Critical issues for building national REDD+ MRV capacities and the role of remote sensing

Martin Herold

GOFC-GOLD

Wageningen University

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Global Observations of Forest Cover and Land Dynamics

What is GOFC-GOLD?

- A technical panel of the UN Global Terrestrial Observing System (GTOS/FAO)

- A coordinated international effort:
  - to ensure a continuous program of space-based and field forest and land observations for global monitoring of terrestrial resources

- A network of participants implementing coordinated research, demonstration and operational projects

- A vision to share data, information and knowledge

- GOFC-GOLD operates through:
  - Executive committee, science and technical board
  - Implementation teams and 3 project office (CA, US, Germany?)
  - Dedicated working groups (REDD, GEO task, biomass)
  - 6 Regional networks (Central/West/East Africa, SE-Asia and Latin america)
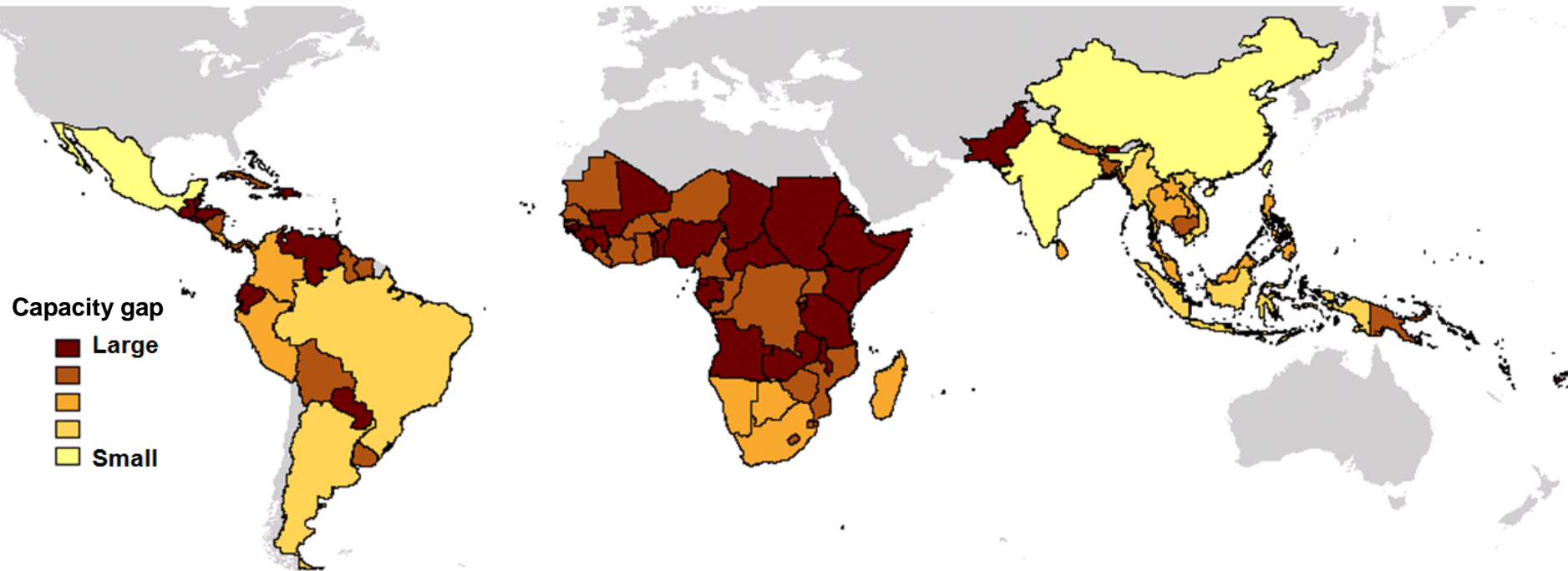
GOFC-GOLD REDD Sourcebook
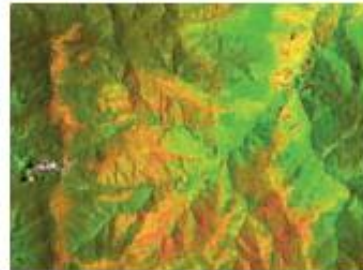
A sourcebook of methods and procedures for monitoring and reporting anthropogenic greenhouse gas emissions and removals caused by deforestation, gains and losses of carbon stocks in forests remaining forests, and forestation

http://www.gofc-gold.uni-jena.de/redd

Variability in capacities for REDD monitoring

Capacity gap
- Large
- (dark orange)
- (orange)
- (yellow)
- Small

Consideration of factors:
1. Requirements for monitoring forest carbon on national level (IPCC GPG)
2. Existing national capacities for national forest monitoring
3. Progress in national GHG inventory and engagement in REDD
4. REDD particular characteristics: importance of forest fires, soil carbon, deforestation rate etc.
5. Specific technical challenges (remote sensing): cloud cover, seasonality, topography, remote sensing data availability and access procedures

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Some key issues

- REDD+ participation requires a much higher priority given to MRV than national forest monitoring in the past

- The development of a national REDD+ MRV system follows a "roadmap":

  - to build sustained capacities based on international requirements and national needs to implement REDD policy

  - Addresses near-term priorities & long-term targets

- Without a clear linkage between MRV and policy from the beginning, results-based compensation for REDD+ actions will be ineffective

