Training Workshop: Preparation and Reporting of Results of National GHG Inventories under the ETF of the Paris Agreement

Kigali, Rwanda 25-27 June 2024

Topic :Adapting national land classification systems to IPCC land use categories and how to use national statistical databases for the purpose of estimating the LULUCF GHG inventory on emissions/removals

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Presentation Outline

➢ Learning Objectives

➢ Land Use definitions in the 2006 IPCC Guidelines: (Forest Land, Cropland, Grassland, Wetlands, Settlements and Other land)

➢ Adapting national land classification systems to IPCC land use categories

➢ IPCC good practices for aligning national land classification with IPCC6 land use classes

➢ Examples of national land use definitions and adapting national land use with IPCC land use categories:

➢ Generation of land use and land use change matrices including generation of annual matrices

➢ How to ensure that the national classification system should be used consistently over time.

➢ Consistent Representation of Lands– Exercise

➢ Consistent Representation of Lands– Reporting

➢ The Paris Agreement and the Common Reporting Tables: Land Use, Land Use Change and Forestry (LULUCF)

➢ Summary

Learning Objectives

➢ Understand importance of adapting national land classification systems to IPCC land use categories

➢ Understand definitions of the land use in the 2006 IPCC Guidelines: 6 land use categories (Forest Land, Cropland, Grassland, Wetlands, Settlements and Other land)

➢ Describe the characteristics of IPCC good practices for aligning national land classification with IPCC6 land use classes

➢ Understand Land use and land use change matrices are generated –including how to ensure that the national classification system should be used consistently over time

➢ Identify the IPCC approaches used for representing land areas and land use data bases used for the inventory preparation

➢ Understand Land use classification under the Paris Agreement and Common Reporting tables

Land-use definitions, classification systems and their correspondence to the Land categories

Land-use definitions, classification systems and their correspondence to the Land categories

- Use national definitions of land use which are consistent with the definitions of the land use categories referred to in Volume 4 of the IPCC 2006 guidelines:

- The IPCC 2006 identifies six broad land-use categories for the purpose of estimating and reporting greenhouse gas emissions and removals from land use and land-use conversions:
  - i.   Forest Land;
  - ii. Cropland;
  - iii. Grassland;
  - iv. Wetlands;
  - v.   Settlements;
  - vi. and Other Land

Rollover a land use category above for more information.

Land-use definitions, classification systems and their correspondence to the Land categories: Forest Land

➢ *2006 IPCC Guidelines* define Forestland as *"… all land with woody vegetation consistent with thresholds used to define Forest Land in the national greenhouse gas inventory. It also includes systems with a vegetation structure that currently fall below, but in situ could potentially reach the threshold values used by a country to define the Forest Land category*".

➢ IPCC Guidelines provide guidance on estimating and reporting anthropogenic emissions and removals only from managed forests as it is assumed that natural undisturbed forests are neither sources nor sinks of GHGs.

➢ Countries should consistently apply national definitions of managed forests over time.

Land-use definitions, classification systems used and their correspondence to the Land categories : Forest Land

Countries may use their own definitions for forest land and should use them consistently across time. UNFCCC asks for an explanation if countries use a different forest definition than the one used for other international reporting.

Considerations for establishing forest definition:
- Thresholds of minimum forest area / crown cover / tree height
- Including / excluding plantation forests
- Separate natural forest class

An example: FAO forest definition:

- Minimum forest area: 0.5 ha
- -Trees potential to reach a minimum height of 5 meters
- Minimum tree crown cover: 10%
- Predominant land use in the area is forest

Land-use definitions, classification systems and their correspondence to the Land categories: Cropland

➢ **Cropland:** includes arable and tillable land, rice fields, and agroforestry systems where the vegetation structure falls below the thresholds used for the Forest Land category, and is not expected to exceed those thresholds at a later time. Cropland includes all annual and perennial crops as well as temporary fallow land (i.e.,)

✓ land set at rest for one or several years before being cultivated again). Annual crops include cereals, oils seeds,

✓ vegetables, root crops and forages. Perennial crops include trees and shrubs, in combination with herbaceous

✓ crops (e.g., agroforestry) or as orchards, vineyards and plantations such as cocoa, coffee, tea, oil palm, coconut,

✓ rubber trees, and bananas, except where these lands meet the criteria for categorisation as Forest Land. Arable

✓ land which is normally used for cultivation of annual crops, but which is temporarily used for forage crops or

✓ grazing as part of an annual crop-pasture rotation (mixed system) is included under cropland.

Land-use definitions and the classification systems used and their correspondence to the Land categories - Grassland

Grasslands:

➢ Grasslands includes rangelands and pastureland that not considered Cropland including systems with woody vegetation and other non-grass vegetation such as herbs and brushes falling below the threshold values used in the Forest Land category.

➢ Grasslands generally have vegetation dominated by perennial grasses, and grazing is the predominant land use.

