arrangement or management and governance system; PFM application can range from public or private owned management boards contracting local people to perform certain monitoring functions through to community forest management.
- Employs a variety of data collection, management and analysis protocols, including forest carbon stocks, other ecosystem service indicators, and biodiversity and social impacts of REDD+ implementation.

(Source: adapted from Swan 2012)

Most of the discussion on PCM in the current REDD+ literature is focused on the utilization of communities for *monitoring* REDD+ activities, and is often limited to community-based field data collection (UN-REDD 2011, Danielsen et al. 2011, Scheyvens et al., 2013). While field monitoring of forest carbon by communities is indeed an important part of PCM, this document purposefully focuses on the participatory and collaborative aspect of a broad range of stakeholders that should be involved in carbon accounting for a national REDD+ programme, not just community level field data collection.

1.2 Potential benefits and limitations

Given the UNFCCC requirement for *"full and effective participation of relevant stakeholders"*[4], those designing carbon accounting systems within a NFMS will benefit from an understanding of both the benefits and limitations of broad and inclusive participation of a range of stakeholders in measuring and monitoring forest carbon (Box 2).

4 UNFCCC Decision 1/CP.16

Box 2: Potential benefits and limitations of a participatory carbon monitoring approach for national REDD+ programmes

Potential benefits

- **Cost-effectiveness** – The use of PCM approaches has the potential to be more cost-effective than carbon monitoring conducted solely by government agencies or external technical experts (Skutsch et al. 2010; Danielsen et al. 2011; UN-REDD 2011; I-REDD+ 2012).

- **Sustainability** – The cost-effectiveness of the participatory approach, coupled with broad stakeholder buy-in is likely to lead to a more sustainable monitoring effort, one that promotes ownership and continuity of the monitoring functions, both within and outside of the government institutions.

- **Social and human capital** – The use of PCM builds social and human capital, empowering institutional and individual stakeholders. The building of social and human capital through training, network development and information exchange can engender more pluralistic and effective forest management and governance structures.

- **Connecting local knowledge** – PCM approaches provide opportunities to integrate valuable local knowledge into managerial considerations and decision making processes on the sustainable use of forest resources.

Potential limitations

- **Data quality control** – The quality of data is dependent on the existing technical capacity and resources available to participating stakeholders. Without a system of ensuring quality at all levels, data collected through a PCM approach may not be of sufficient quality to support carbon accounting for a national REDD+ programme. There is also a risk of information loss or erroneous reporting of data during aggregation from local to higher administrative levels. If benefits are linked to results, this could provide an incentive to report false positive trends, so that higher rewards can be obtained.

- **Initial capacity investments** – Although PCM approaches could be more cost-effective than expert based monitoring in terms of operational running costs, the initial capital outlay for introducing PCM approaches may be high depending on existing capacity to collect data, as well as soft and hardware available to manage those data at the local level. There may also be additional upfront costs in establishing or improving data quality assurance and quality control systems.

Box 2 (cont.)

- **Incentives for participation** – Incentivising and sustaining participation in PCM approaches could be a challenge for reasons of political economy at national and subnational levels (vested interests in maintaining expert-based monitoring systems), and for reasons of opportunity cost at the local level (time spent collecting data for REDD+ might compete with on-farm livelihood mainstay activities). When a PCM approach is implemented, local participants need to be compensated in some form (financial and/or in-kind contributions) for adopting responsibilities. In addition to direct participation payments, indirect incentives that could attract sustained commitment to a PCM approach include: creating a dialogue on resource use between local stakeholders and government; increased stake and legitimacy in management decision-making processes with regard to resources important to livelihoods; improved natural resource management through informed decision making utilising monitoring data, yielding more sustained forest product harvests; and attracting external financing for the management of an area.

1.3 Aims, scope and audience

This operational guidance document on PCM approaches describes functional roles of stakeholders at different levels: national, subnational, and local; and how these roles can complement each other and combine to contribute to GHG accounting under a national REDD+ programme. This document aims to guide national stakeholders involved in the REDD+ readiness process in understanding: a) what a PCM approach is, and what potential and limitations (Section 1); and b) how to organise stakeholders and operationalize a PCM approach for national REDD+ programmes carbon accounting (Section 2). A list of publicly available resources that may be used or adopted by stakeholders in implementing such a PCM approach is also included (Annex I). It should be clearly noted that this document is not a technical methodology or protocol for implementing a PCM approach, detailing how to collect, manage, verify and analyse data forest carbon data. The technical aspects of 'how to do create a PCM system' is covered by other literature (see Annex I). This document complements these technical methods and protocols, with operational guidance on PCM systems.

This guidance document considers only the application of PCM approaches to forest carbon accounting for national REDD+ programmes, but there are other applications that could be considered during design of national programmes and strategies (outlined in Box 3), but not elaborated further in this document.

Box 3: Non-carbon accounting applications of participatory carbon monitoring for national REDD+ programmes

- **Safeguards** – PCM, as part of broader participatory forest monitoring approaches, can contribute to the goals laid out in the UNFCCC REDD+ safeguards. Inherent in its name, PCM contributes to safeguard (d) – stakeholder participation - by enhancing the participation of stakeholders at different levels. PCM could also prove effective as a measure to monitor domestic leakage, helping contribute to safeguard (g) – displacement of emissions -, as well as provide data on changes in extent of biomass carbon, as an indicator of natural forest quality, thus addressing safeguard (e) –

Box 3 (cont.)

natural forests and biodiversity. The system of collaborating stakeholders collecting and aggregating (and potentially verifying) data, that would be necessary for effectively implementing PCM for national carbon accounting, could form and integral part of the system required under the UNFCCC to provide information on how the safeguards are being addressed and respected throughout the implementation of REDD+ activities.

- **Low-Emission Development Planning** – (LEDP) is a multi-stakeholder process to meet pro-poor economic development with sustainable land and forest use planning while lowering carbon emissions within a chosen jurisdiction (Stephen 2013). LEDP presents a framework and a participatory process to operationalize national REDD+ programmes at the subnational level. PCM has an important technical role in contributing to carbon accounting and monitoring within the LEDP framework, but also an equally important social role in building and supporting an inclusive and informed decision making process. PCM is a process that can ensure that local stakeholders have the knowledge and capacity to evaluate different low carbon development scenarios and are equipped to make informed decisions regarding trade-offs between economic, environmental and social development objectives under a low emission land use plan and any benefit sharing mechanism linked to this plan.

