



Use of the IPCC Inventory Software for Establishing National GHG inventories in the Agriculture, Forestry and Other Land Use (AFOLU) sector

GFOI Plenary 2023

ipcc

INTERGOVERNMENTAL PANEL ON climate change



Outline

□ Version 2.85

- ✓ Main features
- ✓ Work in progress
 - Interoperability
 - Supporting tools

□ Example on REDD+ activities: *Reference scenario vs Actual GHG emissions and Removals estimates*

- ✓ Elements
- ✓ Land Dynamic
- ✓ Forest Management Variables
- ✓ Land Use Manager
- ✓ Land Representation Manager
 - Units of Land
- ✓ Land Representation Matrix
- ✓ IPCC Inventory Software TABs for Land (3.B)
- ✓ Forest Land C stock changes in C pools
- ✓ Comparison (*NOT in the IPCC Inventory Software*)

□ Download, use, feedback

The Software

Selecting categories

Selecting Functionalities

Selecting Worksheets

IPCC Inventory Software - TSU

Application Database Inventory Year Worksheets Reports Tools Export/Import Administrate Window Help

2006 IPCC Categories

- Energy
 - 1.A - Fuel Combustion Activities
 - 1.A.1 - Energy Industries
 - 1.A.1.a - Main Activity Electricity an
 - 1.A.1.a.i - Electricity Generation**
 - 1.A.1.a.ii - Combined Heat and
 - 1.A.1.a.iii - Heat Plants
 - 1.A.1.b - Petroleum Refining
 - 1.A.1.c - Manufacture of Solid Fuel
 - 1.A.1.c.i - Manufacture of Solid
 - 1.A.1.c.ii - Other Energy Industr
 - 1.A.2 - Manufacturing Industries and C
 - 1.A.2.a - Iron and Steel
 - 1.A.2.b - Non-Ferrous Metals
 - 1.A.2.c - Chemicals
 - 1.A.2.d - Pulp, Paper and Print
 - 1.A.2.e - Food Processing, Bevera
 - 1.A.2.f - Non-Metallic Minerals
 - 1.A.2.g - Transport Equipment
 - 1.A.2.h - Machinery
 - 1.A.2.i - Mining (excluding fuels) an
 - 1.A.2.j - Wood and wood products
 - 1.A.2.k - Construction
 - 1.A.2.l - Textile and Leather
 - 1.A.2.m - Non-specified Industry
 - 1.A.3 - Transport
 - 1.A.3.a - Civil Aviation
 - 1.A.3.a.i - International Aviation
 - 1.A.3.a.ii - Domestic Aviation
 - 1.A.3.b - Road Transportation
 - 1.A.3.b.i - Cars
 - 1.A.3.b.i.1 - Passenger cars
 - 1.A.3.b.i.2 - Passenger cars
 - 1.A.3.b.ii - Light-duty trucks
 - 1.A.3.b.ii.1 - Light-duty truc
 - 1.A.3.b.ii.2 - Light-duty truc
 - 1.A.3.b.iii - Heavy-duty trucks a
 - 1.A.3.b.iv - Motorcycles
 - 1.A.3.b.v - Evaporative emissio

2006 IPCC Guidelines

Worksheet remarks

1.A.1.a.i - Time Series

CARBON DIOXIDE (CO2) Emissions (Gq CO2 Equivalents)

* Base year for assessment of uncertainty in trend: 1990

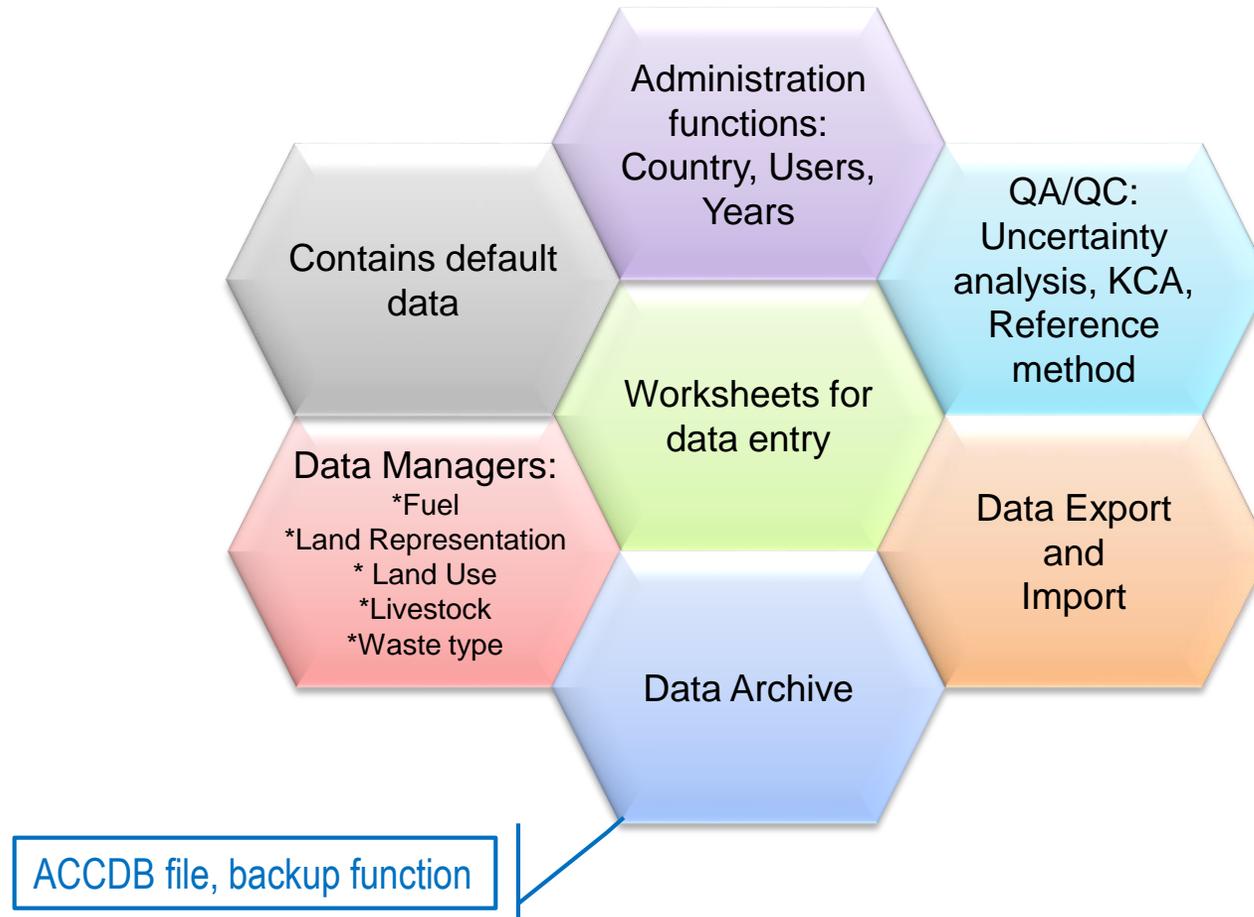
Gas CARBON DIOXIDE (CO2)