➢ Grasslands vary greatly in their degree and intensity of management, from extensively managed rangelands and savannahs to intensively managed (e.g., with fertilization, irrigation, species changes).
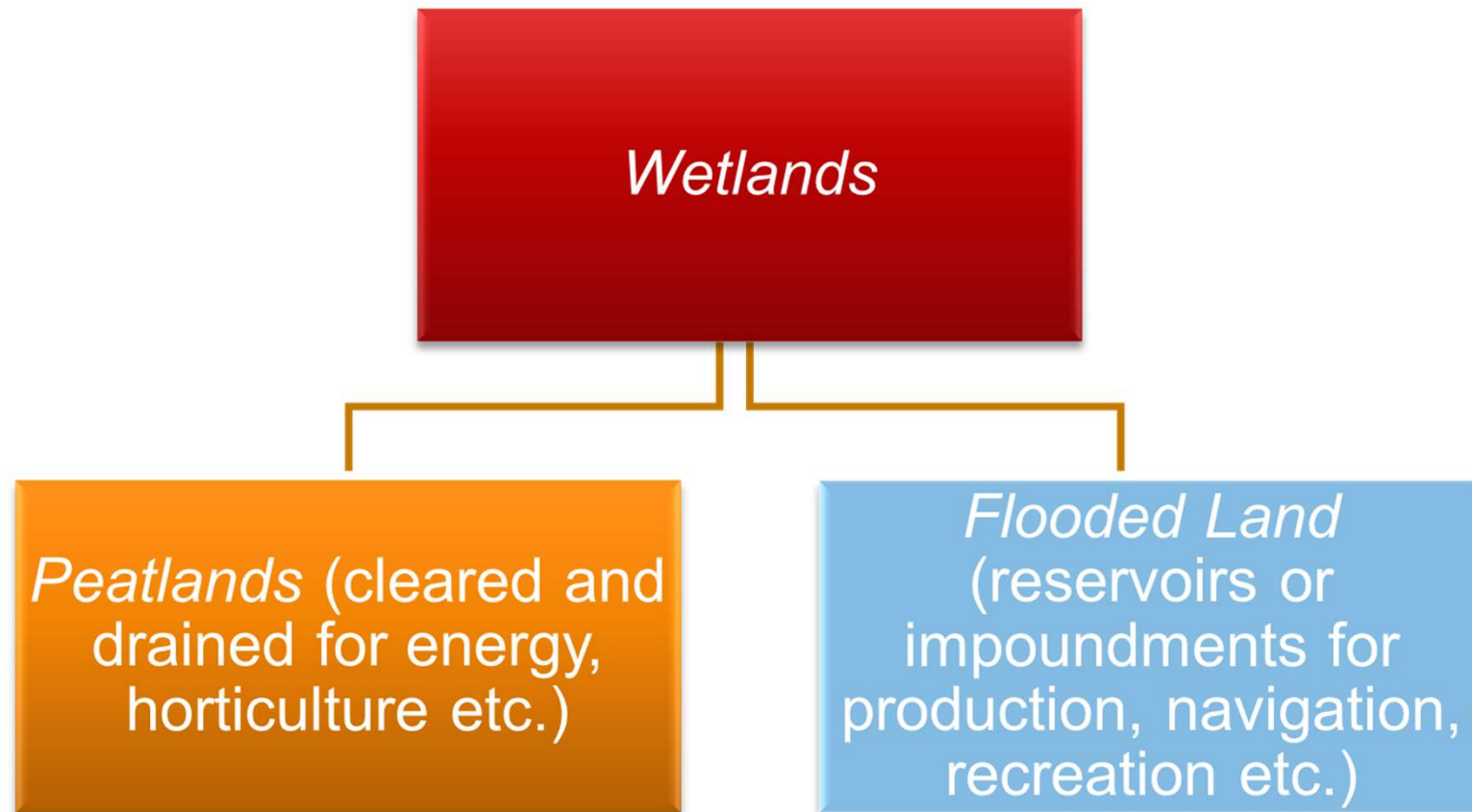
Land-use definitions, classification systems and their correspondence to the Land categories: Wetlands

Wetlands:

-Wetlands include any land that is covered or saturated by water for all or part of the year, and that does not fall into the Forest Land, Cropland, or Grassland categories.

- Guidance is restricted to Managed Wetlands where the water table is artificially changed (e.g., drained or raised) or wetlands created through human activity (i.e., damming a river)2006 IPCC Guidelines and GPG LULUCF provide guidance on two wetlands types:

- Peatlands cleared and drained for production of peat for energy, horticultural and other uses (Peatlands)

- Reservoirs or impoundments, for energy production, irrigation, navigation, or recreation (Flooded Land)

Land-use definitions, classification systems and their correspondence to the Land categories: Wetlands in 2006 IPCC guidelines

Land-use definitions, classification systems and their correspondence to the Land categories: Settlements

Settlements:

- Settlements include all developed land -- i.e., residential, transportation, commercial, and production (commercial, manufacturing) infrastructure of any size, unless it is already included under other land-use categories.

- Settlements include soils, herbaceous perennial vegetation such as turf grass and garden plants, trees in rural settlements, homestead gardens and urban areas.

Land-use definitions, classification systems and their correspondence to the Land categories: Other Land

Other land:

- Other Land includes bare soil, rock, ice, and all land areas that do not fall into any of the other five land-use categories.
- Other Land is often unmanaged, and in that case changes in carbon stocks and non-CO2 emissions and removals are not estimated.