- Any MRV capacity development progress needs to improve national capacities

Needs for guidance, analyses and advice on national MRV

Need	Whose need	Key information provided by
International principles and guidance for measuring & reporting on carbon stock changes & emissions	Individual Parties	IPCC Good Practice Guidance for LULUCF and AFOLU (i.e. Penman, et al., 2003) UNFCCC/SBSTA decisions
Additional information on methods and procedures for MRV	Individual Parties	GOFC-GOLD Sourcebook (GOFC-GOLD, 2009)
Analysis of current national MRV capacities	Individual Parties; International community	Assessment of national forest monitoring capacities, Study supported by PRP/Norway
Analysis on costs of developing national MRV systems	Individual Parties International community	UNFCCC technical paper (UNFCCC, 2009)
Concepts for national REDD architectures (incl. link of policy and MRV)	Individual Parties	CIFOR book on national REDD architecture and policies (Angelsen, 2009)
Advice on how to develop national MRV system	Individual Parties	UN REDD program (framework, www.un-redd.org)

(adapted and edited after Dickson, 2009)

Issues to develop a REDD MRV system

- A matter of priorities

- Requirements for national MRV system:
  - International: principles and procedures specified by the IPCC Good Practice Guidelines
  - National: needs and priorities of the national REDD policy and implementation strategy;

- Bridging the capacity gap:
  - Assessment: of existing national forest monitoring technical capabilities versus the requirements for the MRV system;
  - Develop and implement a roadmap: to build sustained in-country capacities for MRV

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International requirements

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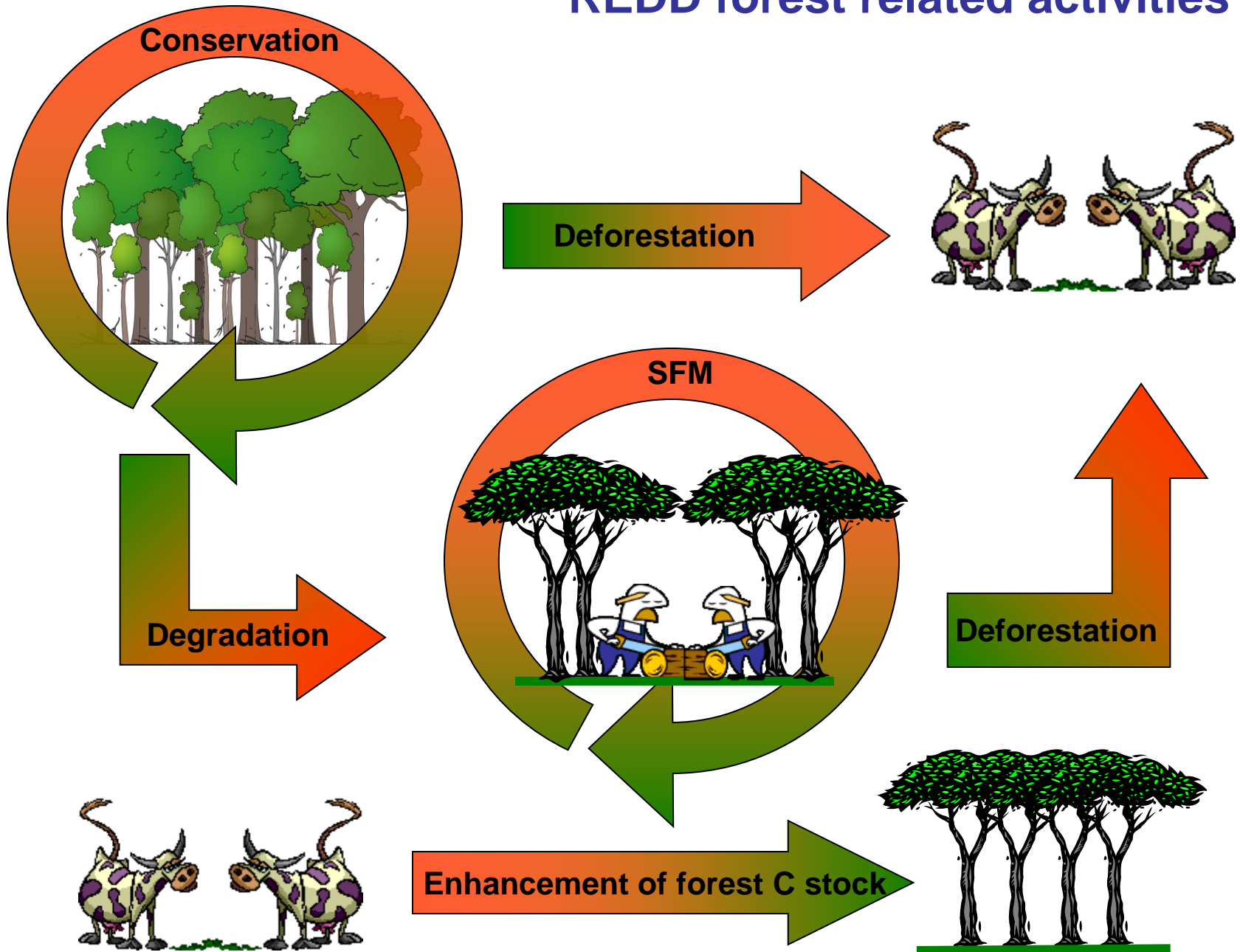GOFC-GOLD

