

REDD+ Training Materials

Guidance Document



Coordinated by:

GOFC-GOLD LC PO & Wageningen University

In partnership with the World Bank FCPF

For more information on the background and aim of the training materials; to download the modules; and for options to contact the developers and to register for the GOFC-GOLD newsletter, please visit the following website:

http://www.gofcgold.wur.nl/redd/Training_materials.php



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1. Introduction

1.1 Background and objectives

Background

Policies and mechanisms for implementing REDD+ are under discussion by the UNFCCC in the process of long-term collaborative action. Among other things, the UNFCCC text, which deals with the technical issues, refers to the need to establish measuring and monitoring systems that use an appropriate combination of remote sensing and ground-based forest carbon inventory approaches with a focus on estimating anthropogenic forest-related greenhouse gas emissions by sources, removals by sinks, forest carbon stocks and forest area changes. All estimates should be transparent, consistent, as accurate as possible, and should reduce uncertainties as far as national capabilities and capacities permit. It is further indicated that these monitoring systems and their results will be open to independent review as agreed by the Conference of the Parties (COP). Currently few countries have the capacity needed for measuring, monitoring and reporting for REDD+ and many countries require serious investments in capacity development before they will be ready to fully participate in an international system that provides performance-based compensation. Any activities for developing an MRV system for REDD+ activities will need to take into account the following:

1. International requirements for MRV:
 - Activities should be guided by the principles and procedures for estimating and reporting carbon emissions and removals at the national level as set out in the Intergovernmental Panel on Climate Change (IPCC) Good Practice Guidelines and Guidance for reporting at the international level.
 - Countries need to track drivers of deforestation and activities affecting forest carbon and measure their impact on carbon emissions and removals as part of a national strategy and a sub-national implementation scheme. The national REDD+ implementation strategy will vary per country, as different activities have different implications for MRV.
2. The existing national capacity for MRV:
 - A roadmap for capacity development needs to be based on an assessment of the gap between the existing national forest monitoring system and the requirements of a REDD+ MRV system; and
 - A roadmap for capacity development needs to elaborate steps to set up an effective, efficient and sustainable institutional and implementation framework for:
 - measuring and monitoring at different levels,
 - supporting national policies and REDD+ actions,
 - international reporting and verification, and
 - linking MRV of actions and MRV of transactions.

With these requirements in mind, the key issue for the coming years in REDD measuring and monitoring is to build sustained capacities in developing countries. Such capacity building efforts are usually long-term processes that follow a set of phases and should aim to fill series of gaps (data gaps, institutional gaps, eligibility gaps, methods gaps, etc.).

Objectives

To respond to the need for technical assistance and guidance for countries to develop REDD+ MRV systems, the overall aim is to provide learning and teaching materials to enable countries to develop capacities and implement REDD+ monitoring and reporting. The materials were developed based on existing good practice guidance on REDD+ related forest monitoring; in particular on technical material provided in the GOFC-GOLD Sourcebook.

The GOFC-GOLD sourcebook is the outcome of an ad-hoc REDD+ working group of Global Observation of Forest and Land Cover Dynamics (GOFC-GOLD), a technical panel of the Global Terrestrial Observing System (GTOS). The sourcebook provides a consensus perspective from the global community of earth observation and carbon experts on methodological issues relating to quantifying greenhouse gas (GHG) impacts of implementing mitigation activities related to the forest land use in developing countries (REDD+); it emphasizes the role of satellite remote sensing as an important tool for monitoring changes in forest cover; it provides guidance on how to obtain credible estimates of forest carbon stocks and related changes; and it provides clarification on the use of IPCC Guidelines for estimating and reporting GHG emissions and removals from forest lands.

The learning and teaching materials were developed by building upon the international GOFC-GOLD expert network and have undergone an independent review process that resulted in a consolidated set of training materials that is ready for use.

Intended use and audience

The training materials are intended for different actors involved in capacity development, such as international agencies, donors, country experts, consultants and researchers and can be used in combination and complementary to available guidance documents (i.e. GOFC-GOLD Sourcebook <http://www.gofcgold.wur.nl/redd/>, GFOI MGD <http://www.gfoi.org/methods-guidance-documentation>, FCMC MRV manual <http://www.fcmcglobal.org/mrvmanual.html>). The materials are self-explanatory and can also be used by individuals who wish to learn more about a certain topic.

Design of the training materials

Each module includes a lecture, concrete country examples and short tutorials or exercises to respond to the broad scope of capacity needs ranging from basic knowledge on the theoretical underpinnings to sharing practical experiences and understanding implications of monitoring choices and costs.

The training modules follow the outline of the GOFC-GOLD REDD+ Sourcebook. A set of fourteen modules under three main components are available:

1. REDD+ background and design
2. REDD+ measuring and monitoring
3. REDD+ assessment and reporting

To make the material useful for different levels of knowledge and capacity needs, the training and learning materials for each module will include three main components as shown in table 1.

Table 1. Components of modules of REDD+ training materials

| Type of material | Content | Format | Target users for training |
|---|---|--|--|
| Background lectures (+/- 2 – 2.5 hours presentation) | Introducing the background, relevance of topic; and providing an overview of possible methodological options and approaches. | Self-explanatory slideshow (Powerpoint) with annotations | REDD+ national and international policy makers, project managers and technical staff |
| Country examples (+/- ½ hour presentation) | Practical examples of successful implementation activities in developing country experiences presenting different national circumstances (i.e. low and high capacity countries, low and high deforestation rates, different drivers and different continents) | slideshows (Powerpoint) | MRV project manager / designers, Technical staff |
| Practical exercises (varies per module and intensity of training; ½ hour - 2 hours workshop) | Practical exercises and short tutorials meant to reinforce the topic and/or to provide simple hands-on exercises for implementation, data processing and analysis | Report / tutorial (MS Word), slideshows (Powerpoint), calculation spreadsheets | Technical staff |

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1.2 Development team

Coordination team

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Alexander Lotsch, Marco van der Linden
- GOFC-GOLD LC PO & Wageningen University
Martin Herold - Overall project leader
Brice Mora - Coordination and cooperation with different international experts and institutions
Erika Romijn - Coordination of the technical and organizational implementation; the design, development, independent review, final editing and dissemination of the different training materials

A number of international experts in remote sensing and carbon measurement and accounting have contributed to the development of the training materials and are thankfully acknowledged for their support (in alphabetical order by institute):

Developers

The development team included: Suvi Monni (Benviroc), Frédéric Achard, Giacomo Grassi, Andreas Langner, Jukka Miettinen, Yosio Shimabukuro (European Commission, Joint Research Centre), Carlos Souza (Imazon), Luigi Boschetti (University of Idaho), Arturo Balderas Torres, Margaret Skutsch (Universidad Nacional Autónoma de Mexico), Veronique De Sy, Martin Herold, Brice Mora, Erika Romijn (Wageningen University), Sandra Brown, Felipe Casarim, Lara Murray (Winrock International)

