UN-REDD PROGRAMME

National Forest Monitoring Systems for REDD+

Mongolia's National Forest Monitoring System Action Plan

Consultation Workshop

19-20th November 2013

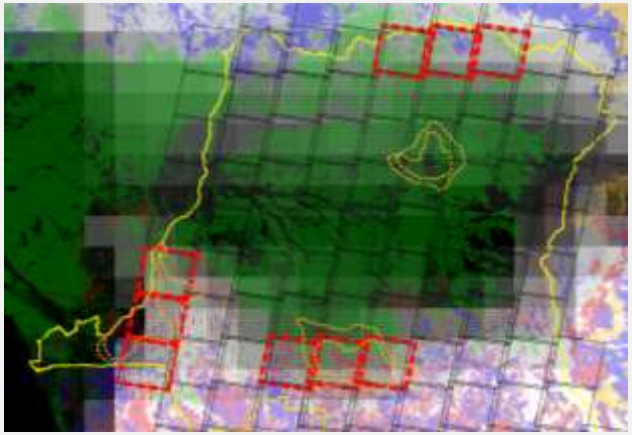
Ulaanbaatar

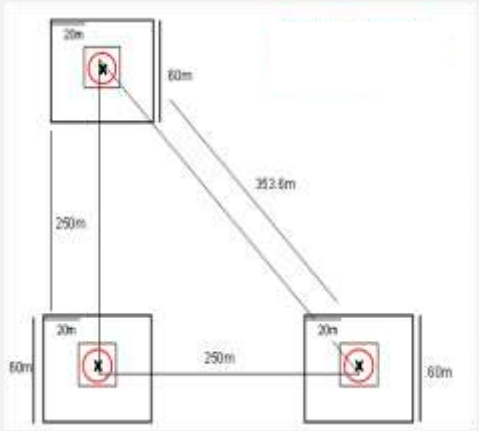
UN-REDD PROGRAMME

National Forest Monitoring Systems for REDD+

Mongolia's NFMS Action Plan Consultation Workshop

NATIONAL FOREST MONITORING SYSTEMS FOR REDD+: Measurement in the MRV System





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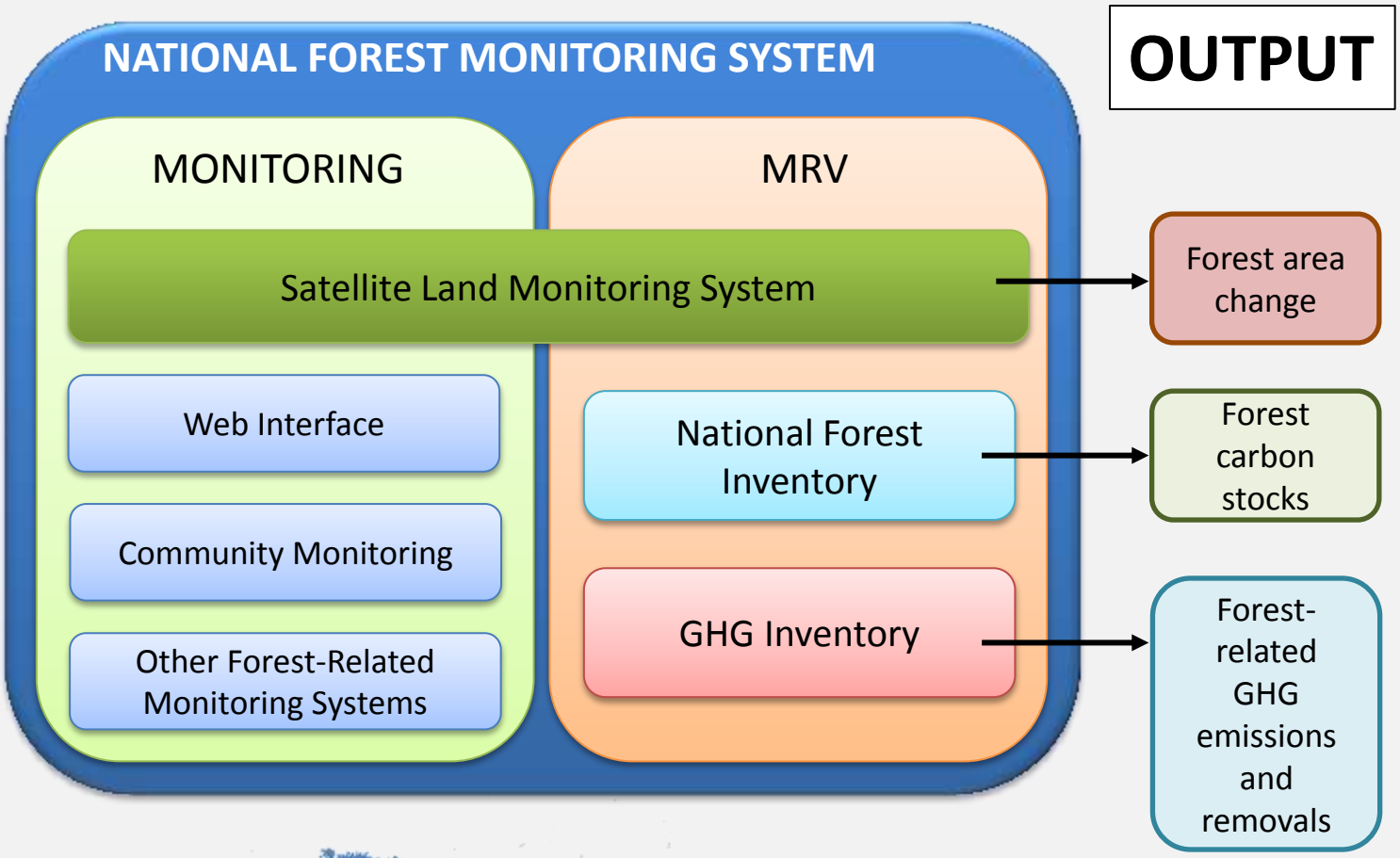
Presentation Outline

- Overview of Measurement, Reporting and Verification for REDD+
- Overview of Measurement in MRV for REDD+ and IPCC key concepts
- Measurement: Assessing Activity Data
- Measurement: Assessing Emission Factors

Two functions of a National Forest Monitoring System for REDD+



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National Forest Monitoring Systems for REDD+

MRV FUNCTION

Measurement, Reporting and Verification

- An example from the **transport sector**
- Aim: to estimate greenhouse gas (GHG) emissions from the transport sector

- Step 1: **Measurement** of emissions
  - Number of cars in a country ("**activity data**") x average emissions per year per car ("**emission factor**") = estimate of emissions from cars per year
  - → Trucks, trains, planes, etc…

- Step 2: Compile into a **national GHG inventory report** (emissions from all sectors)
  - Report the inventory to the UNFCCC through the National Communication

- Step 3: The UNFCCC organizes the **verification** of the data reported in the inventory

MRV for REDD+

- The purpose of MRV for REDD+ is to assess the performance of REDD+ activities in mitigating greenhouse gas emissions that contribute to climate change

    1. **MEASURE** the emissions and removals (sequestration) of anthropogenic greenhouse gas emissions related to forest land

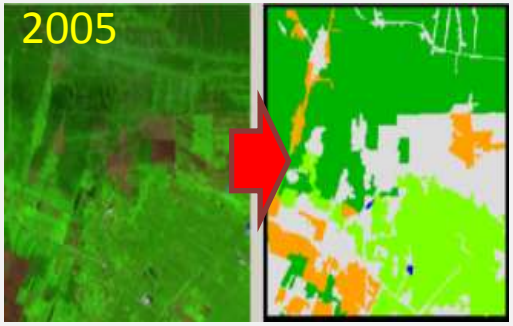
    2. Make an inventory of these emissions and **REPORT** them to the UNFCCC