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International requirements (IPCC GPG)

- Requires capacity for national estimation and reporting:
  - Activity data and carbon stocks

- Principles:
  - Consistency, transparency, completeness, comparability and accuracy

- Priorities and capacity building:
  - Key category analysis
  - Uncertainty analysis and improve system over time
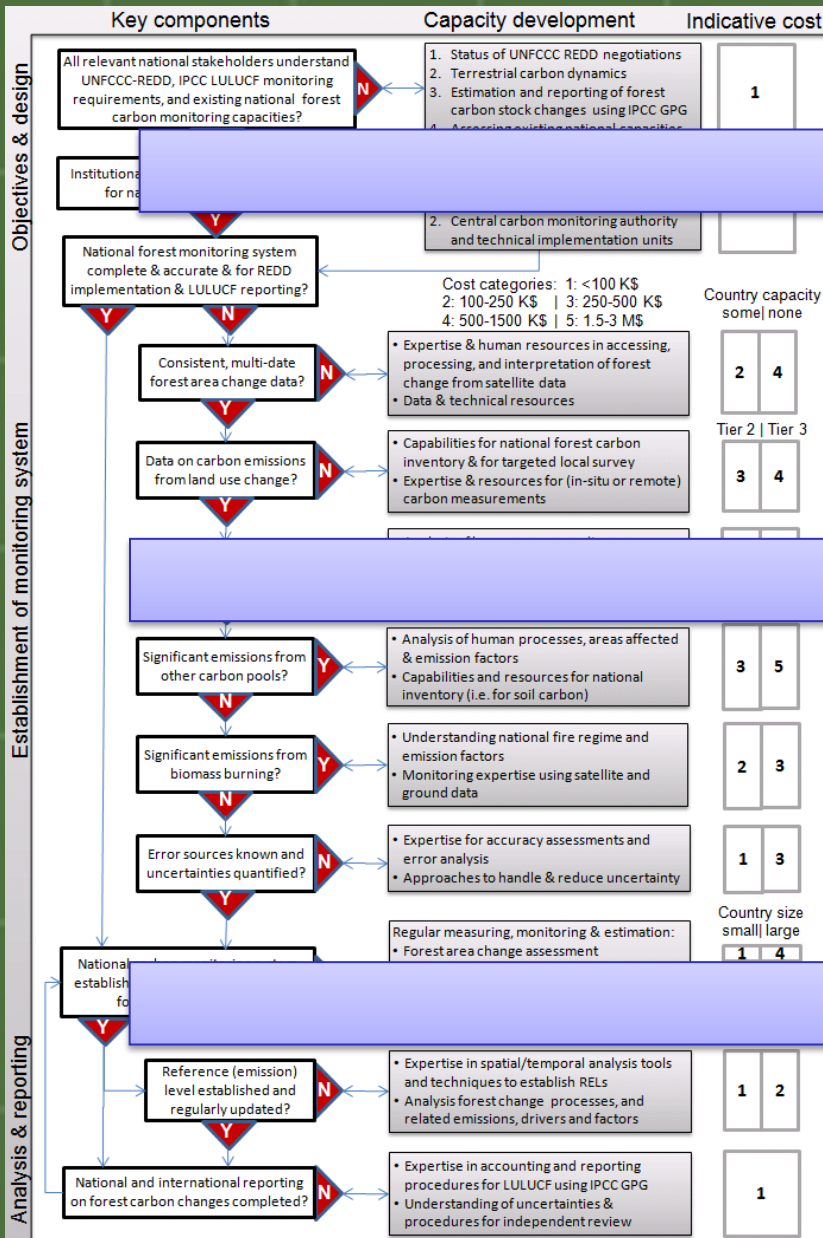
- Independent international review

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CONCEPTS

REDD forest related activities

Conservation

Deforestation

SFM

Degradation

Deforestation

Enhancement of forest C stock

Source: Danilo Mollicone

Process for establishing a national MRV system

UNFCCC technical paper on costs for REDD MRV

Planning & design

Establishment of monitoring system

Analysis & reporting

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Further MRV capacity building considerations

- **A key objective**: any MRV capacity development progress needs to establish sustained national capacities

- **National requirements**: a clear linkage between MRV and national policy

- **Systematic national monitoring**

- **Measurement of REDD action areas (sub-national)**: human impacts causing carbon emissions concentrated in specific areas

- **Capacity building**: along a roadmap addressing near-term priorities and long-term target

REDD monitoring, reporting & verification

Hypothetical Country

Forest land   **Non-Forest land**

Other Forests

Measure changes in forests remaining forest (displacement of emissions?) and impacts of non-spatially explicit policies

REDD-action Forests
(Reduced degradation, sustainable forest management and forest enhancement)

Deforestation   Reforestation

Measure deforestation and reforestation area and associated carbon stock changes

Measure carbon stock change and verify impact of REDD actions

Conservation forests (C)

Measure "no change" or permanence

CIFOR
CENTER FOR INTERNATIONAL FORESTRY RESEARCH

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Drivers and monitoring priorities (Fiji)