Adapting national land classification systems to IPCC land use categories

Adapting national land classification systems to IPCC land use categories (i)

- In order to use the 2006 IPCC GLs and IPCC Inventory Software Tool, the following the steps below would be necessary:

- Identify a National land classification systems of IPCC Land Use Categories for estimation emissions/removals. This means:

- **Step (i)**   Establish a correspondence between National Land Use Categories and the IPCC 6 Land Use categories, first assess the definition of each national land use category and then identify the corresponding   IPCC Land Use Category; (see example in next slide)

Adapting national land classification systems to IPCC land use categories (ii)

An Example of the standardization/mapping of land-use categories: Land use cover map/national classification categories vs. IPCC categories

Land Use Map land classification	IPCC Categories
Agricultural land	Cropland
Meadows and scrubland	Grassland
Native forest, Mixed Forest and Forest plantations	Forest Land (FL), subdivided into Native Forest (FL-NF) and Forest Plantations (FL-FP)
Wetlands	Wetlands stratified by soil type (organic or mineral soils) and wetland type
Urban and industrial areas	Settlements
Areas without vegetation, snow and glaciers, bodies of water and uncharted areas	Other land
Unmanaged land	Report areas of unmanaged land for record keeping and ensuring total land area accounting

Adapting national land classification systems to IPCC land use categories (iii)

Step (ii) Once the correspondence is established, use this mapping to develop land use matrices which show the conversions between Land Use Categories; for e.g. agroforestry in national classification maybe classified forest in IPCC Land Use Categories if the dominant activity on the land is forestry and the land meet the forest definition. An example from South Africa

SANLC No.	Class name	Inventory class	Class definition
1	Contiguous Forest (combined very high, high, medium)	Indigenous forest	Natural tall woody vegetation communities, with 75% or more canopy cover, and canopy heights exceeding 6 metres. Typically representative of tall, indigenous forests. Note that the spatial extent of where spectrally modelled dense woody cover represents indigenous forest is informed by the January 2018 release of the SANBI Vegetation of South Africa dataset (and not the 2006 version as used in the 1990 and 2013-14 SANLC datasets).
2	Contiguous Low Forest & Thicket	Thicket/dense bush	Natural tall woody vegetation communities, with 75% or more canopy cover, and canopy heights ranging between 2.5 - 6 metres. Typically representative of low, indigenous forests and dense thicket communities.
3	Dense Forest & Woodland	**Natural woodland**	Natural tall woody vegetation communities, with canopy cover ranging between 35 - 75%, and canopy heights exceeding 2.5 metres. Typically represented by dense bush, dense woodland and thicket communities.
4	Open Woodland	**Natural woodland**	Natural tall woody vegetation communities, with canopy cover ranging between 10 - 35%, and canopy heights exceeding 2.5 metres. Typically represented by open bush and woodland communities.
42	Fallow Land & Old Fields (Trees)	**Natural woodland**	Long-term, non-active, previously cultivated lands that are now overgrown with tree-dominated woody vegetation. Typically the cultivated land unit boundary is no longer image detectable. Historical field boundaries (supplied by SANBI) have been mapped from archival topographical 1:50,000 maps circa 1950's-70's. This class is only represented if it has not been modified to a more recent, alternative land-cover or land-use class.
43	Fallow Land & Old Fields (Bush)	**Natural woodland**	Long-term, non-active, previously cultivated lands that are now overgrown with bush dominated woody vegetation. Typically the cultivated land unit is no longer image detectable. Historical field boundaries (supplied by SANBI) have been mapped from archival topographical 1:50,000 maps circa 1950's-70. This class is only represented if it has not been modified to a more recent, alternative land-cover or land-use class.

Examples of adapting national land use with IPCC land use categories:

Adapting national land classification systems to IPCC land use categories (i)

In order to use the 2006 IPCC GLs and IPCC Inventory Software Tool, there is a requirement to reclassify national land use categories and align with IPCC 6 land uses categories:; (An example – Tropical Country XX)

	IPCC 2006	National Classification
1	Forest	Dense
		Moderate
		Sparse
		Woodland
2	Grassland	Closed Grassland
		Open Grassland
		Closed Shrubland
		Open Shrubland
3	Perennial Cropland	Perennial Cropland
4	Annual Cropland	Annual Cropland
5	Wetland	Wetland
		Water
6	Settlement	Settlement
7	Other	Bare Soil
		Lava Flow
		Rock Outcrop
		Salt Pan

Adapting national land classification systems to IPCC land use categories (ii)

- This means that all land within Country XX was re-classified into the six IPCC land categories and where all land is treated in this inventory as managed land.

- This implies that all land has been accounted for in the compilation of emissions and removals.

- The land cover change data was provided for example by the local by Regional Centre for Mapping of Resources, the Geospatial Information Institute and Forestry Commission and forms the basis for the land use and land use change and forestry analyses.

- The original data had 17 classes, which were condensed to 7 classes as shown in Table on previous slide. Note: the land change mapping within the 17 national land classes and between the classes was only done for the 7 IPCC land classes.

Adapting national land classification systems to IPCC land use categories (Source Norway National Inventory Report

Table 6.7 NFI land cover and land useage categories and their correspondence to the UNFCCC land-use categories.

