National Aeronautics and Space Administration

ARSET
Applied Remote Sensing Training
http://arset.gsfc.nasa.gov
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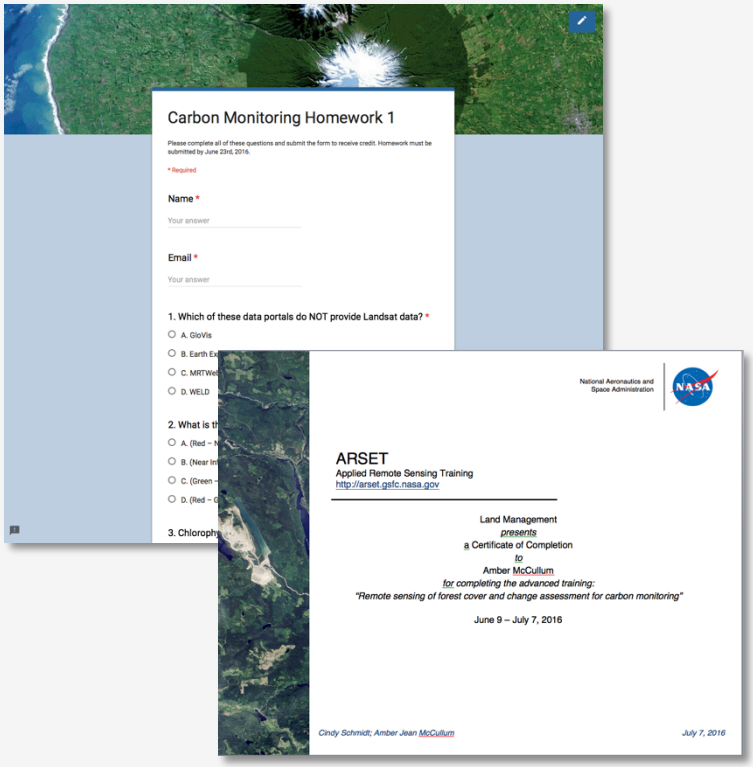
Remote sensing of forest cover and change assessment for carbon monitoring

Instructors: Amber McCullum, Carly Green (Global Forest Observations Initiative), Henrik Flifet (Royal Norwegian Ministry of Climate and Environment)

Week 5: July 7, 2016

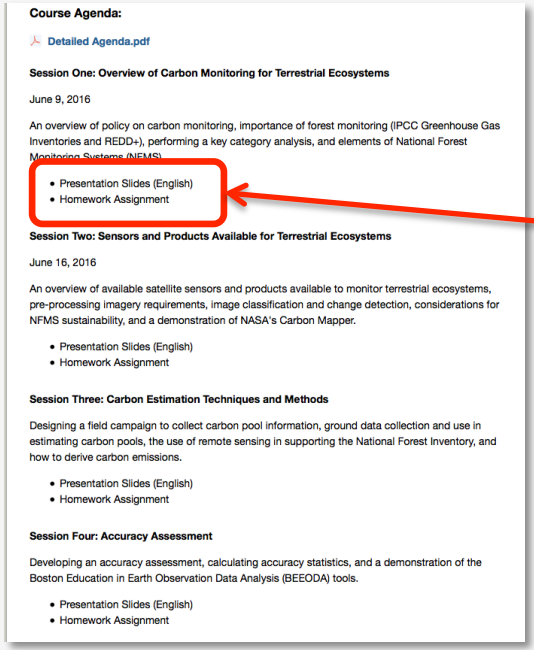
Homework, Certificates, and Survey

- Homework
  - Answers must be submitted via Google Form
- Certificate of Completion:
  - Attend 4 out of 5 live webinars
  - Complete all homework assignments by the deadline
    - Week 4 HW Deadline: July 14thth
  - You will receive certificates approximately 3 months after the completion of the course from: marines.martins@ssaihq.com
  - Please complete the webinar survey. The link is provided in the chat box, and it will be sent via email to all participants.



Accessing Course Materials

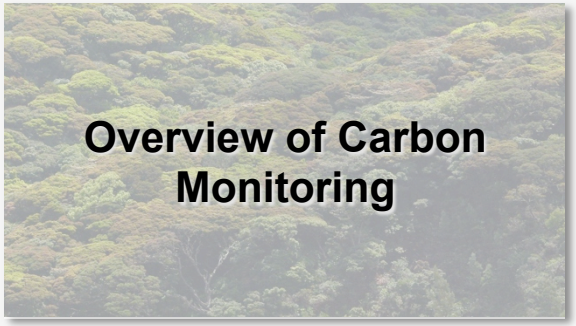
https://arset.gsfc.nasa.gov/land/webinars/carbon-monitoring-2016



Course materials are provided here using each specified link and will be active after each week

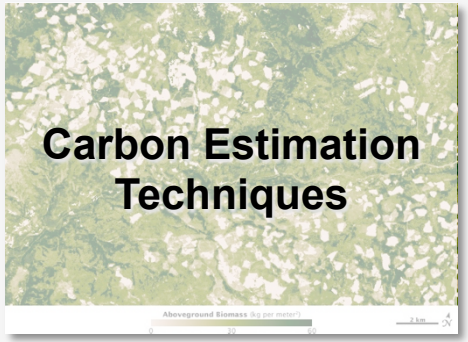
Course Outline

Week 1

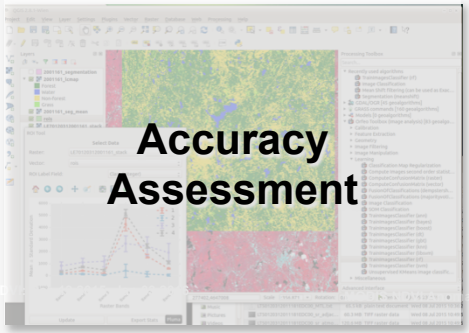


Week 2

Week 3



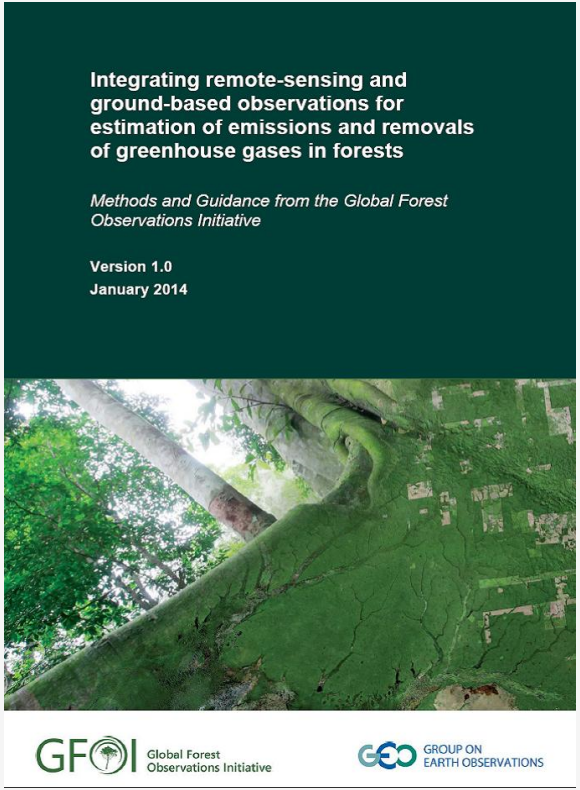
Week 4



Week 5

Week 5 Agenda

- Carly Green:
  - Methods and Guidance document (MDG)
  - MGD Strategy
  - UNFCCC Reporting Requirements
  - REDDcompass
- Henrik Flifet
  - Making REDD+ Operational
  - Reporting REDD+ results
  - Verification
  - Carbon Markets



Methods and Guidance document.