Processes that effect forest carbon stocks	Importance (carbon impact)	Current data	Suggested activity to fill data gap in the near term
Forest conversion for expansion of agriculture	Very high	Some data may be available with NLTB, Forestry & Ministry of Primary Industries, only tracked if commercially logged	1. Remote sensing based area / land use change assessment 2. Gather and evaluate existing national data 3. Conversion of existing inventory data into carbon
Conversion of forest for settlement	high	Some data with Lands Dept & no data for squatters	1. Remote sensing based area / land use change assessment 2. Gather and evaluate existing national data 3. Conversion of existing inventory data into carbon
Plantation clear-fell harvesting	high	Data available from forest companies, no government on tracking on when or where	1. Gather data on national level and evaluate data with remote sensing assessment 2. Conversion of existing harvest estimates into carbon
Selective logging of native forests remaining forest	medium	SFM: data at GTZ, FD Local use (no data) Commercial use - data from the Forestry Department (spatial data and harvest estimates)	1. Gather data on national level and evaluate data with remote sensing assessment 2. Conversion of existing harvest estimates into carbon 3. Study long-term effects
Accidental burning affecting forests	medium	Fiji Pine has fire data for their plantation (pine).	1. Gather data on national level and evaluate data with remote sensing assessment 2. Targeted ground surveys
Forest clear-fell for mining	medium	Mining companies should have data or mineral resources division	1. Gather data on national level and evaluate data with remote sensing assessment

Guyana REDD MRV development roadmap

	National strategy (2010/11) →	**Country readiness (2011/12) →**	**Implementation (post 2012/13)→**
Objectives	Gather and integrate information & fill data gaps for national REDD opportunities, scoping and policy development	Develop capacities, conduct historical monitoring, and implement a (minimum) IPCC Tier 2 national forest carbon monitoring, establish the reference level and report on interim performance	Establish consistent and continuous MRV supporting national REDD+ actions and international IPCC GPG-based reporting and verification
Key results and national capacities developed	1. Comprehensive MRV roadmap developed and national MRV steering body operational 2. Improved national capacities on LCDS, REDD, IPCC-LULUCF, and carbon dynamics 3. Framework and capacities to demonstrate REDD implementation and interim performance 4. All data available and accessible (including acquisition of new forest carbon data) on drivers and processes needed for developing a national REDD policy and interim implementation plan 5. Established communication and participation mechanism to involve relevant stakeholders nationally and internationally 6. Approaches for setting reference levels, linking MRV and policy, and MRV co-benefits and synergies are explored and defined	1. Capacities in place for consistent and continuous acquisition and analysis of key data for Tier 2 nationally and Tier 3 for demonstration/activity sites including international reporting using IPCC LULUCF; uncertainty assessment MRV improvement plan developed 2. Reference level established based on historical data, and future developments using internationally accepted methods 3. All data available and accessible for an updated national REDD implementation plan 4. Regular reporting on REDD demonstrations and interim performance 5. Continued engagement with key national stakeholders for REDD implementation and assuring long-term sustainability of MRV capacities (i.e. universities) 6. Monitoring system explored to cover key variables for other ecosystem services	1. IPCC key category analysis and assessment for Tier 3 approaches completed and implemented (if desired) 2. Independent international review of full MRV system completed 3. Capacity in place and implementation to deliver verification and compliance assessment for REDD results-based compensation 4. National data infrastructure of forest greenhouse gas inventory and assessment in place for regular reporting 5. Implementation plan to use new and proven technologies to reduce uncertainties and increase efficiency of MRV system 6. Framework developed that links REDD into LCDS monitoring, reporting and verification system

Role and issues for remote sensing

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www.fao.org/gtos/gofc-gold
*www.gofc-gold.uni-jena.de*

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Role of remote sensing

- Use of remote sensing essential for many developing countries to derive activity data
  - Compare historical and future deforestation rates
- Experiences in Annex 1 and India, Brazil, Mexico
- Take advantage of potentials but understand limitations and cost implications:
  - Operational applications today
  - Role of evolving technologies and need for research and development
  - Understand and communicate the limitations and challenges

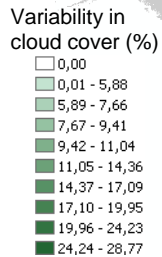**GOFC-GOLD**

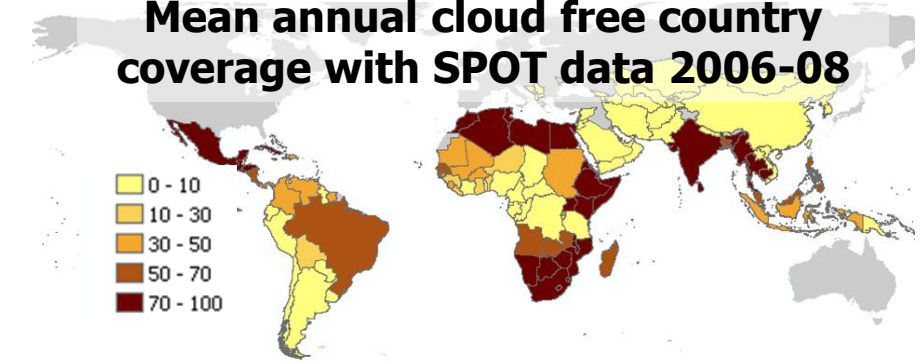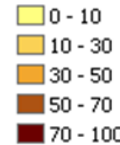# Some technical challenges for remote sensing

