Concept of National Forest Monitoring Systems (NFMS)

in the context of REDD+ and national requirements

2nd Workshop on National Forest Monitoring System in Cambodia

08 October, 2015

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Presentation Outline

- United Nations Forum Convention on Climate Change (UNFCCC) Methodological Guidance for REDD+
- Measurement Reporting and Verification (MRV):
  - Measurement: Activity Data
  - Measurement: Emission Factors
  - Reporting
  - Verification
- Forest Monitoring

Presentation Objectives

By the end of this module, you should be able to:

- Identify the main UNFCCC decisions relating to national forest monitoring systems and MRV
- Identify the components of a national forest monitoring system
- Understand the key principles of guidance and guidelines for measurement, reporting and verification (MRV) for REDD+
- Understand the objectives and tools for forest monitoring

National Forest Monitoring Systems

UNFCCC methodological guidance for REDD+

(1992) Text of the Convention

Article 4: Commitments:

1. *All Parties, taking into account their common but differentiated responsibilities and their specific national and regional development priorities, objectives and circumstances, shall:*

a) Develop, periodically update, publish and make available to the Conference of the Parties, in accordance with Article 12, ***national inventories of anthropogenic emissions by sources and removals by sinks of all greenhouse gases*** *not controlled by the Montreal Protocol, using comparable methodologies to be agreed upon by the Conference of the Parties*

b) Formulate programmes to mitigate climate change by addressing anthropogenic emissions by sources and removals by sinks of GHG gases … and measures to facilitate adaptation to climate change

(2007) The Bali Action Plan

Decision 1/CP.13: 1 (b) Enhanced national/international action on mitigation of climate change, including consideration of:

- *Nationally appropriate mitigation actions by developing country Parties in the context of sustainable development, supported and enabled by technology, financing and capacity-building, in a measurable, reportable and verifiable manner*

The Bali Action Plan encourages all countries to reduce their GHG emissions, according to national circumstances, in a way that is:

- **Measurable** – i.e. one can make estimates of emissions reductions / sink enhancements
- **Reportable** – i.e. one can make an inventory and report emissions in a way that is transparent, accurate and complete
- **Verifiable** – i.e. one can make an inventory of emissions available for review

(2007) The Bali Action Plan

Decision 2/CP.13: **Reducing emissions from deforestation in developing countries:** approaches to stimulate action

2. Encourages all Parties, in a position to do so, to support capacity-building, provide technical assistance, facilitate the transfer of technology to improve, inter alia, data collection, ***estimation of emissions from deforestation and forest degradation, monitoring and reporting****, and address the institutional needs of developing countries to estimate and reduce emissions from deforestation and forest degradation*

6. ***Encourages the use of the most recent [IPCC] reporting guidelines as a basis for reporting greenhouse gas emissions from deforestation****, noting also that Parties not included in Annex I to the Convention are encouraged to apply the [2003] Good Practice Guidance for Land Use, Land-Use Change and Forestry*

Annex: Indicative guidance for demonstration activities:

2. Estimates of reductions or increases of emissions should be ***results based, demonstrable, transparent and verifiable, and estimated consistently over time***

(2009) The Cancun Agreements Decision 1/CP.16

Elements requested to be developed":

"….requested developing country Parties aiming to undertake the REDD+ activities, in the context of the provision of adequate and predictable support, including financial resources and technical and technological support, in accordance with national circumstances and respective capabilities, to develop:

1. *A national strategy or action plan*
2. *Forest reference emission level and/or forest reference level*
3. ***A robust and transparent national forest monitoring system for the monitoring and reporting of REDD+ activities***
4. *A system for providing information on how the safeguards are being addressed and respected"*

(2010) The Copenhagen Accords Decision 4/CP.15

- *"To establish, according to national circumstances and capabilities, robust and transparent **national forest monitoring systems** and, if appropriate, sub-national systems as part of national monitoring systems that*:

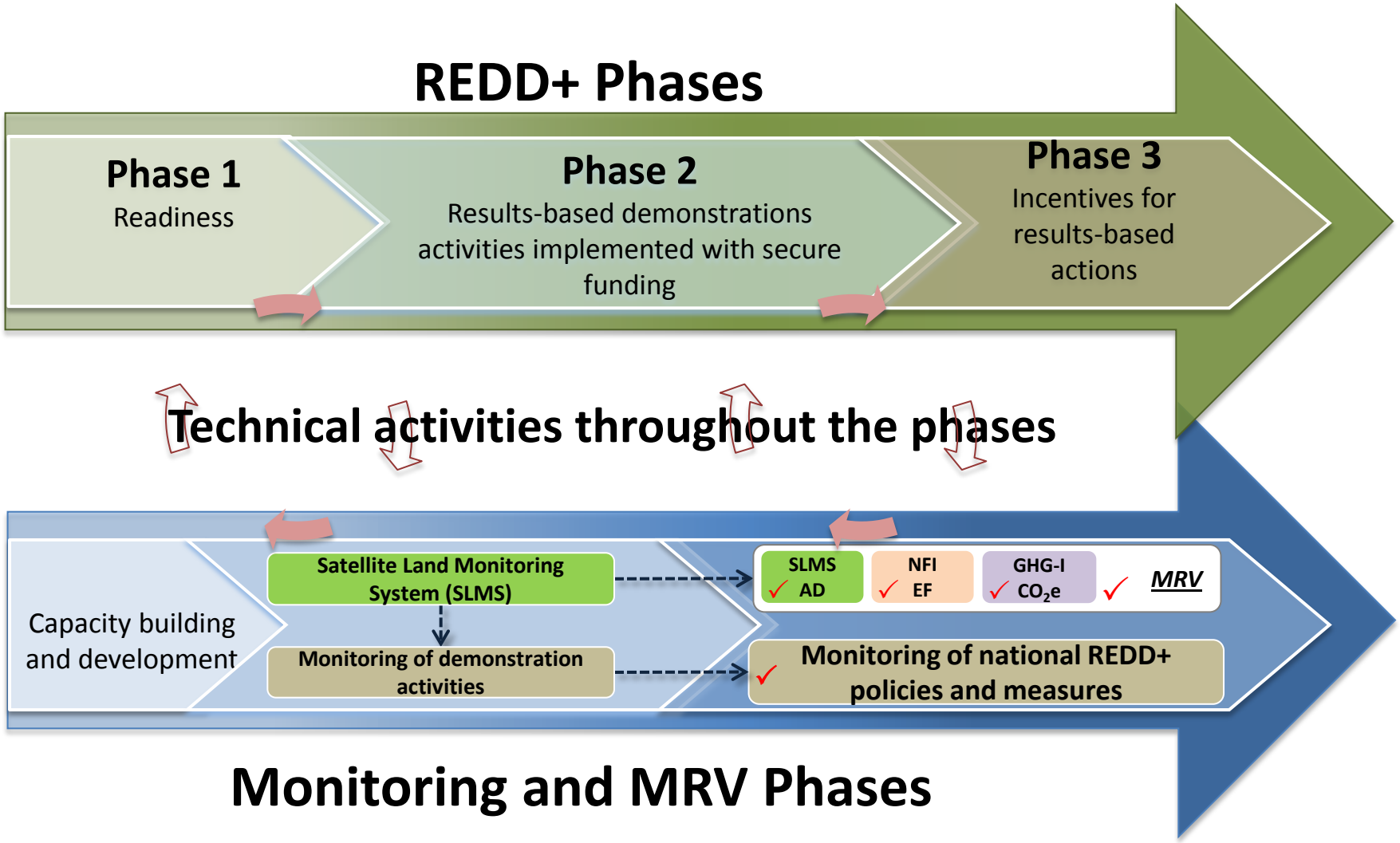
  1. Use a **combination** of **remote sensing** and **ground-based forest carbon inventory** approaches for estimating, as appropriate, anthropogenic forest-related greenhouse gas emissions by sources and removals by sinks, forest carbon stocks and forest area changes;
  2. Provide estimates that **are transparent, consistent**, as far as possible **accurate**, and that **reduce uncertainties, taking into account national capabilities and capacities**; (**i.e. follow IPCC guidance – so that results from different countries can be compared**)
  3. Are **transparent** and their **results are available** and suitable **for review** as agreed by the Conference of the Parties;"