- **Benefit Sharing Mechanisms** – PCM approaches may assist in the transparent and equitable allocation and distribution of benefits (in cash or in kind, individual or collective) across the range of stakeholders implementing REDD+ activities. A PCM approach could provide local actors with an important source of information relating to their performance, and serve as a 'self-check' against the benefits that is awarded to them under a national REDD+ programme. Interactions and feedback across different actors can assist in creating a more equitable incentive allocation to both participation and performance. If benefit sharing mechanisms are used as a participation-based incentive, stakeholders would receive compensation for the data collected and provided to relevant institutions. Stakeholders distributed across a landscape have the potential to collect data at a high sampling intensity, allowing for benefit distribution to the sub-national level to be more closely tied with localised performance in achieving emissions reductions and removals.

- **Policies & measures** – The development of effective policies and measures comprising a national REDD+ strategy or programme that result in the desired reduced GHG emissions or enhanced removals requires a comprehensive understanding of what drives land use and land use change, in addition to feedback on the range of interventions to address these drivers of deforestation and forest degradation. To design and refine effective REDD+ interventions, the NFMS should be used to inform the national policies and local measures adopted to achieve emissions reductions and enhanced removals in the country or jurisdiction. Involvement of local stakeholders, through a PCM approach, can provide a vital link for monitoring the efficacy of REDD+ policies and measures. Local stakeholders are also likely to provide data inputs on emission/removal activities at a higher frequency than a nationally implemented monitoring programme, thus providing information for refining and adjusting policies and measures more quickly and frequently, as well as informing adaptive management at the local level of activity implementation.

The audience of this guidance document is primarily those government agencies responsible for coordinating REDD+ readiness and demonstration activities (e.g. national REDD+ committees, offices, taskforces and the like). This document also targets those agencies with historical responsibilities for forest inventory and monitoring that would be central in operating NFMSs for REDD+, as well as those who provide technical assistance to these national and sub-national institutions.

2.1 Participating stakeholder groups

The various actors involved in the implementation of a PCM approach will have different functional roles. Four key stakeholder groups are identified as necessary to cover the main functional tasks that would comprise PCM for national carbon accounting purposes. These main stakeholder groups, and the relationships between them are presented in Figure 1.The roles of each main stakeholder category are outlined below and summarised in Box 4.

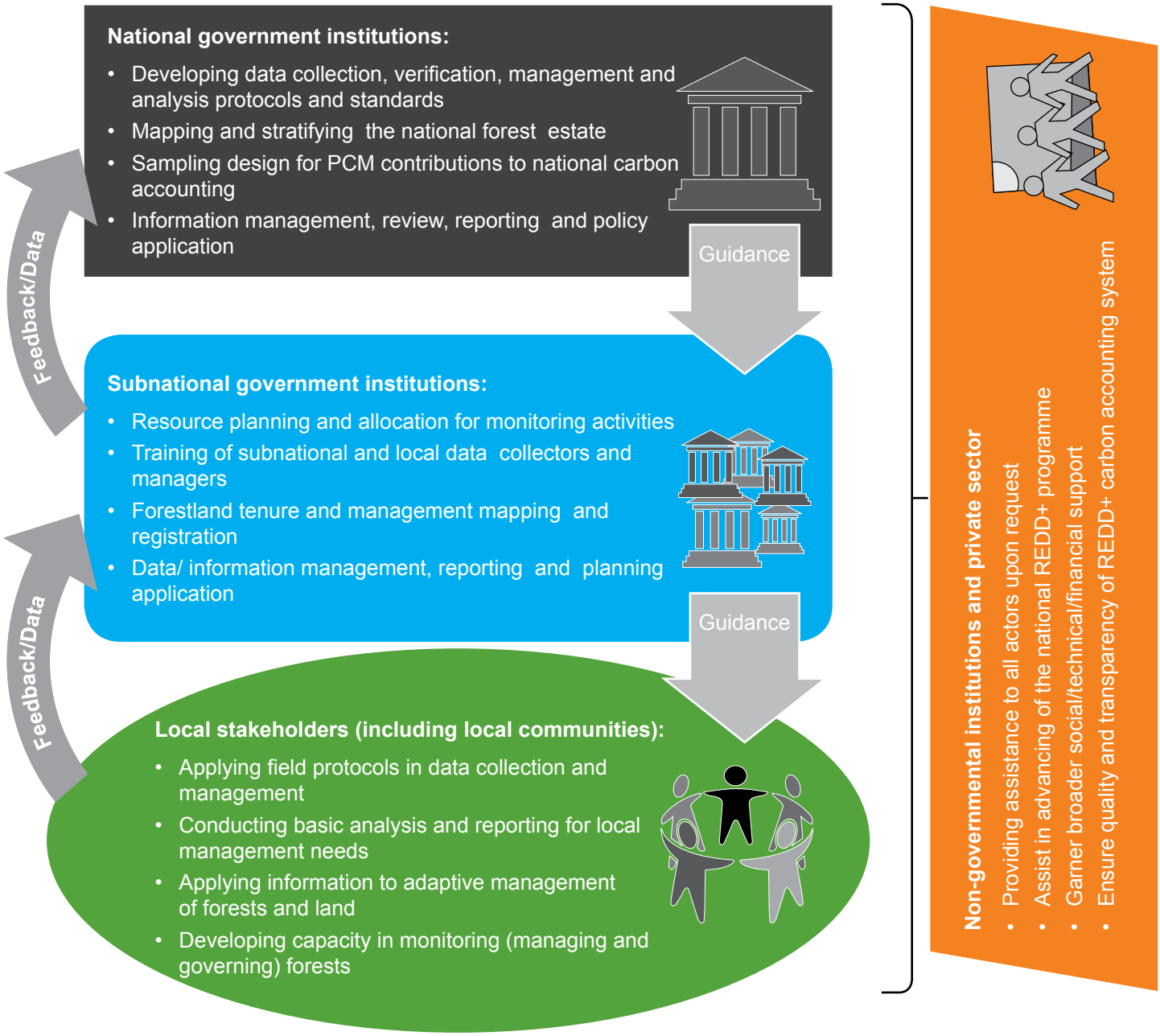


Figure 1: Key stakeholder categories and their primary participatory carbon monitoring functions