    3. Make the emissions inventory data and methods available for independent **VERIFICATION** by the UNFCCC

- Only has to be fully operational in Phase 3 of REDD+

MRV for REDD+

IPCC Equation for Emission Estimates



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CO_2

Area change data from satellite remote sensing

Forest carbon stock change data from a national forest inventory

Inventory of greenhouse gas **emissions** from the forest sector

ACTIVITY DATA

EMISSION FACTOR

EMISSIONS ESTIMATE

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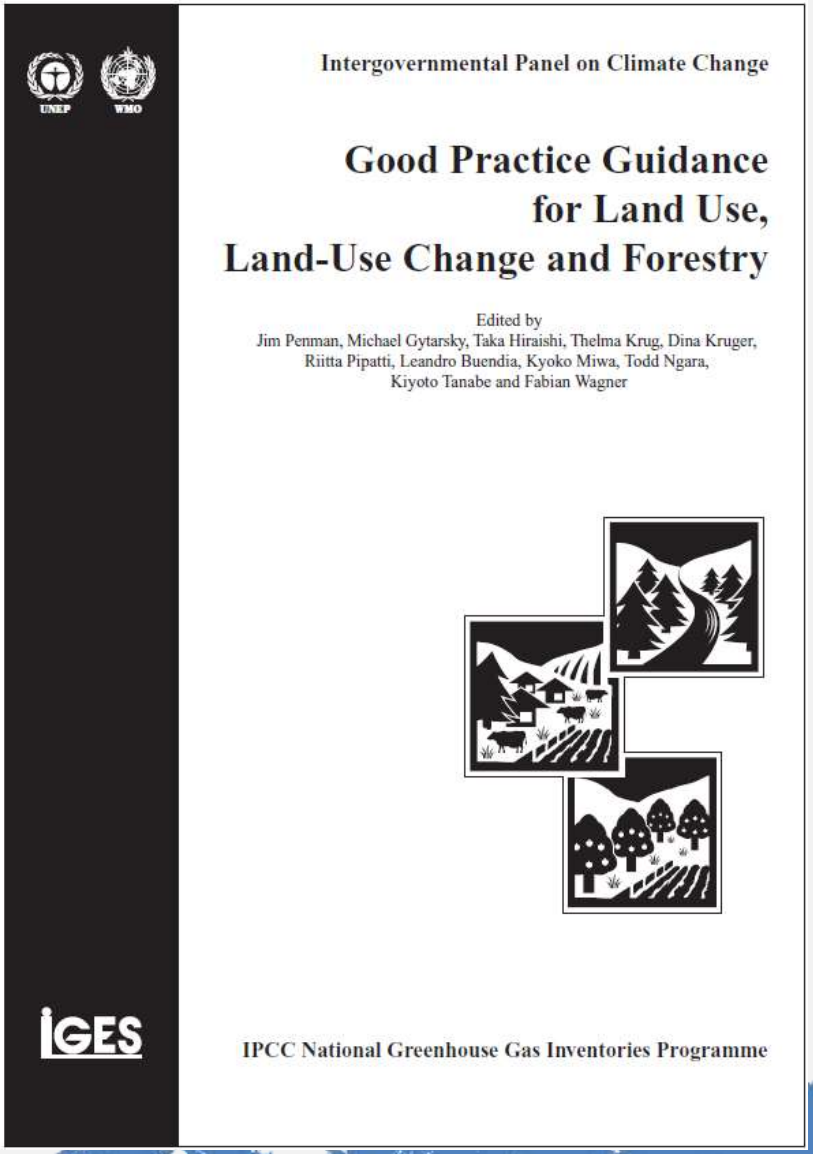
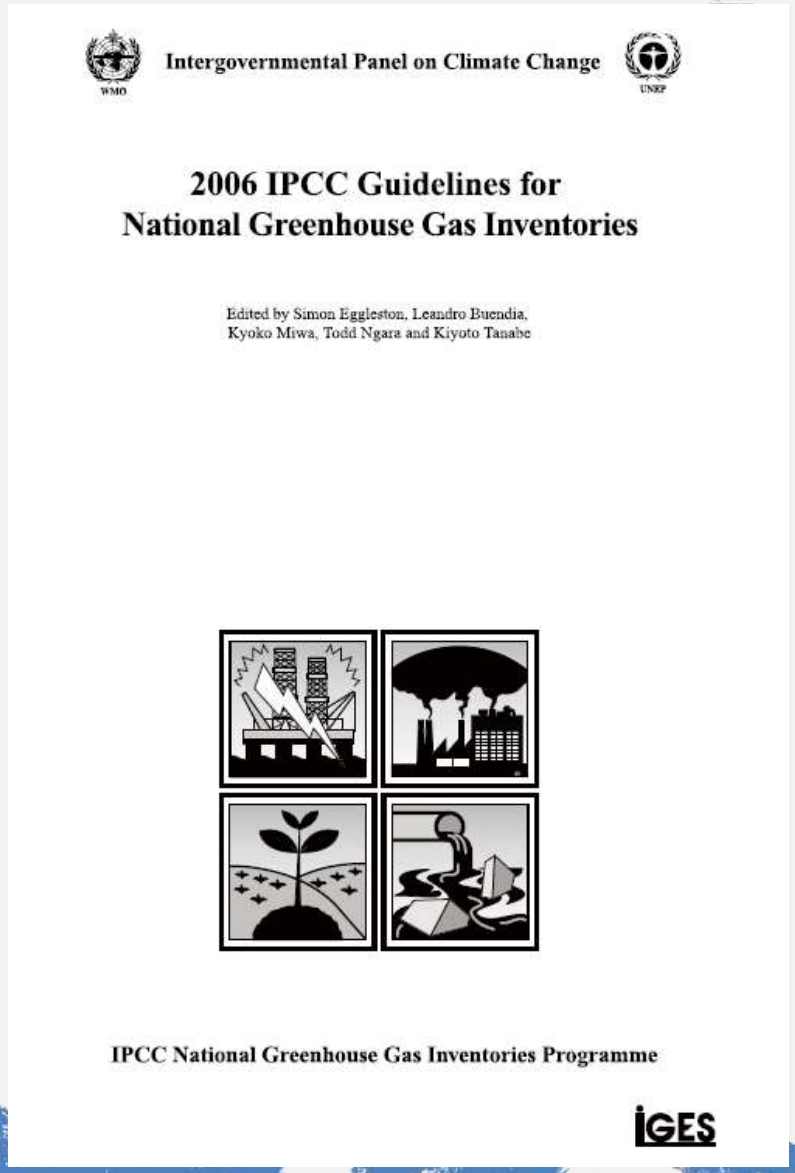
MRV FUNCTION: MEASUREMENT

IPCC Guidance and Guidelines



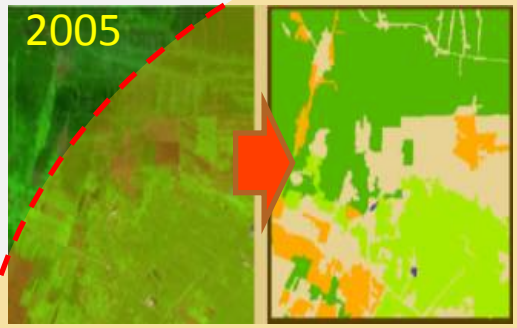


Key Concepts

- IPCC "Good Practice":
  - Assists countries in producing GHG inventories that are accurate in the sense of being neither over nor underestimates so far as can be judged, and in which uncertainties are reduced as far as possible
  - Provides methods to manage uncertainties
  - Supports the development of GHG inventories that are:
    - Transparent
    - Documented
    - Consistent over time
    - Complete
    - Comparable
    - Assessed for uncertainties
    - Subject to quality control and assurance
    - Efficient in the use of resources available to inventory agencies
    - In which uncertainties are gradually reduced as better information becomes available

MRV for REDD+

IPCC Equation for Emission Estimates



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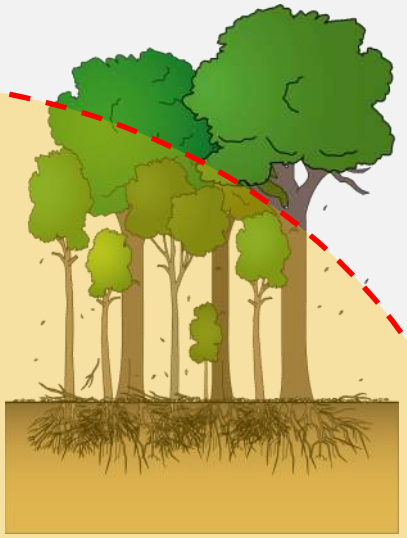

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CO_2

MEASUREMENT

Area change data from satellite remote sensing

Forest carbon stock change data from a national forest inventory

Inventory of greenhouse gas **emissions** from the forest sector

ACTIVITY DATA

EMISSION FACTOR

EMISSIONS ESTIMATE

IPCC Guidance and Guidelines for GHG Inventories

Key Concepts

- Activity Data
  - Data on the **magnitude** of human activity, resulting in emissions/removals taking place during a given period of time (e.g. data on land area or management systems)

- Emission Factor
  - A **coefficient** that relates the activity data to the amount of chemical compound (e.g. CO_2), which is the source of later emissions

- Removal Factor
  - **Rate** at which carbon is taken up from the atmosphere by a terrestrial system and sequestered in biomass and soil

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MRV FUNCTION: MEASUREMENT: **ACTIVITY DATA**

IPCC Guidance and Guidelines for GHG Inventories

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

IPCC Guidance and Guidelines for GHG Inventories

Key Concepts: Land Representation

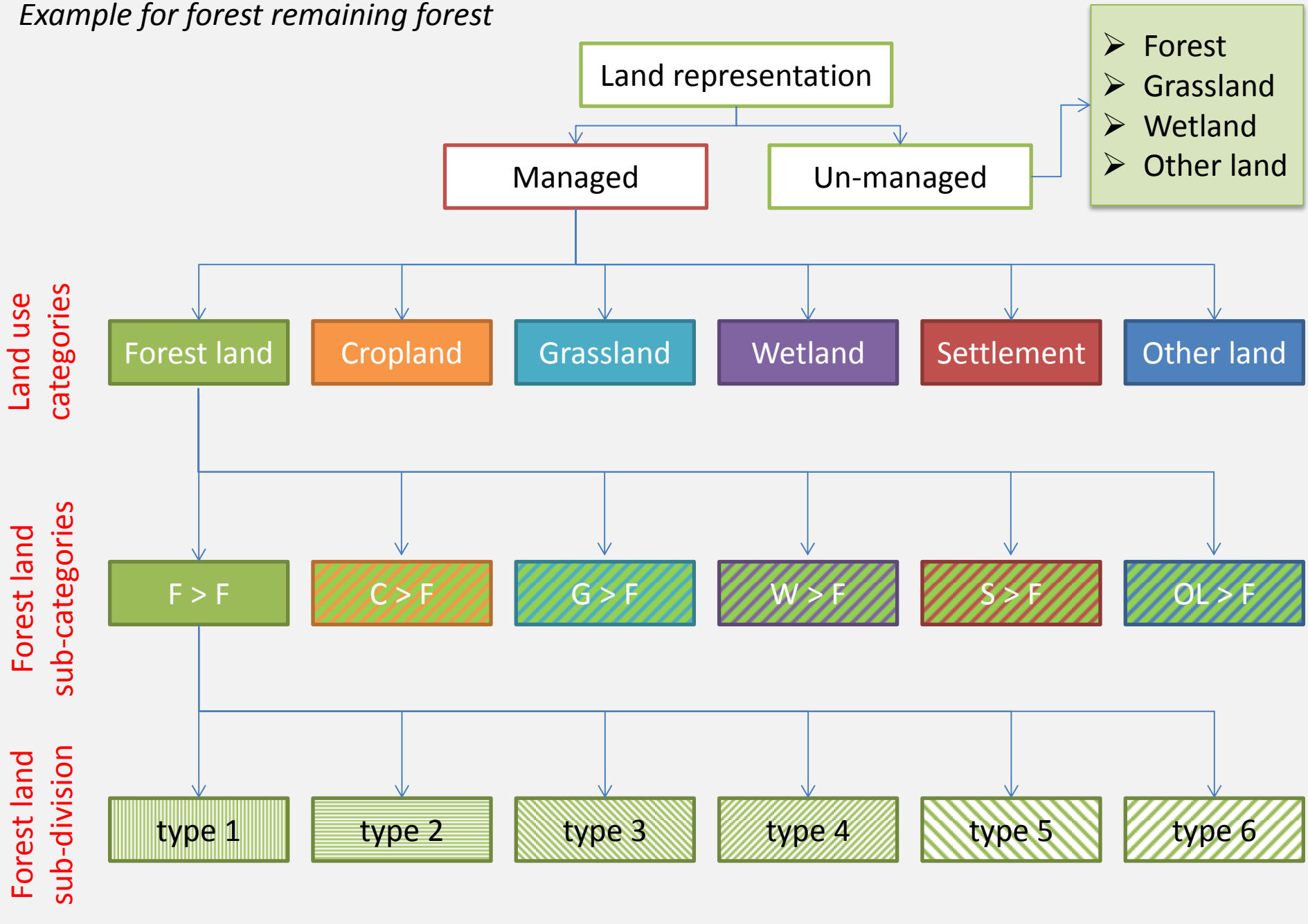
- Six land use categories
  - Forest land, Grassland, Cropland, Wetland, Settlement, Other land

- 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 forest land

- 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:
    - Larch-dominated forest
    - Birch-dominated forest
    - Etc.