Reviewers

The independent reviewers included: Naikoa Aguilar-Amuchastegui, Valerio Avitabile, Veronique De Sy, Sandro Federici, Carly Green, Inge Jonckheere, Ben de Jong, Gabrielle Kissinger, Pham Manh Cuong, Ron McRoberts, Anthea Mitchel, Jim Penman, Rosa Maria Roman Cuesta, Arief Wijaya, Sylvia Wilson

2. REDD+ training modules and relation to relevant background and guidance materials

The REDD+ training materials are based on the GOFC-GOLD Sourcebook chapters and can be used in combination with and complementary to available guidance documents. Below, you can find an overview of related available guidance documents. Table 2 provides an overview of the different REDD+ training modules and which sections in the GOFC-GOLD Sourcebook (2014 – COP20 Version 1), World Bank FCPF Carbon Fund Methodological Framework (December 2013), GFOI MGD (2014 – Version 1) and FCMC MRV manual (2014 – Version 2.0) are of special relevance and provide further technical background information.

GOFC-GOLD Sourcebook

The GOFC-GOLD sourcebook can be used as guidance document to assess historical data for reference emission level (REL) and reference levels (RL), and to design a national forest monitoring system for monitoring REDD+ activities, and estimating according to reporting guidelines, carbon stock changes and non-CO₂ emissions from deforestation and management of forest lands –including their expansion (reforestation and afforestation). All the indications provided by this sourcebook are based on the general reporting requirements set by the United Nations Framework Convention on Climate Change (UNFCCC) and the specific methodologies for the Agriculture, Forestry and Other Land Use (AFOLU) sector provided by the Intergovernmental Panel on Climate Change (IPCC).

World Bank FCPF Carbon Fund Methodological Framework

The Carbon Fund Methodological Framework provides guidance for the development of pilot programs for REDD+ implementation. The Methodological Framework complements other Documents and processes that together contribute to the development and selection of REDD+ Programs. The Methodological Framework was developed by building on the elements and Rationales contained in a set of Guiding Principles, adopted by the Participants Committee of the FCPF while taking into account the needs of REDD Country Participants as well as Carbon Fund Participants. The Framework provides overarching guidance and acts as a standard that is designed to achieve a consistent approach to carbon accounting and programmatic characteristics. The Framework uses a set of criteria and indicators to elaborate requirements for emission reduction programs to be piloted in the Carbon Fund. Emission reduction programs are expected to demonstrate conformity with the Carbon Fund's Methodological Framework and the criteria and indicators listed in this document.

World Bank FCPF A Guide to the FCPF Readiness Assessment Framework

The Readiness Assessment provides a common framework to measure countries' relative progress on core REDD+ readiness activities. REDD country stakeholders can conduct a thorough self-examination to take stock of the activities implemented during the REDD+ readiness preparation phase and assess progress on REDD+ readiness. The assessment framework consists of nine sub-components and corresponding assessment criteria and diagnostic questions. The results of the Readiness Assessment are compiled in an R-Package, which documents the country's progress, captures lessons learned, assesses remaining gaps, and identifies activities for the way forward to transitioning to the implementation of performance-based activities.

GFOI Methods and Guidance Document

The Global Forest Observations Initiative (GFOI) was established by the Group on Earth Observations in 2011, to assist countries to produce reliable, consistent and comparable reports on change in forest cover and forest use and associated anthropogenic greenhouse gas emissions or removals. The purpose of the Methods and Guidance Document is to provide methodological advice on the use of remotely sensed data together with ground-based observations to estimate and report greenhouse gas emissions and removals associated with forests in a manner consistent with the greenhouse gas inventory guidance from Intergovernmental Panel on Climate Change (IPCC), as required by decisions by the United Nations Framework.

The REDD+ Decision Support Toolbox by Winrock International in partnership with the World Bank FCPF provides a methodological framework for countries to enhance their near term capacity for producing REDD+ FRLs/FRELS. The framework outlines the decisions and steps needed to develop a FRL/FREL, the capacity, data, and technical steps needed to carry out each component.

UNEP Forests in a Changing Climate: A Sourcebook for Integrating REDD+ into Academic Programmes Sourcebook provides an extensive overview of REDD+ and related issues, intended for integration of REDD+ into academic programs. Chapters 3, 4, 7 and 10 provide relevant information for Modules 1 (REDD+ background and design). It provides further complementary information on tropical forests, carbon sequestration and climate change, governance issues, social and environmental safeguards and REDD+ financing.

USAID FCMC MRV manual provides an overall review of data, models, techniques and accounting methods relevant for measurement, reporting and verification (MRV) for REDD+. Notably, it includes a section on institutional arrangements, relevant for Module 3.1.

REDD-plus Cookbook is a technical manual, built up with "recipes" that provide basic knowledge and techniques required for REDD-plus forest carbon monitoring.

UN-REDD programme REDD+ academy provides training modules on REDD+, including 13 expert presentations, available at:

<http://www.un-redd.org/REDDAcademyIndonesia/tabid/794522/Default.aspx>

Conservation Training offers an online course on the basics of climate change, deforestation and forest degradation, and the REDD+ concept, available at:

<https://www.conservationtraining.org/mod/page/view.php?id=4254>

VCS offers **REDD Methodology Modules**, with focus on estimation of carbon stocks and emissions in the context of REDD+, available at:

<http://www.v-c-s.org/methodologies/VM0007>

Table 2. Overview of REDD+ training modules and links to relevant sections in the guidance documents GOF-C-GOLD Sourcebook, WB FCPF Carbon Methodological Framework, GFOI MGD and USAID FCMC MRV manual.

| Modules REDD+ training materials | GOF-C-GOLD Sourcebook (2014 - COP 20 Version 1) | WB FCPF Carbon Fund Methodological Framework (December 2013) | GFOI MGD (2014 – Version 1) | USAID FCMC MRV manual (2014 – Version 2.0) |
|---|--|---|--|---|
| 1. REDD+ background and design | | | | |
| 1.1 UNFCCC context and requirements and introduction to IPCC guidelines | 1. Introduction | 3.1 Scope and Methods 4. Safeguards | 1. Design decisions | 1.2 Background 7.1 History of REDD+ under the UNFCCC |
| 1.2 Framework for building national forest monitoring systems for REDD+ | 1. Introduction 4. Country capacity building | 2. Level of Ambition 3.4 Measurement, Monitoring and Reporting on Emission Reductions 4. Safeguards 5. Sustainable Program Design and Implementation | 1.4 Design considerations for national forest monitoring system | 1.2 Background 2. Institutional arrangements |
| 1.3 Assessing and analyzing drivers of deforestation and forest degradation | 2.8.1 Identifying drivers of deforestation and degradation with remote sensing | 5.1 Drivers and Land and Resource Tenure Assessments | 2.2.1 Deforestation 2.2.2 Forest degradation | |
| 2. REDD+ measuring and monitoring | | | | |
| 2.1 Monitoring activity data for forests using remote sensing | 1.2 UNFCCC context and requirements 2.1 Monitoring of changes in forest area 2.7 Estimation of uncertainties 2.9 Guidance on reporting 3.2 Overview of the existing forest area changes monitoring | 3.4 Measurement, Monitoring and Reporting on Emission Reductions | 2.2.1 Deforestation 3. Data Provision for Estimating Emissions and Removals | 5. Remote Sensing of Land Cover Change 7.3 Near-real Time Monitoring and Alert Systems |