Guest Speakers: Carly Green and Henrik Flifet

GFOI Global Forest Observations Initiative

Methods and Guidance for REDD+ Measurement, Reporting and Verification

Carly Green – Methods and Component Manager
Global Forest Observations Initiative

UNFCCC and REDD+

- The United Nations Framework Convention on Climate Change (UNFCCC) has adopted a work programme on results-based finance to progress the full implementation of activities that reduce emissions from deforestation, forest degradation and other activities in developing countries, commonly known as REDD+.

REDD+ Measurement, Reporting & Verification

- Countries who choose to report REDD+ emissions and removals must be able to credibly monitor the change in their forests and conduct robust MRV procedures

- UNFCCC requires countries who opt to voluntarily report REDD+ emissions and removals to use:
  - the most recent guidance of the IPCC as a basis for estimating anthropogenic emissions and removals associated with REDD+ activities;
  - a combination of remote-sensing and ground based data.

GFOI and REDD+

GFOI is an initiative which:

1) Develops methods and guidance, focussing on REDD+
2) Works with space agencies to coordinate data supply
3) Builds capacity – agency and country engagement
4) Coordinates Research & Development

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Methods and Guidance

IPCC Guidance - methodological framework for quantification of land use emissions and removals

- Neither over nor under estimates so far as can be judged and uncertainties reduced as far as practicable
- Not specific to REDD+

GFOI Methods and Guidance Document published in 2013

- Link between IPCC methods and REDD+ activities
- Consistent with UNFCCC Warsaw Framework on REDD+
- Coordinated with UN-REDD, World Bank, IPCC and GOFC-GOLD

GFOI Methods and Guidance Document

- Relevant to all countries, but is particularly intended for technical decision makers and policy colleagues in REDD+ countries, as well as their partners in international agencies, multilateral and bilateral programmes.

GFOI Methods and Guidance Document

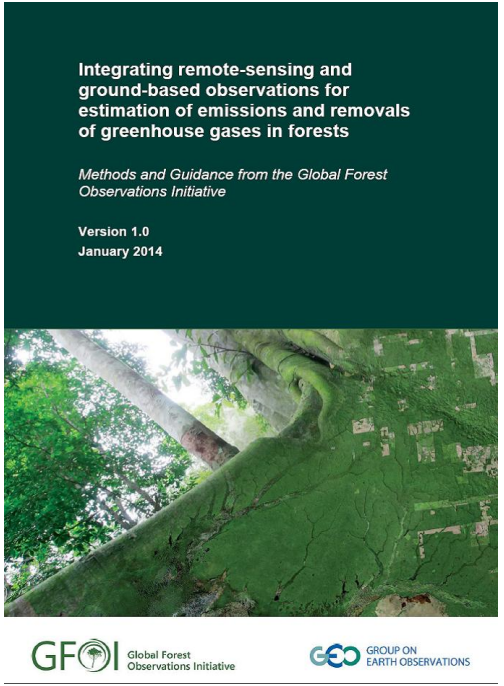
MGD Version 1

- Published January 2014
- Available in English, French, Spanish
- Kept updated by Modules – #1 Relationship with GOFC-GOLD; #2 Use of global datasets; #3 Forest Reference Levels

MGD Version 2 (late 2016)

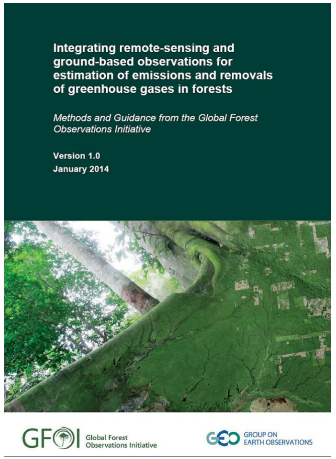
Incorporate experiences from country engagement and new developments:

- more visual material (flow charts, decision trees)
- Strengthen guidance on institutional arrangements; integration methods, statistical inference and uncertainties
- Integration of module material developed over the course of the year (global datasets, reference levels, statistical inference)
- Updates from UNFCCC (Paris, reference level submissions)
- Updated satellite data availability

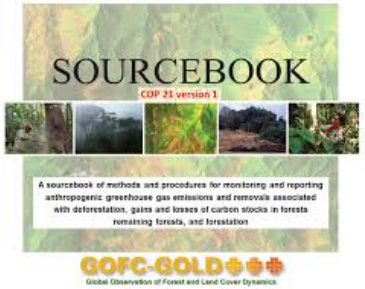


GFOI Methods and Guidance Document

- MGD provides step-by-step advice on readily implementable approaches for REDD+ MRV
  - Intended for technical decision makers and policy colleagues in REDD+ countries, as well as their partners in international agencies, multilateral and bilateral programmes.



- Sourcebook an annually updated review of science related to REDD+ MRV



- They are complementary – use them together to provide estimates of REDD+ activities consistent with IPCC Guidance as required by the UNFCCC.

MGD Strategy – Science in the Policy Context

Issue	Solution
Science background	GOFC-GOLD annual update, GFOI R&D component
Understand policy context	UNFCCC decisions (Warsaw Framework – seven COP decisions covering finance, support, NFMS, safeguards, reference levels, MRV, drivers of deforestation and degradation, Paris decisions (safeguards, non C benefits, joint adaptation and mitigation)
Methodological framework	IPCC Good Practice Guidance (GPG)
Methodological need	Link between IPCC GPG and REDD+ activities; consistency with *good practice* definition
Reporting and verification	Technical Assessment and Analysis processes of the UNFCCC in the context of UNFCCC requirements

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GFOI Global Forest Observations Initiative

Policy Context and Methodological Framework

Institutional Arrangements	Policy + Design Decisions	Measurement + Estimation	Reporting + Verification
Forest Policy and Governance	Forest Definition	Remote Sensing Observations	AFOLU GHG Inventory Reporting
MRV Institutions	REDD+ Activities	Ground Observations	Non-carbon related reporting
Processes	Carbon Pools	Uncertainty	Reference Emission Levels
	Approaches, Methods and Tools	Integration and Estimation	REDD+ Reporting
	LULC Stratification	Record Keeping	Internal and External Analysis
	Spatial and Temporal Scope		