National government institutions

REDD+ has intrinsically complex developmental and implementation requirements in regards to policy measures, financial mechanisms, social arrangements and technical components. Given national REDD+ programmes will be implemented over large geographic areas incorporating a diverse array or stakeholders, the agency/agencies coordinating the national REDD+ programme (i.e. REDD+ Secretariat, REDD+ cell, REDD+ office, REDD+ taskforce, etc.) should have a thorough understanding of resource availability, diversity of social groups/ethnicities, potential stakeholder roles and responsibilities, and existing land use/ land cover practices and policies. National government institutions with existing forest inventory and monitoring responsibilities have three basic PCM functions: 1) quality assurance/quality control (QA/QC) through development of national data protocols and standards; 2) sampling strategy through stratification of forests, setting precision targets and determining sampling effort and frequency; and 3) reviewing, reporting (nationally and internationally) and applying carbon accounting information to REDD+ policy approaches.

Subnational government institutions

Subnational government institutions act as the connection between the national government agencies, through hierarchical tiers, and the local stakeholders. These institutions should strive to bridge the gap in communication by promoting transference of knowledge between national government and local stakeholders. Subnational institutions will likely play a crucial role in operationalizing national REDD+ programmes due to their administrative functions governing the areas where REDD+ activities will be implemented. The principal functions of subnational government in PCM are: 1) financial and human resource planning and allocation; 2) forestland tenure and management mapping; and 3) information management and reporting (to the NFMS) and applying PCM data to subnational planning (i.e. through LEDP, see Box 3).

Local stakeholders (including local communities)

Local stakeholders – owners, managers and users of forests and forest frontier lands - are critical for the execution of PCM as they are the actors implementing REDD+ activities and present a large, locally knowledgeable (low-cost) labour force. These actors, which include, but not necessarily limited to local people, and may include individuals and civil society sector entities, should be engaged in the development of REDD+ activities through a participatory consultation processes, in which local actors may inform national and subnational agencies about local land use practices, historic trends in land use and land cover, their interaction with forests, and overall cultural beliefs (Scheyvens et al., 2013). Such information allows further understanding of local land use practices that may lead to GHG

emission reductions or removals, and thus assisting national and subnational agencies in the development of effective REDD+ programmes and plans respectively. In PCM, local stakeholders have the roles of: 1) applying the national data collection and management protocols to generate data to be aggregated into the NFMS; 2) conducting basic analysis and reporting for adaptive management at the site level of REDD+ activity implementation; and 3) developing capacities to improved governing, managing and monitoring forests.

Non-governmental institutions and private sector 

Non-governmental institutions and the private sector correspond to groups and institutions that do not have a direct and immediate stake in the outcome of benefits from the REDD+ programme. They generally have specialized niches of interest and expertise, ranging from policy development to social engagement, to technical assistance. These stakeholders are important actors in furthering and applying REDD+ - locally, nationally and/or globally – as agents of change, and for generating analysis, experience exchange, methodology development, and knowledge development. As such, non-government institutions and private sector may provide targeted assistance to national and subnational institutions as well as local stakeholders in executing any of their core PCM functions as identified in figure above.

Box 4: Main functional tasks of key stakeholder groups under a participatory carbon monitoring approach to national carbon accounting for REDD+

Stakeholder group	Main functional tasks	Description
 National government institutions	Create an enabling policy, legal and regulatory (PLR) environment for PCM	Securing political will and commitment to using a PCM approach and enshrine this in national REDD+ strategies/programmes, and broader PLR reform Instructing subnational agencies in operational and technical aspects of PCM and application of data protocols and standards Deciding on REDD+ benefit sharing and compensation measures for PCM systems Identifying and allocating national resources needed for PCM activities through regular forestry planning cycles
	Development of standards and protocols for data collection and management	Developing standard operating procedures for measuring, monitoring and reporting Defining precision targets, reporting requirements, and others guidelines (e.g. format, content, etc.) Devising and implementing data storage, management and sharing protocols Ensuring consistency and comparability of data, and replicability of standards/ protocols
	Sampling design for PCM contributions to national carbon accounting	Devising sampling strategies and frequency, and designate role of various stakeholders Mapping land use, land cover and stratifying the national forest estate; updating maps and refining stratification through application of data collected using a PCM approach Providing guidance on required frequency of monitoring activities for each of the REDD+ activities that conforms with the requirements of the existing or planned MRV.
	Data (statistical) analysis and information management, review, reporting	Developing and maintain the NFMS to generate rigorous EF/RFs and activity data for RL estimation and MRV events Providing feedback to subnational agencies submitting substandard data quality, together with guidance on corrective actions Ensuring quality and consistency of spatial and temporal analyses internally and externally, wherever analysis is outsourced to non-government organisations or private sector Ensuring appropriate and variable access to nationally managed data and information (e.g. web-based portal) Refining carbon accounting parameters – forest stratification, stratum-specific allometric equation development

Stakeholder group	Main functional tasks	Description
 Subnational government institutions	Subnational resource planning and allocation	Identifying and allocating subnational resources needed for PCM activities through regular forestry planning cycles Providing and maintaining supply of equipment and materials necessary for data collection and management using a PCM approach Adjusting national standards, protocols and guidelines to local technical, financial and literacy capacities
	Capacity development of local data collectors and managers	Training local levels of government through a training of trainers approach, and subsequently private and community forest owners, managers and users in PCM data collection, management and basic analysis Monitoring the participation of local stakeholders and adjust PCM activities accordingly
	Data / information collection, management, reporting and planning application	Executing sampling strategies for the administrative unit(s) based on national forest stratification and sampling strategy protocols Administering field data collection ensuring QA/QC of protocols and provide (or source) technical assistance as needed Electing to collect data directly when/where necessary, e.g. adverse conditions, where special precautions or equipment are necessary Compiling and submitting data and information to NFMS
 Local stakeholders (including communities)	Application of protocols in data collection and management	Identifying the key agents or drivers of forest cover change, forest degradation, and carbon stock enhancement across the landscape/ jurisdiction Collecting field data according to protocols (for verifying or validating remote sensing products and ground-truthing maps of forest cover and tenure) Building capacities contributing to successful REDD+ programme implementation
	Conduct basic analysis and reporting for local management needs	Conducting basic analysis of PCM data and/or accessing information from the NFMS to inform refinement of management interventions (REDD+ activities) Assisting in accuracy assessments of activity data generated for REDD+ Assessing effectiveness of REDD+ activities at the local level