(2013) The Warsaw REDD+ framework 11/CP.19

- **National forest monitoring systems (NFMS)** should be guided by the most recent Intergovernmental Panel on Climate Change **(IPCC) guidance and guidelines**, as appropriate, as a basis for estimating anthropogenic forest-related greenhouse gas emissions by sources, and removals by sinks, forest carbon stocks, and forest carbon stock and forest-area changes;

  - The data and information estimation should be provided through the **biennial update reports (BURs)** with some flexibility to the least developed countries and small island developing States;
  - The NFMS should **build on existing systems**, as appropriate
  - Enable the **assessment of different types of forest** in the country
  - Allow for improvement, reflecting when possible the **phased approach** of REDD+

Phased approach of REDD+



National Forest Monitoring Systems

Measurement, Reporting & Verification, and Monitoring

National Forest Monitoring system (NFMS)

NFMS has **two functions**:

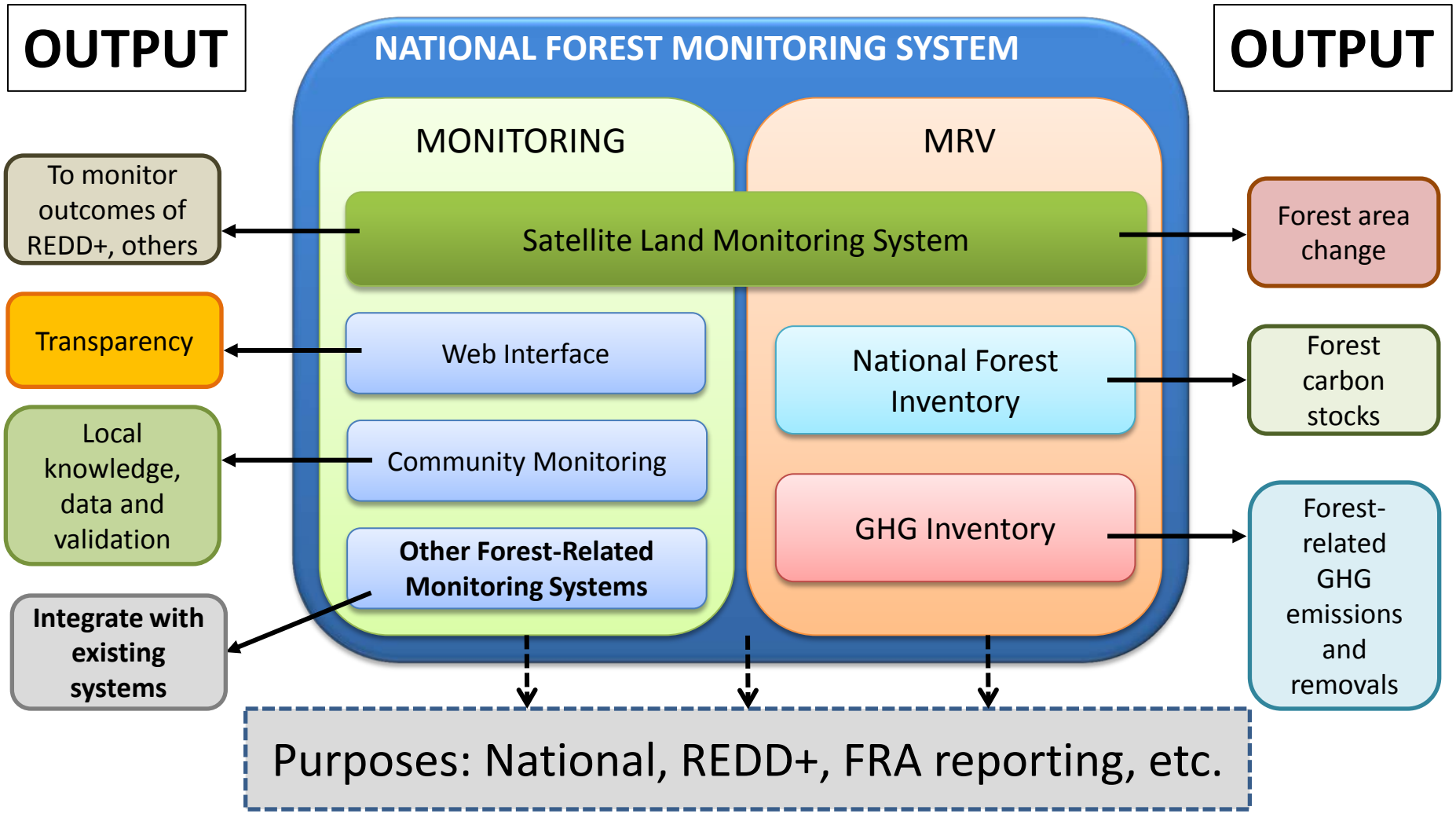
I. **Monitoring** (M) of Policies and Measures

II. **Measurement, Reporting and Verification** (MRV) of emissions & removals

NFMS will be developed in a stepwise approach:

- Develop the NFMS in a stepwise approach through 3 Phases of REDD+ (1. Readiness, 2. Result-based demonstration, 3. Result-based actions)
- Fully operational in Phase 3, to allow for positive incentives under an international mechanism

Two functions of a National Forest Monitoring System



I. **Monitoring** function of NFMS

- In practice the monitoring function of NFMS can be defined only broadly. Its components will vary depending on national circumstances. Therefore primarily a tool to allow countries **to assess and refine Policies and Measures**
  - implementation and performance
  - Indicators to track implementation of a specific policy or measure – proxy indicators for forest carbon e.g volume of timber harvested through an SFM measure, as a proxy for impact on carbon
- Using existing tools where possible (e.g. network of forestry officers) and new tools where necessary (e.g. satellite remote sensing system, web platform)
  - Need to Harmonize existing tools with new tools and with newly required capacities for MRV

II. **MRV** function of NFMS

Objectives:

- To **Measure** the emissions coming from forests and land use change as outcomes of REDD+ activities
- To **Report** these emissions to the UNFCCC following the most recent methodological guidance of the Intergovernmental Panel on Climate Change (IPCC)
- To **Verify** the results by making the emissions inventory available for review by the UNFCCC

The reporting and verification of results will be through **National Communications (NCs)** and **Biennial Update Reports (BURs)** which cover also other sectors.

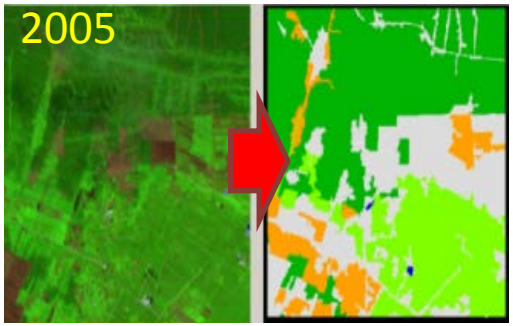
II. **MRV** function of NFMS

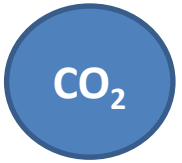
In practice, the MRV function will consist of three (3) main components also called 'pillars':

1. **The satellite land monitoring system (SLMS)**
   To collect Activity Data (AD)
2. **The national forest inventory (NFI)**
   To gather information for obtain emission factors (EFs)
3. **The national GHG inventory (GHG-I)**
   To provide emissions & removals estimates for national report

Data coming from the first (AD) and second pillar (EFs) will be used to provide timely estimates of emissions and removal from the AFULO and/or Forest sub-sector

II. **MRV** function of NFMS





	FL Wet evergreen	FL Moist evergreen	FL Moist semi-deciduous	FL South-east subtype	FL North-west subtype	FL North-west subtype	FL Dry semi-deciduous	Agricultural land	Savanna	Shrub Ticket	Settlements	Wetlands	Other land	Unclassified	Final Area
FL Wet evergreen	51														51
FL Moist evergreen		42													42
FL Moist semi-deciduous			60												60
FL South-east subtype				52											52
FL North-west subtype					12										12
FL North-west subtype						2									2
FL Dry semi-deciduous							25		2						27
Agricultural land	5	2				2	3	1							13
Savanna			1			3	1		20						25
Shrub Ticket					1					12					13
Settlements						1		10			25				36
Wetland								0				2			2
Other land								5					25		30
Unclassified								9						10	19
Initial Area	56	44	61	52	13	8	29	25	22	12	25	17	25	10	
Net change (Δ = T0-T1)	-5	-2	-1	0	-1	-6	-2	-12	3	1	11	-15	5	9	0