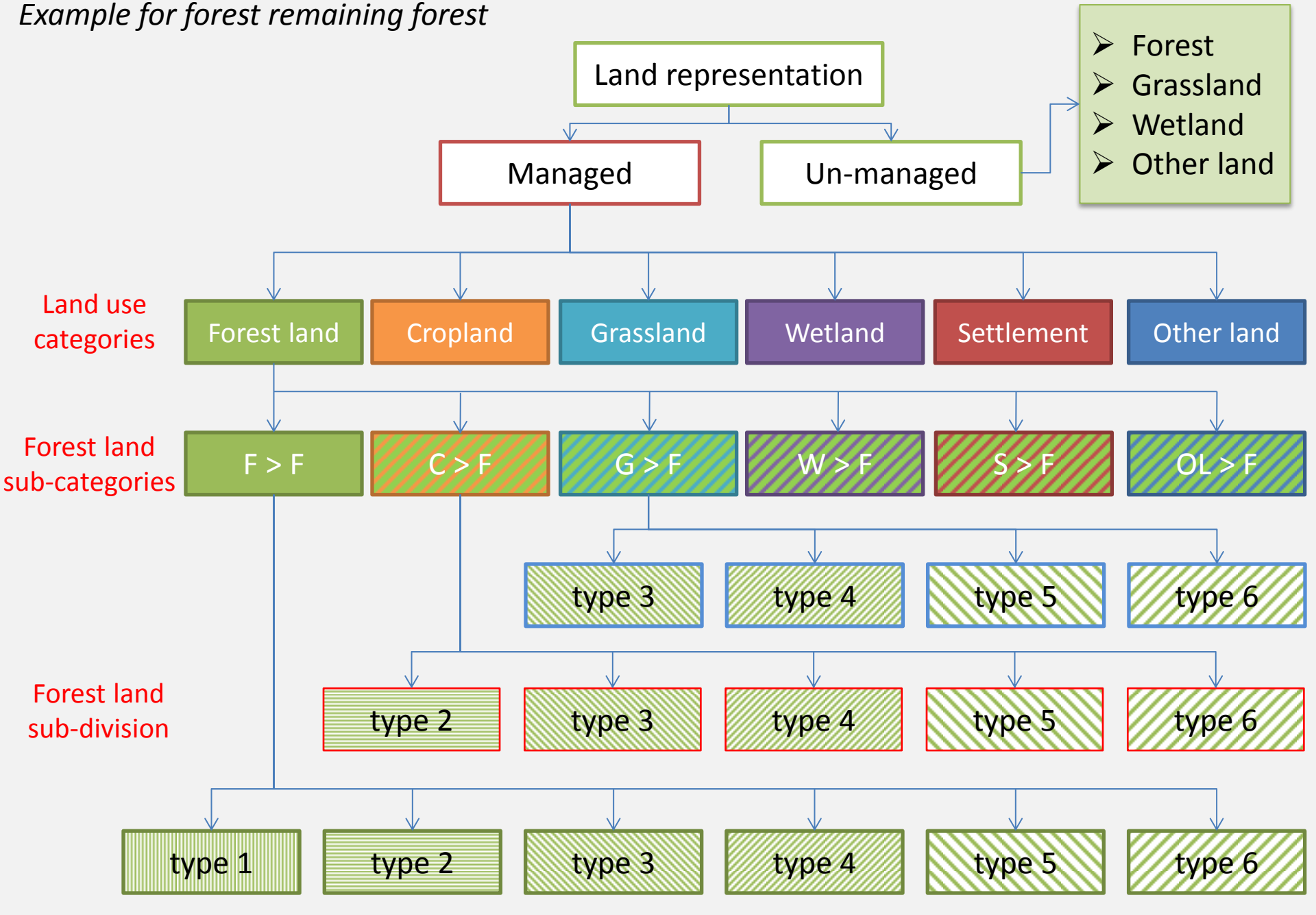
IPCC Land Representation Framework

Example for forest remaining forest

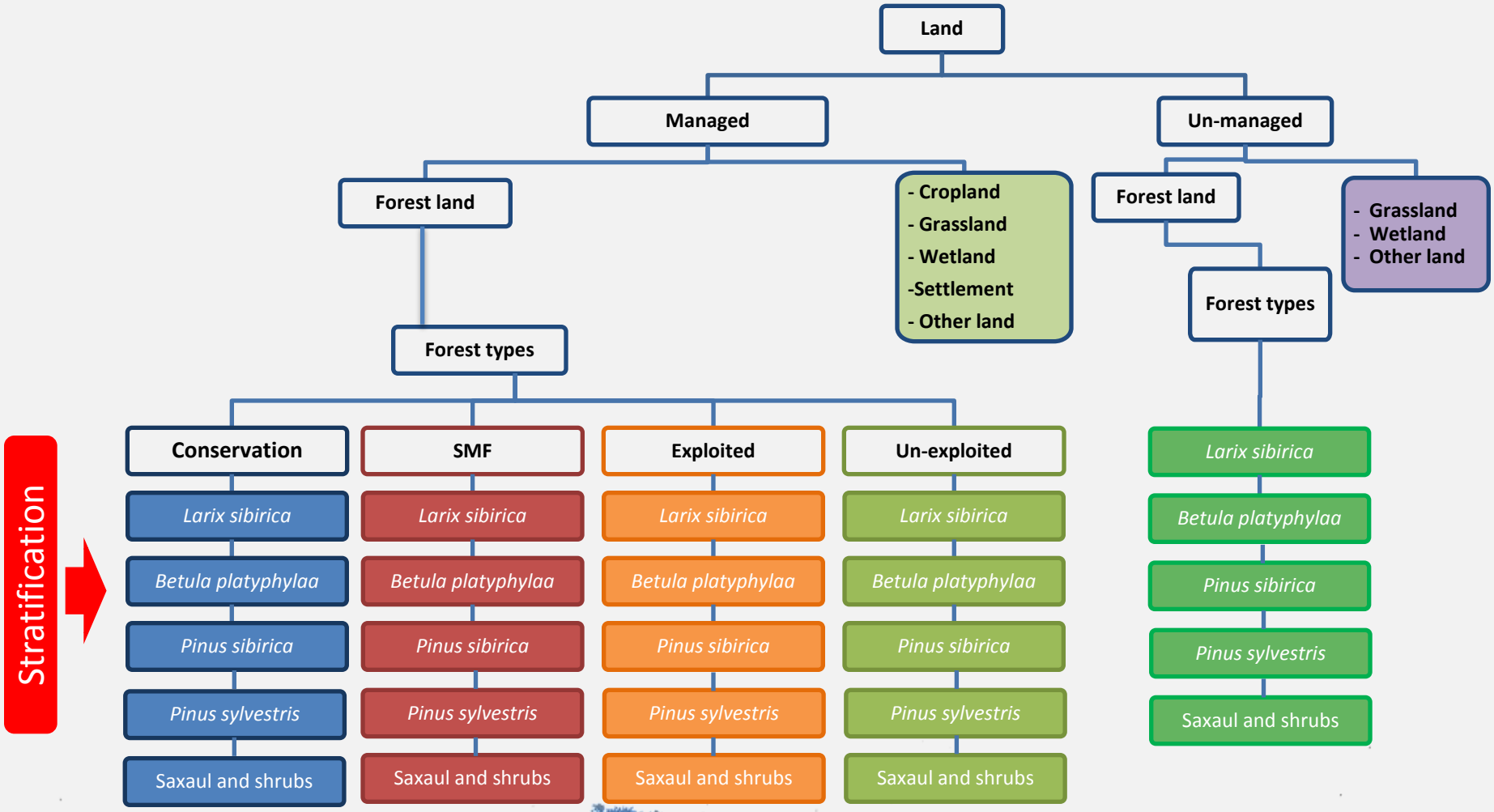


IPCC Land Representation Framework

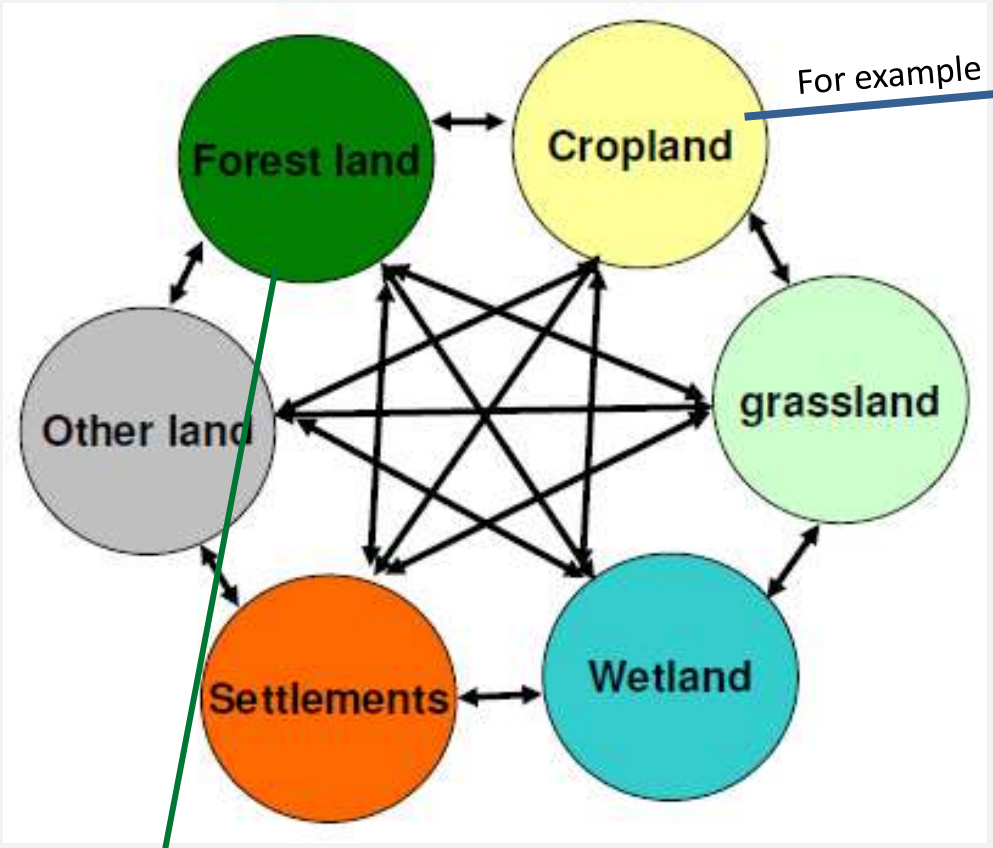
Example for forest remaining forest



A Potential Forest Land Stratification for Mongolia & GHG Reporting Sub-Divisions for REDD+