Policy Context and Methodological Framework

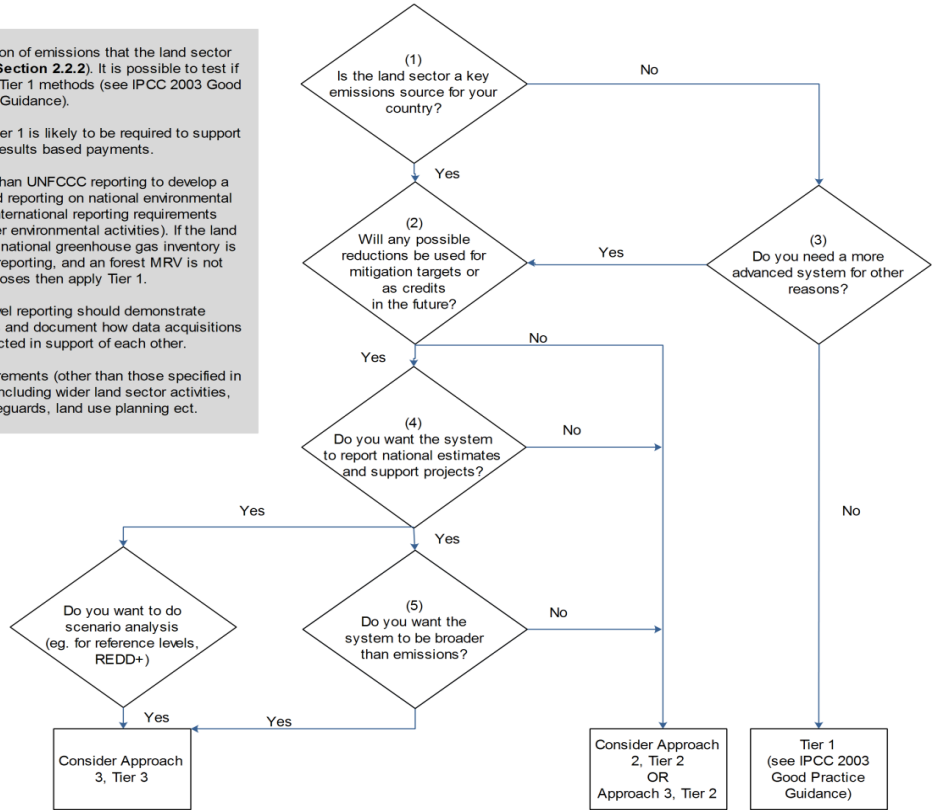
1. This will depend on the proportion of emissions that the land sector emits (see key category analysis **Section 2.2.2**). It is possible to test if it is going to be a key sector using Tier 1 methods (see IPCC 2003 Good Practice Guidance).

2. A more advanced system than Tier 1 is likely to be required to support mitigation targets for results based payments.

3. There are other reasons other than UNFCCC reporting to develop a MRV system (e.g . monitoring and reporting on national environmental policy effectiveness and other international reporting requirements These may include support for other environmental activities). If the land sector is not a key category in the national greenhouse gas inventory is not you don't need a system for reporting, and an forest MRV is not needed for other purposes then apply Tier 1.

4. Sub-national and project level reporting should demonstrate consistency with national estimates and document how data acquisitions and calculations are conducted in support of each other.

5. Some examples of broader requirements (other than those specified in Note 3) include: consideration of including wider land sector activities, environmental and social safeguards, land use planning ect.



Policy Context and Methodological Framework

Box 8: Uncertainty analysis to compare a FREL with deforestation emissions during an assessment period

Suppose that to establish the FREL, a number N successive determinations of deforestation rate were made and that these had values $\hat{\mu}_{A_i}$ ha/yr (i=1…N), and that using the methods outlined in section 5.1.6 of the MGD, the uncertainty of each determination was estimated to be $\hat{Var}\left(\hat{\mu}_{A_i}\right)$ corresponding to the variance of the mean deforestation rate (see also section 5.1.6). In this case, for the FREL the annual area deforested averaged over the N determinations is

$$\hat{\mu}_A = \frac{\sum \hat{\mu}_{A_i}}{N} \qquad \text{(B8.1)}$$

and the corresponding uncertainty is

$$\hat{Var}\left(\hat{\mu}_A\right) = \left(\frac{\sqrt{\sum \hat{Var}\left(\hat{\mu}_{A_i}\right)}}{N}\right)^2 \qquad \text{(B8.2)}$$

Similarly if during the assessment period, M successive determinations of the deforestation rate are made with values $\hat{\mu}_{B_j}$ ha/yr (j=1…M), each determination having an uncertainty of $\hat{Var}\left(\hat{\mu}_{B_j}\right)$ again using the methods set out in section 5.1.6, the average annual deforestation rate during the assessment period is

$$\hat{\mu}_B = \frac{\sum \hat{\mu}_{B_i}}{N} \qquad \text{(B8.3)}$$

and the corresponding uncertainty is

$$\hat{Var}\left(\hat{\mu}_B\right) = \left(\frac{\sqrt{\sum \hat{Var}\left(\hat{\mu}_{B_i}\right)}}{N}\right)^2 \qquad \text{(B8.4)}$$

Comparing the FREL and the assessment period, the difference in annual average deforestation rate is

$$\hat{\mu}_{A-B} = \hat{\mu}_A - \hat{\mu}_B \qquad \text{(B8.5)}$$

and using Eqn. 20 in Section 5.3 the uncertainty of this difference is

$$\hat{Var}\left(\hat{\mu}_{A-B}\right) = \hat{Var}\left(\hat{\mu}_A\right) + \hat{Var}\left(\hat{\mu}_B\right) \qquad \text{(B8.6)}$$

Now suppose that the emissions/removals factor (the carbon density per unit area) is $\hat{\mu}_{EF}$ tCO_2 /ha with an uncertainty of $\hat{Var}\left(\hat{\mu}_{EF}\right)$. The methods for calculating emissions/removals factors and their uncertainties are given in Section 5.3, including the case where permanent plots (with correlated errors) are used in their calculation. Finally the mean annual difference in CO_2 emissions between the FREL and the assessment period is calculated as the difference in area multiplied by the emissions/removals factor

$$\hat{\mu}_\Delta = \hat{\mu}_{EF} \times \hat{\mu}_{A-B} \ tCO_2 \text{ /yr} \qquad \text{(B8.7)}$$

with the uncertainty of $\hat{\mu}_\Delta$ given by Eqn. 26 in Section 5.4

$$\hat{Var}\left(\hat{\mu}_\Delta\right) = \hat{\mu}_{EF}^2 \times \hat{Var}\left(\hat{\mu}_{A-B}\right) + \hat{\mu}_{A-B}^2 \times \hat{Var}\left(\hat{\mu}_{EF}\right) + \hat{Var}\left(\hat{\mu}_{A-B}\right) \times \hat{Var}\left(\hat{\mu}_{EF}\right) \qquad \text{(B8.8)}$$