Country/Territory: Japan | Inventory Year: 1990 | Base year for assessment of uncertainty in trend: 1990 | CO2 Equivalents: SAR GWPs (100 year time horizon) | Database file: (G:\Shared drives\IPCC-TSU\inventory_software\ipcc2006.acddb)

Subdivision	Fuel	Consumption Unit	Consumption (Mass, Volume or Energy Unit)	Conversion Factor (TJ/Unit) (NCV)	Total consumption (TJ)
S	F	U	C	CF	TC = C * CF
Region A	Crude Oil	TJ	500	1	500
Region B	Crude Oil	Gg	50	42.3	2115
Region C	Lignite	Gg	1000	11.9	11900
Region D - Plant X	Oil Shale / Tar Sands	Gg	2000	8.9	17800
Region D - Plant Y	Natural Gas (Dry)	Gg	700	48	33600
Region D - Plant W	Natural Gas + Hydrogen (20%)	Gg	3000	55	165000
Total					230915

➤ Free to use

Architecture



- MSAccess (*ACE OLEDB 12*) for WindowsOS
- Microsoft .NET Framework 4.6.2

Features

IPCC inventory software becomes a central component of a Party's institutional arrangements to facilitate meeting UNFCCC national reporting obligations.

- ❑ Supports Parties in estimating GHG emissions/removals
- ❑ Organizing framework for data collection efforts among entities
- ❑ Minimizes error
- ❑ Reduces reporting burden
- ❑ Ensures archiving of all GHGI information for the whole time series (*par.18(c), annex, dec.18/CMA.1*), thus securing the GHGI 'memory'
- ❑ Facilitates transparency (*e.g., availability of all information during technical expert reviews*)

Version 2.85

- ❑ implements **all IPCC Tiers and Approaches** to estimate GHG emissions/removals, as provided in the 2006 IPCC Guidelines and its 2013 Wetlands Supplement
- ❑ allows **subnational level of reporting** (*e.g. tracking specific activities or regions*)
- ❑ allows for each source/sink to use either a single methodological tier or a mix of tiers
- ❑ allows, in each equation, to **input user-specific values for EFs and parameters**
- ❑ allows different categories/sectors to be developed simultaneously
- ❑ implements **AR5 GWP100** values (*and allows any other metric to be applied*)
- ❑ elements from the **Wetlands Supplement** are distinguishable because marked in **lilac colour**

Ongoing work

□ Paris Agreement requirements

- ✓ Indirect CO₂ emissions
- ✓ (memo item) Indirect N₂O emissions
- ✓ Interoperability with UNFCCC reporting tool for Common Reporting Tables -CRTs- (5/CMA.3)

□ Other

- ✓ Notation Keys
- ✓ Time series export/import
- ✓ Supporting tools

Interoperability

- IPCC inventory software is being modified to match UNFCCC CRTs categorization, as well as information needs

Worksheet: Fuel Consumption Data - Fuel Combustion Emissions

Sector: Energy
Category: Fuel Combustion Activities
Subcategory: 1.A.1.a.i - Electricity Generation
Sheet: Fuel Consumption Data
Data
Fuel Type: Peat

1 User enters underlying data (e.g. AD and EF) into IPCC Inventory Software

Equation 2.4

Subdivision	Fuel	Consumption Unit	Consumption (Mass, Volume or Energy Unit)	Conversion Factor (TJ/Unit) (NCV)	Total consumption (TJ)
Unspecified	Peat	Gg	1	9.76	TC = C * CF 9.76
Total					9.76