Mean annual cloud cover
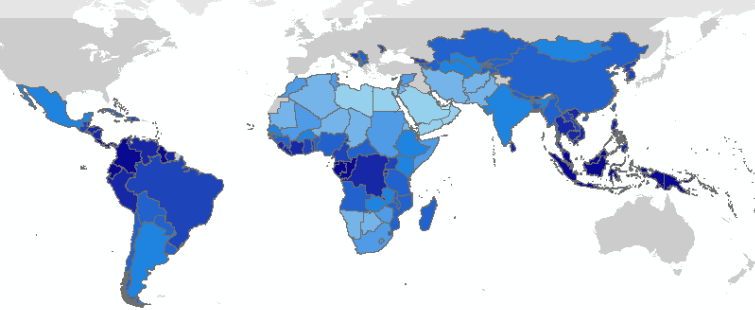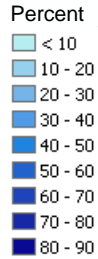
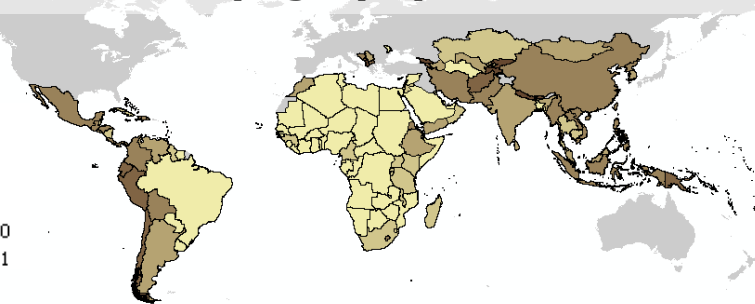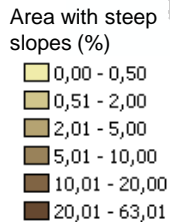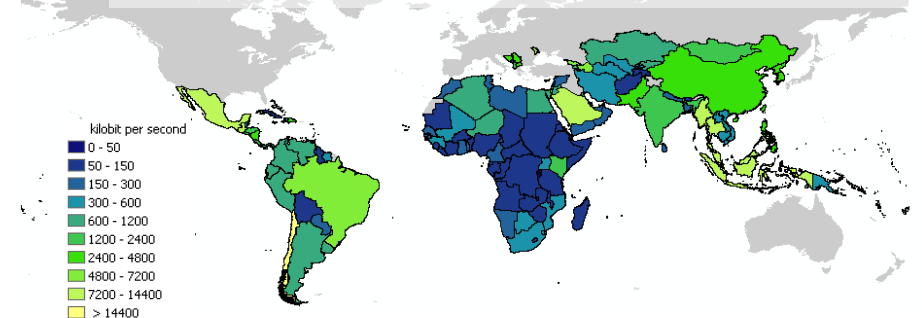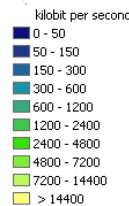**Country coverage of Landsat 5 receiving stations**
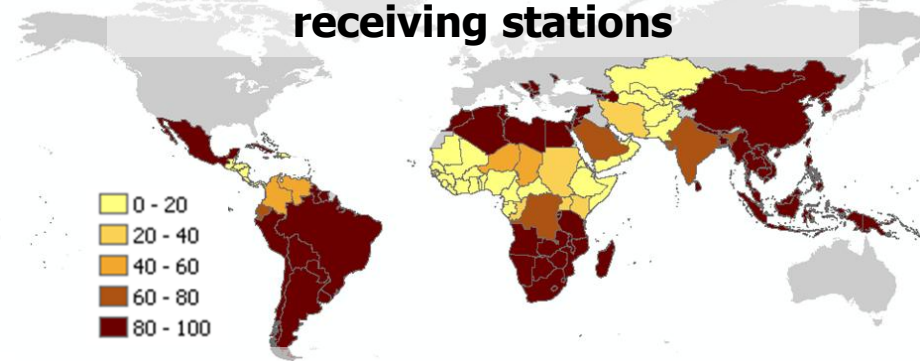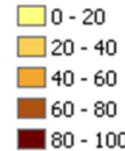
Seasonality

Mean annual cloud free country coverage with SPOT data 2006-08

Topography

Average internet download speed

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Current availability of fine-scale satellite data sources and capacities for global land change observations

	Satellite observation system/program	Technical observation challenges solved	Access to information on quality of archived data worldwide	Continuous observation program for global coverage	Pre-processed global image datasets generated & accessible	Image data available in mapping agencies for land change analysis	Capacities to sustainably produce/use map products in developing countries
O P T I C A L	**LANDSAT TM/ETM**						
	ASTER				On demand		
	SPOT HRV (1-5)				Commercially		
	CBERS 1-3				Regionally		
	IRS / Indian program				Regionally		
	DMC program			Probably	Commercially		
S A R	**ALOS/PALSAR + JERS**				Regionally		
	ENVISAT ASAR, ERS 1/2				Regionally		
	TERRARSAR-X				Commercially		
HR	**IKONOS, GEOEye**			Probably	Potentially		
	ICESAT/GLAS (LIDAR)						