The result can also be expressed in terms of a 95% confidence interval

$$\hat{\mu}_\Delta \pm t_{0.95} \times \sqrt{\hat{Var}\left(\hat{\mu}_\Delta\right)} \qquad \text{(B8.9)}$$

Policy Context and Methodological Framework

Box 6: Case study: Plantation management in Kenya:
In Kenya the standard plantation management practice following harvest is to put crops on the land for 1-2 years before replanting. In this case the remote sensing program will correctly see that the cover has changed from forest to crop. The attribution process notes that this is a human induced change in cover (due to the harvest). However, it is noted that the harvest occurred in a plantation (determined through knowledge of the species and stand maps from the Forest Information system). The policy and reporting rule set by the Government of Kenya is that the short crop cycle is part of plantation management. Consequently the land use does not change, (that is, it remains forestland) and all emissions associated with the harvest and removals from subsequent replanting reported under forestland. However, there is also the chance that the land will have been cleared and will not be returned to trees. If the land cover does not return for forest within a specified number of years, then a land use change is considered to have occurred at the time of harvest and the land areas are updated accordingly in the next report.

MGD strategy – science in the policy context

Issue	Solution
Science background	GOFC-GOLD annual update, GFOI R&D component
Understand policy context	UNFCCC decisions (Warsaw Framework – seven COP decisions covering finance, support, NFMS, safeguards, reference levels, MRV, drivers of deforestation and degradation, Paris decisions (safeguards, non C benefits, joint adaptation and mitigation)
Methodological framework	IPCC Good Practice Guidance (GPG)
Methodological need	Link between IPCC GPG and REDD+ activities; consistency with *good practice* definition
Reporting and verification	Technical Assessment and Analysis processes of the UNFCCC in the context of UNFCCC requirements

UNFCCC Reporting Requirements

The Convention divides countries into three main groups according to differing commitments:

Annex I - Parties include the industrialized countries that were members of the OECD (Organisation for Economic Co-operation and Development) in 1992, plus countries with economies in transition (the EIT Parties), including the Russian Federation, the Baltic States, and several Central and Eastern European States.

Non-Annex I - Parties are mostly developing countries. The Convention emphasizes activities that promise to answer the special needs and concerns of these vulnerable countries, such as investment, insurance and technology transfer.

UNFCCC Reporting Requirements

Reporting requirements differ for Annex I and non-Annex I:

- **Annex I**: National communications (every 4yrs), GHG inventories (annual), biennial reports (BRs, 2yrs), all subject to *review*

  + Forest management reference level (under the KP)

- **Non-Annex I**: National Communications (every 4yrs), and biennial update reports (2yrs)*

  + Forest reference emissions levels and/or Forest reference levels (voluntary, in the context of REDD+)

Guidelines on requirements are detailed for Annex I (especially for GHG inventories), but are more generic for non-Annex I parties.

* Least developed/small island developing parties may submit National Communications and Biannual Update Reports at their discretion.

Reporting and Verification for REDD+

What	UNFCCC Channel	Process	Timing	Information Hub on the REDD+ Platform	Reference
National Strategy (NS) or Action Plan (AP)	None	No further action	When seeking RBP	As appropriate, link to NS or AP	9/CP.19 para 3 & 11
National FREL / FRL	FREL / FRL submission	Technical assessment in context of RBP	When ready (especially when seeking RBP)	FREL/RL Submission & final assessment report	9/CP.19 para 3 & 11 (b) 13/CP.19
Results in tonnes of CO2eq per year	Technical Annex BUR	Technical assessment in context of RBP	Every two years	Final technical report	9/CP.19 para 3 & 11 (a) & (e) 14/CP.19
Safeguard (SG) Information	National Communication Web platform	No further action	Approximately every four years	Summary of information on addressing & respecting SG	9/CP.19 para 3 & 11 (c)

Source: modified from Iversen, 2014

Information to be Included in FREL and REDD+ Results Report

Methodological steps
Forest definition
Definition of forest classes
Choice of Activity Data and (pre-)processing methods
Choice of emission factors and description of their development
Estimation of emissions and removals, including accounting approach
Disaggregation of emissions by Sources and removals by Sinks
Estimation of accuracy, precision, and/or confidence level
Discussion of key uncertainties
Rationale for adjusting emissions
Methods and assumptions associated with adjusting emissions

Maps and/or synthesized data
Accounting area
Activity data
Emission factors
Average annual emissions over the Reference Period
Adjusted emissions
Any spatial data used to adjust emissions

Source: World Bank FCPF Methodological Framework 2013

UNFCCC Reporting Principles

The following principles guide the estimation and the reporting of GHG under UNFCCC and guide the process of review or technical assessment of the estimates:

- *Transparency* - All the assumptions and the methodologies used in the inventory should be clearly explained and documented, so that anybody could verify its correctness
- *Completeness* - Estimates should include—for all the relevant geographical coverage—all the agreed categories, gases, and pools
- *Accuracy* - Estimates should be systematically neither over nor under the true value, so far as can be judged, and uncertainties should be reduced so far as is practicable
- *Consistency* - The same definitions and methodologies should be used in different years

Challenges in Relation to Reporting Principles

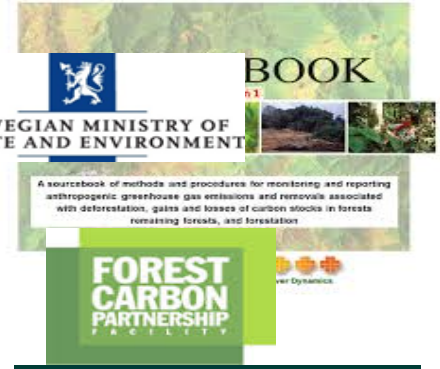
What difficulties can be expected by developing countries when reporting REDD+ following the five principles outlined above?