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

Activity Data: Assessment of Change

- IPCC guidance: 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**

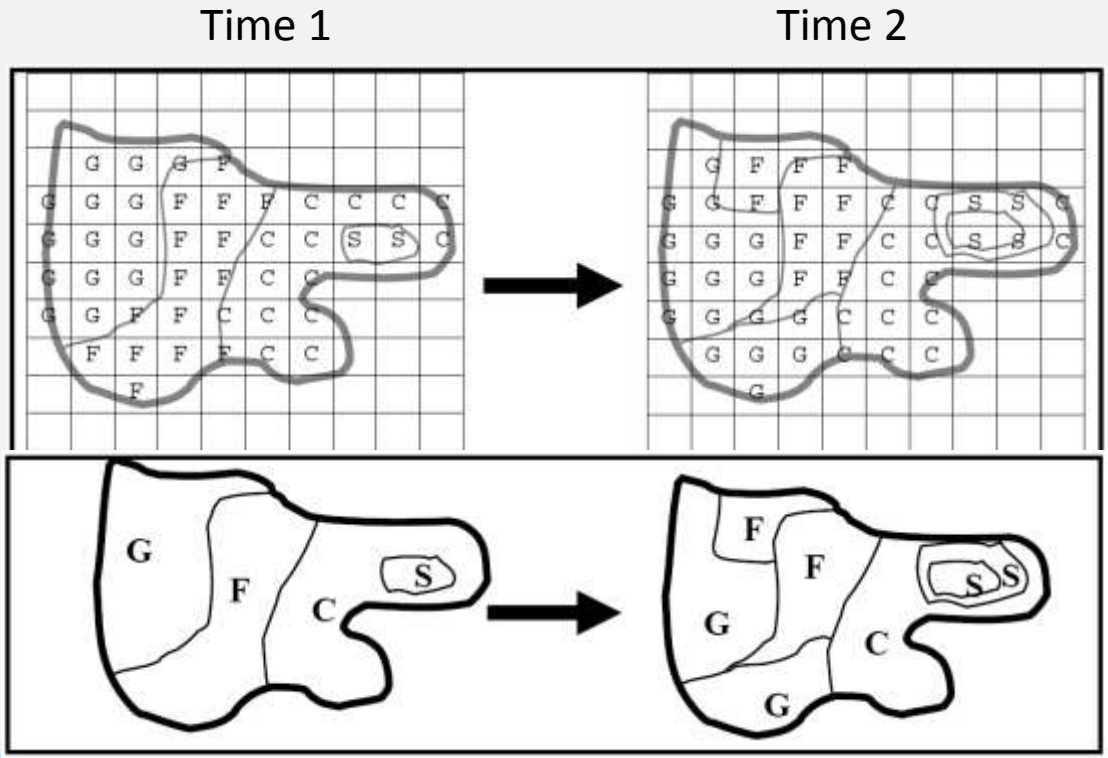
- IPCC 2003 LULUCF Guidance suggests three Approaches:
  - Approach 1: **Basic land-use data** (land use types in time 1 & land use types in time 2)
  - Approach 2: **Survey of land use and land-use change** (changes from & to a category)
  - Approach 3: **Geographically explicit land use data** (known 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 20 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

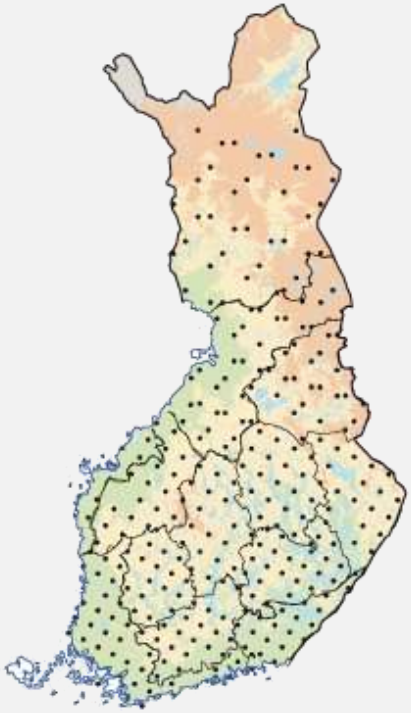
- Requires spatially explicit observations of land use and land-use change.
- The data may be obtained either by 1) sampling of geographically located points, 2) a complete tally (wall-to-wall mapping), or 3) a combination of the two
- Is comprehensive and relatively simple conceptually but data intensive to implement

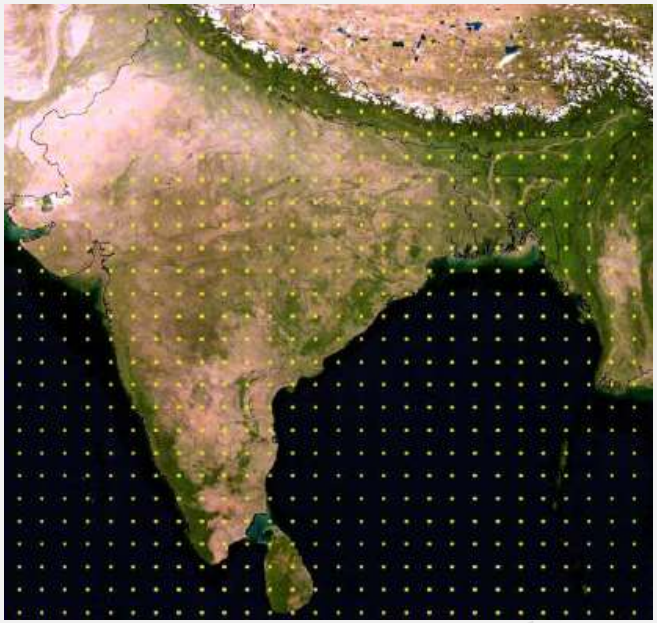


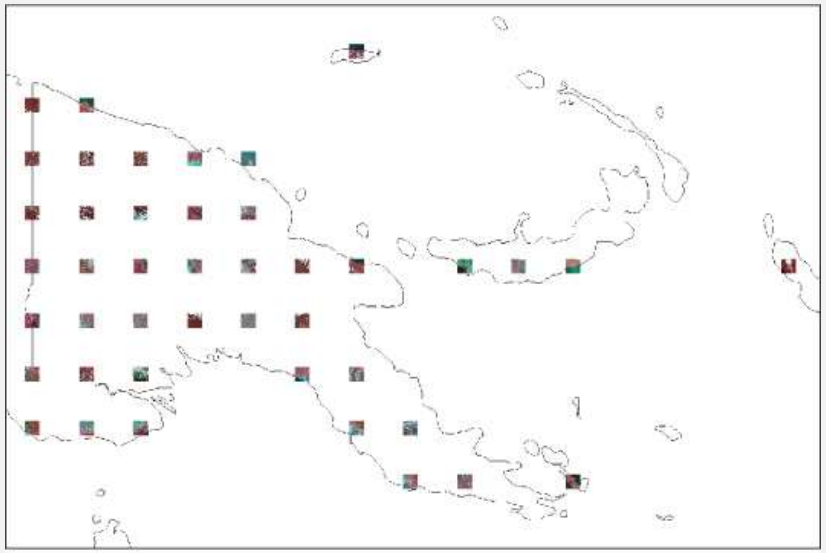
Activity Data: Assessment of Change

Approach 3: Geographically Explicit Land Use Data

- By sampling of geographically located points or area subsets
- Information about those points can then be used to say something about a phenomena over a broader area





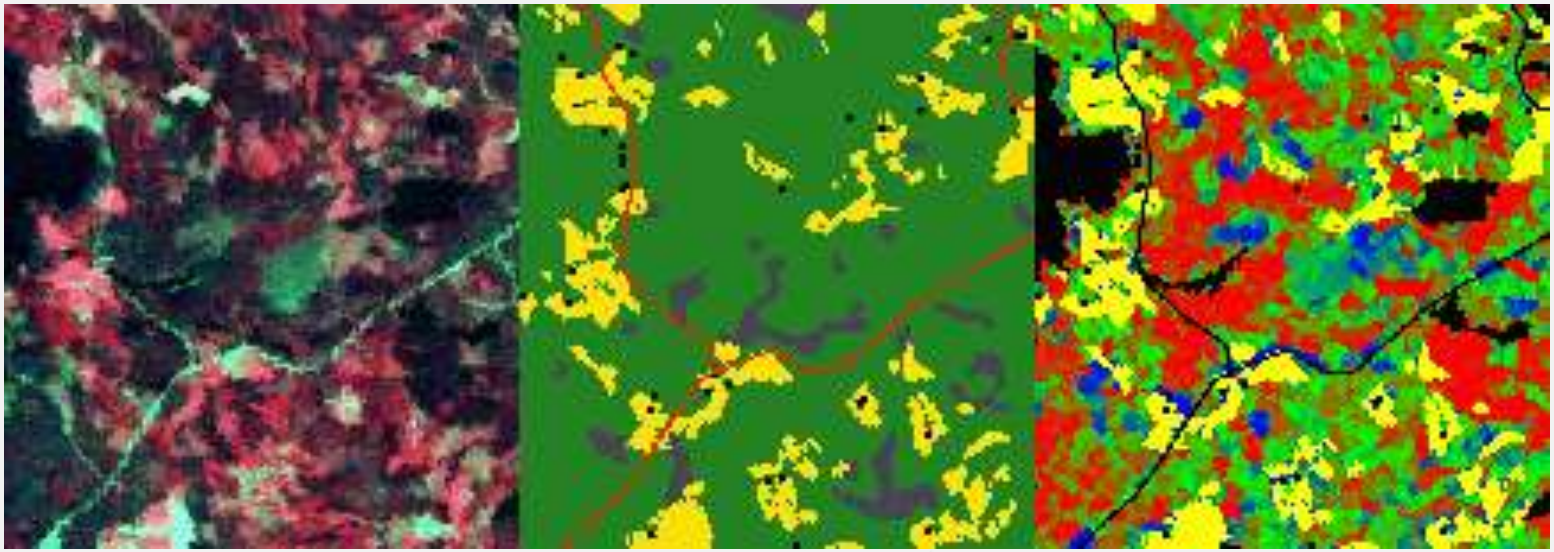


Sample frame: geographical grid (a sample at each 1° × 1°)
Sample size: 20 × 20 km^2 (with extracts of Landsat imagery for year 2000)

Activity Data: Assessment of Change

Approach 3: Geographically Explicit Land Use Data

- By wall-to-wall mapping
- Representation of all land area
- Generally more resource-intensive than sampling
- Sampling approaches in one reporting period can be extended to wall-to-wall coverage in a subsequent period