Land usage / Land cover	Forestry (no other use or restrictions)	City, urban area Settlements of different kinds	Cabin area (excl. cabins)	Recreation area	Military training field	Protected Area, Nature Reserve	Roads/Railroad Airport	Power line	Other
Productive forest (1)	Forest land	Settlements	Forest land	Forest land	Forest land	Forest land	Settlements	Settlements	Settlements
Non-productive forest (2)	Forest land	Settlements	Forest land	Forest land	Forest land	Forest land	Settlements	Settlements	Settlements
Other wooded land with crown cower 5-10% (3)	Grassland (extensive)	Settlements	Grassland (extensive)	Grassland (extensive)	Grassland (extensive)	Grassland (extensive)	Settlements	Settlements	Settlements
Open pastuers,	Grassland (extensive)	Settlements	Grassland (extensive)	Grassland (extensive)	Grassland (extensive)	Grassland (extensive)	Settlements	Grassland (extensive)	Grassland (extensive)
Wooded mire, crown cover 5-10%	Wetlands	Settlements	Wetlands	Wetlands	Wetlands	Wetlands	Settlements	Settlements	Settlements
Coastal calluna heath	Grassland (extensive)	Settlements	Grassland (extensive)	Grassland (extensive)	Grassland (extensive)	Grassland (extensive)	Settlements	Grassland (extensive)	Settlements
Bare rocks & glaciers	Other land	Settlements	Other land	Other land	Other land	Other land	Settlements	Other land	Settlements
Mire without tree cover	Wetlands		Wetlands	Wetlands	Wetlands	Wetlands	Settlements	Wetlands	Wetlands
Lakes and rivers (not sea)		Wetlands		Wetlands	Wetlands	Wetlands	Wetlands		Wetlands
Closed pasture grazing land, not regularly cultivated						Grassland (intensive			Grassland (intensive)
Arable land, regularly cultivated						Cropland			Cropland
Other areas (4)	Settlements	Settlements		Settlements	Settlements	Settlements	Settlements	Settlements	Settlements

# Generation of land use and land use change matrices and Activity Data

Land use and land use change matrices in generating activity data

- In order to develop a land use and land change matrix the following are required:

➢ Two maps produced with a similar methodology, for example , overlay of 2 Landsat land cover maps or 2 Sentinel Remote sensing data.

➢ Two maps with a consistent land use classification.

- Countries generate land use and land change matrices for area and area change data using a combination of remote sensing land cover maps and ground proofing surveys and these are used in the inventory as activity data (See Session by FAO in Day 3:Collect Earth and Logic Tool)

- Determining Activity Data (AD) on land areas and land use changes: Land area and area change data could be generated from the land use maps (National Forest Programme, agricultural surveys on areas of croplands), statistical data on categories of land use change matrices can come from national datasets/global datasets.

- Note that land-use change matrices and the above-mentioned standardized categories matrices should be constructed for annual rates of change between land uses for the different working subcategories. (Day 3 presentation on use of IPCC splicing techniques to annualise matrices and generate a consistent time series)

- See examples in Excel worksheets on how to translate land cover data into land use activity data to be used in the GHG inventory

Land change matrix

SANLC 2013/14

SANLC 2018
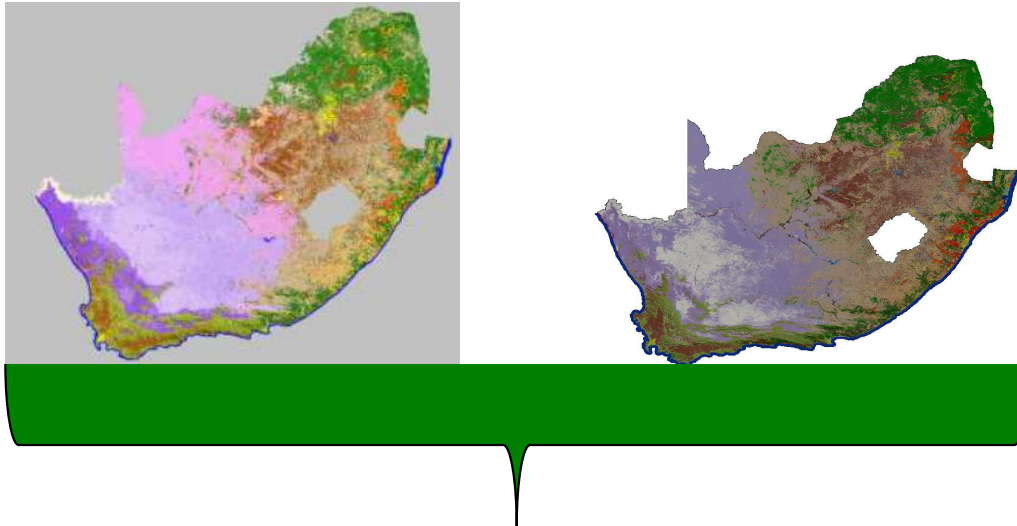
Land change map and matrix

Category	FL-NF	FL-FP	CL	GL	WL	SL	OL	TOTAL
Forest land – native forest		7,868.0	304.1	4,142.9	0.0	70.1	411.6	12,796.5
Forest land – forest plantations	586.1		841.2	1,842.0	0.2	407.0	89.9	3,766.4
Cropland	320.6	25,557.7		2,220.3	2.5	4,572.4	113.7	32,787.3
Grassland	5,266.3	40,420.9	7,975.5		10.6	1,616.7	850.3	56,140.3
Wetlands	6.1	246.7	61.1	61.5		40.8	1.3	417.4
Settlements	1.3	13.9	8.0	4.7	0.0		0.4	28.3
Other land	27.4	468.8	135.6	802.5	0.5	71.8		1,506.7
TOTAL	6,207.8	74,576.1	9,325.4	9,073.9	13.7	6,778.8	1,467.1	107,442.8