| | | | | |
|---|---|--|---|---|
| | systems (for country examples) | | | |
| 2.2 Monitoring activity data for forests remaining forests (incl. forest degradation) | 2.2 Monitoring of change in forest land remaining forest land | 3.4 Measurement, Monitoring and Reporting on Emission Reductions | 2.2.2 Forest degradation 3. Data Provision for Estimating Emissions and Removals | 5. Remote Sensing of Land Cover Change |
| 2.3 Estimating emission factors for forest cover change (deforestation and forest degradation) | 2.3 Estimation of forest carbon stocks | 3.4 Measurement, Monitoring and Reporting on Emission Reductions | 2. Estimating Emissions and Removals | 4. Field-based Inventories |
| 2.4 Incorporating community based monitoring (CBM) in national (or jurisdictional) REDD+ monitoring | 3.4 Community forest monitoring | 3.4 Measurement, Monitoring and Reporting on Emission Reductions | | 7.2 Community-based Monitoring |
| 2.5 Estimation of carbon emissions from deforestation and forest degradation | 2.5 Methods for estimating CO2 emissions from deforestation and forest degradation 3.1.4 National carbon budget models | 3.4 Measurement, Monitoring and Reporting on Emission Reductions | 2. Estimating Emissions and Removals | 3. Estimating Greenhouse Gas Emissions and Removals |
| 2.6 Estimation of GHG emissions from biomass burning | 2.6 Methods for estimating CO2 emissions from deforestation and forest degradation | | 2. Estimating Emissions and Removals | 7.3 Near-real Time Monitoring and Alert Systems |
| 2.7 Estimation of uncertainties | 2.7 Estimation of uncertainties | 3.2 Uncertainties | 3.7 Area, uncertainties and statistical inference for activity data 4. Overall Uncertainties | 4.6.5 Quantifying Uncertainty 5.4 Remote Sensing Overview |
| 2.8 Overview and status of evolving technologies | 2.10 Status of evolving technologies | | 3.2.4 Synthetic aperture radar 3.2.5 LiDAR | 5.4 Remote Sensing Overview 5.5 Emerging Areas of Research |

| | | | | |
|--|---------------------------|--|---------------------------|---|
| 3. REDD+ assessment and reporting | | | | |
| 3.1 National data organization and management | | 6.2 Data Management and ER Transaction Registries | | 2. Institutional arrangements 4.7 Data checking |
| 3.2 Data and guidance on developing REDD+ reference levels | | 3.3 Reference Levels | 1.4.2 Reference Levels | Box 7.4 Guidelines for submissions of information on reference levels |
| 3.3 Guidance on reporting REDD+ performance using IPCC Guidelines and Guidance | 2.9 Guidance on reporting | 3. Carbon Accounting 3.7 Calculation of Emission Reductions | 5. Reporting Requirements | 6. Reporting and Verification: Elements and Guidance |

References:

FFPRI, Nov. 2012. REDD+ Cookbook. REDD Research and Development Center, Japan. Available at: <http://www.ffpri.affrc.go.jp/redd-rdc/en/reference/cookbook.html>

GFOI, 2014. Integrating remote-sensing and ground-based observations for estimation of emissions and removals of greenhouse gases in forests: Methods and Guidance from the Global Forest Observations Initiative: Pub: Group on Earth Observations, Geneva, Switzerland, 2014. Available at: <http://www.gfoi.org/methods-guidance-documentation>

GOFC-GOLD, 2014. 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. GOFC-GOLD Report version COP20-1, GOFC-GOLD Land Cover Project Office, Wageningen University, The Netherlands. Available at: <http://www.gofcgold.wur.nl/redd/index.php>

Hewson, J., Steininger, M. and Pesmajoglou, S., eds. 2013. REDD+ Measurement, Reporting and Verification (MRV) Manual. USAID-supported Forest Carbon, Markets and Communities Program. Washington, DC, USA. Available at: <http://www.fcmglobal.org/mrvmanual.html>

Winrock International, 2015. The REDD+ Decision Support Toolbox by Winrock International in partnership with the World Bank FCPF. Available at: www.forestcarbonpartnership.org/dst

UNEP, 2014. Forests in a Changing Climate: A Sourcebook for Integrating REDD+ into Academic Programmes, United Nations Environment Programme, Nairobi, Kenya. Available at: http://www.unep.org/Training/docs/Forest_in_a_Changing_Climate.pdf

World Bank FCPF, 2013. A Guide to the FCPF Readiness Assessment Framework. Available at: <https://www.forestcarbonpartnership.org/readiness-fund>

World Bank FCPF, 2013. Carbon Fund Methodological Framework. Available at: <https://www.forestcarbonpartnership.org/carbon-fund-methodological-framework>

3. Module specific guidance

Module 1.1 UNFCCC context and requirements and introduction to IPCC guidelines

Developers

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Erika Romijn, Wageningen University
Brice Mora, Wageningen University

Learning objectives

After the course the participants should be able to:

- Understand the UNFCCC context and requirements for monitoring and reporting of REDD+ activities
- Explain fundamental concepts of the IPCC guidelines for national GHG inventories and reporting for forest related activities

Outline of lecture

1. Introduction to UNFCCC REDD+ process
2. UNFCCC context and requirements for measurement and reporting of REDD+ activities
3. IPCC guidelines for national GHG inventories and reporting for forest land
 - a. Reporting principles
 - b. Estimation of carbon emissions

Country examples

1. Review of FCPF country REDD+ readiness preparation proposals
2. Phased approach to improving greenhouse gas inventories in Mexico
3. Experiences from Annex-I countries using Tier-3 models for carbon accounting

To make countries ready for full implementation of REDD+, they follow a phased approach, taking into consideration the national circumstances and technical and institutional capacities and improving them over time. Countries can start at phase 1 and move to phase 2 and phase 3 when they develop more capacities to implement REDD+ and perform MRV.

The first country example gives an overview from a review of 30 countries, most of which are in phase one of REDD+ implementation. The second example introduces a phased approach to improving greenhouse gas inventories in Mexico. The third example discusses phase 3 systems in Canada and Australia.

Exercises

There are no exercises for this module. Exercises will start in Module 1.2.