Worksheet: Fuel Consumption Data - Fuel Combustion Emissions

Sector: Energy
Category: Fuel Combustion Activities
Subcategory: 1.A.1.a.i - Electricity Generation
Sheet: Fuel Combustion Emissions
Data
Fuel Type: Peat

2 IPCC Inventory Software calculates emissions

Equation 2.4

Subdivision	Fuel	Total consumption (TJ)	CO2 Emissions (Gg CO2)	CH4 Emissions (Gg CH4)	N2O Emissions (Gg N2O)
Unspecified	Peat	TC 9.76	CO2 1.03456	CH4 0.00001	N2O 0.00001
Total		9.76	1.03456	0.00001	0.00001

Type of Technology	Technology penetration (%)	Consumption (TJ)	CO2 Emission Factor (Gg CO2/TJ)	Amount Captured (Gg CO2)	CO2 Emissions (Gg CO2)	CH4 Emission Factor (Gg CH4/TJ)	CH4 Emissions (Gg CH4)	N2O Emission Factor (Gg N2O/TJ)	N2O Emissions (Gg N2O)
Unspecified	100	9.76	106000	2	1.03456	1	0.00001	15	0.00001
Total		9.76			1.03456	1	0.00001	15	0.00001

TABLE 1.A(a) SECTORAL BACKGROUND DATA FOR ENERGY
Fuel combustion activities - sectoral approach
(Sheet 1 of 4)

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GREENHOUSE GAS SOURCE AND SINK CATEGORIES	AGGREGATE ACTIVITY DATA		IMPLIED EMISSION FACTORS			EMISSIONS			AMOUNT CAPTURED (Gg CO ₂)
	Consumption (TJ)	NCV/GCV ⁽¹⁾	CO ₂ ⁽¹⁾ (t/TJ)	CH ₄ ⁽¹⁾ (t/TJ)	N ₂ O ⁽¹⁾ (t/TJ)	CO ₂ ^(2,3) (Gg)	CH ₄ ⁽²⁾ (Gg)	N ₂ O ⁽²⁾ (Gg)	
Biomass ⁽¹⁾									
<i>Drop-down list:</i>									
1.A.1.a.i. Electricity generation									
Liquid fuels									
Solid fuels									
Gaseous fuels ⁽⁴⁾									
Other fossil fuels ⁽¹⁾									
Peat ⁽¹⁾									
Biomass ⁽¹⁾									

3 AD, EFs, ancillary parameters input into cells of CRT

Supporting tools

☐ User Guidebook for each sector (step-by-step instructions)

☐ Land representation Add-on

1. based on wall-to-wall data collection and analysis (*maps*)

Under development by FAO SEPAL Team

2. based on sampling data collection and analysis (*inventories*)

Under development through FAO-COLLECT EARTH customization

☐ Excel-based tool for data upload

1. Harvested Wood Products (*available*)

2. Land Representation – LoGlc

(under development with FAO – Office of Climate Change, Biodiversity and Environment)

Guidebook - Scope

Guide in implementing all methodological tiers and approaches provided in the:

- ✓ 2006 IPCC Guidelines, its
- ✓ 2013 Wetlands Supplement and, where relevant for consistency with UNFCCC CRTs, its
- ✓ 2019 Refinement,

to estimate anthropogenic GHG emissions and removals from each inventory category

Software users must be familiar with the IPCC methodologies and read the Software manual (downloadable from the “Help” menu) before going through the Guidebook. *The Guidebook does not replace guidance provided in the IPCC Methodological Reports*

Guidebook - Structure

- ❑ **Category by category, the Guidebook shows the workflow of data input in each and every worksheet to be used when implementing any of the available IPCC methodological guidance:**
 - ✓ From AD (*and ancillary parameters*)
 - ✓ To EF (*and ancillary parameters*)

To get the estimate of associated anthropogenic GHG emissions/removals

- ❑ **Appendices describe the use of multi-category components** (*e.g. Land representation manager*)

Example

Example on the use of the IPCC Inventory Software to prepare time series of estimates of anthropogenic GHG emissions and removals from land subject to REDD+ activities

Scope

- ❑ This example **DOES NOT** represent the point of view of IPCC on reporting for REDD+ activities under the UNFCCC
- ❑ It is an example on how REDD+ activities can be reported and tracked within IPCC Inventory categories when the entire dynamic of forest land use is included in the GHG Inventory, and therefore on how the IPCC Inventory Software could be efficiently used

Example (elements)

- ❑ A territory of 4,000 ha divided in 3 land uses; where the **historical dynamic** of land-use/land-management in the period **2006-2015 (10 years)** is used to **project expected C stock changes** in the period **2016-2035 (20 years)**
- ❑ Forest management practices are assumed not to change, although the area to which different forest management practices are applied has historically changed and it is projected to change further
- ❑ Reference scenario and Actual emissions/removals have been compiled in 2 different databases of the IPCC Inventory Software for which C stock changes only have been estimated for all C pools in land that are undergoing a use/management change and in the woody biomass C pool of land not undergoing a use/management change
- ❑ For DOM and SOM changes in land undergoing a use/management change the time dependency for the transition from a long-term average to another long-term average is 20 years (IPCC default), while transition to a 0 stock value is assumed to occur completely in the conversion year

Example (Land categories)

The territory subject to the Inventory is composed by:

- ❑ 3 land use categories:
 - Forest land
 - Cropland
 - Grassland

- ❑ 3 Forest land subdivisions:
 - Unmanaged Natural Primary
 - Managed Natural Secondary
 - Forest Plantation