Increase usefulness through demonstration

(Note: dark gray=common or fully applicable, light gray=partially applicable/several examples, white=rare or no applications or examples)
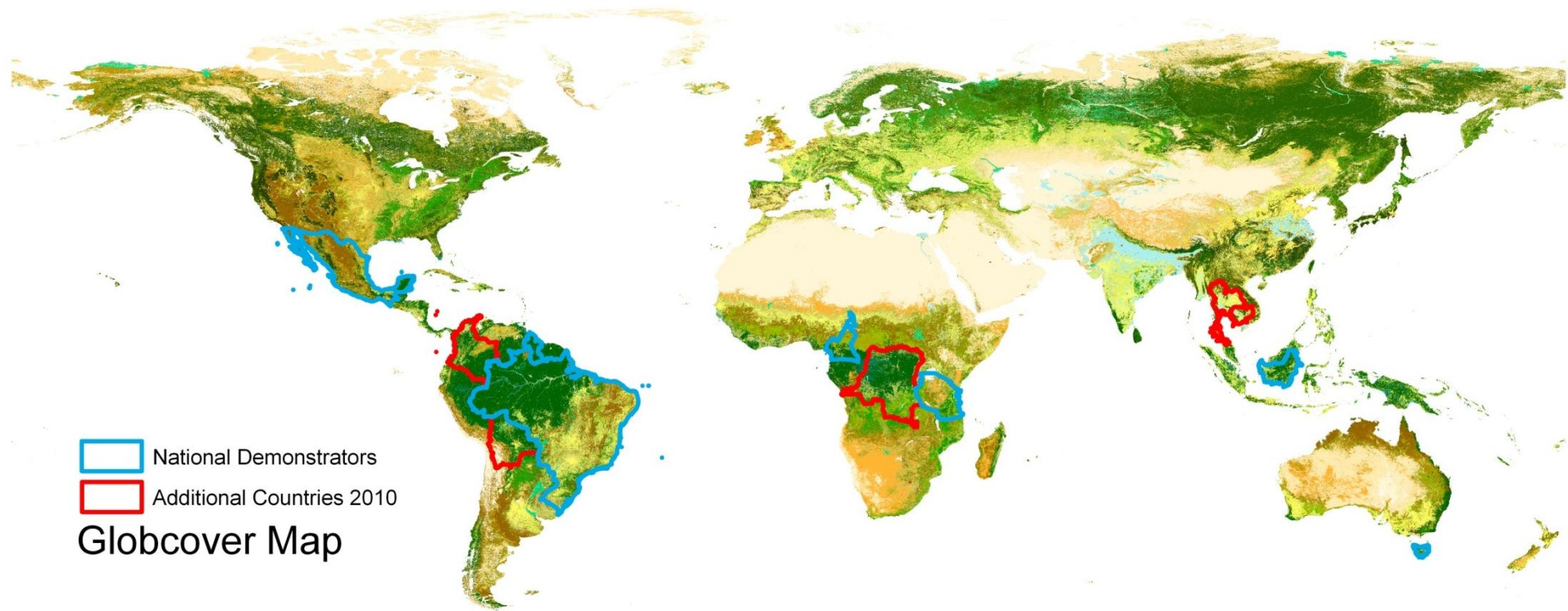
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GEO forest carbon tracking task demonstrator countries & sites

National Demonstrators
Additional Countries 2010
Globcover Map

Costs for remote sensing

The implementation of a satellite-based monitoring system includes a number of cost factors:

- Satellite data including data access and processing;

- Software, hardware and office resources, including satellite data archive;

- Human resources for data interpretation and analysis;

- Monitoring in readiness phase;

- Operational monitoring;

- Accuracy assessment;

- Regional cooperation for capacity building and technical assistance.

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Potentials for regional cooperation

Regional capacity	Opportunity for reducing costs & efforts
Centralized access and pre-processing of key remote sensing datasets for national analysis and estimation of forest area change	Reduce cost for data access and pre-processing, while interpretation may still be done within country
Establish regional remote sensing data interpretation facility	Reduce costs for technical/office resources and human resources
Regional processing and analysis of coarse resolution satellite data for near real-time detection of forest fires and deforestation	Increase availability of and reduce costs on useful data and observations
Focal point for technical capacity-building for forest monitoring in the region	Reduce costs for continuous training, technical support, and foster South-South cooperation
Support for verification and independent accuracy assessments	Standard procedures for transparent and independent verification of results
Standardization of methodologies for LULUCF estimation and reporting	Inter-regional exchange of results and experiences, and integration with carbon crediting / reducing transaction costs

1. **Existing regional networks and activities (FAO, GOFC-GOLD etc.)**
2. **Foster South-South cooperation**