Area change data from satellite remote sensing

Forest carbon stock data from a national forest inventory

Inventory of greenhouse gas **emissions/removals** from the forest sector/AFOLU

ACTIVITY DATA

EMISSION FACTOR

EMISSIONS ESTIMATE

National Forest Monitoring Systems

MRV: activity data

Activity Data: Assessment of Change

Countries should characterize and account for all relevant land areas in a country consistently and as transparently as possible. Data should reflect the historical trends in land-use area and land use change

IPCC Guidance suggests three Approaches:

- **Approach 1**: Basic land-use data (land-use types in time 1 & land-use types in time 2)
- **Approach 2:** Survey of land-use and land-use change (changes from & to a category)
- **Approach 3:** Geographically explicit land-use data (known locations of changes between categories)

In most developing countries the only way to represent land in a consistent and transparent way with a historical time frame of 10+ years is the **use of satellite remote sensing data, which allows the adoption of Approach 3**

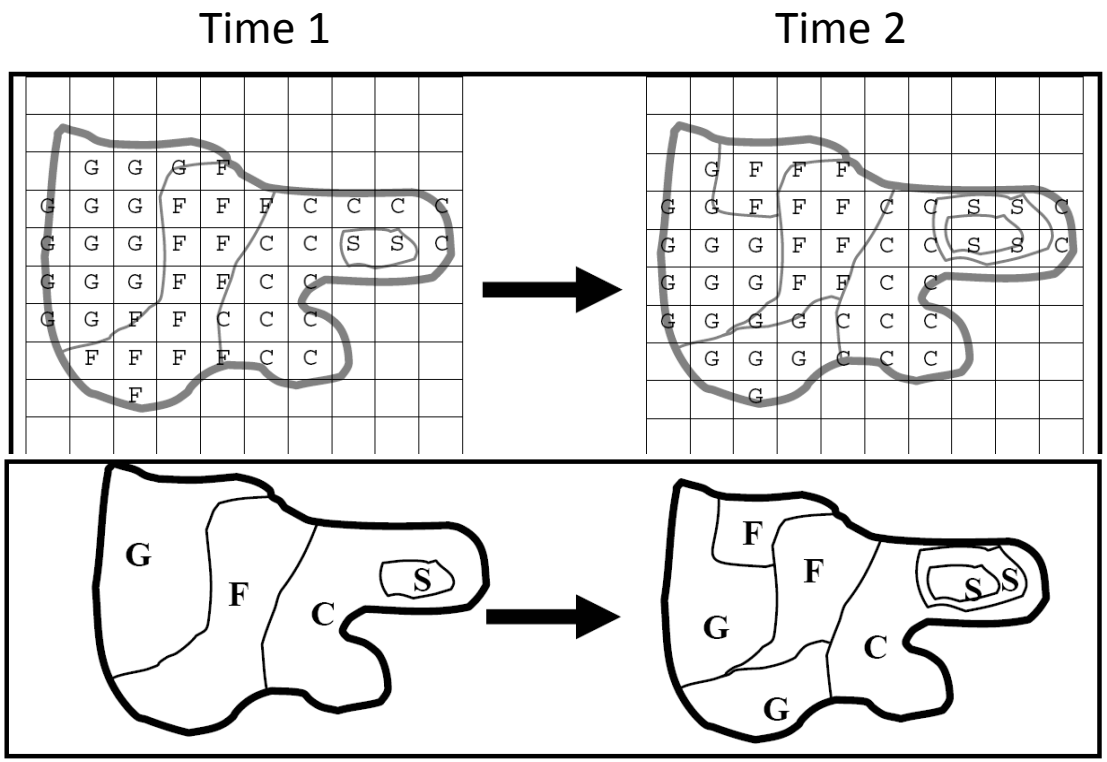
Activity Data: Assessment of Change

Approach 3: Geographically Explicit land-use Data

Requires **spatially explicit observations of land-use and land-use change**.

The data may be obtained either by 1) sampling of geographically located points, 2)a complete tally (wall-to-wall mapping), or 3) a combination of the two

Is comprehensive and conceptually relatively simple but data intensive to implement



Key Concepts: Land Representation

Systems for land **representation should be**:

Adequate: capable of representing land-use categories, and conversions between land-use categories, as needed to estimate carbon stock changes and greenhouse gas emissions and removals

Consistent: capable of representing land-use categories consistently over time, without being unduly affected by artificial discontinuities in time-series data

Complete: that all land within a country should be included, with increases in some areas balanced by decreases in others, recognizing the bio-physical stratification of land if needed

Transparent: data sources, definitions, methodologies and assumptions should be clearly described

Key Concepts: Land Representation

UNFCCC defines **six broad land-use categories**:

Forest land, Grassland, Cropland, Wetland, Settlement, Other land

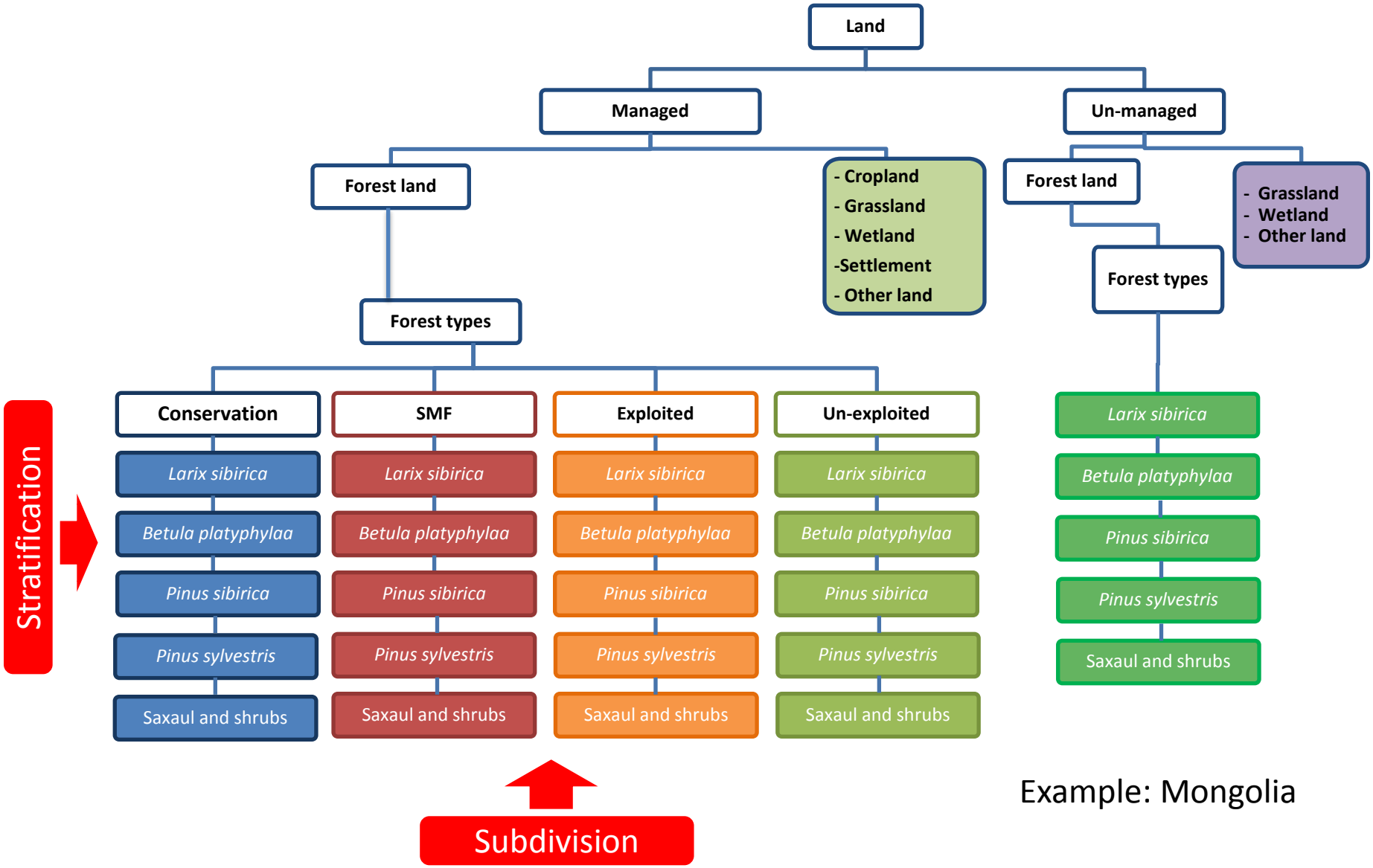
Each land-use category is **further disaggregated to reflect the past and the current land-use**, for example under forest land you report the sub-categories:

- Forest land remaining forest land
- Lands converted to another type of land-use

Land-use categories and sub-categories may be **further sub-divided** according to land-use practices or biophysical characteristics of the land. For example forest land sub-divided by forest type:

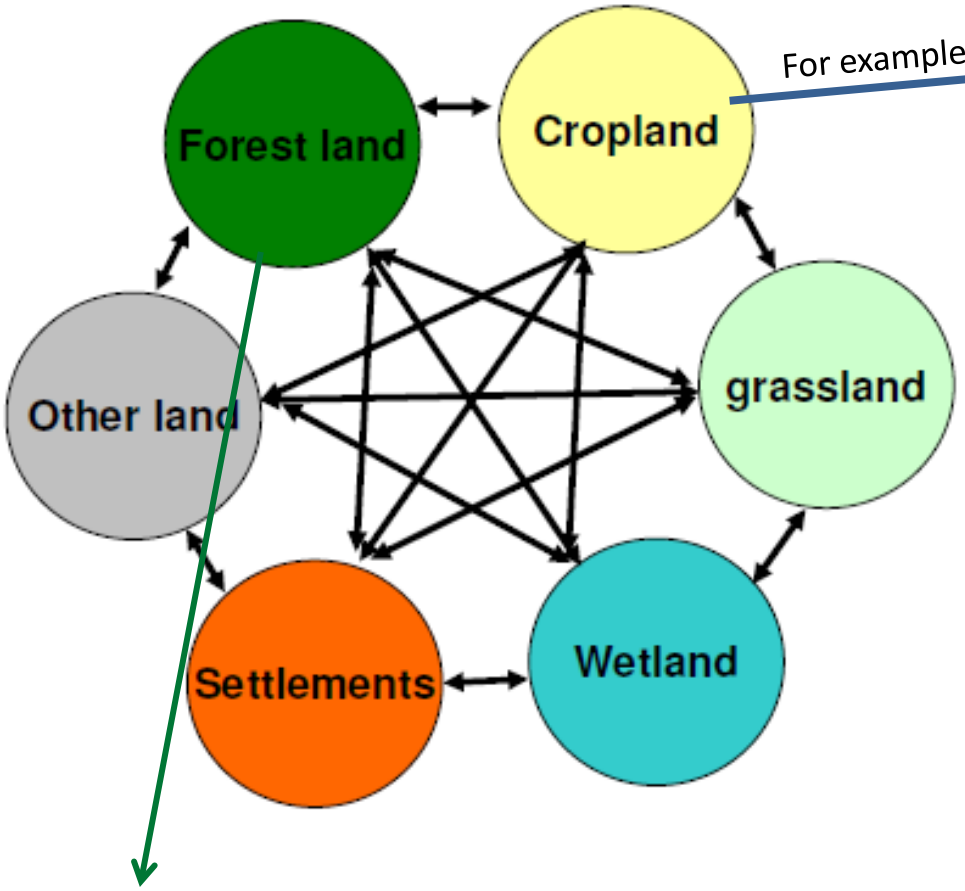
- Lowland tropical forest
- Mangrove

A possible Forest Land Stratification with GHG Reporting Sub-Divisions for REDD+



Example: Mongolia

Activity Data: Assessment of change



For example

Time 1	Time 2
Number of hectares	Number of hectares

Number of hectares of
Cropland remaining Cropland

Number of hectares of
Other land-uses converted to Cropland

Number of hectares of
Forest Land remaining Forest Land

Number of hectares of
Other land-uses converted to Forest Land

To assess deforestation, we want to know the area of Forest Land converted to other land-uses – this all gives an indication of the drivers of deforestation

National Forest Monitoring Systems

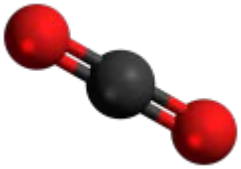
MRV: emission factors

Emission/Removal Factors

Emission factor

A coefficient that relates the activity data to the amount of chemical compound that is the source of later emissions

LULUCF: emissions of CO_2, CH_4, CO, N_2O and NO_x resulting from land-use (change) and forestry activities (measured in tCO2e/ha)

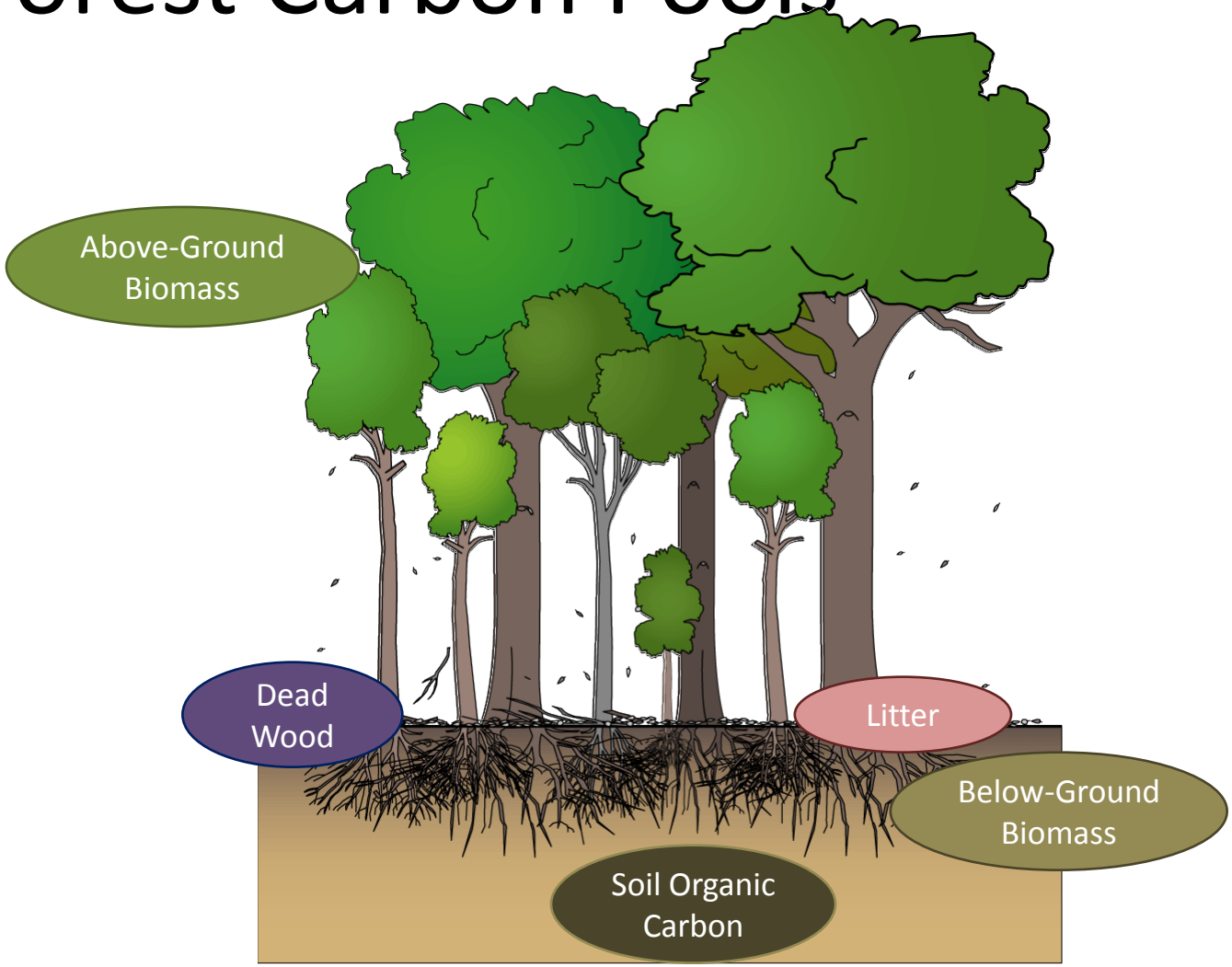


Removal factor

Rate at which carbon is taken up from the atmosphere by terrestrial systems and sequestered in biomass and soil (measured in tCO2e/ha)