- ❑ Other subdivisions:
 - 1 Annual Generic Cropland
 - 1 Managed Grassland Rangeland

Example (Land dynamic)

Ongoing land use/management dynamics:

- ❑ Conversion of Unmanaged Forest land to Annual Generic Cropland (*Deforestation*)
- ❑ Management change of Unmanaged Natural Primary Forest to Managed Natural Secondary Forest (*Long-term average C stock Degradation*)
- ❑ Management change of Managed Natural Secondary Forest to Forest Plantation (*Long-term average C stock Degradation*)
- ❑ Management change of Forest Plantation to Managed Natural Secondary Forest (*Long-term average C stock Enhancement*)
- ❑ Conversion of Managed Grassland Rangeland to Forest land Plantation (*Long-term average C stock Enhancement*)
- ❑ Sustainable Management of Forests:
 - ✓ selective logging of secondary forests (every 20-year)
 - ✓ clearcut of forest plantations (20% thinning every 20-year and clearcut every 80-year)

(Long-term average C stock impact determined by species/harvesting-cycle changes. None modeled in this example)

Example (elements)

- 2 databases compiled in the IPCC Software: **GFOI_example_reference** vs **GFOI_example_actual** with data on the REDD+ activities and calculation of associated C stock changes
- GFOI_example_reference** contains 7 inventory years: 2005 / 2010 / 2015 / 2020 / 2025 / 2030 / 2035
- GFOI_example_actual** contains 5 inventory years : 2005 / 2010 / 2015 / **2020** / **2025**

Year		GFOI_example_reference	GFOI_example_actual	vs
reference period	2005	X	X	same historical
	2010	X	X	
	2015	X	X	
projected period	actual estimates			comparison
	2020	X	X	
	2025	X	X	
	2030	X		
	2035	X		

Example (Projected land dynamic 2020-2035)

category	subcategory	subdivision	Area						yearly area change			
			ha						rate (ha yr ⁻¹)			
			2005	2010	2015	2020	2025	2030	2035	(2006-2015)		
Forest land	FLrFL	unmanaged	Primary Forest [un]	[unRun]	1,000	970	910	865	820	775	730	-----
		managed	Secondary Forest [mn]	[mnRmn]	900	870	810	765	720	700	705	-----
		managed	Forest plantation [fp]	[fpRfp]	100	95	85	78	70	133	265	-----
		managed	Primary Forest to Secondary Forest	[unCmn]	0	20	60	90	120	130	120	12
		managed	Secondary Forest to Forest Plantation	[mnCfp]	0	30	90	135	180	195	180	18
		managed	Forest Plantation to Secondary Forest	[fpCmn]	0	5	15	22	30	32	30	2.95
	LcFL[GLcFL]	managed	Grassland to Forest Plantation	[mgCmp]	0	40	120	180	240	260	240	24
Primary and Secondary Forest Land Total Area					1,900	1,865	1,795	1,742	1,690	1,637	1,585	-----
Cropland	CLrCL	annual	Generic crop [gc]	[gcRgc]	1,000	1,000	1,000	1,000	1,000	1,010	1,030	-----
	LcCL	annual	Primary Forest to Cropland	[unCgc]	0	10	30	45	60	65	60	6
Grassland	GLrGL	managed	Rangeland [mg]	[mgRmg]	1,000	960	880	820	760	700	640	-----
			Reducing Deforestation									
			Reducing Degradation									
			Sustainable Forest Management									
			Conservation									
			Enhancement of C stocks									

Excluding pre-2005 land dynamic. Historical rates applied to projected estimates

Example (Actual land dynamic 2020-2025)

category	subcategory	subdivision	Area								
			ha								
			2005	2010	2015	2020	2025	2030	2035		
Forest land	FLrFL	unmanaged	Primary Forest [un]	[unR un]	1,000	970	910	870	840		
		managed	Secondary Forest [mn]	[mnR mn]	900	870	810	770	740		
		managed	Forest plantation [fp]	[fpR fp]	100	95	85	78	73		
		managed	Primary Forest to Secondary Forest	[unC mn]	0	20	60	87	107		
		managed	Secondary Forest to Forest Plantation	[mnC fp]	0	30	90	130	160		
		managed	Forest Plantation to Secondary Forest	[fpC mn]	0	5	15	22	27		
	LcFL[GLeFL]	managed	Grassland to Forest Plantation	[mgC mp]	0	40	120	173	213		
Primary and Secondary Forest Land Total Area					1,900	1,865	1,795	1,748	1,713		
Cropland	CLrCL	annual	Generic crop [gc]	[gcR gc]	1,000	1,000	1,000	1,000	1,000		
	LcCL	annual	Primary Forest to Cropland	[unC gc]	0	10	30	43	53		
Grassland	GlrGL	managed	Rangeland [mg]	[mgR mg]	1,000	960	880	827	787		
			Reducing Deforestation								
			Reducing Degradation								
			Sustainable Forest Management								
			Conservation								
			Enhancement of C stocks								

Example (Forest management variables)