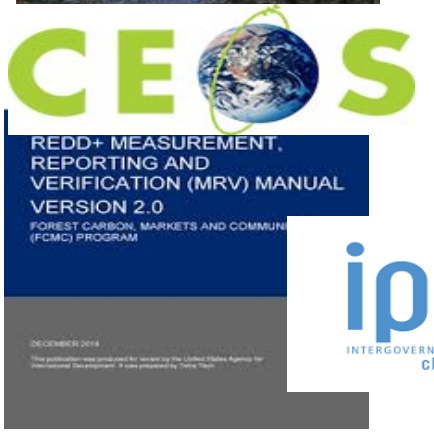
- **Transparency, consistency, and comparability**: Achievable by most countries (after adequate capacity building if needed)
- **Completeness**: From official reports (UN National Communications, FAO Forest Resource Assessment) only a few countries currently report data on soil carbon, although these emissions following deforestation are likely to be "significant"
- **Accuracy**: According to IPCC, *key categories* and *significant pools* should be estimated with higher tiers (2 or 3), i.e., country-specific data stratified by climate, forest, soil, and conversion type at a fine/medium spatial scale → big challenge

Source: FCPF Training Module 3.3

GFOI Global Forest Observations Initiative

Guiding you through REDD+

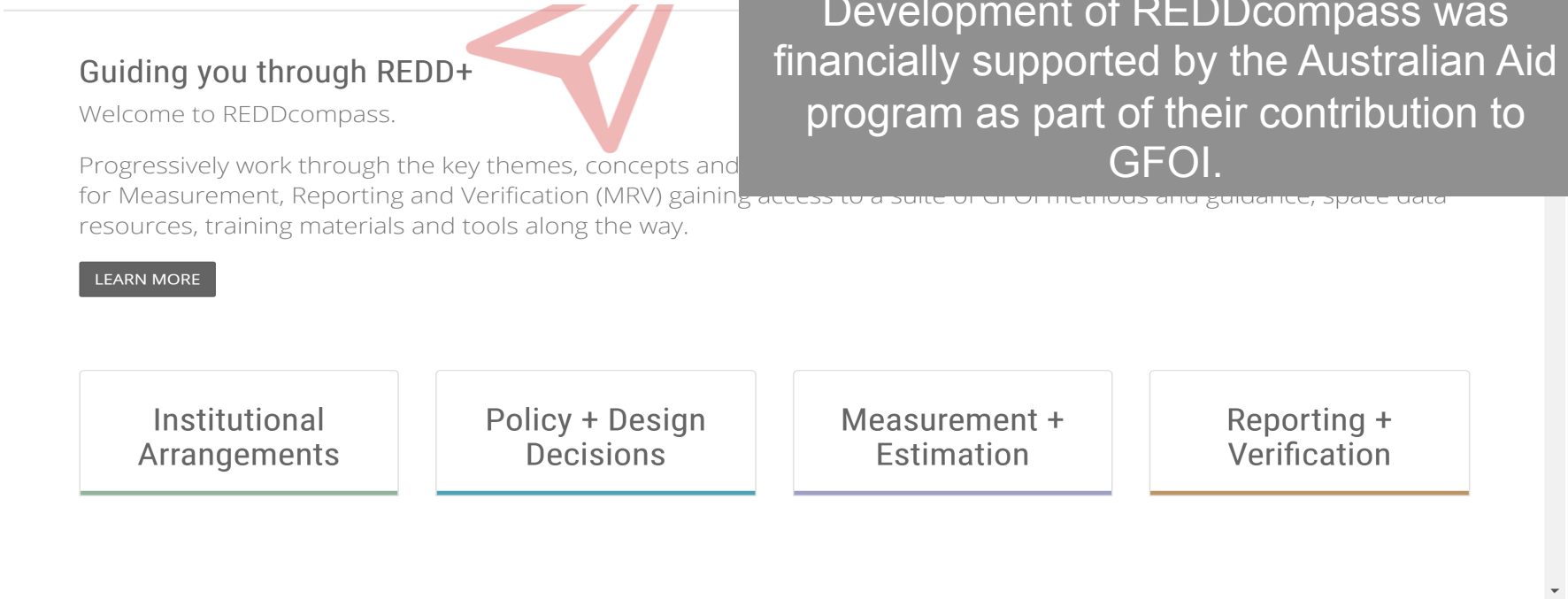




REDDcompass

www.gfoi.org/reddcompass

Development of REDDcompass was financially supported by the Australian Aid program as part of their contribution to GFOI.



Purpose of REDDcompass

- Collates guidance, training resources and tools consistent with the GFOI MGD in one location
- Presents REDD+ MRV in a step-by-step approach through a series of actions
- Provides access to guidance, decision trees and training material/tool aligned with each action
- Enables users to mark actions as complete, identify priority areas and communicate training needs in the context of their MRV progress

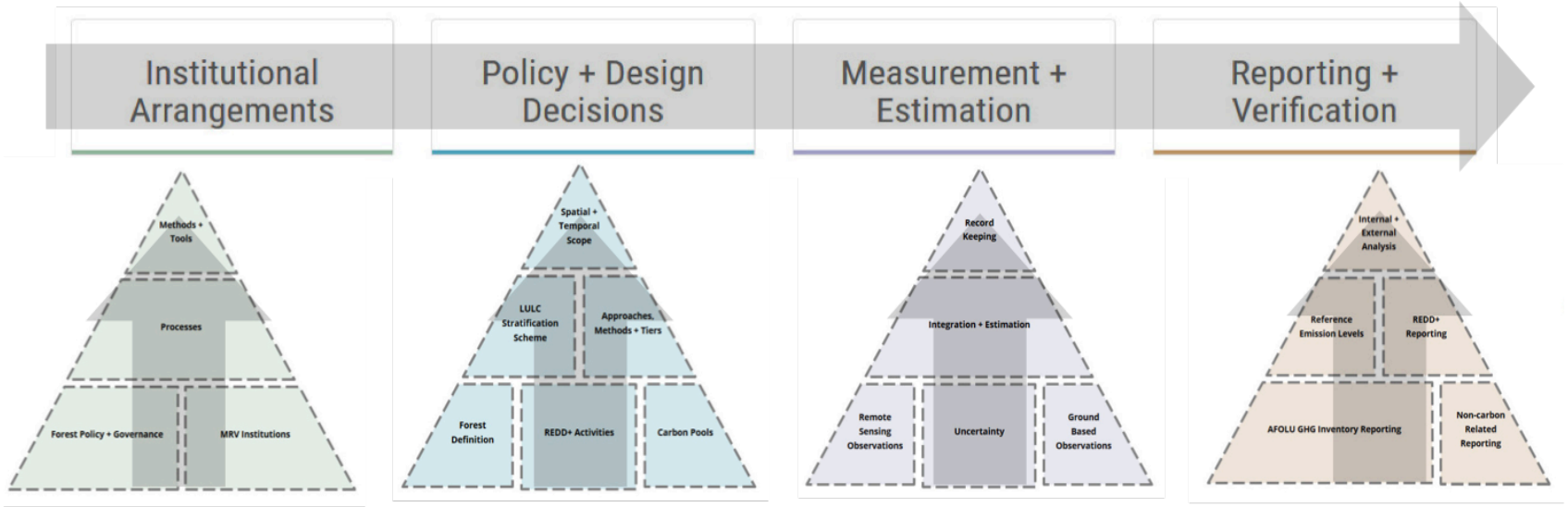
> *I really like the way the information was integrated. Its nicely done.*

SilvaCarbon
South East Asia Regional Workshop (Indonesia)

> *It gives me more a structured view on the available data. Kind of refreshing from the texts.*

SilvaCarbon
South East Asia Regional Workshop (Philippines)