Fictious example

Source South African National Inventory Report, 2017?
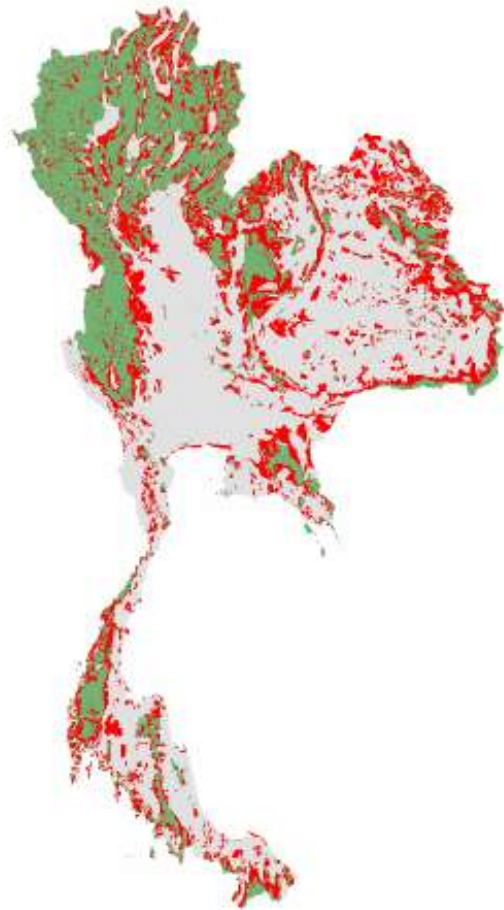
Forest Cover Mapping Example from Thailand

Forest area
in **1993**

Forest area
in **1998**

Forest Cover Mapping Example from Thailand

Forest area change between 1993 and 1998

Examples of land use change/transition matrices used in generating activity data

- An example of a land use matrix generated from the land cover maps for 2003 and 2008

Initial year	2003
Final year	2008

2003 / 2008	Forest land	Cropland	Grassland	Wetlands	Settlements	Other lands	Total
Forest land	6,554,745.80	2,295,960.60	5,339,823.10	57,333.10	874.90	138,238.10	14,386,975.60
Cropland	1,857,556.00	10,902,281.50	6,788,072.20	21,555.00	2,403.70	175,946.80	19,747,815.20
Grassland	3,198,734.70	5,182,337.50	45,800,613.30	154,310.40	2,823.20	3,975,602.40	58,314,421.50
Wetlands	81,930.50	35,881.80	347,762.80	740,765.50	6.20	72,563.60	1,278,910.40
Settlements	5,064.70	22,276.20	12,392.70	460.10	109,328.00	3,678.90	153,200.60
Other lands	96,143.80	193,934.10	3,922,433.90	73,714.20	181.20	8,869,164.20	13,155,571.40
Total	11,794,175.50	18,632,671.70	62,211,098.00	1,048,138.30	115,617.20	13,235,194.00	

TRUE

Examples of land use change/transition matrices used in generating activity data

- An example of a land use matrix generated from the land cover maps for 2008 and 2013

Initial year	2008
Final year	2013

2008 / 2013	Forest land	Cropland	Grassland	Wetlands	Settlements	Other lands	Total
Forest land	7,019,030.70	4,215,923.40	5,806,105.60	159,840.60	16,633.20	361,832.10	17,579,365.60
Cropland	2,699,882.50	9,652,734.10	7,591,145.00	38,584.00	30,294.60	259,851.80	20,272,492.00
Grassland	4,468,588.80	5,581,823.60	41,366,995.80	316,629.70	17,737.90	4,357,534.20	56,109,310.00
Wetlands	56,062.50	44,216.70	202,928.20	726,599.40	1,038.10	125,966.00	1,156,810.90
Settlements	14,160.50	47,254.80	21,117.40	782.90	79,620.70	1,775.20	164,711.50
Other lands	129,250.60	205,862.60	3,326,129.50	36,473.80	7,876.10	8,048,612.10	11,754,204.70
Total	14,386,975.60	19,747,815.20	58,314,421.50	1,278,910.40	153,200.60	13,155,571.40	

TRUE

Examples of land use change/transition matrices used in generating activity data

- An example of a land use matrix generated from the land cover maps for 2013 and 2018

Initial year	2013
Final year	2018

2013 / 2018	Forest land	Cropland	Grassland	Wetlands	Settlements	Other lands	Total
Forest land	7,913,862.20	3,105,494.60	4,770,479.60	82,020.80	17,656.30	162,674.10	16,052,187.60
Cropland	5,199,437.00	11,844,672.90	12,962,646.80	86,845.90	32,188.70	792,409.00	30,918,200.30
Grassland	3,871,395.80	4,537,118.50	35,971,706.00	189,253.40	23,139.50	2,114,582.60	46,707,195.80
Wetlands	166,190.80	167,727.80	437,592.30	665,462.70	679.50	42,883.30	1,480,536.40
Settlements	10,414.00	31,541.20	14,869.00	574.00	90,595.40	2,991.10	150,984.70
Other lands	418,065.80	585,937.00	1,952,016.30	132,654.10	452.10	8,638,664.60	11,727,789.90
Total	17,579,365.60	20,272,492.00	56,109,310.00	1,156,810.90	164,711.50	11,754,204.70	