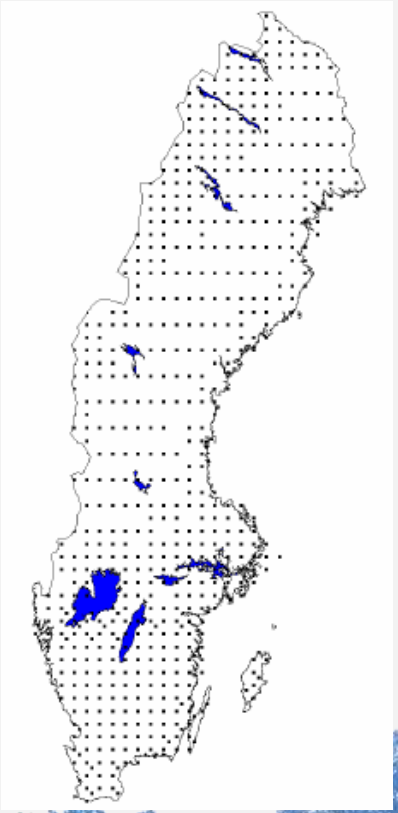
Activity Data: Assessment of Change

Approach 3: Geographically Explicit Land Use Data

- All Annex I countries use IPCC Approach 3 to assess activity data

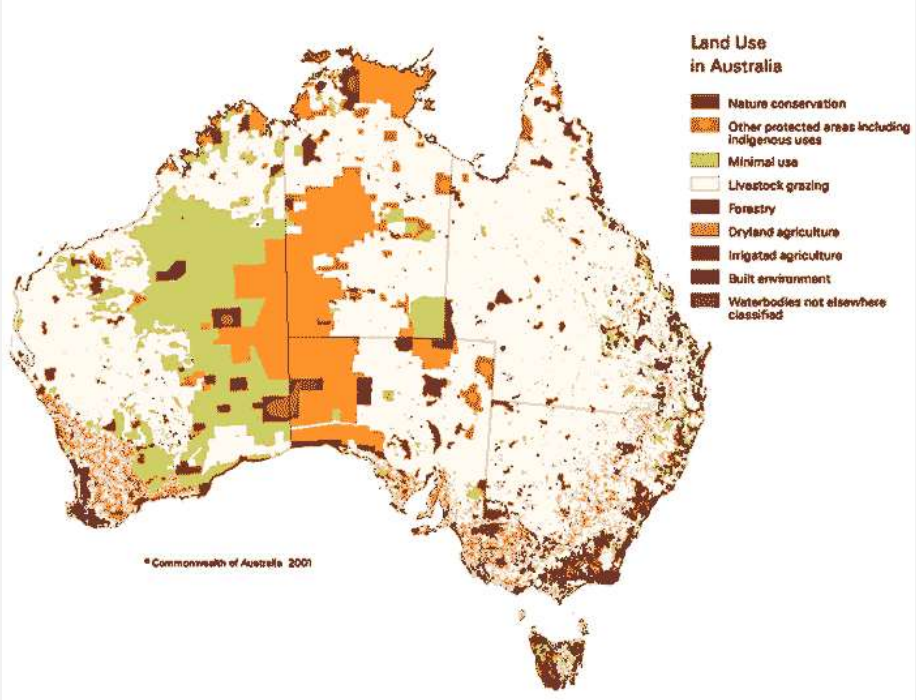
Most countries use sampling approaches

Sweden



A few countries use wall to wall approaches

Australia



Activity Data in the GHG Inventory

UN-REDD PROGRAMME

FAO UNDP UNEP

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	
Land-Use Category	**Sub-division[1]**
A. Total Forest Land	
1. Forest Land remaining Forest Land	
	RZ10 Boreal Plains
	RZ11 Subhumid prairies
	RZ12 Semiarid prairies
	RZ13 Taiga Plain
	RZ14 Montane Cordillera
	RZ15 Pacific Maritime
	RZ16 Boreal Cordillera
	RZ17 Taiga Cordillera
	RZ18 Taiga Shield West
	RZ4 Taiga Shield East
	RZ5 Boreal Shield East
	RZ6 Atlantic Maritime
	RZ7 Mixedwood Plains
	RZ8 Hudson Plains
	RZ9 Boreal Shield West
2. Land converted to Forest Land[10]	
2.1 Cropland converted to Forest Land	
	RZ10 Boreal Plains
	RZ11 Subhumid prairies
	RZ12 Semiarid prairies
	RZ13 Taiga Plain
	RZ14 Montane Cordillera
	RZ15 Pacific Maritime
	RZ16 Boreal Cordillera
	RZ17 Taiga Cordillera

TABLE 5.A SECTORAL BACKGROUND DATA FOR LAND USE, LAND

Forest Land

(Sheet 1 of 1)

Inventory 2011

Submission 2013 v1.1

CANADA

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		ACTIVITY DATA		CHANGES IN CARBON STOCK					
				k change in living biomass[11,14]		Net carbon stock change in dead organic matter[4]	Net carbon stock change in soils[4,10]		Net CO_2 emissions/ removals[8,10]
Land-Use Category	Sub-division[1]	Area[3] (kha)	Area of organic soi (kha)	Losses	Net change		Mineral soils	Organic soils[7]	
				(Gg C)					(Gg)
A. Total Forest Land		229,346.62	IE	-800,176.11	-2,744.55	17,304.02	7,421.12	IE,NO	-80,595.57
1. Forest Land remaining Forest Land		229,266.44		-800,078.62	-2,910.81	17,264.78	7,436.41	IE	-79,898.03
	RZ10 Boreal Plains	36,032.12		-138,279.98	-13,325.02	16,302.40	1,030.36	IE	-14,695.08
	RZ11 Subhumid prairies	1,822.59		-5,799.63	366.58	48.54	71.99	IE	-1,780.10
	RZ12 Semiarid prairies	18.24		-47.90	1.56	0.88	0.57	IE	-11.04
	RZ13 Taiga Plain	20,027.59		-42,621.38	6,180.43	2,015.12	615.50	IE	-32,307.18
	RZ14 Montane Cordillera	35,407.71		-140,824.00	-9,300.97	-9,613.87	1,947.37	IE	62,214.07
	RZ15 Pacific Maritime	13,204.16		-93,856.53	58.77	-2,966.47	298.18	IE	9,568.28
	RZ16 Boreal Cordillera	16,618.57		-56,734.56	2,617.79	4,239.63	698.22	IE	-27,703.99
	RZ17 Taiga Cordillera	412.08		-1,008.11	163.55	-119.06	15.74	IE	-220.81
	RZ18 Taiga Shield West	1,829.57		-4,462.33	-309.79	1,184.54	3.49	IE	-3,220.20
	RZ4 Taiga Shield East	1,102.86		-3,442.46	-607.68	120.25	24.72	IE	1,696.63
	RZ5 Boreal Shield East	55,637.29		-166,309.17	14,747.54	-5,472.73	1,544.17	IE	-38,669.57
	RZ6 Atlantic Maritime	15,409.20		-56,082.22	2,679.10	-1,676.59	254.91	IE	-4,610.56
	RZ7 Mixedwood Plains	2,664.15		-10,311.93	2,244.18	-127.33	18.04	IE	-7,827.91
	RZ8 Hudson Plains	302.26		-781.59	152.38	-15.79	15.07	IE	-536.10
	RZ9 Boreal Shield West	28,778.05		-79,516.86	-8,579.21	13,345.24	898.10	IE	-20,768.46
2. Land converted to Forest Land[10]		80.17	IE	-97.50	166.26	39.25	-15.28	IE,NO	-697.49
2.1 Cropland converted to Forest Land		80.17	IE	-97.50	166.26	39.25	-15.28	IE,NO	-697.49
	RZ10 Boreal Plains	5.92		-9.11	14.88	4.50	-1.09	IE	-67.07
	RZ11 Subhumid prairies	0.49		-0.87	2.28	0.41	-0.06	IE	-9.65
	RZ12 Semiarid prairies	NO		NO	NO	NO	NO	NO	NO
	RZ13 Taiga Plain	NO		NO	NO	NO	NO	NO	NO
	RZ14 Montane Cordillera	4.06		-1.69	3.04	0.81	-1.06	IE	-10.24
	RZ15 Pacific Maritime	0.80		-1.18	2.07	0.48	-0.15	IE	-8.80
	RZ16 Boreal Cordillera	NO		NO	NO	NO	NO	NO	NO

Activity Data in the GHG Inventory

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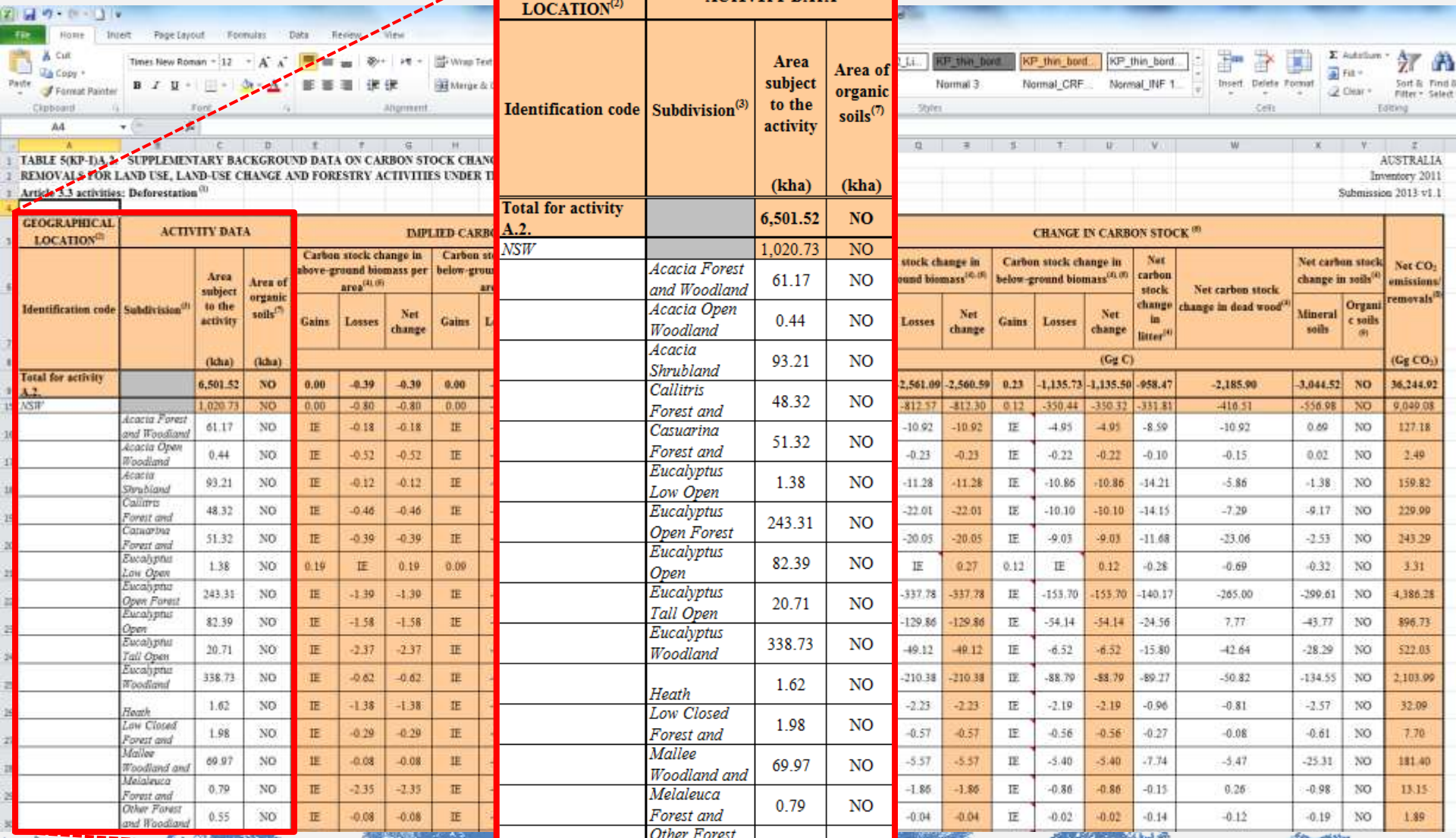