Emission/removal factors are **often based on a sample of measurement data averaged to develop a representative rate of emission or removal** for a given activity level under a given set of operating conditions (e.g. logging, deforestation, reforestation)

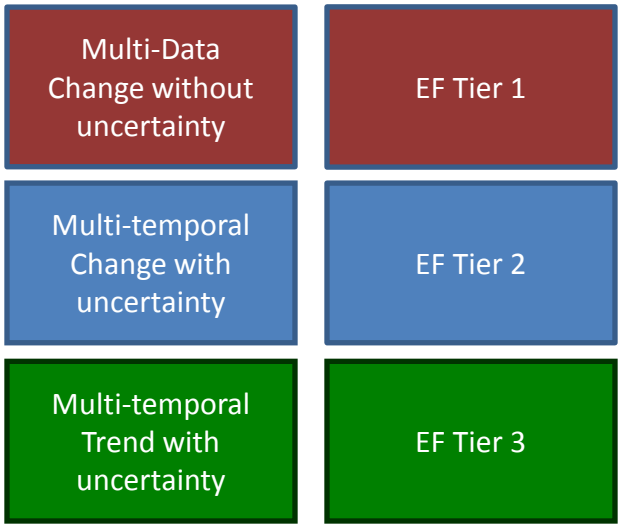
Forest Carbon Pools



Designing National Forest Inventories (NFIs) to Assess EFs

Estimation must be made:

- For carbon stock **CHANGES**!
- For diverse ecological conditions and/or management regimes
- Emissions and removals due to human activity
- For changes in carbon pools



IPCC requirements for NFIs

Estimations of Emission Factors made to Tier 2 or Tier 3 level, this requires:

- Country-specific estimates of emission factors
- Multi-temporal inventory data
- Uncertainty analysis
- Quality Assurance / Quality Control (QA/QC)

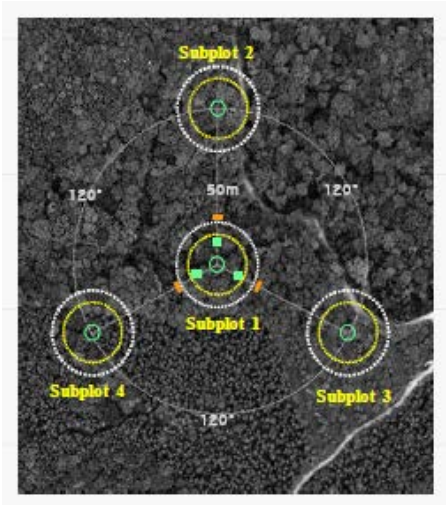
National Forest Inventories (NFIs)

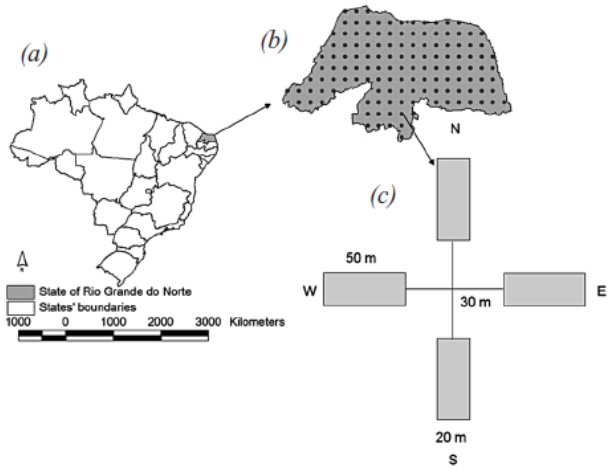
The goal of a NFI is to generate information for:

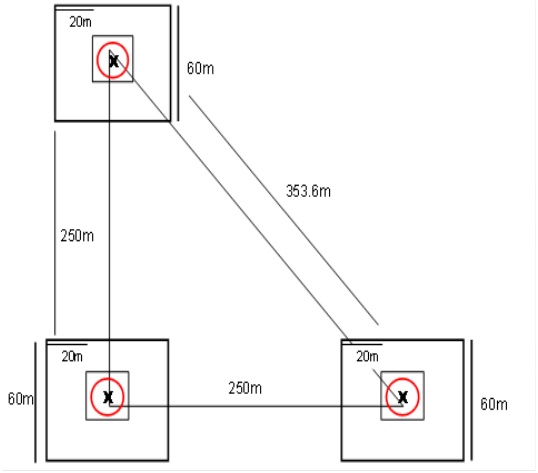
- **Decision making** (national / sub-national)
- **Monitoring** in forestry & related sectors

Fulfills IPCC requirement of **'completeness'**

Example, diverse approaches around the world:







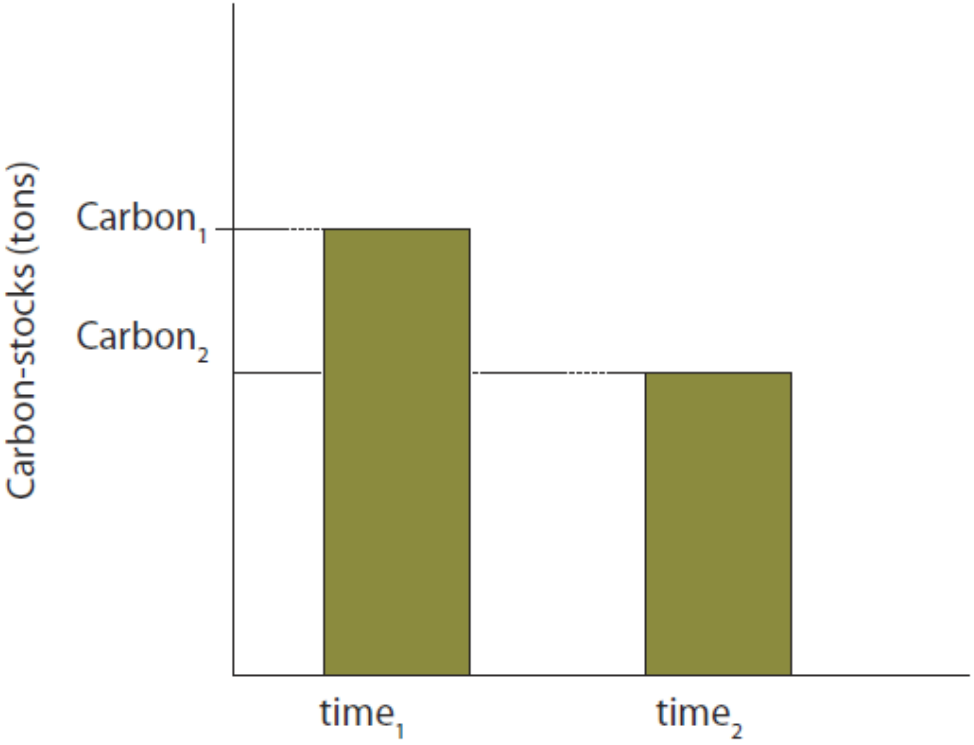
Direct Measurement of Changes

Stock-Difference and Gain-Loss

METHOD 1

Stock-difference

The difference between carbon stocks gives carbon emissions



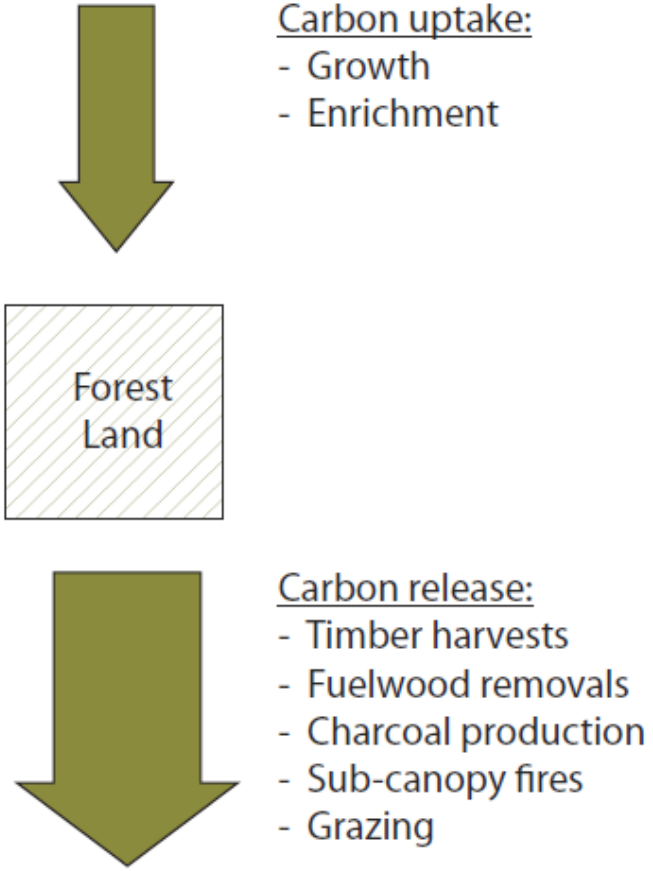
$Carbon_1$: Carbon stocks $time_1$

$Carbon_2$: Carbon stocks $time_2$

METHOD 2

Gain-loss

Carbon emissions are calculated from gain minus loss



National Forest Monitoring Systems

MRV: Reporting

What is Reporting?