Stakeholder group	Main functional tasks	Description
 Non-governmental institutions and private sector	Technical, financial, political and outreach assistance to stakeholders	Assisting stakeholders in execution of functional tasks by transferring knowledge and building capacity Assisting stakeholders in the development of training materials and training courses for their application Developing and introducing innovative (e.g. Information Communications Technology) methods that assist stakeholders in the implementation of PCM
	Strengthen 'communities of best practice'	Developing knowledge products on international best practice and national context specific solutions for PCM operationally and technically Sharing knowledge and experiences on operational and technical aspects of PCM Securing public and private sector financing for PCM innovation and application in novel contexts Contribute to on-going dialogue on the development of PCM and facilitate the introduction of advances in a process of inclusive and adaptive management
	Third party review/ verification of procedures and data/ information quality	Conducting independent verification and quality assurance/quality control checks Monitoring effectiveness, and guide improvement, of PCM activities throughout REDD+ programme implementation

2.2 Integrating Participatory Carbon Monitoring into the National Forest Monitoring Systems

Countries aiming to undertake REDD+ activities under the auspices of the UNFCCC are requested to develop, *inter alia*, a robust and transparent national forest monitoring system (NFMS) for the monitoring and reporting of these REDD+ activities (with, if appropriate, subnational monitoring and reporting as an interim measure)[5]. The NFMS is a domestic tool to allow countries to assess the results of REDD+ activities, as implemented by different stakeholders and institutions. Importantly, in the context of forest carbon accounting, the NFMS should provides international GHG measurement and reporting functions of the MRV requirement (UN-REDD 2013). A NFMS can encompass multiple objectives beyond monitoring and MRV for REDD+, such as monitoring of changes in timber stocks, non-timber forest products, biodiversity, and other ecosystem services besides carbon sequestration. The carbon accounting aspects of NFMS comprise the estimation of a reference level and the MRV of emissions reductions and enhanced removals that can be attributed to a national REDD+ programme against that reference level.

A PCM approach could contribute to the development of activity data (AD) and emissions/removal factors (EF/RF) – the two fundamental components in carbon accounting partially generated by the NFMS that feed into reference level estimation and the MRV system. PCM approach could also be applied to the broader monitoring function of a NFMS for assessing the outcomes of polices and measures, at the national level, and adaptive management of local activity implementation under a national REDD+ programme (see Box 3). The following guidance concerns only application of PCM to carbon accounting functions of establishing reference levels and subsequent MRV.

Figure 2 below, depicts the general overview of the roles and process for the various stakeholders involved in a PCM approach to carbon accounting for a national REDD+ programme. Although this document provides guidance to engaging the key generic stakeholder groups, the specific division of roles and functions is a sovereign decision. Thus, the guidance presented in here should be tailored to each country's specific needs and reflect national circumstances and legal frameworks for the inclusion of stakeholders in any national REDD+ programme.

5 UNFCCC Decision 1/CP.16

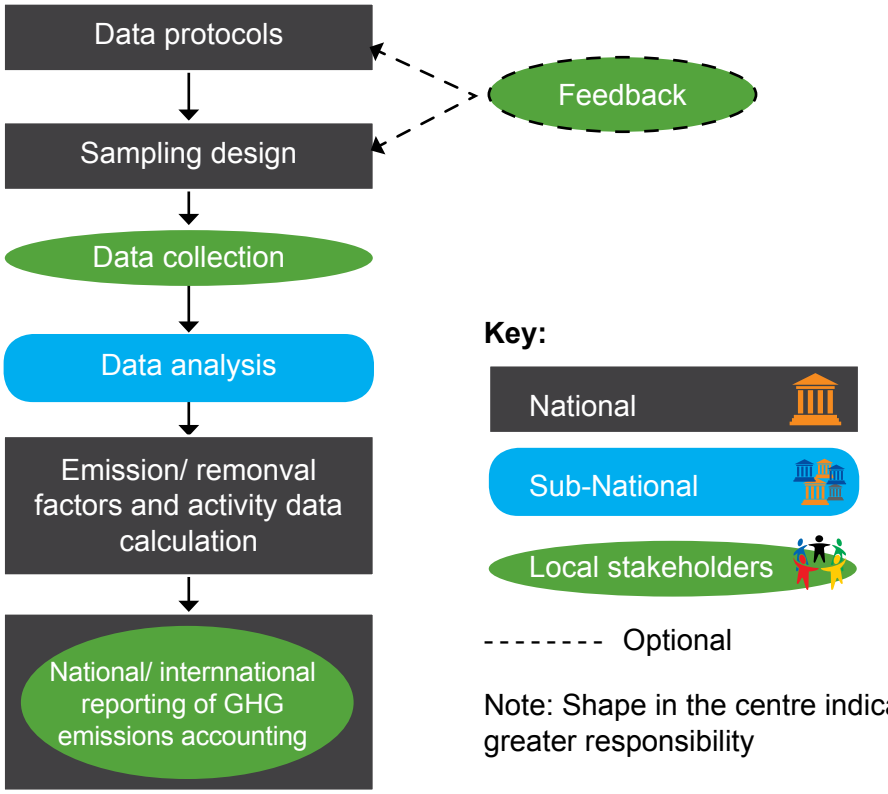


Figure 2: Generic participatory carbon monitoring operational framework for national REDD+ programme carbon accounting

As illustrated in Figure 2, a PCM approach contributes to national GHG accounting for land use/land cover change practices. It is also important to emphasize that QA/QC procedures should be conducted in every step of the national GHG accounting, for improving accuracy and ensuring best practices (IPCC, 2006; GOFC-GOLD, 2013), whether employing a PCM approach or not. Consequently, protocols for QA/QC within a forest carbon accounting system, produced by national and applied by subnational government, are absolutely necessary to reduce errors of data reported, and therefore strengthen the confidence of estimates produced. The non-governmental institutions and private sector may assist technically, financially, politically and socially, for all of the participating stakeholders involved in national accounting of GHG emissions from the land use sector.