	Reference								Actual						
	Harvesting practices and cycle														
	Natural Secondary Forest				selective logging	every	20-year	followed by natural regeneration							
	Forest Plantation				thinning	every	20-year	followed by							
					clearcut	every	60-year	followed by replanting							
Harvestable Area under SFM	2005	2010	2015	2020	2025	2030	2035		2005	2010	2015	2020	2025	2030	2035
Natural Secondary Forest	900	870	810	765	720	675	655		900	870	810	770	740		
Forest Plantation	100	95	85	78	70	63	125		100	95	85	78	73		
Area harvested under SFM	2005	2010	2015	2020	2025	2030	2035		2005	2010	2015	2020	2025	2030	2035
Natural Secondary Forest	46	45	42	39	37	35	34		46	45	42	40	38		
Forest Plantation	1.3	1.2	1.1	1.0	0.9	0.8	1.6		1.3	1.2	1.1	1.0	0.9		
Wood removal (m³)	2005	2010	2015	2020	2025	2030	2035		2005	2010	2015	2020	2025	2030	2035
Natural Secondary Forest	3,146	3,042	2,832	2,674	2,517	2,360	2,290		2,635	2,547	2,372	2,254	2,167		
Forest Plantation	1,269	1,206	1,079	984	889	980	1,945		1,269	1,206	1,079	994	931		
Fuelwood removal (m³)	2005	2010	2015	2020	2025	2030	2035		2005	2010	2015	2020	2025	2030	2035
Natural Secondary Forest	787	760	708	669	629	590	572		1298	1255	1168	1110	1067		
Forest Plantation	-	-	-	-	-	-	-		-	-	-	-	-		

Data Input

Data Input in the IPCC Inventory Software for Land (3.B) categories follows these steps:

- I. **Input land-use subdivisions in the “Land Use Manager”**
- II. **For each Region, input a consistent timeseries of activity data in the “Land Representation Manager”**
- III. **For each C pool, Input C stock gains and losses or C stocks at different points in time**
(depending on methods selected)

Land Use Manager (LUM)

- Input land-use subdivisions to the 12 main land subcategories
[managed Forest land, unmanaged Forest land, annual Cropland, perennial Cropland , managed Grassland, unmanaged Grassland, managed Wetlands, unmanaged Wetlands, Settlements (Treed), Settlements (Other), managed Other land, unmanaged Other land]
- Describe as **subdivisions**, each and every different use/management-system of land in the territory inventoried, **further stratified by climate zone and soil type**
- Parameters to be input are subcategory-specific and are used by the software to estimate C stock changes and associated GHG emissions/removals
- There are not limits to the number of subdivisions that can be input

Land Use Manager (LUM) – Primary Forest

Land Use Manager

Land use structure

- Forest Land
 - Managed Forest Land
 - Unmanaged Forest Land
 - Unamanged Natural
- Cropland
- Grassland
- Wetlands
- Settlements
- Other Land

Land use subdivision - common parameters

Land use subdivision name: Unamanged Natural

Country/Territory: Italy

Soil Type: High Activity Clay Mineral

Continent: Europe

Soil Status: Natural

Climate Region: Warm Temperate Dry

It is not possible to change some of the parameters since subdivision is already being used in Land Representation Manager

Land use subdivision - Unmanaged Forest Land specific parameters

Ecological zone: Subtropical dry forest

Species: User-defined
Mediterranean Primary Forest

Land mass: Unspecified

Above-ground biomass stock (t d.m. / ha): 502.320

Ratio of below-ground biomass to above-ground biomass (R) (t root d.m. / t shoot d.m.): 0.330

Biomass carbon fraction (t C / t d.m.): 0.470

Growing stock level (V) (m³ / ha): >80

Biomass conversion and expansion factor for standing stock (BCEFs) (t d.m. / m³ wood volume): Specified

Basic wood density (D) (t d.m. / m³ fresh volume):

Biomass expansion factor for conversion of merchantable volume to above-ground biomass (BEF2):

Reference soil organic carbon stock (SOCref) (t C / ha): 45.200

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Land Use Manager (LUM) – Secondary Forest

Land Use Manager

Land use structure

- Forest Land
 - Managed Forest Land
 - Managed Natural**
 - Plantation
 - Unmanaged Forest Lan
- Cropland
- Grassland
- Wetlands
- Settlements
- Other Land

Land use subdivision - common parameters

Land use subdivision name: Managed Natural

Soil Type: High Activity Clay Mineral

Soil Status: Natural

Country/Territory: Italy

Continent: Europe

Climate Region: Warm Temperate Dry

It is not possible to change some of the parameters since subdivision is already being used in Land Representation Manager

Land use subdivision - Managed Forest Land specific parameters

Ecological zone: Subtropical dry forest

Species: User-defined
Mix

Natural Forest Abandoned managed land

Plantation

Land mass: Unspecified

Age class (yr): Unspecified

Above-ground biomass stock (t d.m. / ha): 336.840

Above-ground biomass growth (G) (t d.m. / ha / yr): 3.864

Ratio of below-ground biomass to above-ground biomass (R) (t root d.m./t shoot d.m.): 0.330

Biomass carbon fraction (t C / t d.m.): 0.470

Growing stock level (V) (m³ / ha): >80

Average net annual increment of growing stock (Iv) (m³ / ha / yr): 4.600

Biomass conversion and expansion factor for increment (BCEFi) (t d.m. / m³ wood volume): Specified 0.840

Biomass conversion and expansion factor for standing stock (BCEFs) (t d.m. / m³ wood volume): Specified 0.840

Biomass conversion and expansion factor for wood and fuelwood removal (BCEFr) (t d.m. / m³ wood volume): Specified 0.950