Recommended modules as follow up

- Module 1.2 as a continuation of the UNFCCC context within a country and to learn more about building a national forest monitoring system for REDD+
- Modules 2.1-2.8 to continue with REDD+ measuring and monitoring
- Modules 3.1-3.3 to learn more about REDD+ assessment and reporting

Module 1.2 Framework for building national forest monitoring systems for REDD+

Developers

Erika Romijn, Wageningen University
Martin Herold, Wageningen University
Brice Mora, Wageningen University

Learning objectives

After the course the participants should be able to:

- Understand the needs and priorities of a national REDD+ policy and implementation strategy
- Assess and characterize current forest monitoring and reporting capacities taking national circumstances into account
- Develop a roadmap for building sustained in-country capacities for REDD+ MRV

Outline of lecture

1. UNFCCC requirements for national forest monitoring systems (NFMS) and measurement, reporting and verification (MRV) of REDD+ activities
2. Framework for NFMS
3. Building technical and institutional capacity for NFMS and REDD+ MRV
4. Planning and implementing a NFMS for REDD+ MRV
5. Cost implications and different factors contributing to the costs

Country examples

1. UN-REDD monitoring framework for Democratic Republic of Congo
2. Establishment of a system for monitoring, reporting and verification of REDD+ in Guyana

As part of the UNFCCC REDD+ mitigation mechanism, countries need to establish a system for measurement, reporting and verification (MRV) of greenhouse gas (GHG) emissions. Several countries participating in REDD+ have developed a Readiness Preparation Proposal (R-PP) which provides information on how the country proposes to develop a national forest monitoring system and perform MRV for REDD+. In the first country example the UN-REDD monitoring framework for the Democratic Republic of Congo (DRC) is explained, based on information derived from the Readiness Preparation Proposal of the DRC. The second country example provides a detailed

overview of the process of establishing an MRV system in Guyana. The example starts with assessing the current country capacities and then provides an overview of the development of a roadmap for building sustained in-country capacities.

Exercises

1. Assessing forest monitoring and reporting capacities for a few selected countries, based on FAO Forest Resources Assessment reports
2. Assessing monitoring capacity and REDD+ and remote sensing (technical) challenges in your own country

The first exercise is a general exercise using national data from the FAO FRA reports to assess forest monitoring and reporting capacities. The second exercise deals with the country where the training is given. For this country, participants will assess the institutional capacity, the monitoring capacities and available datasets, and the REDD+ and remote sensing technical challenges which are present in the particular country cases. The powerpoint file can be used to introduce the exercise to the course participants. It can also be used to have a general discussion with the group. The Word document describes in detail how the exercises can be performed. First the participants can try to do the exercises themselves and afterwards the outcomes can be discussed with the whole group.

Recommended modules as follow up

- Module 1.3 for considering national circumstances within a national forest monitoring system and assessing and analyzing drivers of deforestation and forest degradation
- Modules 2.1-2.8 to continue with REDD+ measuring and monitoring
- Modules 3.1-3.3 to learn more about REDD+ assessment and reporting

Module 1.3 Assessing and analyzing drivers of deforestation and forest degradation

Developers

Erika Romijn, Wageningen University
Martin Herold, Wageningen University

Learning objectives

After the course the participants should be able to:

- Explain the need for monitoring direct and indirect drivers of deforestation and forest degradation within the UNFCCC REDD+ context
- Summarize different approaches to monitor drivers of deforestation and forest degradation
- Assess likely direct drivers of deforestation and degradation in a country

Outline of lecture

1. Background and UNFCCC requirements on addressing drivers of deforestation and forest degradation
2. Definitions and overview of drivers
3. Different approaches for monitoring drivers of deforestation and forest degradation
4. Role of drivers in developing national forest reference (emission) levels and designing policy interventions

Country examples

National analysis of drivers of deforestation in:

1. Democratic republic of the Congo (DRC)
2. Indonesia

Both cases show examples of how an analysis of drivers of deforestation and forest degradation can be performed within the national context. For the DRC example, qualitative assessments as well as quantitative assessments (including univariate and multivariate analysis) for estimating direct and indirect drivers are explained. For the Indonesia example a step-by-step approach is presented on how to quantify drivers of deforestation based on analysis of multiple landcover maps that were derived from Landsat satellite data.

Exercises

Assessing and analyzing drivers of deforestation in a tropical country

1. Strategy development on how to address drivers
2. Qualitative assessment of drivers of deforestation

These are general exercises. The main objective of the first exercise is to provide course participants the opportunity to discuss a strategy for addressing drivers in their national context in a structured way. In the second exercise the participants can make a qualitative assessment of drivers of deforestation in their national context, based on the existing knowledge in the group. The instructor can lead the discussion with use of the powerpoint file. The Word document supports the powerpoint file and provides more information and can be used by the participants and the instructor to perform the exercise.

Recommended modules as follow up

- Module 2.1 to proceed with REDD+ measuring and monitoring and focus on monitoring activity data for forests using remote sensing
- Modules 3.1-3.3 to learn more about REDD+ assessment and reporting

Module 2.1 Monitoring activity data for forests using remote sensing

Developers

Frédéric Achard, European Commission - Joint Research Centre
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Brice Mora, Wageningen University

Learning objectives

After the course the participants should be able to:

- Differentiate between different (remote sensing) approaches to monitor changes in forest areas
- Perform forest area change analysis using Landsat satellite data

Outline of lecture

1. Introduction
2. Selection of a monitoring approach
3. Image classification and analysis
4. Accuracy assessment
5. Limitations to using satellite data

Country examples

1. Brazil - (PRODES deforestation monitoring program)
2. India - (FSI - The Forest Survey of India)
3. Democratic Republic of the Congo (DRC) – (JRC-FAO Systematic sampling)

In the interest of illustrating some approaches selected for practical implementation of forest cover monitoring around the tropical countries, three country examples are presented. The examples are deliberately selected to include different kinds of approaches, to highlight the variability of possibilities in the practical implementation of national level forest cover monitoring.

Exercises

- Using Landsat time series data to derive forest area change estimates

The tutorial presents a practical example of an image interpretation process to derive estimates of forest cover change, using the JRC-FAO Remote Sensing Survey approach. The example provided here is by no means a unique solution to the task. The forest cover change monitoring approach presented here is based on multi-temporal image segmentation and subsequent classification using a signature databank and visual verification and briefly describes the main steps that need to be taken.