2.2.1 Activity data

Activity data (AD) is defined by the IPCC (2006) as the data on the extent of anthropogenic activity over a given period of time that results in emissions. Activity data portrays the magnitude of human intervention on the land use/land cover change leading to GHG emissions and/or removals; therefore activity data is driver-specific. Activity data is often reported in terms of area of change (e.g. hectares deforested), but it is not limited to spatial extent of changes. Activity data can also be reported as non-spatial metrics, such as volume of timber harvested, kilograms of fuelwood collected, amount of fertilizer applied, or even quantity of animals on grazing land. The measurement of such activity data may be monitored with remote sensing technologies detecting changes in land use, or by sampling, as for localised fuel wood collection. The activity data may also be based on developed and proven

relationships between a given activity that results in emissions/removals and easily measured parameters or parameters that are already monitored for other purposes (such as population, timber production, crop production, etc. All stakeholder groups can contribute to the various steps in activity data generation (see Figure 3). A summary of main stakeholder functions and the process of activity data generation through a PCM approach is presented below.

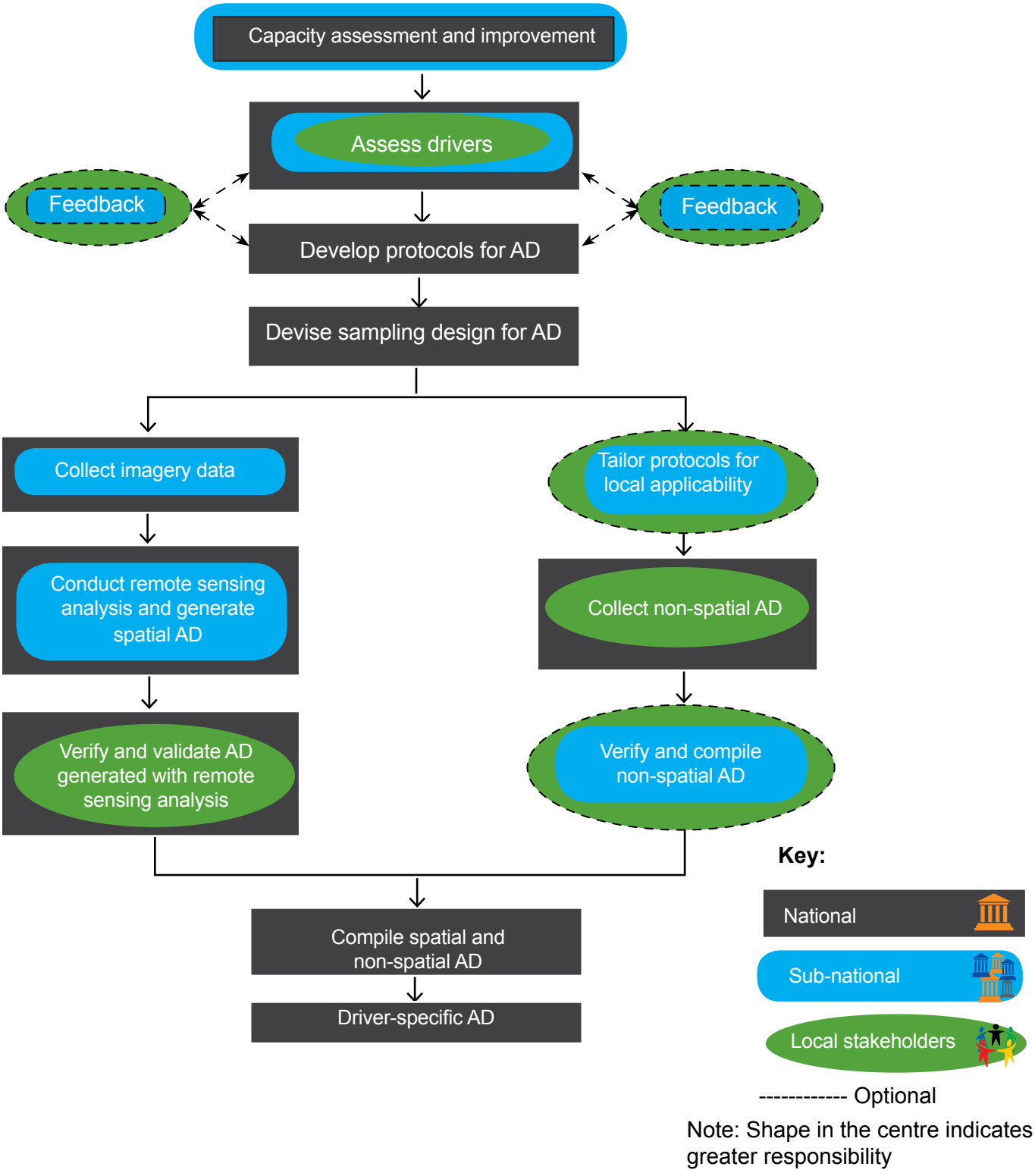


Figure 3: Activity data generation through a participatory carbon monitoring approach

1. Capacity assessment and improvement  : A realistic understanding of the existing capacity and existing infrastructure is key for activity data generation. Needs assessments should be developed by national institutions to identify the required capacity and infrastructure for activity data generation. The subnational institutions should fine-tune these needs assessments towards local applicability and ensure the assessments are given to relevant authorities who responded accurately and in due time. The outcome of these needs assessments shall inform the strategies to develop and improve capacity and infrastructure at all stakeholder levels for activity data generation.

2. Assessment of drivers of GHG emissions/removals  : The assessment of the cause of emissions and removals can be a collaborative and consultative effort involving national, subnational and local stakeholders. Using a PCM approach, local knowledge about common land use practices that lead to GHG emissions/removals can be collected, transferred to subnational institutions and communicated to the national institutions for devising a detailed plan for generating activity data. This driver assessment should include an analysis of the significance of a particular emission/ removal source.