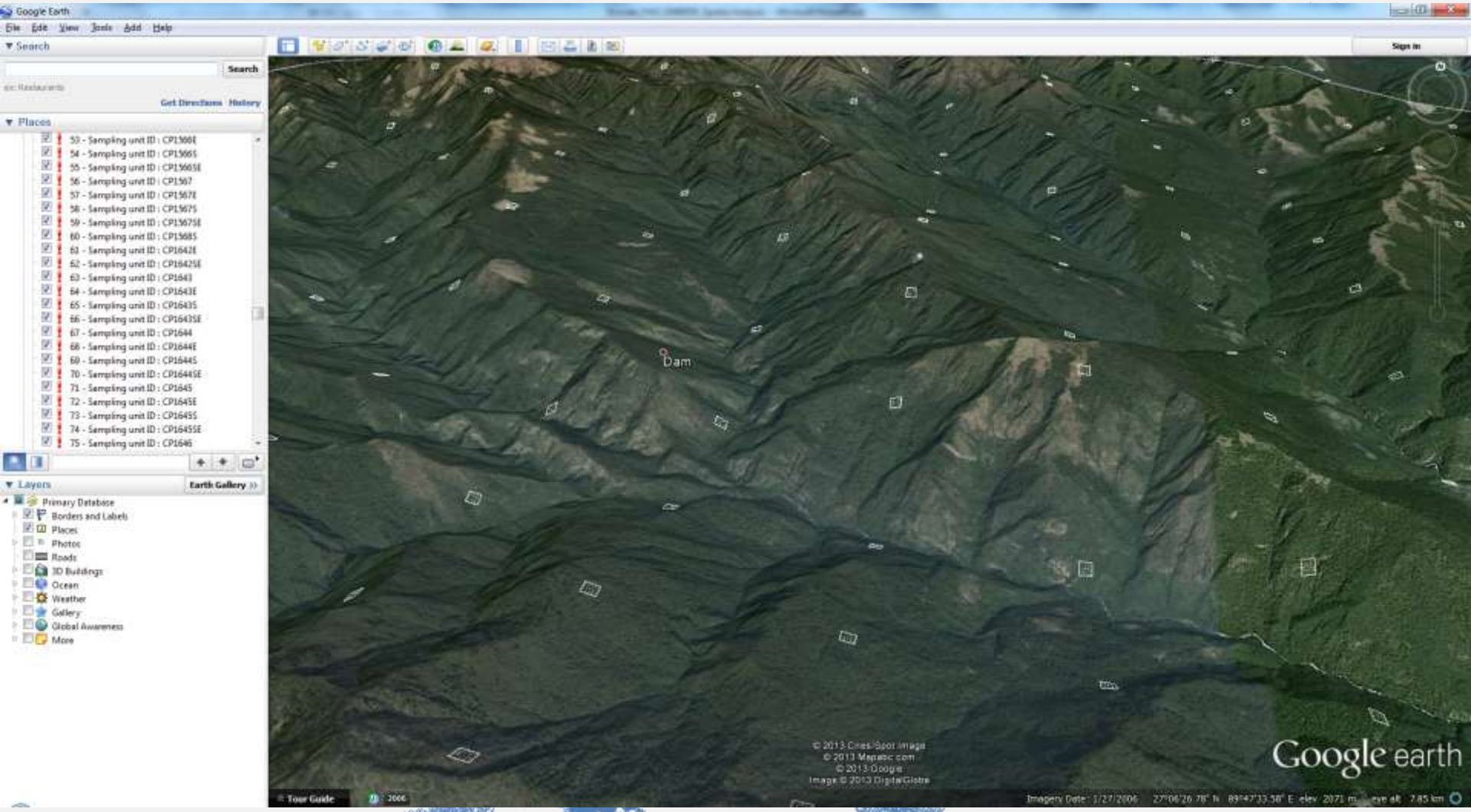
TABLE 5(KP-I)A.2 SUPPLEMENTARY BACKGROUND DATA ON CARBON STOCK CHANG
REMOVALS FOR LAND USE, LAND-USE CHANGE AND FORESTRY ACTIVITIES UNDER T
Article 3.3 activities: Deforestation (1)

AUSTRALIA
Inventory 2011
Submission 2013 v1.1

GEOGRAPHICAL LOCATION(2)		ACTIVITY DATA		IMPLIED CARBO					CHANGE IN CARBON STOCK (8)								
Identification code	Subdivision(3)	Area subject to the activity	Area of organic soils(7)	Carbon stock change in above-ground biomass per area(4),(8)			Carbon st below-grou ar		stock change in ound biomass(4),(8)		Carbon stock change in below-ground biomass(4),(8)			Net carbon stock change in dead wood(4)	Net carbon stock change in soils(4)		Net CO_2 emissions/ removals(9)
				Gains	Losses	Net change	Gains	L	Losses	Net change	Gains	Losses	Net change	Net carbon stock change in litter(4)		Mineral soils	Organic soils (9)	
		(kha)	(kha)	(Gg C)													(Gg CO_2)
Total for activity A.2.		6,501.52	NO	0.00	-0.39	-0.39	0.00		-2,561.09	-2,560.59	0.23	-1,135.73	-1,135.50	-958.47	-2,185.90	-3,044.52	NO	36,244.92
NSW		1,020.73	NO	0.00	-0.80	-0.80	0.00		-812.57	-812.30	0.12	-350.44	-350.32	-331.81	-416.31	-556.98	NO	9,049.08
	Acacia Forest and Woodland	61.17	NO	IE	-0.18	-0.18	IE		-10.92	-10.92	IE	-4.95	-4.95	-8.59	-10.92	0.69	NO	127.18
	Acacia Open Woodland	0.44	NO	IE	-0.52	-0.52	IE		-0.23	-0.23	IE	-0.22	-0.22	-0.10	-0.15	0.02	NO	2.49
	Acacia Shrubland	93.21	NO	IE	-0.12	-0.12	IE		-11.28	-11.28	IE	-10.86	-10.86	-14.21	-5.86	-1.38	NO	159.82
	Callitris Forest and	48.32	NO	IE	-0.46	-0.46	IE		-22.01	-22.01	IE	-10.10	-10.10	-14.15	-7.29	-9.17	NO	229.99
	Casuarina Forest and	51.32	NO	IE	-0.39	-0.39	IE		-20.05	-20.05	IE	-9.03	-9.03	-11.68	-23.06	-2.53	NO	243.29
	Eucalyptus Low Open	1.38	NO	0.19	IE	0.19	0.09		IE	0.27	0.12	IE	0.12	-0.28	-0.69	-0.32	NO	3.31
	Eucalyptus Open Forest	243.31	NO	IE	-1.39	-1.39	IE		-337.78	-337.78	IE	-153.70	-153.70	-140.17	-265.00	-299.61	NO	4,386.28
	Eucalyptus Open	82.39	NO	IE	-1.58	-1.58	IE		-129.86	-129.86	IE	-54.14	-54.14	-24.56	7.77	-43.77	NO	896.73
	Eucalyptus Tall Open	20.71	NO	IE	-2.37	-2.37	IE		-49.12	-49.12	IE	-6.52	-6.52	-15.80	-42.64	-28.29	NO	522.03
	Eucalyptus Woodland	338.73	NO	IE	-0.62	-0.62	IE		-210.38	-210.38	IE	-88.79	-88.79	-89.27	-50.82	-134.55	NO	2,103.99
	Heath	1.62	NO	IE	-1.38	-1.38	IE		-2.23	-2.23	IE	-2.19	-2.19	-0.96	-0.81	-2.57	NO	32.09
	Low Closed Forest and	1.98	NO	IE	-0.29	-0.29	IE		-0.57	-0.57	IE	-0.56	-0.56	-0.27	-0.08	-0.61	NO	7.70
	Mallee Woodland and	69.97	NO	IE	-0.08	-0.08	IE		-5.57	-5.57	IE	-5.40	-5.40	-7.74	-5.47	-25.31	NO	181.40
	Melaleuca Forest and	0.79	NO	IE	-2.35	-2.35	IE		-1.86	-1.86	IE	-0.86	-0.86	-0.15	0.26	-0.98	NO	13.15
	Other Forest and Woodland	0.55	NO	IE	-0.08	-0.08	IE		-0.04	-0.04	IE	-0.02	-0.02	-0.14	-0.12	-0.19	NO	1.89

GEOGRAPHICAL LOCATION(2)	ACTIVITY DATA		
Identification code	Subdivision(3)	Area subject to the activity (kha)	Area of organic soils(7) (kha)
Total for activity A.2.		6,501.52	NO
NSW		1,020.73	NO
	Acacia Forest and Woodland	61.17	NO
	Acacia Open Woodland	0.44	NO
	Acacia Shrubland	93.21	NO
	Callitris Forest and	48.32	NO
	Casuarina Forest and	51.32	NO
	Eucalyptus Low Open	1.38	NO
	Eucalyptus Open Forest	243.31	NO
	Eucalyptus Open	82.39	NO
	Eucalyptus Tall Open	20.71	NO
	Eucalyptus Woodland	338.73	NO
	Heath	1.62	NO
	Low Closed Forest and	1.98	NO
	Mallee Woodland and	69.97	NO
	Melaleuca Forest and	0.79	NO
	Other Forest and Woodland	0.55	NO