Recommended modules as follow up

- Module 2.2 to proceed with monitoring activity data for forests remaining forests (incl. forest degradation)
- Module 2.8 for overview and status of evolving technologies, including e.g. Radar data

- Modules 3.1-3.3 to learn more about REDD+ assessment and reporting

Module 2.2 Monitoring activity data for forests remaining forests (incl. forest degradation)

Developers

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Sandra Brown, Winrock International

Jukka Miettinen, European Commission - Joint Research Centre

Frédéric Achard, European Commission - Joint Research Centre

Martin Herold, Wageningen University

Learning objectives

After the course the participants should be able to:

- Describe different types of forest degradation and the approaches to monitor degradation
- Map and analyze various forest degradation processes using ground surveys and the remote sensing tools provided in the module

Outline of lecture

1. Definition of forest degradation and IPCC GPG context
2. Types of forest degradation
3. Approaches to assess forest degradation areas
 - i. Monitoring forest degradation from selective logging
 - ii. Remote sensing approaches
 - a) direct methods
 - b) indirect methods
4. Software requirements

Country examples

1. Peru: Monitoring forest degradation using CLASlite
2. Cameroon: Monitoring forest degradation using NDFI
3. Bolivia: Monitoring forest degradation using a combination of SMA fractions and NDFI

The examples of this module illustrate how forest degradation has been mapped in three countries: Peru, Democratic Republic of the Congo and Bolivia. Up to now, there is no operational forest monitoring of forest degradation besides Brazil with the official system (DEGRAD from INPE) and an independent system from Imazon. The applications covered in this tutorial are based on scientific studies; these results hold promise to scaling up operational forest monitoring programs of forest degradation. The examples focus on Landsat-like sensors.

Exercises

1. Monitoring forest degradation processes, using ImgTools:
 - Part 1: Introducing ImgTools
 - Part 2: Forest Change Detection using SMA fractions and NDFI
 - Part 3: Decision Tree Classification using a time-series of SMA and NFDI images
2. Intact/non-intact forest mapping using a proxy approach

The first exercise is a practical hands-on exercise. Course participants need to install the software package ImgTools, for which an installation package is provided with the materials (ImgTools). ImgTools is multi-sensor image processing software developed by Imazon to facilitate operational forest monitoring in Brazil. The tutorial guides them step-by-step through 3 different parts of the exercise. Data are provided in a separate folder (ImgData).

The second exercise provides a set of examples illustrating how the intact/non-intact approach can be implemented in practice. The first three examples illustrate different cases of visual detection of potential signs of disturbance, typically followed by manual delineation of non-intact areas. The last example illustrates an alternative approach, used in the Module 2.7 REDD+ matrix exercise, utilizing an existing forest/non-forest map and performing a buffering of forest/landscape features based on morphological spatial pattern analysis

Recommended modules as follow up

- Module 2.3 for methods to assess emission factors in order to calculate changes in forest carbon stocks
- Modules 3.1-3.3 to learn more about REDD+ assessment and reporting

Module 2.3 Estimating emission factors for forest cover change (deforestation and forest degradation)

Developers

Sandra Brown, Winrock International

Lara Murray, Winrock International

Felipe Casarim, Winrock International

Learning objectives

After the course the participants should be able to:

- Describe the procedures and methods to develop estimates of emission factors for deforestation and for forest degradation by selective logging within a national forest monitoring system at a Tier 2-3 level
- Estimate emission factors including all pools for deforestation for a selected forest region within a country and estimate emission factors for forest degradation by selective logging

Outline of lecture

1. Changes in C stocks from deforestation and forest degradation by selective logging
2. IPCC Tiers for estimating emission factors
3. Emission factors using stock-difference and gain-loss methods
4. Estimating emission factors for deforestation
 - i. Strategies
 - ii. Stratification of lands
 - iii. Carbon pools
 - iv. Collecting data for estimating C stocks – field measurements
 - v. Estimating C stocks and developing EFs
 - vi. Sources of error and Quality assurance/Quality control
5. Estimating emission factors for forest degradation by selective logging
 - i. Strategies
 - ii. Collecting data for estimating the EFs – field measurements
 - iii. Estimating EFs and total emissions
 - iv. How to estimate gains through regrowth of logged areas

The lecture starts with a general introduction to estimating emission factors (sections 1-3). The rest of the lecture consists of two main parts: 4. Estimating emission factors for deforestation and 5. Estimating emission factors for forest degradation by selective logging. Therefore, the lecture is quite long (76 slides). Because of the total length of the presentation, the lecture can be split up in two presentations: e.g. section 4 before the break and section 5 after the break. The general introduction applies to both sections.

Country example

- Estimating emission factors (biomass and soil) for forest cover change in Guyana

The country example explains how emission factors were developed for Guyana, using a “stratification by threat” approach to divide the country in different strata where samples were collected. This stratification process was chosen, because it focuses on measuring and monitoring in areas where changes are most likely to occur. This may seem quite a difficult approach as it requires a lot of data and a spatially explicit land use change modeling process to come up with a stratification map. Countries can also do a less sophisticated stratification by threat analysis. Other options for stratification is stratifying by C stocks, where forest and other land covers with similar carbon stocks are grouped. More info on estimating carbon emissions (combining emission factors and activity data) for Guyana can be found in the country examples of Module 2.5 Estimation of carbon emissions from deforestation and forest degradation.

Exercises

- Tutorial on how to estimate EFs:
 1. Estimating Emissions from Deforestation
 2. Estimating Emissions from Degradation by Logging

This tutorial provides step-by-step guidance on how to estimate emission factors and emissions from deforestation and forest degradation. The ppt slideshow provides a basic introduction. The Word file explains the exercise in detail. The excel sheet can be used to make calculations and also provides answers to the exercise. More extensive exercise on estimation of carbon emissions from deforestation and forest degradation can be found in Module 2.5.

Recommended modules as follow up

- Module 2.4 to learn about involving communities / local experts in monitoring changes in forest area and carbon stocks
- Module 2.5 to estimate carbon emissions from deforestation and forest degradation
- Modules 3.1-3.3 to proceed REDD+ assessment and reporting

Module 2.4 Incorporating community based monitoring (CBM) in national (or sub-national/ jurisdictional) REDD+ monitoring

Developers

Margaret Skutsch, Universidad Nacional Autónoma de Mexico
Arturo Balderas Torres, Universidad Nacional Autónoma de Mexico

Learning objectives

After the course the participants should be able to:

- Present arguments for the benefits of CBM as an element within national REDD+ monitoring
- Explain the steps needed to set up CBM as an element within national REDD+ monitoring

Outline of lecture

1. Why CBM should be part of national monitoring for REDD+
2. How CBM can relate to the NFMS and national monitoring
3. Setting up protocols for CBM
4. Monitoring other (non-carbon) variables
5. How to feed local data into a national database
6. Other issues: verification and the basis of benefit sharing
7. How much does CBM cost?
8. Planning a national CBM monitoring exercise

The lecture of this module differs slightly from the other modules, in that it is presented in a more interactive way. Throughout the lecture, a few Discussion slides are included, which the presenter can use to initiate an interactive discussion with the course participants. This allows them to think about and process the acquired knowledge during the lecture.