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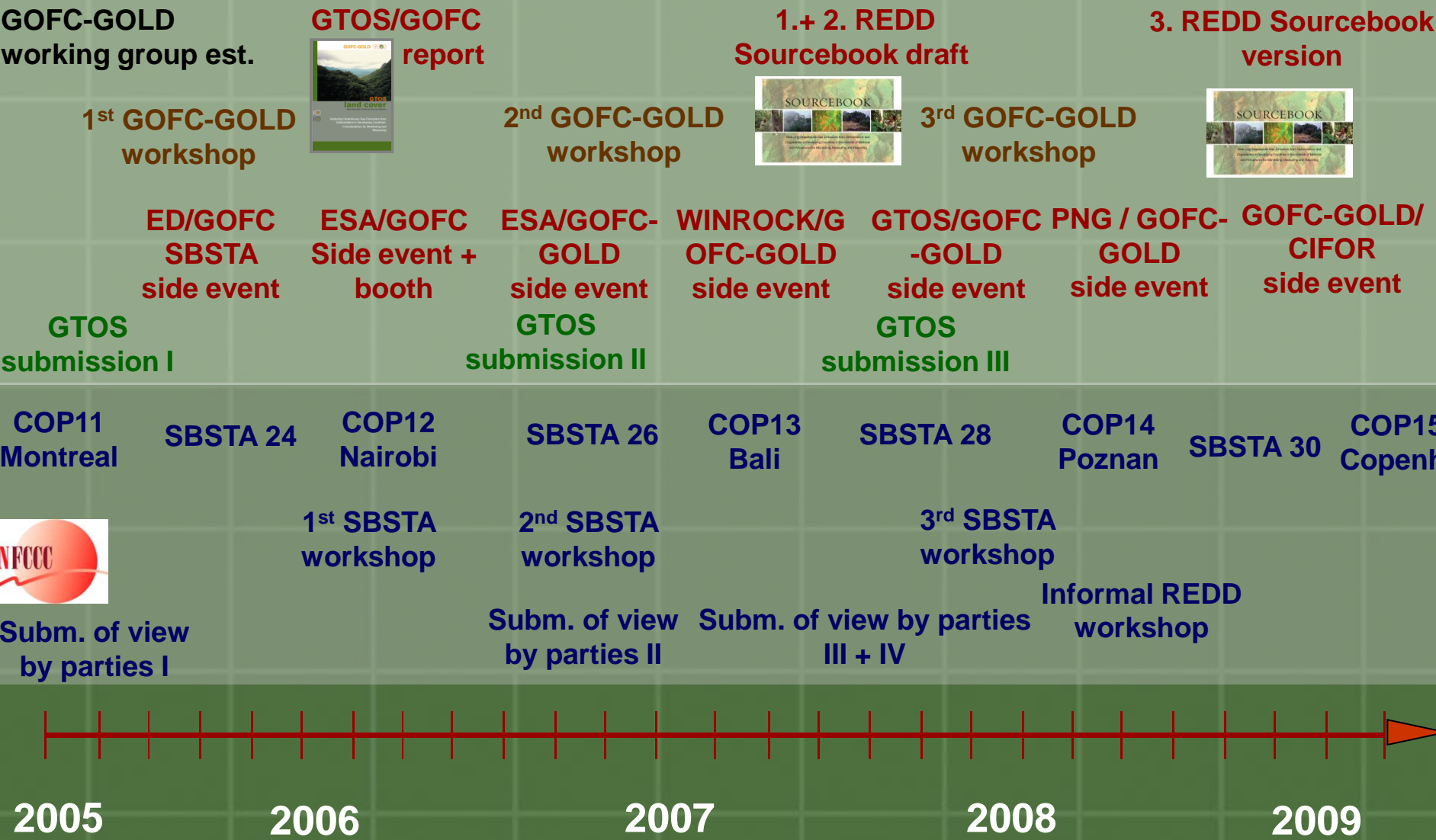
GOFC-GOLD REDD Sourcebook

SOURCEBOOK
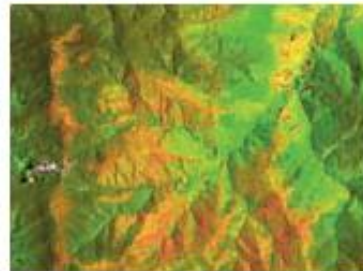
A sourcebook of methods and procedures for monitoring and reporting anthropogenic greenhouse gas emissions and removals caused by deforestation, gains and losses of carbon stocks in forests remaining forests, and forestation

http://www.gofc-gold.uni-jena.de/redd

Earth observation contribution to UNFCCC-REDD

GOFC-GOLD
working group est.

GTOS/GOFC
report

1.+ 2. REDD
Sourcebook draft

3. REDD Sourcebook
version

1st GOFC-GOLD
workshop

2nd GOFC-GOLD
workshop

3rd GOFC-GOLD
workshop

ED/GOFC
SBSTA
side event

ESA/GOFC
Side event +
booth

ESA/GOFC-
GOLD
side event

WINROCK/G
OFC-GOLD
side event

GTOS/GOFC
-GOLD
side event

PNG / GOFC-
GOLD
side event

GOFC-GOLD/
CIFOR
side event

GTOS
submission I

GTOS
submission II

GTOS
submission III

COP11
Montreal

SBSTA 24

COP12
Nairobi

SBSTA 26

COP13
Bali

SBSTA 28

COP14
Poznan

SBSTA 30

COP15
Copenh.