3. Develop protocols  : Protocols shall be developed to ensure standardization of methods for generating activity data at all locations across the nation. Protocols should standardize the imagery collected, software used, sampling methods, sampling intensity/ imagery coverage, algorithms and methods employed in analysis, precision levels, and output format. Prior to the development of protocols, studies may be required to determine the most appropriate, accurate, precise, and cost-effective methods and parameters to monitor a certain activity. For activities that dominate emissions, it is recommended that protocols be developed that result in a high degree of accuracy while activities resulting in smaller emissions may be allowed to be monitored at lower accuracy levels. Protocol development should build upon the prevalent forest measurement conventions as far as practicable. National government institutions should be responsible for developing these protocols applicable to all activity data generation to ensure procedures employed will be nationally consistent and fit within available resources for national REDD+ programme implementation. Protocols will need to be tailored to suit the needs and capacity of those implementing the methods, and therefore a system of providing feedback and protocol alteration should be instituted.

4. Sampling design  : A formal sampling design is necessary to ensure standardized and statistically robust methods are employed in data collection. It is recommended that a national institution be appointed responsible for this task and assume responsibility for the sampling design across forest lands, as this task requires advanced technical background in geospatial modelling and statistics. A transparent, consistent and standard approach to be used across all sampling areas. Direct feedback from subnational institutions and local stakeholders is strongly encouraged, especially because the sampling design should have considerations to applicability of methods to the variety of conditions on the ground.

5. Collection and compilation of data sources  : As previously mentioned, there are spatial and non-spatial activity data. Both types of activity data shall be ultimately compiled by national institutions regardless of which actors collects the information.

a. Spatially explicit activity data  : will entail complex remote sensing interpretation and analysis using geographic information systems (GIS). As such, satellite imagery or other remote sensing and/or GIS products must be collected as stipulated on the protocols developed (See task 3 above). Collection of these datasets may require purchasing appropriate data sources, software and equipment, and formal educational training for technicians in the remote sensing and GIS fields. Depending on the data sources used and the capacity at different institutions, this task may be performed either at a national or subnational levels.

b. Non-spatially explicit activity data  : will entail communication with on-the-ground stakeholders for the collection of non-spatial data such as volumes of timber harvested, kilograms of fuelwood collected, amount of fertilizer applied, number of animals grazing, etc. The collection of this information may be more efficiently done by local stakeholders, with the oversight of subnational institutions. The various non-spatial activity data could be compiled at the subnational institution prior to transferring to the national institution.

6. Accuracy assessment  : Remote sensing based outputs or products have inherent uncertainty, as land-cover classification is done based only on the reflective properties of the earth's surface (e.g. spectral reflectance). Therefore, verification and validation of remote-sensing derived products is necessary. Collection of ground data for verification and validation of these products may be conducted by the local stakeholders, assuming they are dispersed over the landscape and can easily verify the products with ground observations. Training of these stakeholders on field verification techniques will be required, and oversight and quality assurance should be carried out by the subnational institution or non-government institutions. Compilation of field verification data should be conducted by local and subnational institutions and then provided to national institutions for validation of the products.

7. Data analysis  : After collection of appropriate datasets and verification of remote sensing products, analysis of the data by driver is required. This entails using the various remote sensing products in a GIS environment to characterize the activity data per driver and calculate associated statistics, such as uncertainty. Depending on capacity at different institutions and on the protocols established, this step may be performed both at a national and/or the subnational level.

8. Activity data generation  : The magnitude of the activity data is dictated by the different drivers, which are related to local social and economic behaviours and the fluxes/ demand for a particular natural resource. It is recommended for information generated at national and subnational levels to be compiled by national institutions.

It is important to remember that, given their specialized niche of work, non-governmental institutions and private sector may assist the recommended responsible actors in any of the steps towards activity data generation for example, in developing capacity, introducing advanced technologies, providing technical assistance in generating and verifying activity data, etc.

2.2.2 Emission/removal factors

Emission factor/removal factors (EF/RF) are defined by the IPCC (2006) as the emission or removal rate of GHG per unit of the activity. EF/RF are directly linked to the activity that results in GHG emissions and along with the activity data, form the basis for GHG emissions/removals accounting. EF/RF are derived from ground sampling of carbon dynamics and flows in the landscape. Forest carbon assessment is a key process for estimating EF from deforestation and forest degradation, although post-deforestation carbon assessment is an important but often overlooked in the estimation of EFs from deforestation.