Two channels for countries to report to the UNFCCC on progress within the LULUCF/AFOLU sector and implementations of REDD+:

- **National communications**
- **Biennial Update Reports**

Countries will report through these channels to access REDD+ finance, based on the mitigation results from the implementation of REDD+ activities. Additionally REDD+ results to be reported through a **technical annex to the BUR**

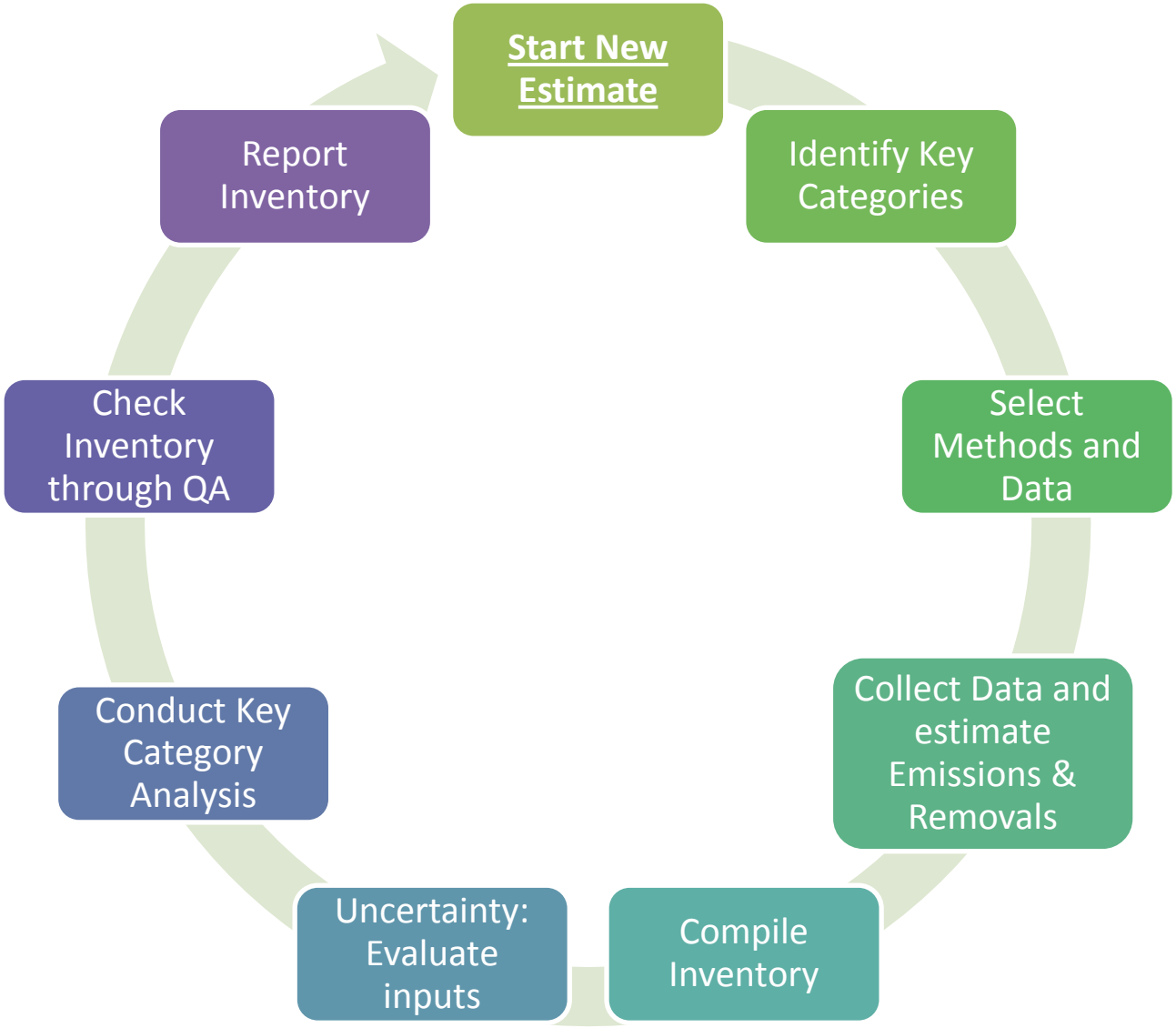
National Communications include data and information on:

- National circumstances
- Vulnerability assessment
- Financial resources and technology transfer for climate change
- Education, training, public awareness
- National GHG inventory

Reporting

Transparent	Sufficient and clear documentation showing how inventory was compiled
	Following IPCC Good Practice requirements
Complete	Estimates are reported for all sources, sinks and gases
	National coverage
Comparable	Reporting should follow international guidance and templates
Consistent	Inventories should aim to reflect the real fluctuations in emissions and removals
	Not be subject to changes resulting from methodological differences
Accurate	GHG inventory contains neither under- nor over-estimates so far as can be judged
	Efforts have been made to reduce bias

Reporting


Start New Estimate
Identify Key Categories
Select Methods and Data
Collect Data and estimate Emissions & Removals
Compile Inventory
Uncertainty: Evaluate inputs
Conduct Key Category Analysis
Check Inventory through QA
Report Inventory

Reporting: Biennial Update Reports (BURs) and Technical Annex for REDD+

To provide an update on the most recently submitted national communication in the following areas:

- National circumstances and institutional arrangements
- National GHG inventory
- Mitigation actions and their effects, including methodologies
- Constraints and gaps and related financial, technical and capacity needs
- Level of support received to prepare and submit the BUR
- Domestic measurement, reporting and verification