1st SBSTA
workshop

2nd SBSTA
workshop

3rd SBSTA
workshop

Informal REDD
workshop

Subm. of view
by parties I

Subm. of view
by parties II

Subm. of view by parties
III + IV

UNFCCC

2005   **2006**   **2007**   **2008**   **2009**

A community effort

Core author team

- Frédéric Achard, Sandra Brown, Ruth De Fries, Giacomo Grassi, Martin Herold, Danilo Mollicone, Devendra Pandey, Carlos Souza Jr.,

Contributors:

- Olivier Arino, Gregory P. Asner, Luigi Boschetti, Barbara Braatz, Michael Brady, Emilio Chiuvieco, Ivan Csiszar, Michael Falkowski, Sandro Federici, Scott Goetz, Nancy Harris, Yasumasa Hirata, Hans Joosten, Chris Justice, Josef Kellndorfer, Stephen Kull, Werner Kurz, Eric Lambin, Suvi Monni, Erik Næsset, Ross Nelson, Marc Paganini, Tim Pearson, David Shoch, Florian Siegert, Margaret Skutsch, Allan Spessa, Patrick Van Laake, Michael Wulder

Registered users : 830 (voluntary)

Coarse outline (200 pages)

Japanese translation of REDD Sourcebook

A SOURCEBOOK OF METHODS AND
PROCEDURES FOR MONITORING AND
REPORTING ANTHROPOGENIC GREENHOUSE
GAS EMISSIONS AND REMOVALS CAUSED BY
DEFORESTATION, GAINS AND LOSSES OF
CARBON STOCKS IN FORESTS REMAINING
FORESTS, AND FORESTATION

Background and Rationale for the Sourcebook

This sourcebook provides a consensus perspective from the global community of earth observation and carbon experts on methodological issues relating to quantifying the greenhouse gas (GHG) impacts of implementing activities to reduce emissions from deforestation and degradation in developing countries (REDD). While international policies and mechanisms for implementing REDD are still under discussion within the UN Framework Convention on Climate Change (UNFCCC), it is emphasized that not only reduced emissions from deforestation and degradation, but also forest conservation, sustainable forest management and enhancement of forest carbon stocks are to be included in the agreement which will be discussed during the Conference of the Parties of the UNFCCC in Copenhagen in December 2009. The UNFCCC negotiations and related country submissions on REDD have advocated that methodologies and tools become available for estimating emissions and removals from deforestation and forest land with an acceptable level of certainty. Based on the current status of negotiations and UNFCCC approved methodologies, the Sourcebook aims to provide additional explanation, clarification, and methodologies to support REDD early actions and readiness mechanisms for building national REDD monitoring systems. It compliments the Intergovernmental Panel on Climate Change (IPCC) good practice guidelines for Land Use, Land-Use Change and Forestry (LULUCF). The book emphasizes the role of satellite remote sensing as an important tool for monitoring changes in forest cover, provides guidance on how to obtain credible estimates of forest carbon stocks, and provides clarification on the IPCC Guidelines for estimating and reporting emissions and removals of carbon from changes in forest carbon stocks at the national level.

森林減少、森林劣化による炭素収支、および植林によりひきおこされる、人為起源の温室効果ガスの排出と吸収のモニタリングと報告のための手法と手順についてのソースブック

ソースブックの背景と論拠

　本書は、発展途上国における森林減少・森林劣化からの排出の削減（REDD）のために実施されている活動の温室効果ガス（GHG）のインパクトの定量化に関連する方法論的課題について地球観測と炭素の専門家のグローバル・コミュニティーからの一致した展望を提供する。REDDを履行するための国際的な政策とメカニズムが今なお国連気候変動枠組条約（UNFCCC）で議論されている一方、2009年12月のコペンハーゲンにおけるUNFCCC締約国会議の期間中に議論される政治的合意に、森林減少および森林劣化の排出削減のみならず、森林保全、持続的森林経営、炭素蓄積の増進も含まれることになっていることを強調しておく。REDDについてのUNFCCCの交渉と関連の各国からの意見提出において、方法論と手段が許容可能な確実性のレベルで森林減少と林地からの排出と吸収の推定のために利用可能になっていることが示されてきている。現時点における交渉とUNFCCCで認められている方法論に基づき、本書はREDDの早期活動と国家REDDモニタリングシステムを構築するための迅速なメカニズムを援助するための追加的な解説、解釈、方法論を提供することを目的とする。本書は気候変動に関する政府間パネル（IPCC）の土地利用、土地利用変化と林業（LULUCF）のための良好な実践ガイドライン（グッドプラクティスガイドライン）を補足している。本書はリモートセンシングの役割を森林被覆変化のモニタリングための重要な手段として強調し、信頼しうる炭素蓄積の推定値をいかにして得るかについてのガイダンスを提供し、また、国家レベルでの森林炭素蓄積における変化から炭素の排出と吸収を推定し報告するためのIPCCガイドラインの解釈を提供する。

- Member
  - Yasumasa HIRATA, Tomoaki TAKAHASHI, Naoko FUJITA, Shin-ya TANAKA, and Toshiya MATSUURA (Forestry and Forest Products Research Institute (FFPRI))

- On going from Jan 2010.

Remarks for REDD+ NRV

1. Guidance for monitoring and implementation provided under the UNFCCC;

2. Monitoring should be part of national REDD+ policy and implementation strategy and objectives;

3. Knowledge in the use and application the methods of IPCC LULUCF good practice guidelines;

4. Use existing and improve national forest monitoring capabilities along a roadmap;

5. The consideration of different capabilities for monitoring forest changes in the historical and for the future

6. Important role of remote sensing

Web resources

- **GOFC-GOLD:**
  - http://www.fao.org/gtos/gofc-gold/
- **GOFC-GOLD land cover project office:**
  - http://www.gofc-gold.uni-jena.de/
- **GOFC-GOLD REDD sourcebook:**
  - http://www.gofc-gold.uni-jena.de/redd
- **UNFCCC/SBSTA technical paper on costs of monitoring for REDD**
  - http://unfccc.int/resource/docs/2009/tp/01.pdf

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