Country examples

Community / local expert forest monitoring in:

1. Guyana (Norad funded pilot-project)
2. Nepal (Norad funded pilot-project)
3. Vietnam (Projects by Sumernet, Wageningen University, SNV)

This module contains extensive and detailed country examples of community forest monitoring practices and the set-up of the documents differs from the other modules. The course instructor is advised to start with the Intro_Country_Examples file and to present slide 1-4 (Introduction to country examples), then to proceed with the three separate country cases and to end with slides 5-10 of the Intro_Country_Examples file. These final slides provide discussion points on the lessons that can be learned from the three country cases.

Exercise

- Recording data using cybertracker

In this exercise the course participants will experiment with recording data using Cybertracker and an application which has been especially developed for community carbon monitoring. For this exercise, they need a smartphone. Additional material to the exercise is CIGA_UNAM_2014_Community manual.pdf. Step 6 (p.22) in the manual explains how to record data on the smartphone using Cybertracker. The ppt file guides the lecturer and the participants through the exercise. The last slide includes some points that can be discussed after the exercise has been performed. The Word document includes additional instructions for the exercise on how to download and use Cybertracker and it includes the data table that has to be used to enter data on the smartphone.

Recommended modules as follow up

- Module 2.5 to estimate carbon emissions from deforestation and forest degradation
- Modules 3.1-3.3 to proceed with REDD+ assessment and reporting

Module 2.5 Estimation of carbon emissions from deforestation and forest degradation

Developers

Sandra Brown, Winrock International

Lara Murray, Winrock International

Learning objectives

After the course the participants should be able to:

- Make an estimation of carbon emissions and removals from deforestation and forest degradation in accordance with the requirements from the IPCC guidelines and guidance

Outline of lecture

1. 2006 IPCC AFOLU Guidelines and 2003 GPG-LULUCF land use categories and subcategories
2. Estimating emissions and removals: Combining Emission Factors (EFs) and Activity Data (AD)
3. Methods for estimating C emissions from deforestation (conversion of forests to non-forests)—country example of Guyana
4. Methods for estimating C emissions from forest degradation—e.g. selective logging—country example of Berau, East Kalimantan, Indonesia

Required knowledge: To combine EFs and AD, practitioners should already understand GOF-C-GOLD Sourcebook sections 2.1, 2.2, 2.3, and 2.4 as well as Modules 2.1, 2.2 and 2.3. This module builds further on the acquired knowledge and explains how to estimate emissions from deforestation and forest degradation by selective logging, using the IPCC guidelines and guidance.

Country example

- Combining emission factors and activity data for Guyana

This country example further builds on the example in Module 2.3 (Estimating emission factors (biomass and soil) for forest cover change in Guyana). This example explains how estimations of carbon emissions were made for Guyana. It explains in detail how AD were gathered and processed using RS and GIS software; how data were gathered to estimate EFs, which approach was used to estimate EFs; and finally how AD and EF were combined to estimate emissions (tCO₂) from deforestation in Guyana.

Exercises

1. Estimating carbon emissions from deforestation
2. Estimating carbon emissions from degradation by selective logging using the gain-loss method

The exercises deal with the hypothetical case of Freedonia. Input data (AD and EFs) and the equations are provided in order to make estimations of carbon emissions from deforestation and from forest degradation by selective logging.

Recommended modules as follow up

- Module 2.6 to continue with estimating GHG emissions from biomass burning
- Module 2.7 to continue with estimation of uncertainties
- Modules 3.1-3.3 to proceed with REDD+ assessment and reporting

Module 2.6 Estimation of GHG emissions from biomass burning

Developer

Luigi Boschetti, Department of Forest, Rangeland and Fire Sciences, University of Idaho

Learning objectives

After the course the participants should be able to:

- Understand the strengths and limitation of satellite remote sensing of fire
- Describe a range of fire monitoring approaches and techniques
- Use available fire products to calculate emissions from biomass burning

Outline of lecture

1. Fire in the global environment
2. Biomass burning monitoring for REDD+
3. IPCC guidelines for estimating fire-related emissions (CO₂ and non-CO₂)
4. Fire monitoring from satellites
 - Detection of active fires
 - Mapping of post fire burned areas
5. Available remote sensing fire products (Global burnt areas JRC, MODIS active fires and burned areas, FIRMS, ...)
6. Calculating GHG emissions from biomass burning
7. Error sources
8. Other potential uses of fire data for REDD+ support

The general introduction text provides an introduction to an audience that might not have any background on fire. If the instructor thinks that it is redundant for the specific audience, the introduction may be skipped or condensed. The lecture explains how to compute emissions from biomass burning and should be seen in the context of the rest of the material, with the MRV process discussed in the previous modules.

Country examples (regions)

1. Africa – Burned areas and active fires maps
2. Amazonia – Burned areas and active fires maps

The trainer should reinforce the fact that the topic is covered in depth in the lecture, and recommend looking at the lecture material if more information is needed.

Exercise

- Using available fire datasets to estimate GHG emissions from biomass burning in national context for Botswana and Brazil

The exercises and some background information are described in the power point presentation. The Word document explains in detail how to estimate fire emissions for a selected geographic area. The excel spreadsheet guides the course participant through the exercise and includes the use of the formulas provided in the sourcebook (section 2.5) for calculating fire emissions with real data. The section requires that the participants have a basic knowledge of remote sensing and /or GIS techniques, and that they can perform some degree of data preprocessing. The step-by-step procedure for handling the data would necessarily be tied to one specific commercial software and it would be beyond the scope of this tutorial.

Recommended modules as follow up

- Module 2.7 to continue with estimation of uncertainties
- Module 2.8 to learn more about evolving technologies for monitoring of forest area changes, carbon stocks and emissions
- Modules 3.1-3.3 to proceed with REDD+ assessment and reporting

Module 2.7 Estimation of uncertainties

Developers

Giacomo Grassi, European Commission - Joint Research Centre

Suvi Monni, Benviroc

Frédéric Achard, European Commission - Joint Research Centre

Andreas Langner, European Commission - Joint Research Centre

Martin Herold, Wageningen University

Learning objectives

After the course the participants should be able to:

- Identify sources of uncertainty in the estimates of area change (“activity data”) and carbon stocks change (“emission factor”)
- Implement the correct steps to calculate uncertainties for estimates in area change and carbon stock change
- Understand the possible treatment of uncertainties in a conservative way

Outline of lecture

1. Importance of identifying uncertainties
2. General concepts
3. Uncertainties in area change estimates
4. Uncertainties in carbon stocks change estimates
5. Combination of uncertainties

This module requires a basic understanding of statistics and uncertainty analysis. All the concepts needed for estimation of uncertainties in the context of REDD+ are explained in the lecture.

However, some previous experience with assessing uncertainties in maps and remote sensing data will help in comprehending the materials presented.

Country examples

1. Biomass burning
2. Uncertainty analysis: LULUCF in Finland
3. Applying the conservativeness approach to the DRC example (matrix approach) - *See also Exercise 4*

For this module there is a diverse set of country examples. The first country example shows combination of uncertainties for non-CO₂ emissions from biomass burning for an Annex I Party. Example two explains how uncertainty analysis is done for the GHG inventory for the LULUCF sector in Finland. In example three the conservativeness approach is applied to the DRC example, using the matrix approach. This approach is explained in detail.