REDD+ results to be reported through a **technical annex to the BUR**

- Non-Annex 1 countries requested to submit by December 2014

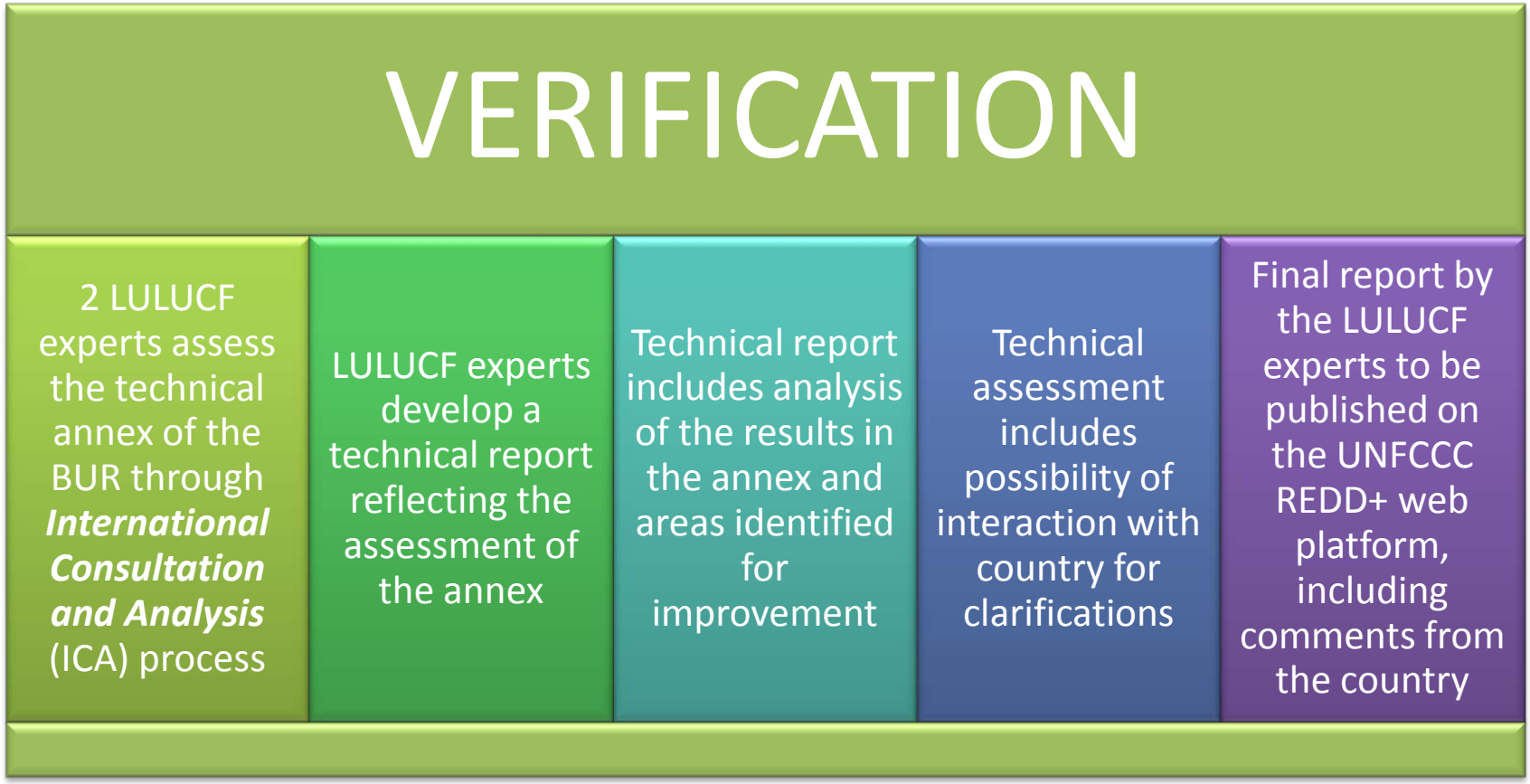
Reporting: brief check list for REDD+

1. Consistent with IPCC guidance and guidelines
2. Data and information are transparent
3. Consistency with FREL/FRL
4. Results reported through Biennial Update Reports
5. When seeking results-based payments (technical annex)
6. Expressed in tonnes of CO2e per year

National Forest Monitoring Systems

MRV: Verification for REDD+

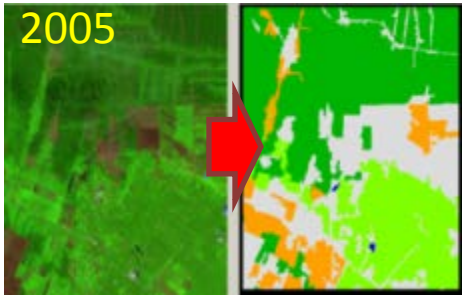
What is Verification for REDD+?



Summary: Measurement, Reporting and Verification (MRV) for REDD+

M

ACTIVITY DATA
Satellite land monitoring system



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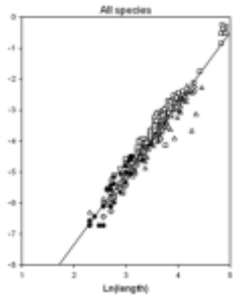
EMISSION FACTOR
National Forest Inventory



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GHG Inventory for the LULUCF sector

LULUCF Inventory

UNFCCC

Inventory compilation QA/QC

Emission Inventory Database

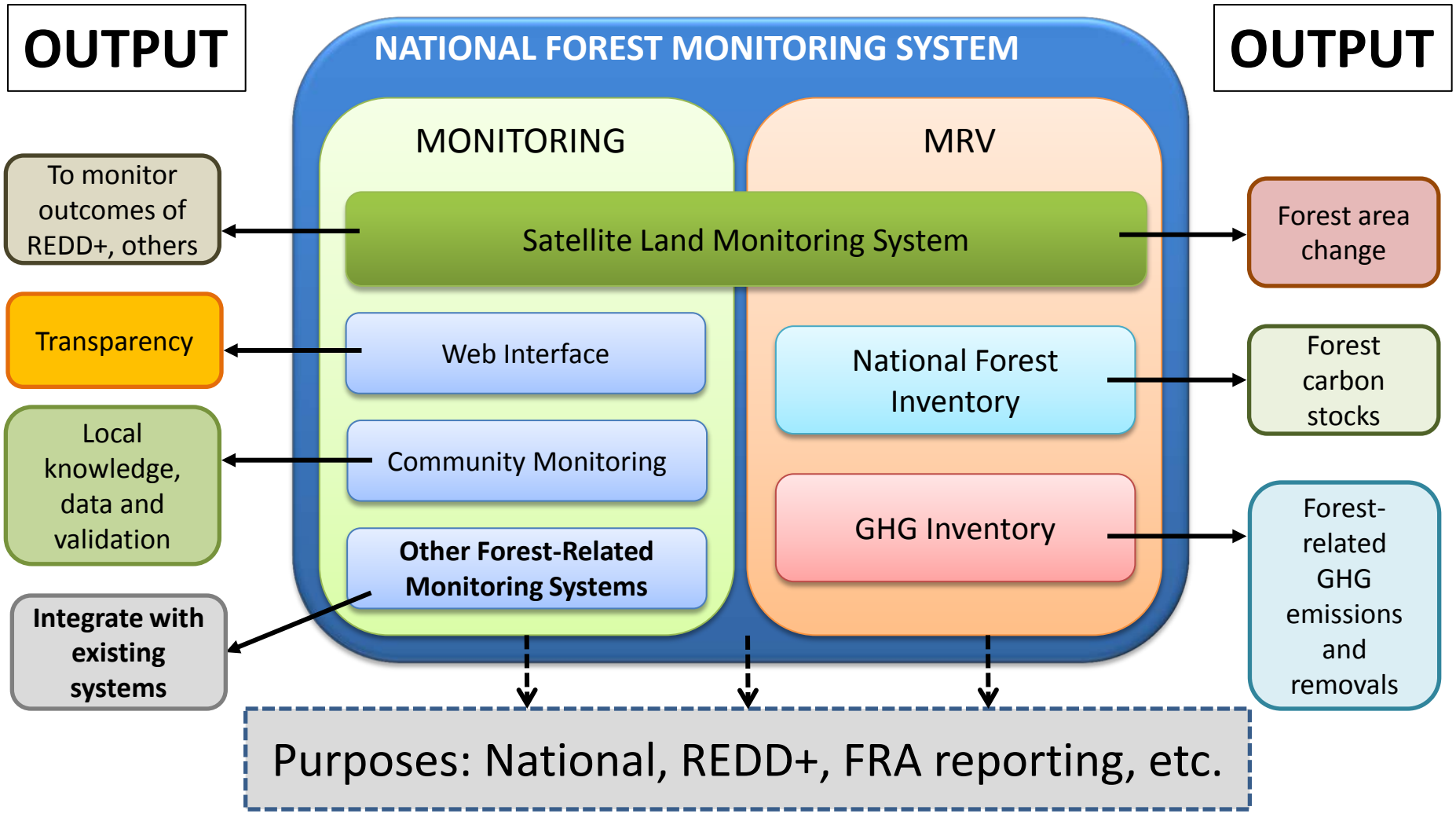
V

Roster of Experts (UNFCCC Secretariat)

National Forest Monitoring Systems

Forest Monitoring

Two functions of a National Forest Monitoring System



Forest Monitoring

Purpose of Monitoring is defined by the country.