Sampling approach:
Open Foris Collect Earth – Bhutan



UN-REDD PROGRAMME

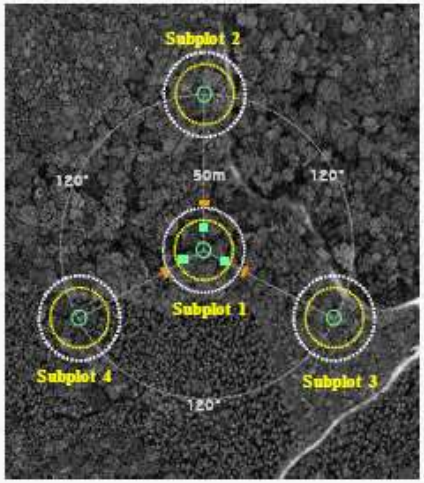
National Forest Monitoring Systems for REDD+

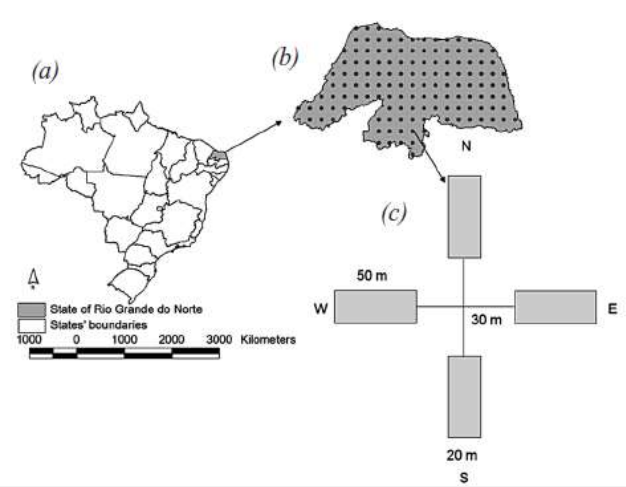
MRV FUNCTION: MEASUREMENT: **EMISSION FACTORS**

Assessing Emission Factors

National Forest Inventories

- Emission Factor: A coefficient that quantifies the **emissions or removals** in areas undergoing human-induced changes (CO_2e/ha)
- Emission factors are quantified through **changes in carbon stocks** in the pools considered by the IPCC
- 41 out of 42 Annex 1 countries use NFIs as a data source to compile their national GHG inventory
  - Fulfills IPCC requirement of 'completeness'
- Diverse approaches to NFIs around the world





Assessing Emission Factors

Carbon Inventories for the Land Use Sector

- Estimation must be made:
  - For carbon stock **CHANGES**! (= EFs)
  - For diverse ecological conditions
  - Under diverse management regimes
  - Emissions and removals due to **human activity**
  - For changes in all 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 and Quality Assurance / Quality Control (QA/QC)

Main steps for Accurate Carbon Inventories in the Land Use Sector

1. Assess areas (Activity Data)
2. Consider all **five carbon pools**
3. Assess all **gains and losses**
4. Use best available data
5. Assess **uncertainty**
   - Depends on methodology used, assumptions, activity data, time series consistency of data
6. Try to verify

Need to Report on Changes in the Five Forest Carbon Pools

- Above-ground biomass
- Below-ground biomass

} biomass

- Deadwood
- Litter

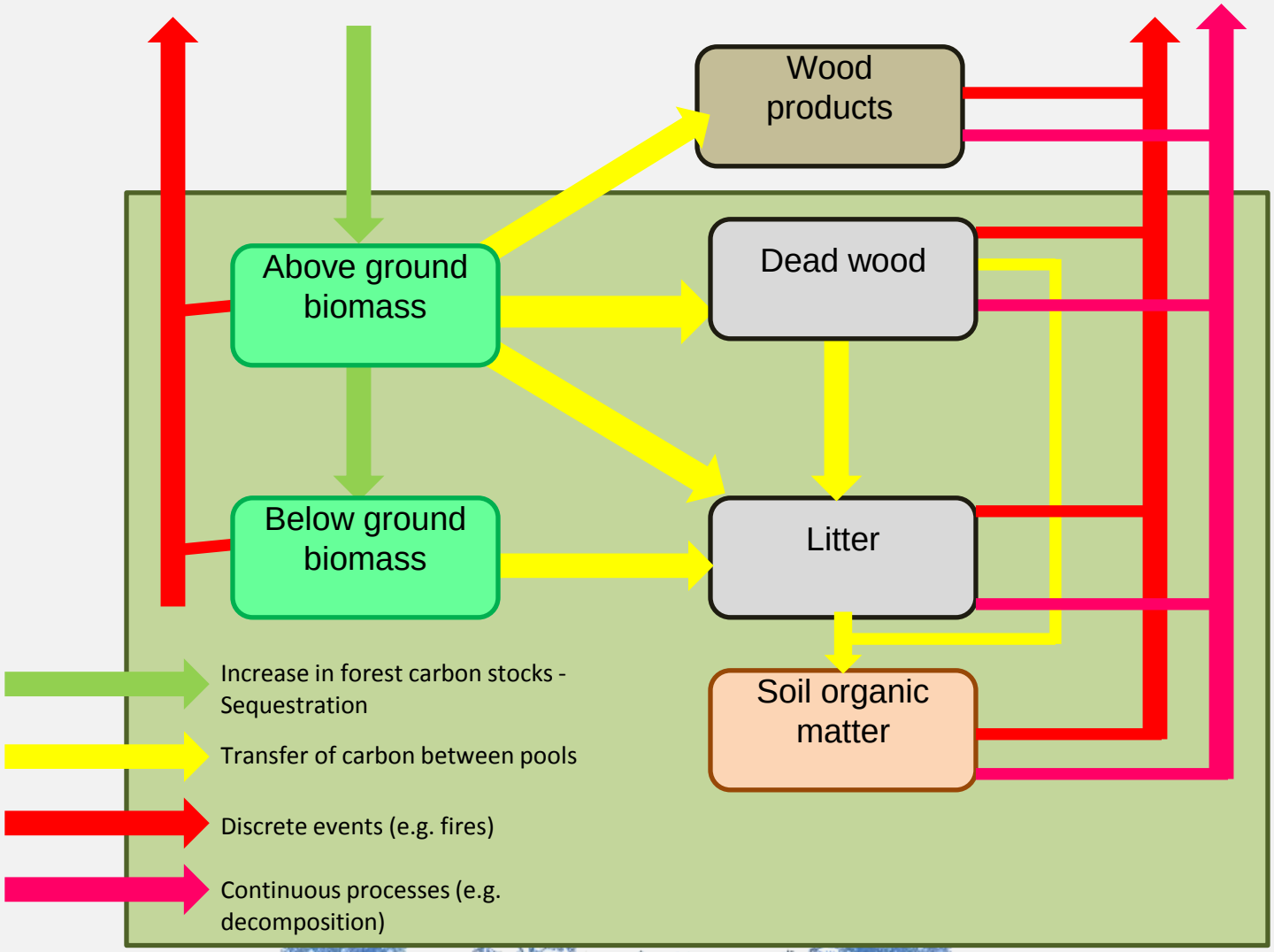
} dead organic matter

- Soil

{ - mineral
- organic

$$\Delta C = \Delta C_{AB} + \Delta C_{BB} + \Delta C_{DW} + \Delta C_{LI} + \Delta C_{SO}$$

Changes in Forest Carbon Pools



How NFIs are used to generate EFs

- Tier 2 or Tier 3 (Tier 1: Default values: no NFI)
  - **Tier 2**: IPCC default assumptions + default methodology + country specific data
  - **Tier 3**: Country specific assumptions + methodology + data (to be internationally reviewed)

- NFI strategies/methodological approaches for assessing C pool changes:
  1. **Direct measurement of changes**: Gain-Loss ('default') or Stock-Difference methods applied in permanent sample plots (Tier 2 or Tier 3)
  2. **Empirical modelling of changes**: NFI data used for reconstruction of e.g. a forest age class distribution or of an activity chronosequence (Tier 2 or Tier 3)
  3. **Carbon budget modelling**: NFI data inserted into a model with other data, e.g. climatological, biogeographical (e.g. Canada's Carbon Budget Model, CBM-CFS3) (Tier 3)

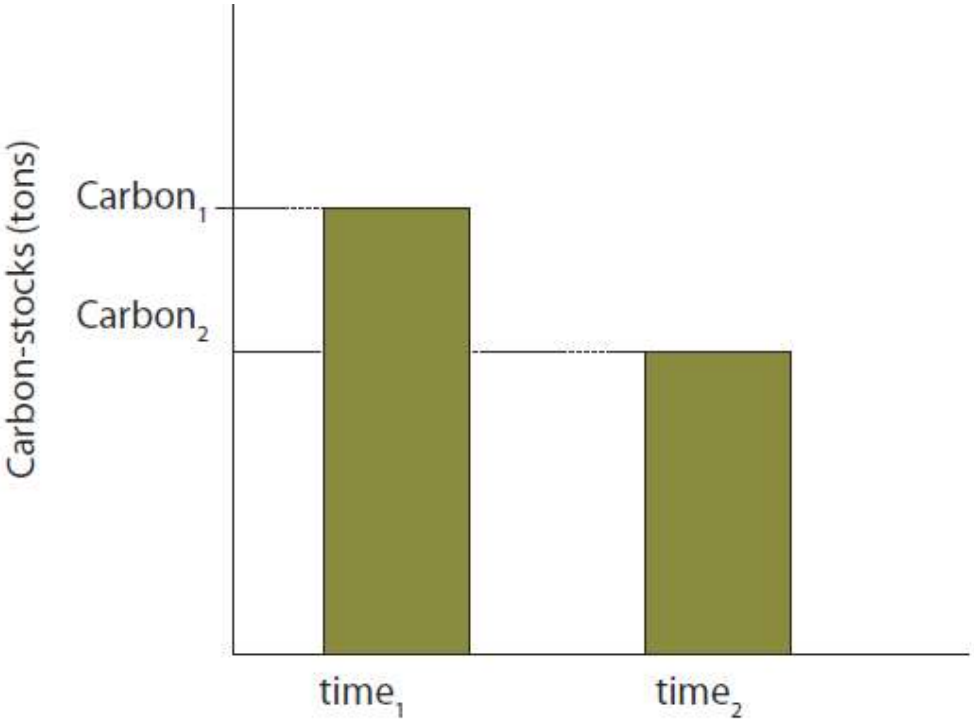
Direct Measurement of Changes

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

Carbon uptake:
- Growth
- Enrichment

Forest Land

Carbon release:
- Timber harvest
- Fuelwood removals
- Sub-canopy fires
- Grazing