Exercises

1. Uncertainties in area and area change
2. Using IPCC equations to combine uncertainties
3. Using IPCC equations to assess trend uncertainties
4. The REDD+ matrix approach (*see xls exercise file and country example 3. – this exercise is in common with Module 3.3*)
5. Preparations for Monte Carlo

The first exercise deals with uncertainties in area and area change estimates. Exercises 2-4 deal with uncertainties in emission estimates. In exercise 5 Monte Carlo preparations are made to estimate uncertainties of relative change in Biomass expansion factors.

Recommended modules as follow up

- Module 2.8 to learn more about the role of evolving technologies for monitoring of forest area changes and changes in forest carbon stocks
- Modules 3.1-3.3 to proceed with REDD+ assessment and reporting

Module 2.8 Overview and status of evolving technologies

Developers

Brice Mora, Wageningen University
Erika Romijn, Wageningen University

Learning objectives

After the course the participants should be able to:

- Mention and characterize existing evolving technologies in remote sensing for measuring and monitoring purposes for REDD+; their status and near-term developments
- Describe the measurement techniques using LIDAR and RADAR data

Outline of lecture

1. Role of LIDAR observations for forest characterization and experiences with LIDAR for monitoring purposes
2. The use of RADAR for forest monitoring

This lecture is quite technical and explains the LIDAR and RADAR techniques in detail. It emphasizes the usefulness of these techniques for tropical forest monitoring. Participants already need to understand the principles of tropical forest monitoring, biomass estimation and assessing uncertainties (modules 2.1-2.7) before starting with this module.

Country examples

- Monitoring tropical deforestation in Kalimantan using Radar
- Use of LiDAR and InSAR as auxiliary data to estimate forest biomass in a boreal forest area

As RADAR and LIDAR techniques are emerging technologies, there were no existing cases of operational implementation in a country available. Therefore, the country examples are based on scientific studies. The first example demonstrates the usefulness of combining RADAR and LIDAR data for monitoring tropical deforestation in Kalimantan. The second example describes the paper from Naesset et al (2011) on “Model-assisted regional forest biomass estimation using LIDAR and InSAR as auxiliary data: A case study from a boreal forest area”. The study was performed in a boreal forest area, however the methods are promising for application in tropical countries.

Recommended modules as follow up

- Modules 3.1-3.3 to proceed with REDD+ assessment and reporting

Module 3.1 National data organization and management

Developers

Erika Romijn, Wageningen University
Veronique De Sy, Wageningen University / CIFOR

Learning objectives

After the course the participants should be able to:

- Explain the importance of having a clear and stable institutional set-up
- Describe the different types of roles and responsibilities that agencies may have in organizing and managing data
- Understand the procedures on how to ensure IPCC reporting principles when collecting and managing data associated with MRV and carbon accounting

Outline of lecture

1. Institutional framework
2. Data management

This module only contains a lecture which explains the aspects for organizing and managing data in the context of preparing a national GHG inventory for reporting of carbon emissions and removals from REDD+. The first section indicates the importance of having an institutional framework and explains the different components of the framework. The second section emphasizes the importance of having a spatial data infrastructure; a data management system which stores data from different agencies and connects data providers with end-users. Different country cases are embedded in the lecture, to provide immediate examples of the theory explained in the lecture. There are no exercises with this module.

Recommended modules as follow up

- Module 3.2 to continue with guidance on developing REDD+ reference levels
- Module 3.3 to learn more about reporting REDD+ performance using IPCC Guidelines and Guidance

Module 3.2 Data and guidance on developing REDD+ reference levels

Developers

Martin Herold, Wageningen University
Erika Romijn, Wageningen University
Sandra Brown, Winrock International

Learning objectives

After the course the participants should be able to:

- Describe the procedures to develop REDD+ forest reference levels (RLs)

Outline of lecture

1. Importance of REDD+ forest reference (emission) levels and types of reference levels
2. UNFCCC context on developing REDD+ forest reference (emission) levels
3. Considerations for business-as-usual (BAU) baseline estimation and data needs
4. Approaches for estimating BAU baselines
5. Technical assessment of REDD+ forest reference (emission) levels

Country example

- Brazil's submission of a subnational forest reference emission level to the UNFCCC

Brazil is one of the first countries that has submitted a forest reference level to the UNFCCC for technical assessment in order to pursue results-based payments. Brazil's RL submission is an example of a sub-national RL that is established for a selected region (the Amazon biome) and for a selected activity (deforestation), with focus on some key pools (above-ground biomass, below-

ground biomass and litter). The submission of information on the RL follows the guidelines from UNFCCC (2012, Decision 12-II Annex/CP17). The country example gives an overview of the methodology used to construct the RL and the information that was submitted to the UNFCCC.

Exercise

- Developing a forest reference level for Indonesia using different historical datasets – implications of different types of activity data on RL development

In this exercise the course participants are going to calculate forest reference levels for Indonesia, using Excel spreadsheet software. The Powerpoint file can be used to introduce the exercise. The Word document provides a detailed description of the exercise and the Excel sheet provides some possible answers. Two different historical datasets can be used for this exercise: one from the Indonesian Ministry of Forestry (MOFOR) and one from the FAO forest resources assessment (FRA). Depending on the size of the group, the group can be split in two: one part may develop a national RL for deforestation using the MOFOR data, the other part using the FAO data. Using the MOFOR data, participants can choose data following three different forest definitions. There is also the option to develop a RL for degradation or for the separate islands in Indonesia. Afterwards, the results can be compared among the group participants and they can discuss the implications of the use of different datasets and different forest definitions. In this way they will get more insight on the considerations for developing a RL.

Recommended modules as follow up

- Module 3.3 to continue with guidance on reporting REDD+ performance using IPCC Guidelines and Guidance

Module 3.3 Guidance on reporting REDD+ performance using IPCC Guidelines and Guidance

Developers

Giacomo Grassi, European Commission - Joint Research Centre
Erika Romijn, Wageningen University
Martin Herold, Wageningen University

Learning objectives

After the course the participants should be able to:

- Understand the general reporting and review principles
- Perform reporting of GHG emissions using the existing IPCC reporting tables
- Implement the conservative approach as a possible way to address potential overestimation of achieved mitigation

Outline of lecture

1. Reporting and accounting REDD+ performance: UNFCCC reporting requirements
2. Guidance and modalities on reporting REDD+ performance from UNFCCC
3. Reporting principles under the UNFCCC: transparency, consistency, comparability, completeness and accuracy
4. Structure of a GHG inventory (reporting tables, additional tables, inventory report)
5. Major challenges for reporting REDD+ by developing countries
6. Conservativeness as a possible way to address potential incompleteness and potential overestimation of achieved mitigation of REDD+ estimates

Country examples

1. Annex 1 country example of GHG inventory reporting (LULUCF)
2. Applying the conservativeness approach to the DRC example (matrix approach) – see module 2.7

The first case provides an example of GHG inventory reporting (selected CRF tables for LULUCF) of an Annex I country under the Kyoto Protocol (KP). The second example is in common with module 2.7, where the conservativeness approach is applied to estimate forest C stock changes, thereby taking uncertainties into account.