TRUE

Generating annual land use change matrices for LULUCF GHG compilation

Annualised land use change matrices for LULUCF GHG compilation- Activity Data

Annual land use matrix generated from the land cover maps for 2003 and 2008

Initial year	2003
Final year	2008

2003 / 2008	Forest land	Cropland	Grassland	Wetlands	Settlements	Other lands	Total annual conversion
Forest land		459,192.12	1,067,964.62	11,466.62	174.98	27,647.62	1,566,445.96
Cropland	371,511.20		1,357,614.44	4,311.00	480.74	35,189.36	1,769,106.74
Grassland	639,746.94	1,036,467.50		30,862.08	564.64	795,120.48	2,502,761.64
Wetlands	16,386.10	7,176.36	69,552.56		1.24	14,512.72	107,628.98
Settlements	1,012.94	4,455.24	2,478.54	92.02		735.78	8,774.52
Other lands	19,228.76	38,786.82	784,486.78	14,742.84	36.24		857,281.44
Total annual conversion	1,047,885.94	1,546,078.04	3,282,096.94	61,474.56	1,257.84	873,205.96	

Annualised land use change matrices for LULUCF GHG compilation- Activity Data

Annual land use matrix generated from the land cover maps for 2008 and 2013

Initial year	2008
Final year	2013

2008 / 2013	Forest land	Cropland	Grassland	Wetlands	Settlements	Other lands	Total annual conversion
Forest land		843,184.68	1,161,221.12	31,968.12	3,326.64	72,366.42	**2,112,066.98**
Cropland	539,976.50		1,518,229.00	7,716.80	6,058.92	51,970.36	**2,123,951.58**
Grassland	893,717.76	1,116,364.72		63,325.94	3,547.58	871,506.84	**2,948,462.84**
Wetlands	11,212.50	8,843.34	40,585.64		207.62	25,193.20	**86,042.30**
Settlements	2,832.10	9,450.96	4,223.48	156.58		355.04	**17,018.16**
Other lands	25,850.12	41,172.52	665,225.90	7,294.76	1,575.22		**741,118.52**
Total annual conversion	**1,473,588.98**	**2,019,016.22**	**3,389,485.14**	**110,462.20**	**14,715.98**	**1,021,391.86**	

Annualised land use change matrices for LULUCF GHG compilation- Activity Data

Annual land use matrix generated from the land cover maps for 2013 and 2018

Initial year	2013
Final year	2018

2013 / 2018	Forest land	Cropland	Grassland	Wetlands	Settlements	Other lands	Total annual conversion
Forest land		621,098.92	954,095.92	16,404.16	3,531.26	32,534.82	1,627,665.08
Cropland	1,039,887.40		2,592,529.36	17,369.18	6,437.74	158,481.80	3,814,705.48
Grassland	774,279.16	907,423.70		37,850.68	4,627.90	422,916.52	2,147,097.96
Wetlands	33,238.16	33,545.56	87,518.46		135.90	8,576.66	163,014.74
Settlements	2,082.80	6,308.24	2,973.80	114.80		598.22	12,077.86
Other lands	83,613.16	117,187.40	390,403.26	26,530.82	90.42		617,825.06
Total annual conversion	1,933,100.68	1,685,563.82	4,027,520.80	98,269.64	14,823.22	623,108.02	

Challenges when generating a consistent time series in land use

- What to do when you have gaps in land area data?
- What if we have land cover maps data for 2003, 2008, 2013 and 2013 but no data for the intervening years?
- New activity data become available, but not for historical years
- A new source or sink category is added to the inventory, for which historical data are not available
- Department of Forestry stopped collecting data on National Forest Inventory or disaggregated data for wood removals/Timber data
- These problems can be especially a challenge for agriculture and LULUCF sectors.

Data availability and how to address LULUCF data gaps : An example-Interpolation Splicing technique

Interpolation: Filling gaps in existing time series.

Techniques:

- ✓ Linear or nonlinear, justify choice
- ✓ Should not be used for variables that have large variability from year to year.

$$Y_t = Y_{start} + \frac{(T_t - T_{start})}{(T_{end} - T_{start})} * (Y_{end} - Y_{start})$$

					T_{start}	T_1	T_2	T_3	T_4	T_{end}						
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Total forest area	946837.1	941190.6	935544.1	929897.7	924251.2					896018.9	890372.5	878217.7	866062.9	853908.2	841753.4	829598.6
Forestland remaining forestland	910620.8	904974.3	899327.9	893681.4	888035.0					859802.7	854156.2	838430.2	822704.2	806978.2	791252.2	775526.2
Land converted to Forest land	36216.3	36216.3	36216.3	36216.3	36216.3					36216.3	36216.3	39787.5	43358.7	46930.0	50501.2	54072.4
Interpolated - Total forest area						918604.76	912958.307	907311.8497	901665.3925							
Interpolated - Forestland remaining forestland						882388.5	876742.0461	871095.5889	865449.1316							
Interpolated - Land converted Forest land						36216.261	36216.26084	36216.26084	36216.26084							
					Y_{start}	Y_1	Y_2	Y_3	Y_4	Y_{end}						

How to ensure that the national classification system should be used consistently over time

Ensuring that the national classification system is used consistently over time

- Considerations for the ensuring a consistent land representation in terms acquiring of AD for land areas.

- Use the same land use definition across time – use of IPCC 6 land use categories (Forest Land, Cropland, Grassland, Wetlands, Settlements and Other Land)

- Use land cover maps with the similar land use classifications

- Identify the IPCC approaches used for representing land areas and land use data bases used for the inventory preparation

Consistent Representation of Lands: An Exercise

Ex. # 1: Land Use matrix: Can you fill in the missing values?