REDDcompass MRV Guidance Structure

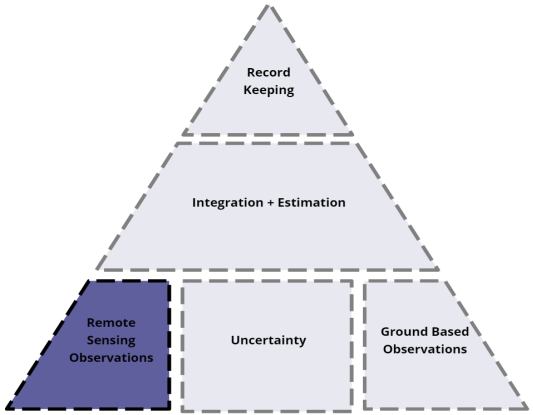


REDDcompass Themes and Concepts

Institutional Arrangements | Policy + Design Decisions | Measurement + Estimation | Reporting + Verification

Related Concepts (Marked as)

Remote Sensing Observations



MGD Sections

- Design considerations for national forest monitoring systems
- Activity data requirements
- Area, uncertainties and statistical inference for activity data
- Guiding principles for remote sensing data sources and methods
- Methods for mapping activity data
- Map products estimated from remote sensing
- Pre-processing of satellite data
- Remote sensing data sources
- Annex B Remote sensing data anticipated to be available through GFOI arrangement with the CEOS Space Data Coordination Group

REDDcompass Action Table

Actions

Consult remote sensing experts (domestic and international) to identify the most efficient approach for developing activity data.	
Show	? Not Done
Identify the most appropriate remote sensing data sources to support documented design decisions (i.e. spatial and temporal resolution both historically and into the future; selected forest definitions and REDD+ activities; MRV system development and operational cost).	
Show	Enter Action State
Generate consistent, multi-date, forest area change activity data with associated uncertainty estimates.	
Show	Enter Action State
Document process to ensure transparency and identify any areas for future development or research.	
Show	Enter Action State
Implement quality assurance and quality control procedures related to activity data.	

REDDcompass MRV Action Detail

Consult remote sensing experts (domestic and international) to identify the most efficient approach for developing activity data.

Tags:
Further Action Required

Competency:
Training Required

Response:
Additional training and support required in defining land use / land cover stratification scheme.

Related Links

Related Concepts
- Forest Definition
- LULC Stratification Scheme
- REDD+ Activities
- Spatial + Temporal Scope
- Approaches, Methods + Tiers

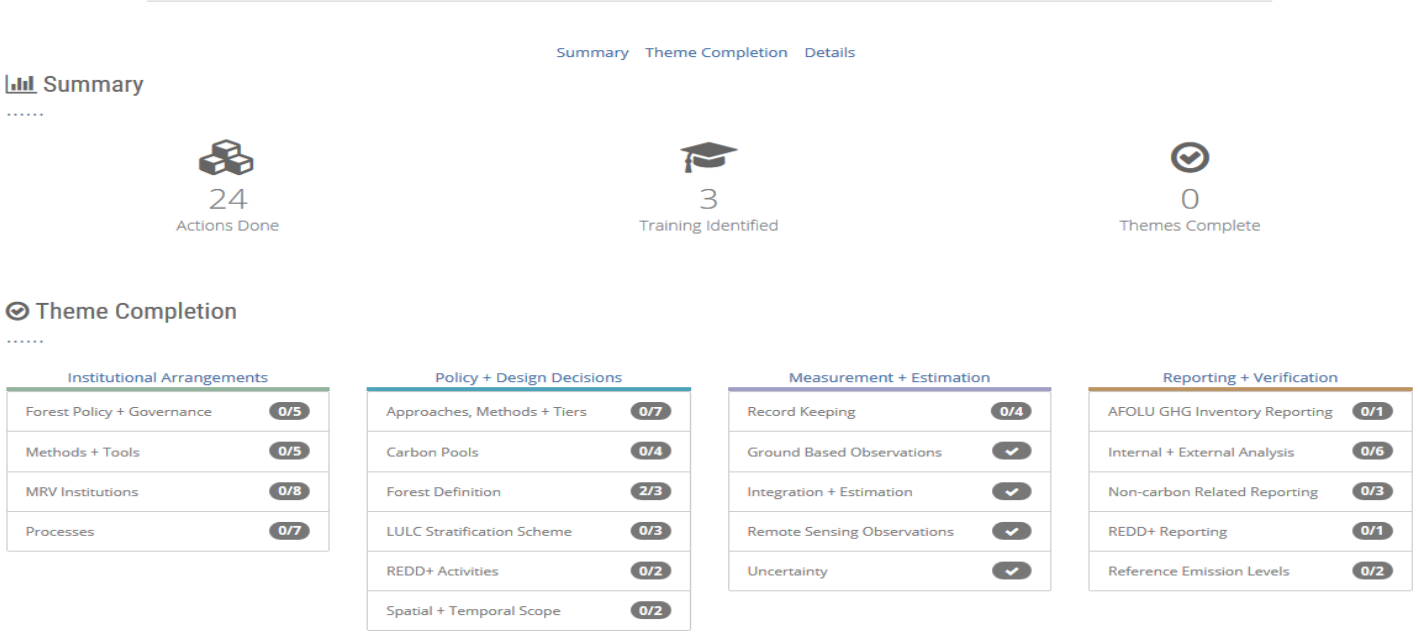
Related Resources/Tools
- FCPF Module 2.1 Monitoring activity data for forests using remote sensing
- FCPF Module 2.2 Monitoring activity data for forests remaining forests (incl. degradation)
- CEOS Cove Tool
- Landsat Coverage Country Reports

Hide

? Not Done

Identify the most appropriate remote sensing data sources to support documented design decisions (i.e. spatial and

Reporting on Progress



Summary Slide

- REDD+ Measurement Reporting and Verification (MRV) is voluntary
- Countries should use a combination of remote sensing and ground data
- IPCC methods and approaches should be applied
- GFOI Methods and Guidance Document provides step-by-step advice on readily implementable approaches for REDD+ Measurement, Reporting and Verification
- REDDcompass provides a development framework to systematically progress through the steps to completing REDD+ Measurement, Reporting and Verification, gaining access to guidance, training and tools as users need them

REDDcompass

www.gfoi.org/reddcompass

Guiding you through REDD+

Welcome to REDDcompass.

Progressively work through the key themes, concepts and actions of REDD+ National Forest Monitoring Systems (NFMS) for Measurement, Reporting and Verification (MRV) gaining access to a suite of GFOI methods and guidance, space data resources, training materials and tools along the way.