Basic wood density (D) (t d.m. / m³ fresh volume): 0.670

Biomass expansion factor for conversion of annual net increment to above-ground biomass increment (BEF1):

Biomass expansion factor for conversion of merchantable volume to above-ground biomass (BEF2):

Reference soil organic carbon stock (SOCref) (t C / ha): 45.200

Relative C stock change factors

Land use (FLU): 1.000

Management (FMG): 0.840

Input (FI): 1.000

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Land Use Manager (LUM) – Forest Plantation

Land Use Manager

Land use structure

- Forest Land
 - Managed Forest Land
 - Managed Natural
 - Plantation
 - Unmanaged Forest Lan
 - Cropland
 - Grassland
 - Wetlands
 - Settlements
 - Other Land

Land use subdivision - common parameters

Land use subdivision name:

Country/Territory:

Soil Type:

Continent:

Soil Status:

Climate Region:

It is not possible to change some of the parameters since subdivision is already being used in Land Representation Manager

Land use subdivision - Managed Forest Land specific parameters

Ecological zone:

Species:

Natural Forest

Abandoned managed land

Plantation

Land mass:

Age class (yr):

Above-ground biomass stock (t d.m. / ha):

Above-ground biomass growth (G) (t d.m. / ha / yr):

Ratio of below-ground biomass to above-ground biomass (R) (t root d.m. / t shoot d.m.):

Biomass carbon fraction (t C / t d.m.):

Growing stock level (V) (m3 / ha):

Average net annual increment of growing stock (Iv) (m3 / ha / yr):

Biomass conversion and expansion factor for increment (BCEF1) (t d.m. / m3 wood volume):

Biomass conversion and expansion factor for standing stock (BCEFs) (t d.m. / m3 wood volume):

Biomass conversion and expansion factor for wood and fuelwood removal (BCEFr) (t d.m. / m3 wood volume):

Basic wood density (D) (t d.m. / m3 fresh volume):

Biomass expansion factor for conversion of annual net increment to above-ground biomass increment (BEF1):

Biomass expansion factor for conversion of merchantable volume to above-ground biomass (BEF2):

Reference soil organic carbon stock (SOCref) (t C / ha):

Relative C stock change factors

Land use (FLU):

Management (FMG):

Input (FI):

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Land Use Manager (LUM) – Cropland

Land Use Manager

Land use structure

- Forest Land
- Cropland
 - Cropland Annual Crops
 - Generic Annual Cro
 - Cropland Perennial Crops
- Grassland
- Wetlands
- Settlements
- Other Land

Land use subdivision - common parameters

Land use subdivision name: Generic Annual Cropland

Country/Territory: Italy

Soil Type: High Activity Clay Mineral

Continent: Europe

Soil Status: Natural

Climate Region: Warm Temperate Dry

It is not possible to change some of the parameters since subdivision is already being used in Land Representation Manager

Land use subdivision - Annual Crops specific parameters

Rice ecosystem

Herbaceous biomass (t C / ha): 3.000

C fraction (t C / t d.m.): 1.000

Ratio of below-ground biomass to above-ground biomass (R) (t root C / t shoot C): 0.170

Reference soil organic carbon stock (SOCref) (t C / ha): 45.200

Relative C stock change factors

Land use (FLU): 0.800

Tillage (FMG): 1.000

Input (FI): 1.000

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Land Use Manager (LUM) – Grassland

Land Use Manager

Land use structure

- Forest Land
- Cropland
- Grassland
 - Managed Grassland
 - Managed Rangeland**
 - Unmanaged Grassland
- Wetlands
- Settlements
- Other Land

Land use subdivision - common parameters

Land use subdivision name: Managed Rangeland

Country/Territory: Italy

Soil Type: High Activity Clay Mineral

Continent: Europe

Soil Status: Natural

Climate Region: Warm Temperate Dry

It is not possible to change some of the parameters since subdivision is already being used in Land Representation Manager

Land use subdivision - Managed Grassland specific parameters

Vegetation type: Semi-Arid

Improved grassland

Abandoned managed land

Herbaceous biomass (t d.m. / ha): 6.100

Ratio of below-ground herbaceous biomass to above-ground herbaceous biomass (R) (t root d.m./t shoot d.m.): 2.800

Carbon fraction of herbaceous biomass dry matter (t C / t d.m.): 0.470

Woody biomass (t d.m. / ha): 0.000

Age class (yr): Unspecified Value:

Woody biomass accumulation rate (G) (t d.m. / ha / yr):

Ratio of below-ground woody biomass to above-ground woody biomass (R) (t root d.m./t shoot d.m.):