Initial / Final	FL	CL	GL	WL	SE	OL	Final Area
FL	50	2	6	0	2	0	??
CL	5	35	8	0	2	0	50
GL	3	7	??	0	0	0	37
WL	8	0	0	20	3	0	31
SE	0	0	0	0	32	0	32
OL	0	0	0	0	0	5	5
Initial Area	66	44	??	20	??	5	215

And the answer is...

Initial / Final	FL	CL	GL	WL	SE	OL	Final Area
FL	50	2	6	0	2	0	60
CL	5	35	8	0	2	0	50
GL	3	7	27	0	0	0	37
WL	8	0	0	20	3	0	31
SE	0	0	0	0	32	0	32
OL	0	0	0	0	0	5	5
Initial Area	66	44	41	20	39	5	215

Lands Consistent Representation of Lands– Reporting

Consistent Representation of Lands– Reporting (1)

- Reporting - Annual matrices of land use and land use change
- Let's identify how matrices are complied, what information they contain and what they look like by following the example below.

Country X has been subdivided in a number of strata homogeneous by climate zone, ecological zone and soil type.

Then, for each stratum a time series of annual matrices has been prepared as shown in the below matrices. For instance, a stratum could be: Warm Temperate Moist climate zone (WTM), Temperate Mountain Systems ecological zone (TMS), and High Activity Clay soil type (HAC). As reported in the example below:

Inventory year is 2005

| Hectares | 2004 | | | | | | | | | Total |
	Unmanaged Forest land	Manged Forest Land	Cropland	Unmanaged Grassland	Managed Grassland	Unmanaged Wetlands	Managed Wetlands	Settlements	Other Land	2005
Unmanaged Forest land	6,308	0	0	0	0	0	0	0	0	6,308
Manged Forest Land	0	322,330	352	0	0	0	0	0	0	322,682
Cropland	0	130	324,480	0	260	0	0	0	0	324,870
Unmanaged Grassland	0	0	0	1,965	0	0	0	0	0	1,965
Managed Grassland	0	0	708	0	648,840	0	0	0	0	649,548
Unmanaged Wetlands	0	0	0	0	0	6,254	0	0	0	6,254
Managed Wetlands	0	0	0	0	0	0	5,191	0	0	5,191
Settlements	0	0	196	0	66	0	0	25,954	0	26,216
Other Land	0	0	0	0	0	0	0	0	6,488	6,488
Total 2004	6,308	322,460	325,736	1,965	649,166	6,254	5,191	25,954	6,488	1,349,522

(Row label on left side: 2005)

Consistent Representation of Lands– Reporting (2)

Inventory year is   2006

Hectares	2005									Total
	Unmanaged Forest land	Manged Forest Land	Cropland	Unmanaged Grassland	Managed Grassland	Unmanaged Wetlands	Managed Wetlands	Settlements	Other Land	2006
Unmanaged Forest land	6,178	0	0	0	0	0	0	0	0	6,178
Manged Forest Land	130	322,552	195	0	0	0	0	0	0	322,877
Cropland	0	0	323,766	0	708	0	0	0	0	324,474
Unmanaged Grassland	0	0	0	1,900	0	0	0	0	0	1,900
Managed Grassland	0	0	260	65	648,580	0	0	0	0	648,905
Unmanaged Wetlands	0	0	0	0	0	6,254	0	0	0	6,254
Managed Wetlands	0	0	0	0	0	0	5,191	0	0	5,191
Settlements	0	130	649	0	260	0	0	26,216	0	27,255
Other Land	0	0	0	0	0	0	0	0	6,488	6,488
Total 2005	6,308	322,682	324,870	1,965	649,548	6,254	5,191	26,216	6,488	1,349,522

(2006)

➢ *How should I read matrices?*

✓ Note that a time series is composed by a number of tables corresponding to the number of years for which the land representation has to be built plus 19.

✓ For example, the time series for the GHG inventory period 2005-2017 will be composed by 30 annual matrices (i.e. from matrix 1985-1986 till matrix 2015-2016)

✓ Finally, data reported in the time series of annual matrices (1 time series for each combination of climate zone, ecological zone and soil type) are then aggregated according to GHGI category reporting (i.e., in land use and land-use change categories).

The Paris Agreement and the Common Reporting Tables:
Land Use, Land Use Change and Forestry (LULUCF)

Year
Submission
Country

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO$_2$ emissions/removals [1,2]	CH$_4$ [2]	N$_2$O [2]	NO$_x$	CO	NMVOC	Total GHG emissions/removals [3]
	(kt)						CO$_2$ equivalents (kt) [4]
4. Total LULUCF							
4.A. Forest land							
4.A.1. Forest land remaining forest land							
4.A.2. Land converted to forest land							
4.B. Cropland							
4.B.1. Cropland remaining cropland							
4.B.2. Land converted to cropland							
4.C. Grassland							
4.C.1. Grassland remaining grassland							
4.C.2. Land converted to grassland							
4.D. Wetlands [5]							
4.D.1. Wetlands remaining wetlands							
4.D.2. Land converted to wetlands							
4.E. Settlements							
4.E.1. Settlements remaining settlements							
4.E.2. Land converted to settlements							
4.F. Other land [6]							
4.F.1. Other land remaining other land							
4.F.2. Land converted to other land							
4.G. Harvested wood products [7]							
4.H. Other *(please specify)*							

Memo item:							
Emissions and subsequent removals from natural disturbances on managed lands [8]							

(1) For the purposes of reporting, the signs for removals are always negative (–) for removals and positive (+) for emissions.