LEARN MORE

Institutional Arrangements	Policy + Design Decisions	Measurement + Estimation	Reporting + Verification

Acknowledgements

- GFOI Leads Australia, Norway, the USA, the Food and Agriculture Organization of the United Nations (FAO), and the Committee on Earth Observation Satellites (CEOS)
- MGD Advisory Group and Authors and Reviewers
- Governments, agencies and other organisations supporting participation

Policy Perspectives

Henrik Flifet

Reporting & verification in REDD+ partnerships

The role of carbon markets

Outline

- Making REDD+ operational: What to pay for and how much to pay
- Reporting REDD+ results
- Verification
- Carbon markets

Objective of this session

- Review the current state of REDD+ (Reduced emissions from deforestation and degradation, and the enhancement of carbon stocks)
  - REDD+ in terms of global development and climate change mitigation
- Present the complexities between green house gas (GHG) inventory reporting vs. financial incentive mechanism for REDD+.
  - consequences for Measurements Reporting and Verification (MRV) – including remote sensing
- Insight into common reporting requirements
- Insight into common verification requirements
- Overview of potential carbon markets

Outline

- **Making REDD+ operational: What to pay for and how much to pay**
- Reporting REDD+ results
- Verification
- Carbon markets

Norway's International Climate and Forest Initiative (NICFI)

- Established in 2007
- Goals: Establish REDD+ in the United Nations Framework Convention on Climate Change (UNFCCC), reward rapid emission reductions, preserve natural forests
- 500 million USD per year
- Has supported readiness efforts all over the world, including establishments and improvements of NFMS
- Three active results-based partnerships (Brazil, Colombia, Guyana)
- Multilateral funds: www.forestcarbonpartnershipfacility.org www.wbcarbonfinance.org
- Website: https://www.regjeringen.no/en/topics/climate-and-environment/climate/climate-and-forest-initiative

REDD+ in practice: from negotiations to operations

- Underlying problem: Market failure in valuation of forests
  - "Trees are worth more dead than alive"
- Pre-Copenhagen expectations of large scale finance
  - Have not materialized, highly unlikely
- Paris Agreement article V endorses REDD+ decisions
- REDD+ is an incentive mechanism
  - Integrated in Nationally Determined Contributions (NDCs)

REDD+ as incentive mechanism

- 4 commodities: beef, soy, palm oil, pulp & paper
  - main drivers of deforestation
- REDD+ finance small in comparison
- REDD+ is additional incentive
  - Source of strategic financing
  - Political support, attention and momentum
- Goal: Countries choose sustainable development pathways
- Considerable effort by each country

REDD+ as incentive mechanism

- Structure must be consistent and reliable
- Urgent: limit global warming to 2 (1.5) degrees Celsius
- Solution: phased approach & step wise improvement
- Result: tension between GHG inventory reporting and financial incentive mechanism
  - In a world of incomplete data, particular pragmatic flexibility on:
    - Completeness
    - Neither over- nor underestimate
    - Accuracy
- MRV requirements formalized in bilateral and multilateral agreements

MRV receives significant REDD+ attention

- Necessary to document emission reductions with sufficient level of detail, and independent verification, to underpin payments
  - Verification sensitive topic
- Phased approach – Start early, feedback loop from verification process
  - Rapid access to finance
- National forest monitoring → key to implementation of sustainable development policies
  - Important to view utility of national forest monitoring systems (NFMS)in broader national development context
  - Contributes to transparency, democratization, rule of law
  - Improved resource management
- Political priorities shape MRV to higher degree than technical limitations

Outline

- Making REDD+ operational: What to pay for and how much to pay
- **Reporting REDD+ results**
- Verification
- Carbon markets

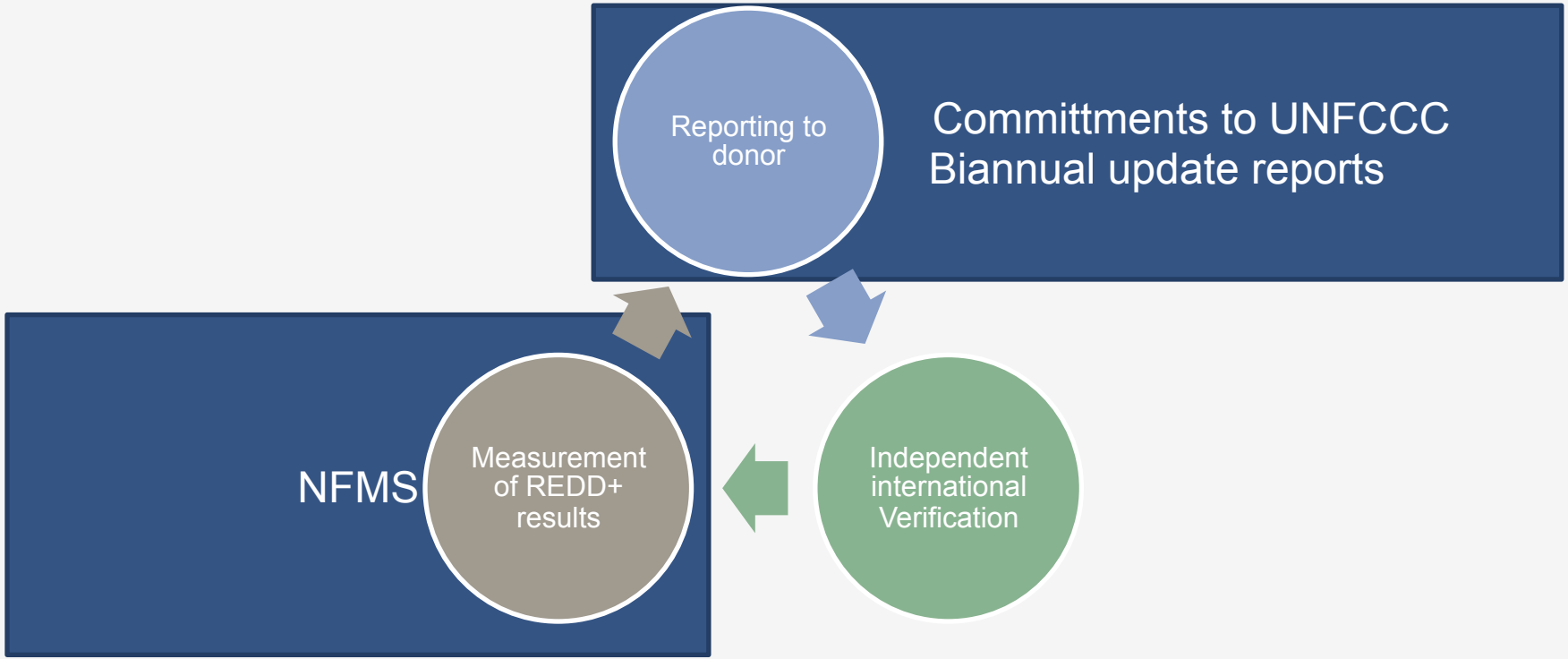
Is the UNFCCC sufficient?