Carbon fraction of woody biomass dry matter (t C / t d.m.): 0.470

Reference soil organic carbon stock (SOCref) (t C / ha): 45.200

Relative C stock change factors

Land use (FLU): 1.000

Management (FMG): 1.000

Input (FI): 1.000

Add Copy Delete Save Undo Close

LUM – Soil Types

Soil Type Manager

Soil Type Name	Composition	Remark
Coastal Wetlands soil	Mixed	Table 4.11 WS
High Activity Clay Mineral	Mineral	Soils with high activity clay (HAC) minerals are lightly to moderately weathered soils, which are dominated by 2:1 silicate clay minerals (in the World Reference Base for Soil Resources (WRB) classification these include Leptosols, Vertisols, Kastanozems, Chernozems, Phaeozems, Luvisols, Alisols, Albeluvisols, Solonetz, Calcisols, Gypsisols, Umbrisols, Cambisols, Regosols; in USDA classification includes Mollisols, Vertisols, high-base status Alfisols, Aridisols, Inceptisols).
Inland Organic soil	Organic	Soils classified as histosols. See glossary of IPCC GPG 2003 for additional details.
Low Activity Clay Mineral	Mineral	Soils with low activity clay (LAC) minerals are highly weathered soils, dominated by 1:1 clay minerals and amorphous iron and aluminium oxides (in WRB classification includes Acrisols, Lixisols, Nitisols, Ferralsols, Durisols; in USDA classification includes Ultisols, Oxisols, acidic Alfisols).
Sandy Mineral	Mineral	Includes all soils (regardless of taxonomic classification) having > 70% sand and < 8% clay, based on standard textural analyses (in WRB classification includes Arenosols; in USDA classification includes Psamment).
Spodic Mineral	Mineral	Soils exhibiting strong podzolization (in WRB classification includes Podzols; in USDA classification Spodosols)
Volcanic Mineral	Mineral	Soils derived from volcanic ash with allophanic mineralogy (in WRB classification Andosols; in USDA classification Andisols)
Wetland Mineral	Mineral	Soils with restricted drainage leading to periodic flooding and anaerobic conditions (in WRB classification Gleysols; in USDA classification Aquic suborders).
* Terra preta	Mineral	average black carbon content 33 Mg ha ⁻¹ m ⁻¹
*		

➤ User-specific soil classification can be input and applied to estimate SOC changes in mineral soils

Default soil types as well as soil types already used in any Land Use Subdivision cannot be changed nor deleted.

Save Undo Close

LUM – Climate Regions

Climate Region Manager

Climate domain	Climate Region	Remark	
Tropical	Tropical Dry	Mean Annual Temperature >18°C and ≤7 days of frost/year; Elevation <1,000m; Mean Annual Precipitation ≤1,000mm	
	Tropical Moist	Mean Annual Temperature >18°C and ≤7 days of frost/year; Elevation <1,000m; Mean Annual Precipitation ≤2,000mm	
	Tropical Montane Dry	Mean Annual Temperature >18°C and ≤7 days of frost/year; Elevation ≥1,000m; Mean Annual Precipitation ≤1,000mm	
	Tropical Montane Moist	Mean Annual Temperature >18°C and ≤7 days of frost/year; Elevation ≥1,000m; Mean Annual Precipitation >1,000mm	
	Tropical Wet	Mean Annual Temperature >18°C and ≤7 days of frost/year; Elevation <1,000m; Mean Annual Precipitation >2,000mm	
Subtropical (Mediterranean)	Warm Temperate Dry	Mean Annual Temperature >10°C and ≤18°C; Mean Annual Precipitation lower than Potential Evapo-Transpiration	
	Warm Temperate Moist	Mean Annual Temperature >10°C and ≤18°C; Mean Annual Precipitation higher than Potential Evapo-Transpiration	
Temperate	Cool Temperate Dry	Mean Annual Temperature >0°C and ≤10°C; Mean Annual Precipitation lower than Potential Evapo-Transpiration	
	Cool Temperate Moist	Mean Annual Temperature >0°C and ≤10°C; Mean Annual Precipitation higher than Potential Evapo-Transpiration	
Boreal	Boreal Dry	Mean Annual Temperature ≤0°C; Each Month Mean Temperature ≥10°C; Mean Annual Precipitation lower than Potential Evapo-Transpiration	
	Boreal Moist	Mean Annual Temperature ≤0°C; Each Month Mean Temperature ≥10°C; Mean Annual Precipitation higher than Potential Evapo-Transpiration	
Polar	Polar Dry	Mean Annual Temperature ≤0°C; Each Month Mean Temperature <10°C; Mean Annual Precipitation lower than Potential Evapo-Transpiration	
	Polar Moist	Mean Annual Temperature ≤0°C; Each Month Mean Temperature <10°C; Mean Annual Precipitation higher than Potential Evapo-Transpiration	
* Tropical	eastern amazonia climate	mean annual precipitation > 2,500 mm; mean annual temperature 31 C	✘
*			✘

User-specific climate classification can be input

Default climate regions as well as climate regions already used in any Land Use Subdivision cannot be changed nor deleted.

Save

Undo

Close

Consistent Land Representation

- A consistent land representation is a time series of annual area estimates of units of land, as disaggregated according to stratification, that:
 - ✓ reports the total area of the territory constant across the entire time series
 - ✓ classify land using a consistent methodology across the entire timeseries (*no artifact land conversions caused by changes in the classification method/background-data*)
 - ✓ in each year Y, all units of land under conversion are reported within the “*Land converted to*” relevant category until the end of the transition period (D)
 - ✓ in each year Y, all units of land that did not undergo a conversion in the last Y-D years are reported within the “*Land remaining*” relevant category

Land Representation Manager (LRM)

- **Allows to use any of the three IPCC approaches**
 - ✓ Approach 1 -no land use change identification-
 - ✓ Approach 2 -land use change identification-
 - ✓ Approach 3 -land use change identification and tracking across time-
- **Ensures consistency of land representation**
 - ✓ Discrepancy-check in area data input
 - ✓ Tracking of unit of lands across the time series -*spatially explicit tracking under Approach 3*-
- Area data are automatically transferred to relevant worksheets where GHG emissions/removals from land-related activities are estimated
- Each unit of land gets assigned an identification code based on the current and previous land use/management; although, to ease the work of compilers, an additional user-defined code can be assigned to each unit of land