(2) For each land-use category and subcategory, this table sums the net CO_2 emissions and removals shown in tables 4.A to 4.F, and the CO_2, CH_4 and N_2O emissions shown in tables 4(I)–(IV) and 4.G.

(3) "Total GHG emissions/removals" does not include NO_X, CO and NMVOC.

(4) As per decision 18/CMA.1, annex, para. 37, each Party shall use the 100-year time-horizon GWP values from the IPCC Fifth Assessment Report, or 100-year time-horizon GWP values from a subsequent IPCC assessment report as agreed upon by the CMA, to report aggregate emissions and removals of GHGs, expressed in CO_2 eq. Each Party may in addition also use other metrics (e.g. global temperature potential) to report supplemental information on aggregate emissions and removals of GHGs, expressed in CO_2 eq. In such cases, the Party shall provide in the national inventory document information on the values of the metrics used and the IPCC assessment report they were sourced from.

(5) Parties may decide not to prepare estimates for CH_4 emissions from flooded land contained in appendix 3 of vol. 4 of the 2006 IPCC Guidelines, although they may do so if they wish.

(6) This category includes bare soil, rock, ice, and all land areas that do not fall into any of the other five categories thus enabling the total of identified land areas to match the national area.

(7) End of life non-CO_2 emissions from HWP are covered in the energy sector or waste sector.

(8) Parties may report the emissions and subsequent removals from natural disturbances on managed lands, in the case of a Party addressing these emissions and subsequent removals, in accordance with decision 18/CMA.1, annex, para. 55.

Note: Minimum level of aggregation is needed to protect confidential business and military information, where it would identify particular entity's/entities' confidential data.

Documentation box:
• Parties should provide a detailed description of the LULUCF sector in chapter 6 ("Land Use, Land-Use Change and Forestry" (CRT sector 4)) of the NID. Use this documentation box to provide references to relevant sections of the NID, if any additional information and/or further details are needed to understand the content of this table.
• If estimates are reported under the category 4.H. (other), use this documentation box to provide information regarding activities covered under this category and to provide a reference to the section of the NID where background information can be found.
• Parties may indicate in this documentation box whether national totals include estimates of the emissions and subsequent removals from natural disturbances on managed lands, in accordance with decision 18/CMA.1, annex, para. 55.

Table 4.1 LAND TRANSITION MATRIX

Areas and changes in areas between the previous and the current inventory year [1]

Year
Submission
Country

TO: → / FROM: ↓	Forest land (managed)	Forest land (unmanaged)	Cropland	Grassland (managed)	Grassland (unmanaged)	Wetlands (managed)	Wetlands (unmanaged)	Settlements	Other land	Total unmanaged land	Initial area
FROM:	(kha)										
Forest land (managed) [2]											
Forest land (unmanaged) [2]											
Cropland [2]											
Grassland (managed) [2]											
Grassland (unmanaged) [2]											
Wetlands (managed) [2]											
Wetlands (unmanaged) [2]											
Settlements [2]											
Other land [2]											
Total unmanaged land [3]											
Final area											
Net change [4]											

[1] For Parties using reporting approach 1 to represent land areas, only data on the initial and final area per land use should be included. "NA" should then be used for the specific land-use transitions, allowing for the formulas in the cells for final and initial areas to be overwritten. Coastal wetlands areas which are not part of the total land area should not be included in this land matrix.

[2] Definitions for the respective land-use categories used by the Party should be provided in the NID, in accordance with the definitions of land use categories in the 2006 IPCC Guidelines (Vol. 4, chap. 3.2).

[3] Parties may report only the total area of unmanaged land area and report "IE" under the individual unmanaged land uses categories. Conversely, if areas are reported under the individual unmanaged land-use categories, Parties should report "IE" for the total area of unmanaged land.

[4] Net change is the final area minus the initial area for each of the conversion categories shown at the head of the corresponding row. Under the final area row the sum of the net change equals zero. In case of land upheaval from the sea (and other geological processes beyond human control), the "new" area should be reflected. In such cases, the net change would differ from zero. Any such processes should be explained and documented in the NID.

Note: Minimum level of aggregation is needed to protect confidential business and military information, where it would identify particular entity's/entities' confidential data.

Refer to the attached Excel file for the CRT for the following:

Forest Land

Cropland

Grassland

Wetlands

Settlement

Other land and

Harvested Wood Products (HWP)

Summary

Concluding summary

Define national land use classes

- Establish a correspondence between national land use classes and the IPCC land use categories,

- Once the correspondence is established, use this mapping to develop land use matrices which show the conversions between Land use categories;

- Adapt national land classification systems to IPCC land use categories based on information from land cover maps generated either by remote sensing or national survey data

- Ensure that the national classification system is used consistently over time

- Identify the IPCC approaches used for representing land areas and land use data bases used for the inventory preparation

- Understand how information from land representation is used in generation activity data used estimating GHG emissions/removals

- The Paris Agreement and the Common Reporting Tables: Land Use, Land Use Change and Forestry (LULUCF)

Thank you for your attention!

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