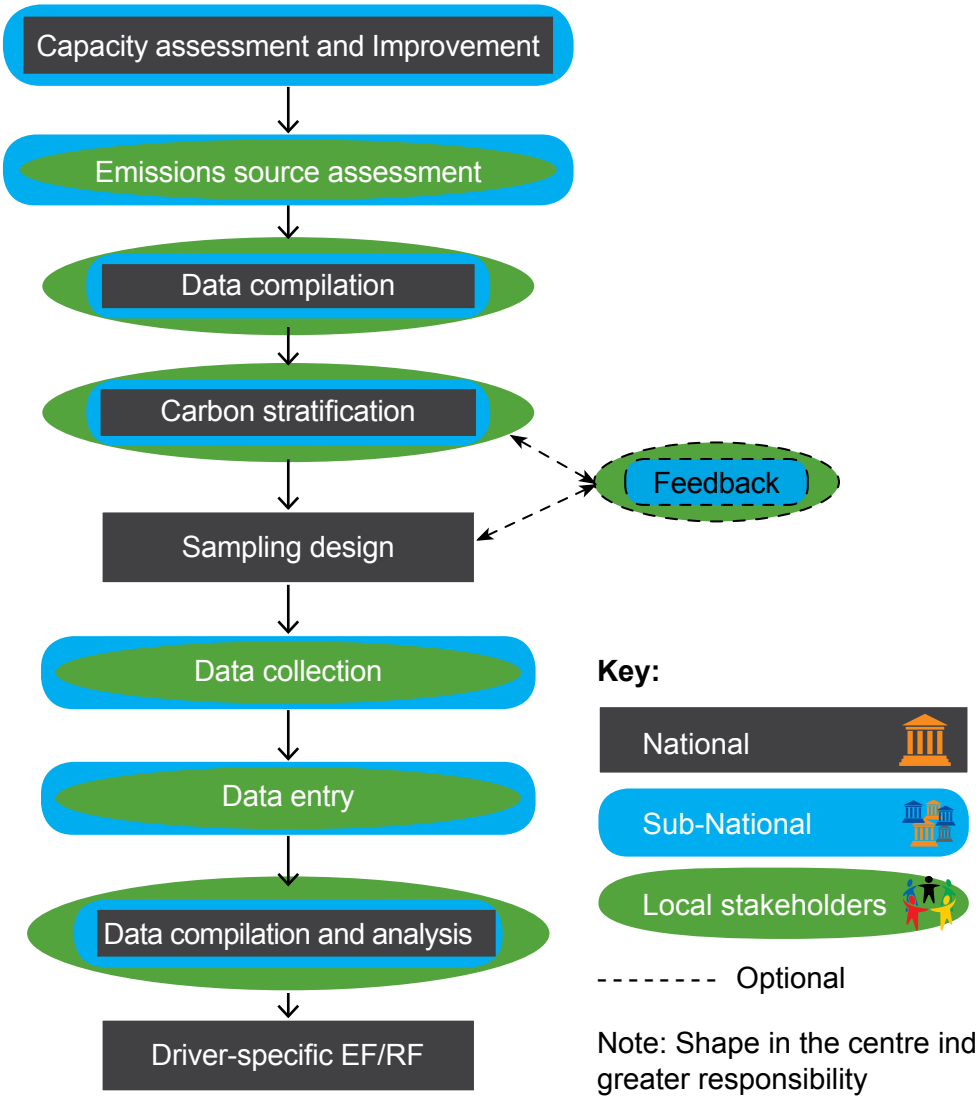


Figure 4: Emission factor/removal factor generation through a participatory carbon monitoring approach

All stakeholder groups can contribute to the different steps that are needed for developing robust emission factor/removal factors (EF/RF) that meet IPCC standards as shown in Figure 4. The general steps to develop EF/RF, indicating key stakeholder groups responsible, are:

1. Capacity evaluation and improvement  : Realistic understanding of the existing capacity and existing infrastructure is critical for EF/RF development. Need assessments should be developed by national institutions to identify the required capacity and infrastructure for development of emission/removal factors. The subnational institutions must fine-tune these need assessments towards local applicability and ensure the assessments are given to relevant authorities who respond accurately and in due time. The outcome of these needs assessments shall inform the strategies to develop and improve capacity and infrastructure for EF/RF generation.

2. Assessment of emission sources  : The assessment of the cause of emissions and removals should be conducted by local stakeholders with oversight from subnational institutions. Using a PCM approach, local knowledge about common land use practices that lead to GHG emissions/removals can be collected and conveyed to the national institutions to inform on the types of EF/RFs that need to be generated.

3. Compilation of existing data  : Existing data on carbon stocks and fluxes from forest and non-forest land cover (i.e. carbon stocks from post-deforestation land use) can be gathered by local stakeholders with the assistance from subnational institution. Ultimately however, the responsibility of assessing the appropriateness of data characterizing the carbon stocks and fluxes in the landscape is recommended to be assigned to national government institutions.

4. Carbon Stratification  : Carbon stratification refers to the division of the landscape into distinct categories (i.e. strata) based on the carbon content of vegetation (GOFC-GOLD, 2013). Stratification can be done multiple ways, but all require spatial information on forest cover (GOFC-GOLD, 2013). Subnational institutions, local stakeholders and communities may contribute to the stratification process by providing ground thruthed data and verifying the products generated from remote sensing and geospatial analysis. However, finalizing carbon strata will most likely need to be conducted by national institutions as carbon stock distribution across the forest estate will cross sub-national administrative boundaries, but needs to be consistent nationally.

5. Develop protocols  : Protocols shall be developed to ensure standardization of methods for generating EF/RF at all locations across the nation. Protocols should standardize the sample design, the field data collection procedures, precision requirements, QA/QC protocols, data calculation methods, and data storage and management systems. National government institutions should be responsible for developing these protocols applicable to all EF/RF generation to ensure procedures employed will be nationally consistent and fit within available resources for REDD+ carbon accounting. The protocols will likely need to be adjusted based on subnational field testing and responding to the needs and capacity of those implementing the methods, and therefore a system of providing feedback and protocol alteration should be instituted. As stated previously, studies may be required to determine the most appropriate EF/RF estimation method. In addition, for activities that dominate emissions, it is recommended that protocols be developed that result in EF/RF with high precision while for activities resulting in smaller emissions emission factors with low precision may be most cost effective.

6. Sampling design  : A sampling design entails determining the procedures for field data collection, the location and frequency of data sampling points, and precision targets. There are multiple ways of designing a sampling strategy for forest carbon across a landscape, but it must ensure that data quality meets the requirement of IPCC guidance and employs the principles of conservativeness and consistency so data collection can be compared across the country. Given the complexity of this task, which requires strong technical background on statistics and geospatial analysis, sampling design is recommend to be carried out by national institutions.

7. Data collection  : Field data collection is necessary when existing data is insufficient or inappropriate. Field data collection must follow the devised sampling design and protocols, and can be conducted by local stakeholders with oversight from national and subnational institutions. With proper training, the methods used for field data collection can be learned by most individuals, regardless of formal education, and thus local communities can effectively conduct such data collection (UN-REDD, 2011; Scheyvens et al., 2013). In order to facilitate data collection, survey instruments and standard operational procedure manuals must be designed in local language(s) with user-friendly illustrations and checklists to reinforce the step-by step protocols. Annex I shows existing resources that can be used. Quality control measures (i.e. QA/QC protocols) should be employed by sub-national institutions to ensure the quality of field data collection and allow for uncertainty estimation from data collection.

8. Data entry  : As far as practicable, data entry should be conducted by the same personnel who led the field data collection (i.e. field crew leader). Thus local stakeholders, assuming quality control checks are conducted by the subnational institution, can be assigned responsibility for this task. Using the same participants for data entry as collection may reduce errors associated with transcribing field data. Proper training on the use of computers, specific software, and any other devices required for entering data should be carried out prior to data entry. Quality control measures (i.e. QA/QC protocols) should be employed by sub-national institutions to ensure the accuracy of data entered. It is important to note that as technologies evolve, systems that automate data entry are being developed in which field data is directly collected in electronic format for later analysis.