For REDD+: The purpose of monitoring is to assess whether REDD+ activities are working

Phased implementation of monitoring for REDD+

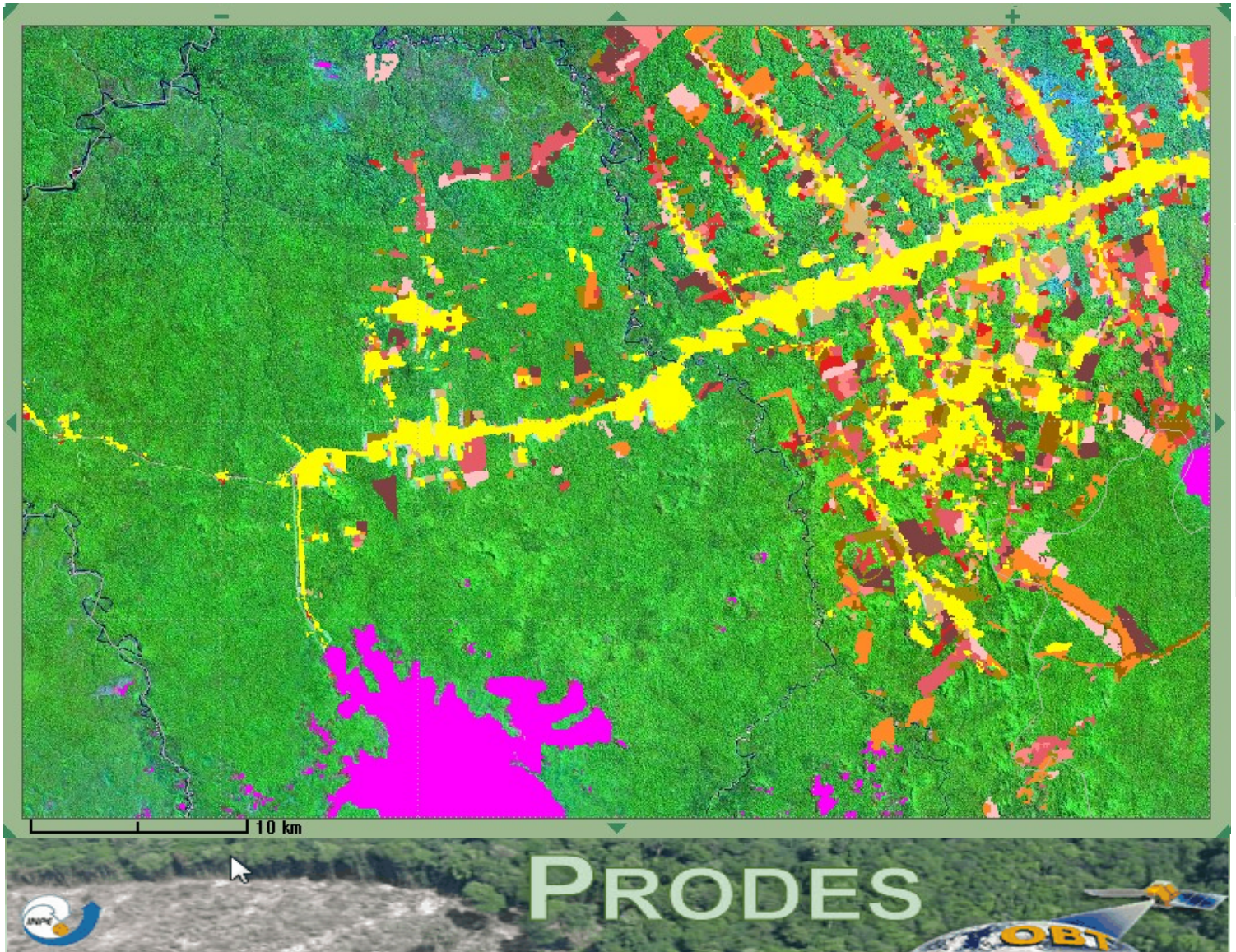
- ***Phase 2***: Monitoring of REDD+ demonstration activities
- ***Phase 3***: National monitoring of REDD+ policies and measures

Combination of tools to gather a range of data/information

- ***Satellite remote sensing***: Cost-effective to large area coverage
- ***Web-GIS portal***: To share data transparently
- ***Community monitoring***: Bottom-up validation of satellite data, incorporation of local knowledge into national monitoring
- ***Other forest monitoring systems***: Build on existing systems (e.g. systems to monitoring logging concessions or protected areas)

Forest Monitoring

Satellite Remote Sensing: Brazil: PRODES



Forest Monitoring

Web-GIS Portals

Allows a country to monitor the outcomes of the implementation of its REDD+ policies and measures and communicate the results to the international community (transparent and open data access)

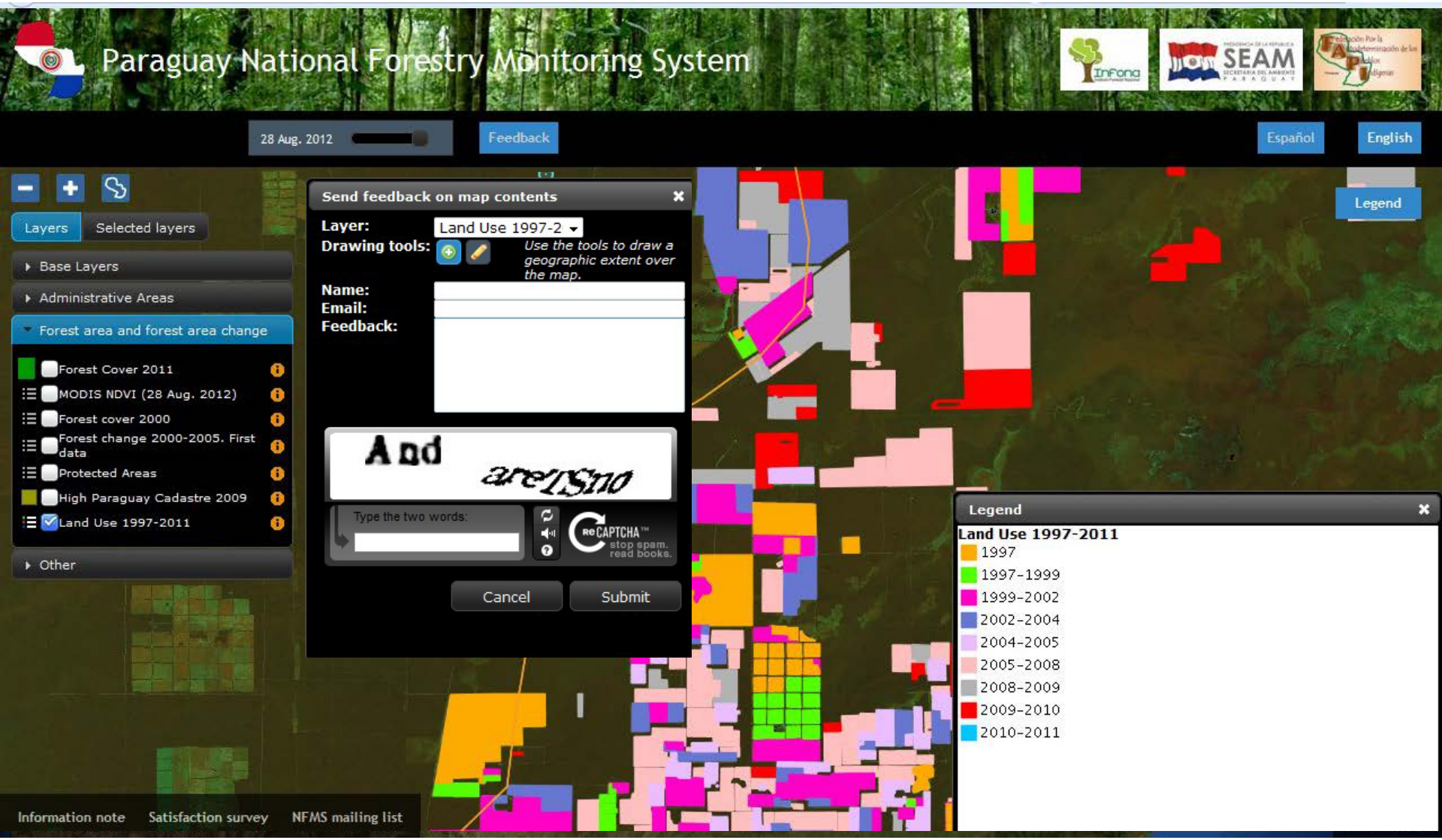
Allows any user to interact with the system through a **user-friendly web-interface**

- Visualise data
- Manipulate data layers, e.g. to select areas and layers of interest
- Download statistics
- Visualise information on logging concessions, protected areas, REDD+ activities, etc.

Allows users to provide feedback, e.g. on areas of deforestation

Forest Monitoring

Web-GIS Portals: Paraguay



Thank You!

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