- UNFCCC decisions on REDD+ form the framework
  - Flexibility for financial entities to include specific provisions
- Additional detailing and specification necessary
  - No guidance on level of ambition
  - Reference levels also sensitive topic
- Formalized in bilateral or multilateral agreements
  - Include specifications for MRV with consequences for remote sensing
- Reports delivered directly to donors
  - Consistent with national reports to the UNFCCC
  - Additional specifications

NICFI MRV policy

- Principles of transparency, accuracy, completeness, and consistency in monitoring, reporting and verification of REDD+.
- Learning-by-doing approach, incentives for improvements in MRV over time.
- MRV provisions in NICFI agreements will build on internationally acknowledged guidance from the IPCC, GOFC-GOLD, GFOI, the FCPF methodological framework and related sources of international guidance.
  - www.ipcc.ch www.gfoi.org www.gofcgold.wur.nl
- NICFI prioritizes rewarding reductions in emissions from gross deforestation over other performance indicators, such as forest restoration.
- Conservative accounting shall be applied; when completeness and accuracy are lacking, the risk of overestimation shall be lower than the risk of underestimation.

Cycles of reporting and verification in NICFI agreements



General reporting issues with MRV consequences

- Reporting cycles
  - Annual? Biennial? How to link change estimates to annual payments
- Coverage
  - Regional, jurisdictional, biome-level
  - Specific activities - deforestation, restoration
  - Other performance indicators - degradation proxies
- Level of detail
  - Completeness
  - Accuracy
  - Time period

General reporting issues with MRV consequences

- Transparency
  - Access to methods
  - Access to underlying data
  - Ability of external reviewers to reconstruct analysis
- Plans for NFMS and MRV improvement

General experiences with REDD+ MRV

- Beyond new activities (degradation, restoration) there is a:
- Need for reference data
- Need for improved estimation of accuracy, key uncertainties and bias
  - NICFI flexible in accepting high uncertainty and low accuracy
  - Scale of, and consequences of, accuracy, uncertainty and bias must be known

NFMS relevance beyond REDD+ reporting

- Goal to support systems that can also report on carbon
  - Carbon-exclusive systems are not sustainable
- Remote sensing highly relevant in partner countries beyond Measurement for MRV:
  - Early warning systems
  - Estimates of leakage
  - Land-use mapping and planning
  - Supply chain monitoring

Outline

- Making REDD+ operational: What to pay for and how much to pay
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- **Verification**
- Carbon markets

Why the need for Verification of REDD+ results?

- Independent, international verification gives confidence for public financing of REDD+ results
- Verification is not validation – verifiers walk a fine line
  - Are methods applied appropriately?
  - Are results free from omissions, errors and misrepresentations that could lead to material misstatements?
  - Are the results reconstructable?
  - Verifiers usually tasked to provide recommendations for future improvement
- Repetitive reporting and verification cycles provide vital resources of improvement

Verification of REDD+ results

- Parties to the UNFCCC have agreed to international verification
- Controversial topic for most countries
  - Insight into methods and data is a sensitive issue
- Annex 1 countries (industrialized countries) under Kyoto undergo verification
  - Paris Agreement does not differentiate between developing and developed countries
- UNFCCC International Consultation and Analysis (ICA) is not sufficient for donor needs
- Subject to tense negotiations in REDD+ agreements

Country examples of reporting and verification requirements

- Guyana's repetitive cycles of reporting and verification
  - 5 years of experience of annual reporting and verification – step wise improvement
  - http://www.forestry.gov.gy/
- National level agreement, and subnational REDD+ Early Movers agreement between Colombia, Germany, United Kingdom and Norway.
  - Agreement includes provisions for reporting and verification
  - https://www.regjeringen.no/en/topics/climate-and-environment/climate/climate-and-forest-initiative/kos-innsikt/colombia/
- World Bank FCPF Carbon Fund - Methodological Framework:
  - Multilaterally negotiated rules and requirements for MRV
  - Cutting edge: This is where REDD+ is operationalized
  - https://www.forestcarbonpartnership.org/carbon-fund-0

Outline

- Making REDD+ operational: What to pay for and how much to pay
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- **Carbon markets**

The role of carbon markets

- Can market mechanisms deliver on climate targets?
  - And have necessary integrity to contribute to 2 degree goal?
- Persistent expectation that markets must be part of the solution
  - Public funding unsustainable
- Market requirements more stringent than development-aid funded incentives
  - Permanence
  - Leakage
  - Traceability
  - Legal right to carbon credits
  - No double counting

Carbon markets and REDD+

- REDD+ is national, but project scale view is dominant in markets
  - Halting deforestation requires transformational change at large scale
  - Successful projects rarely impact underlying drivers of deforestation
  - "Islands of perfection in sea of deforestation"
- Attempts at scaling up certification – Verified Carbon Standard
- World Bank FCPF Carbon Fund developed to be able to cater to markets
  - National/jurisdictional scale required
  - Contract of purchase from REDD+ countries
  - Majority of participants retire purchases – no offsets

Potential future markets

- California Cap & Trade
  - Second economy-wide phase of 2006 law
  - Regulated entities can meet up to 8 % of obligations from offsets
  - Up to half from international credits
  - 2018-2020 expected implementation, ~150 million USD/yr
  - California is potentially first compliance market to accept REDD+ credits
  - Precedence on rules
  - Important signal effect
  - Decision expected in September

Potential future markets

- ICAO – International Civil Aviation Organization
  - Goal of carbon neutral growth by 2020
  - Expected continuous growth, over 1 Gigaton CO_2 by 2030
  - Improved aircraft technology, operations, fuels not sufficient
  - Bulk of emission reduction need likely to go to markets
  - Could be 400 million tons demand per year in 2020s
  - Potentially significant source of REDD+ finance
  - Not a sure thing
    - Coverage within ICAO uncertain
    - Consistency with Paris Agreement and goal of curtailing global emissions uncertain. Must contribute to increased ambition
    - Must follow REDD+ decisions (safeguards, MRV, double counting)
    - http://www.conservation.org/publications/Documents/CI_Linking-Flight-and-Forests-Briefing-Paper-Apr-2016.pdf

Objective of this session

- To learn of the current state of REDD+
  - REDD+ in terms of global development and climate change mitigation
- Awareness of tensions between GHG accounting vs. financial incentive mechanism and consequences for MRV – including remote sensing
- Insight into common reporting requirements
- Insight into common verification requirements
- Overview of potential carbon markets

Summary

- REDD+ not complete correction of market failure
- Operationalization of REDD+ leads to MRV demands above and beyond UNFCCC framework
  - For both reporting and verification
  - Requires wall-to-wall NFMS. Remote sensing of activity data and reference data
- REDD+ goal is to incentivize sustainable development
  - Financial incentive mechanism requires pragmatic and robust approach
  - NFMS and remote sensing part of broader country development
- Carbon markets part of the solution, but future uncertain
- MRV is key to safeguard environmental integrity of REDD+ and climate ambition

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National Aeronautics and Space Administration

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Thank You