Emission Factors in the GHG Inventory

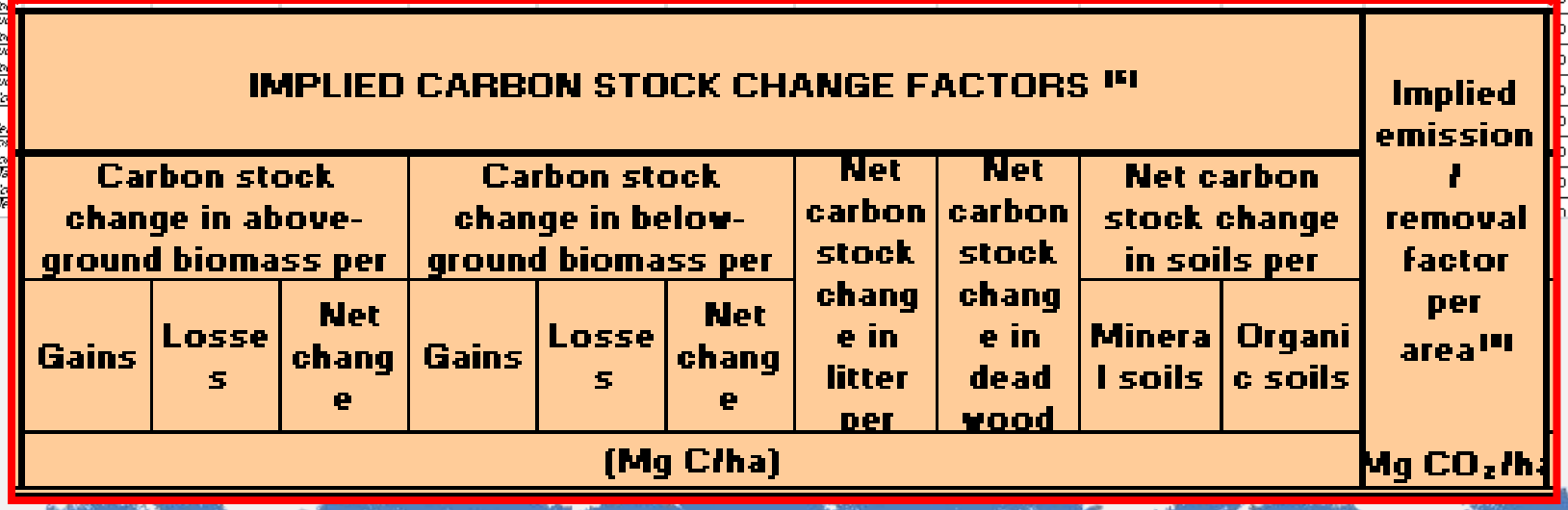
UN-REDD PROGRAMME

TABLE 5(KP-I)A.2. SUPPLEMENTARY BACKGROUND DATA ON CARBON STOCK CHANGES AND NET CO_2 EMISSIONS AND REMOVALS FOR LAND USE, LAND-USE CHANGE AND FORESTRY ACTIVITIES UNDER THE KYOTO PROTOCOL

Article 3.3 activities: Deforestation [1]

AUSTRALIA
Inventory 2011
Submission 2013 v1.1

GEOGRAPHICAL LOCATION [2]	ACTIVITY DATA			IMPLIED CARBON STOCK CHANGE FACTORS [5]										Implied emission / removal factor per area [5]	CHANGE IN CARBON STOCK [5]										Net CO_2 emissions/ removals [5]
				Carbon stock change in above-ground biomass per			Carbon stock change in below-ground biomass per			Net carbon stock change in litter per	Net carbon stock change in dead wood	Net carbon stock change in soils per			Carbon stock change in above-ground biomass [4], [5]			Carbon stock change in below-ground biomass [4], [5]			Net carbon stock change in litter [4]	Net carbon stock change in dead wood [4]	Net carbon stock change in soils [4]		
Identification code	Subdivision [3]	Area subject to the activity	Area of organic soils [7]	Gains	Losses	Net change	Gains	Losses	Net change			Mineral soils	Organic soils		Gains	Losses	Net change	Gains	Losses	Net change			Mineral soils	Organic soils [5]	
		(kha)	(kha)	(Mg C/ha)										Mg CO_2/ha	(Gg C)										(Gg CO_2)
Total for activity A.2.		6,501.52	NO	0.00	-0.39	-0.39	0.00	-0.17	-0.17	-0.15	-0.34	-0.47	NO	5.57	0.50	-2,561.09	-2,560.59	0.23	-1,135.73	-1,135.50	-958.47	-2,185.90	-3,044.52	NO	36,244.92
NSW		1,220.73	NO	0.00	-0.80	-0.80	0.00	-0.34	-0.34	-0.33	-0.41	-0.55	NO	8.87	0.27	-812.57	-812.30	0.12	-350.44	-350.32	-331.81	-416.51	-556.98	NO	9,049.08
	Acacia Forest and Woodland	61.17	NO	IE	-0.18	-0.18	IE	-0.08	-0.08	-0.14	-0.18	0.01	NO	2.08	IE	-10.92	-10.92	IE	-4.95	-4.95	-8.59	-10.92	0.69	NO	127.18
	Acacia Open Woodland	0.44	NO	IE	-0.52	-0.52	IE	-0.50	-0.50	-0.22	-0.33	0.04	NO	5.61	IE	-0.23	-0.23	IE	-0.22	-0.22	-0.10	-0.15	0.02	NO	2.49
	Acacia Shrubland	93.21	NO	IE	-0.12	-0.12	IE	-0.12	-0.12	-0.15	-0.06	-0.01	NO	1.71	IE	-11.28	-11.28	IE	-10.86	-10.86	-14.21	-5.86	-1.38	NO	159.82
	Callitris Forest and Woodland	48.32	NO	IE	-0.46	-0.46	IE	-0.21	-0.21	-0.29	-0.15	-0.19	NO	4.76	IE	-22.01	-22.01	IE	-10.10	-10.10	-14.15	-7.29	-9.17	NO	229.99
	Casuarina Forest and	51.32	NO	IE	-0.39	-0.39	IE	-0.18	-0.18	-0.23	-0.45	-0.05	NO	4.74	IE	-20.05	-20.05	IE	-9.03	-9.03	-11.68	-23.06	-2.53	NO	243.29
	Eucalyptus Low Open	1.38	NO	0.19	IE	0.19	0.09	IE	0.09	-0.20	-0.50	-0.23	NO	2.40	0.27	IE	0.27	0.12	IE	0.12	-0.28	-0.69	-0.92	NO	3.31
	Eucalyptus Open																								4,386.28
	Eucalyptus Open																								896.73
	Eucalyptus Open																								522.03
	Eucalyptus Woodland																								2,103.99
	Heath																								32.09
	Low Open																								7.70
	Forest																								181.40
	Mallee Woodland																								13.15



IMPLIED CARBON STOCK CHANGE FACTORS [5]									Implied emission / removal factor per area [5]
Carbon stock change in above-ground biomass per			Carbon stock change in below-ground biomass per			Net carbon stock change in litter per	Net carbon stock change in dead wood	Net carbon stock change in soils per	
Gains	Losses	Net change	Gains	Losses	Net change			Mineral soils	Organic soils	
(Mg C/ha)									Mg CO_2/ha

Data Sources for Tier 1 default values

- Emission Factor Database: http://www.ipcc-nggip.iges.or.jp/EFDB/main.php
- Good Practice Guidance for Land Use, Land Use Change and Forestry (LULUCF) (2003)
- Guidelines for Agriculture, Forestry and Other Land Uses (AFOLU) (2006): many tables available

TABLE 1.2
LAND-USE CATEGORIES, CARBON POOLS AND NON-CO_2 GASES TO BE ESTIMATED UNDER TIER 1, THEIR RELEVANCE TO AFOLU SECTIONS, AND THE REFERENCE TO *1996 IPCC GUIDELINES*

Land-use category/ Chapter	Subcategory	C pool & non-CO_2 gases	Methods Section	Chapter 2 Method	Linkage to *1996 IPCC Guidelines*	Tier 1 Method
Forest Land (Chapter 4)	Forest Land Remaining Forest Land (FF)	Above-ground biomass	4.2.1	2.3.1.1	5A	⊕
		Below-ground biomass	4.2.1	2.3.1.1	NE	⊕
		Dead organic matter	4.2.2	2.3.2.1	NE	0
		Soil carbon	4.2.3	2.3.3.1	5D	⊕ [1]
		Non-CO_2 from biomass burning	4.2.4	2.4.1	NE	⊕
		Above-ground				

Assessing Emission Factors through NFIs

Key Messages

- NFIs are national decision-making tools so should be designed to meet a country's individual data / information needs
- NFIs are commonly used by countries (almost all Annex 1 countries) to assess Emission Factors for their national GHG inventory
- Changes in all five forest carbon pools should be reported on
- Two approaches set out by the IPCC for EF assessment are the Gain-Loss method (can be done using one NFI) and the Stock-Difference method (requires two NFIs)
- Land use stratification can be a useful first step to divide forest land into homogenous strata and ensure field sampling is statistically robust and cost-effective

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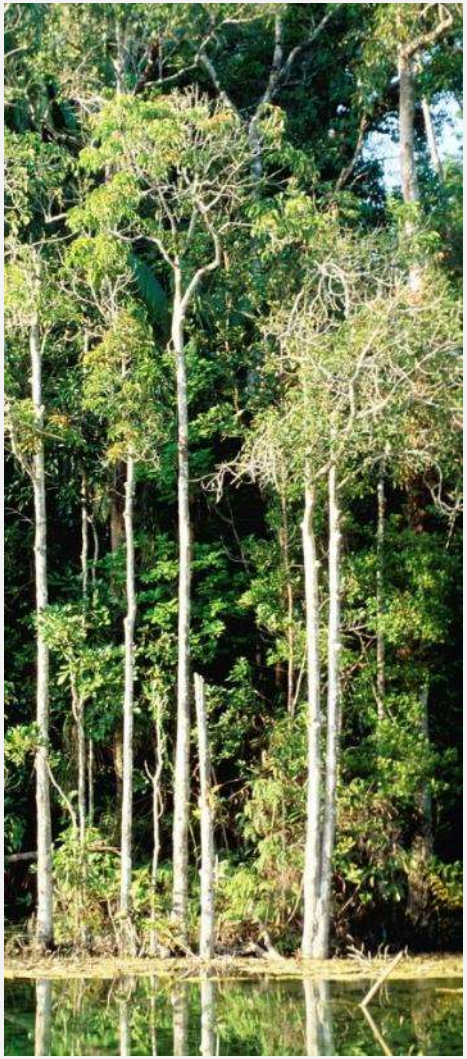

Thank you

Joel.Scriven@fao.org

http://www.un-redd.org