Exercises

- Reporting GHG emissions and removals using IPCC reporting tables
 1. Land transition matrix
 2. Emissions from deforestation

The exercises are shortly presented in the powerpoint file. This can be used to give an introduction to the exercises to the course participants. The excel files contain tables and data for each exercise and participants can make calculations using these files.

4. List of acronyms

| | |
|-----------------|--|
| AD | activity data |
| AFOLU | agriculture, forestry, and other land use |
| AGB | above ground biomass |
| BGB | below ground biomass |
| BUR | biennial update report |
| C | carbon |
| CO ₂ | carbon dioxide |
| COP | Conference of the Parties of the UNFCCC |
| DBH | diameter at breast height |
| DD | deforestation and forest degradation |
| EF | emission factor |
| ELE | extracted log emissions |
| FAO | Food and Agriculture Organization (United Nations) |
| FCPF | The World Bank's Forest Carbon Partner Facility |
| FLUIS | forest and land-use information system |
| FREL | forest reference emission level |
| FRL | forest reference level |
| GFOI | Global Forest Observation Initiative |
| GHG | greenhouse gas or greenhouse gases |
| GOFC-GOLD | Global Observation of Forest Cover - Global Observation of Land Dynamics |
| GPG | good practice guidance |
| ICA | international consultation and analysis |
| IPCC | Intergovernmental Panel on Climate Change |
| JRC | Joint Research Centre (European Commission) |
| KP | Kyoto Protocol |
| LANDSAT | land satellite (US satellite series) |
| LDF | logging damage factor |

| | |
|---------|---|
| LIDAR | light detection and ranging |
| LIF | logging infrastructure factor |
| LTP | long-term products |
| LULUCF | land use, land-use change, and forestry |
| MRV | measuring, reporting and verification |
| NDFI | normalized differencing fraction index |
| NFI | national forest inventory |
| NFMS | national forest monitoring system |
| NPV | non-photosynthetic vegetation |
| REDD+ | reducing emissions from deforestation and forest degradation in developing countries; and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries |
| R-PP | Readiness Preparation Proposals |
| RSS | remote sensing survey |
| SAR | synthetic aperture radar |
| SBSTA | the Subsidiary Body for Scientific and Technological Advice |
| SOP | standard operation procedure |
| UNFCCC | United Nations Framework Convention on Climate Change |
| UN-REDD | United Nations Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation |

5. Glossary

Source: GFOI MGD, 2014. “Short Glossary of terms related to the UNFCCC”.

This glossary provides explanations rather than formal definitions.

| Concept | Meaning | Notes | Example reference (where applicable) |
|---|---|---|--|
| Activity data | Data on the extent of human activity causing emissions and removals. | Activity data are often areas or changes in area. | GPG2003. |
| Emission or removal factors | GHG emissions or removals per unit of activity data. | | GPG2003. |
| Forest Monitoring | Functions of a national forest monitoring system to assist a country to meet measuring, reporting and verification requirements, or other goals. | | |
| Greenhouse gas inventory | Anthropogenic greenhouse gas estimates with national territorial coverage produced using IPCC methods in accordance with decisions taken at the UNFCCC Conference of the Parties (COP). | Covers energy, industrial processes and product use, agriculture, forests and other land use and waste. The COP has agreed to base REDD+ emissions and removals estimates on the latest IPCC methods agreed for the purpose. | COP decision 4/CP.15 requests the use of the most recent IPCC guidance and guidelines as adopted or encouraged by the COP; Annex III, part III of decision 2/CP.17 identifies these as the <i>Revised IPCC 1996 Guidelines</i> and the <i>IPCC Good Practice Guidance 2000</i> and 2003. |
| Ground based data | Data gathered by measurements made in the field. | Measurement of gaseous concentrations could also be regarded as remotely sensed if the point of measurement is distant from what is being measured. | |
| Measuring, Reporting and Verifying, also called Measurement, Reporting and Verification (MRV) | Procedures associated with the communication of all mitigation actions of developing countries. | Measuring is estimating the effect of the action, reporting is communication to the international community, and verifying is checking the estimation; procedures for all three are to be agreed by the UNFCCC. Sometimes incorrectly called Monitoring, Reporting and Verifying. | Cancun Agreements (paras 61 to 64, COP decision 1/CP.16; decision 14/CP.19 (Modalities for measuring, reporting and verifying). |

| Concept | Meaning | Notes | Example reference (where applicable) |
|--|--|---|---|
| National Forest Inventory (NFI) | A periodically updated sample-based system to provide information on the state of a country's forest resources. | Historically not linked to greenhouse gas emissions, but where it exists, obviously a potential source of relevant data. | <i>National Forest Inventories</i> , Tomppo, E.; Gschwantner, Th.; Lawrence, M.; McRoberts, R.E. (Eds.), Springer 2010. |
| National Forest Monitoring System (NFMS) | The institutional arrangements in a country to monitor forests. NFMS will presumably include representation from responsible Ministries, indigenous peoples and local communities, forest industry representatives, and other stakeholders. In the REDD+ context, a system for monitoring and reporting on REDD+ activities, in accordance with guidance from the COP. | The COP has established that a NFMS should use a combination of remote-sensing and ground-based data, provide estimates that are transparent, consistent, as far as possible accurate, and that reduce uncertainties, taking into account national capabilities and capacities; and their results are available and suitable for review as agreed by the COP. NFMS may provide information on safeguards. | COP decisions 4/CP.15, 1/CP.16 and 11/CP19 (Modalities for national forest monitoring systems). |
| REDD+ | Reducing emissions from deforestation; Reducing emissions from forest degradation; Conservation of forest carbon stocks; Sustainable management of forests; Enhancement of forest carbon stocks. | | COP decision 1/CP.16. |
| Remote Sensing | Acquiring and using data from satellites or aircraft. | Measurement of gaseous concentrations, could be regarded as remotely sensed if the point of measurement is distant from what is being measured. | |
| Safeguards | Undertakings to protect and develop social and environmental sustainability. | Covers consistency with national forest programmes and relevant international conventions and agreements; transparency and effectiveness of national forest governance; respect for the knowledge and rights of indigenous peoples and members of local | COP decisions 1/CP.16 and 12/CP19 (covering the timing and frequency of presentation of summary information on safeguards). |

| | | | |
|--|--|---|--|
| | | communities; participation of relevant stakeholders, in particular indigenous peoples and local communities. | |
|--|--|---|--|