9. Data compilation and analysis  : Data analyses require strong organizational skills, attention to detail, and formal education in statistics. Therefore, data compilation, and especially data analysis, should be the responsibility of national institutions. Subnational institutions may also compile and analyse the data, assuming proper training has been conducted. Ultimately, responsibility for data control and quality of analysis should rest with national institutions., so results/estimates are robust, accurately portray the reality on the ground and comparable across the country.

10. Generation of EF/RF  : The transformation of carbon stock data into EF/RF generation is the outcome of all the work conducted in the previous steps. Directing the creation of EF/RF generation should remain with national institutions to ensure a consistent approach.

Once again it is worth emphasizing that non-governmental institution and private sector may effectively assist the relevant stakeholders in any of the steps towards EF/RF generation.

2.2.3 Reference level and measurement, reporting and verification

A reference level is the quantity of GHG emissions and removals that are projected to take place in the absence of a national or subnational REDD+ programme (Harris et al, 2012a). Methodological guidance of the UNFCCC for activities relating to REDD+ recognises that the projection of such emissions/removals for a 'business as usual' scenario (no REDD+ mitigation activities implemented) can be conducted by: i) first establishing historical emissions, and then ii) projecting emissions based on consideration of national circumstances[6]. The MRV function for REDD+ refers to the estimation and international reporting of national-scale forest GHG emissions and removals, which would likely be subject to verification by accredited auditors. Although the three different steps of a MRV process are lumped into a single abbreviation, they are very distinct processes towards ensuring true emissions reductions and removals from the forestry and land use change sector. The measurement component is essentially based on the three components i.e., satellite monitoring of land use change, the national forest inventory (NFI) and the national GHG inventory. At the time of publication of this operational guidance, there has been no detailed methodological guidance or modalities decided by the UNFCCC for developing a reference level or MRV which countries can adopt or apply in their REDD+ programmes. Until such a decision is made, countries may propose and use their own modalities for reference level and MRV development[7]. Recommended guidance for reference level development may be found in Walker et al. (2013).

Through PCM, the local stakeholders who provide the information on spatially explicit drivers of deforestation and forest degradation may be able to contribute information on locally effective mitigation activities that may help national and subnational institutions derive an adjustment to reference level. The non-governmental institutions and private sector may play a role of third party verification of, or adjustment to, such reference level.

Upon the initiation of the national REDD+ programme, the continuous assessment of activity data and EF/RF informs the actual emissions and removals that take place over time through a monitoring system under the NFMS, which will then be used to compare against the projected reference levels to measure the performance of the REDD+ interventions. This process is referred to as 'measurement' and represents the "M" in MRV. The measurement is the component of the MRV that can benefit the most from PCM schemes engaging different stakeholder in the various processes cited above to ultimately measure the emissions and compare it to the estimated reference level

In terms of reporting emissions (reductions or not) – the "R" in MRV – currently no guidance has been made with respect to reporting on REDD+ related activities. Given the complexity and level of formality required for reporting, this is recommended to be conducted at the national government level. Non-governmental institutions and private sector may assist and provide guidance to national governments in preparing and submitting the reports.

The verification process, namely the "V" in MRV, is also recommended to be handled at the national government level, although verifiers might likely want to check information and consistency in implementation of protocols, standards and requirements across all levels of stakeholder engagement. Non-governmental institutions and private sector may assist and provide guidance to any of the stakeholders involved in preparing for the verification process.

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6 UNFCCC CoP15 Decision 4/CP.15

7 It is expected that draft decision on guidance forest reference emissions levels and /or forest reference levels as well as for MRV will be reached at thirty-ninth sessions of SBSTA followed by recommendation for a draft decisions for consideration and adoption by COP 19. (UNFCC/SBSTA/2013/L.12).

Conclusion 3

Participation in national REDD+ programmes is a safeguard requirement under the proposed mechanism of the UNFCCC. But safeguard compliance is not the only or main incentive for adopting a participatory carbon monitoring approach to REDD+. Engaging stakeholders at different levels – national, subnational and local – will engender ownership of the programme's activities and in doing so, mitigating the risk of ineffective REDD+ actions.

Using a PCM approach offers a pragmatic opportunity for different stakeholder, from national government to local forest-dependent villagers, to engage in a national REDD+ programme for mutual benefit. A participatory approach to monitoring forest carbon stocks and fluxes, and forest cover changes, and forest conservation status can contribute to carbon accounting requirements essential to a national REDD+ programme. As such, a PCM approach complements more knowledge-intensive and technical monitoring approaches based on remote sensing products and GIS manipulation as well as highly centralised forest inventory practices.

As indicated in the introductory section defining PCM, the approach has broader REDD+ application than just carbon accounting. Similar operational and technical guidance should be elaborated to expand the scope of PCM applications in subnational low emissions development planning; sharing of benefits (and responsibilities) in the results-based action phase of REDD+; and informing national policy reform and adaptive management of REDD+ activity implementation on the ground.

This guidance document introduces and defines PCM (distinguishing it from 'community-based' carbon monitoring) and presents general steps for its application within a national REDD+ programme, including the generation and verification of activity data and EF/RF necessary for the establishment of forest reference levels and subsequent MRV. To this end, it is hoped that this operational guidance document complements the carbon accounting methodologies already available and collated in Annex I. It is also hoped that REDD+ countries and their development partners take these technical and operational guidance, including this PCM operational guidance document, to the field to test the methods and systems through 'real world' applications. From these practical experiences second generation guidance, together with more interactive decision support tools[8], can be developed to foster more cost-effective forest monitoring practices, not just for REDD+ but for multiple management interventions and policy approaches.

Ultimately, as with all things REDD+, a no regrets approach should be taken wherever possible. Implementing a participatory approach to monitoring carbon, might seem redundant in the absence of REDD+ and the need to account for emissions reductions and enhanced removals. But the underlying principles and operational systems of PCM would still benefit national forest inventory and monitoring programmes, through strengthened capacities of all stakeholders to collect, manage and apply better data for better management and governance of tropical forested landscapes.

8 *cf.* Harris et al. (2012a) for developing reference levels for REDD+; and Broadhead et al. (2013) for integrated REDD+ accounting frameworks and nested national approaches.

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Annex I: Technical resources for participatory carbon monitoring

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