Units of land Area (ha) Time Series REFERENCE

Unit of Land		2005	2010	2015	2020	2025	2030	2035
F o r e s t L a n d	1 I Unmanaged Natural Forest remaining Unmanaged Natural Forest	1,000	970	910	865	820	775	730
	2 II Managed Natural Forest remaining Managed Natural Forest	900	870	810	765	720	700	705
	2.11	0	20	20	20	20	0	0
	2.12	0	0	40	40	40	40	0
	2.13	0	0	0	30	30	30	30
	2.14 III Unmanaged Natural Forest converted to Managed Natural Forest	0	0	0	0	30	30	30
	2.15	0	0	0	0	0	30	30
	2.16	0	0	0	0	0	0	30
	2.21	0	5	5	5	5	0	0
	2.22	0	0	10	10	10	10	0
	2.23 IV Forest Plantation converted to Managed Natural Forest	0	0	0	7	7	7	7
	2.24	0	0	0	0	8	8	8
	2.25	0	0	0	0	0	7	7
	2.26	0	0	0	0	0	0	8
	3 V Forest Plantation remaining Forest Plantation	100	95	85	78	70	133	265
	3.11	0	30	30	30	30	0	0
	3.12	0	0	60	60	60	60	0
	3.13 VI Managed Natural Forest converted to Forest Plantation	0	0	0	45	45	45	45
	3.14	0	0	0	0	45	45	45
	3.15	0	0	0	0	0	45	45
	3.16	0	0	0	0	0	0	45
	3.21	0	40	40	40	40	0	0
	3.22	0	0	80	80	80	80	0
	3.23 VII Managed Rangeland converted to Forest Plantation	0	0	0	60	60	60	60
	3.24	0	0	0	0	60	60	60
	3.25	0	0	0	0	0	60	60
3.26	0	0	0	0	0	0	60	
C r o p l a n d	4 I Annual Cropland Remaining Annual Cropland	1,000	1,000	1,000	1,000	1,000	1,010	1,030
	4.11	0	10	10	10	10	0	0
	4.12	0	0	20	20	20	20	0
	4.13 II Unmanaged Natural Forest converted to Cropland	0	0	0	15	15	15	15
	4.14	0	0	0	0	15	15	15
	4.15	0	0	0	0	0	15	15
	4.16	0	0	0	0	0	0	15
Grassland	5 I Managed Grassland remaining Managed Grassland	1,000	960	880	820	760	700	640
		4,000	4,000	4,000	4,000	4,000	4,000	4,000

Land use	Unit of Land	2005	2010	2015	2020	2025	2030	2035
F o r e s t L a n d	1 I Unmanaged Natural Forest remaining Unmanaged Natural Forest	1,000	970	910	870	840		
	2 II Managed Natural Forest remaining Managed Natural Forest	900	870	810	770	740		
	2.11	0	20	20	20	20		
	2.12	0	0	40	40	40		
	2.13	0	0	0	27	27		
	2.14 III Unmanaged Natural Forest converted to Managed Natural Forest	0	0	0	0	20		
	2.15	0	0	0	0	0		
	2.16	0	0	0	0	0		
	2.21	0	5	5	5	5		
	2.22	0	0	10	10	10		
	2.23 IV Forest Plantation converted to Managed Natural Forest	0	0	0	7	7		
	2.24	0	0	0	0	5		
	2.25	0	0	0	0	0		
	2.26	0	0	0	0	0		
	3 V Forest Plantation remaining Forest Plantation	100	95	85	78	73		
	3.11	0	30	30	30	30		
	3.12	0	0	60	60	60		
	3.13	0	0	0	40	40		
	3.14 VI Managed Natural Forest converted to Forest Plantation	0	0	0	0	30		
	3.15	0	0	0	0	0		
	3.16	0	0	0	0	0		
	3.21	0	40	40	40	40		
	3.22	0	0	80	80	80		
	3.23 VII Managed Rangeland converted to Forest Plantation	0	0	0	53	53		
	3.24	0	0	0	0	40		
	3.25	0	0	0	0	0		
3.26	0	0	0	0	0			
C r o p l a n d	4 I Annual Cropland Remaining Annual Cropland	1,000	1,000	1,000	1,000	1,000		
	4.11	0	10	10	10	10		
	4.12	0	0	20	20	20		
	4.13 II Unmanaged Natural Forest converted to Cropland	0	0	0	13	13		
	4.14	0	0	0	0	10		
	4.15	0	0	0	0	0		
	4.16	0	0	0	0	0		
Grassland	5 I Managed Grassland remaining Managed Grassland	1,000	960	880	827	787		
Total		4,000	4,000	4,000	4,000	4,000		

Units of land Area (ha) Time Series ACTUAL

Land Representation Manager (LRM)

- **Data input shall be done from the first inventory year forward**
- Once input in an inventory year, the unit of land is copied by the software in all years of the time series updating its “conversion-status” according to the time passed since its conversion and the transition period set
- Approach 1 does not identify land-use conversions, thus:
 - ✓ SOC changes are estimated comparing total SOC stock across the land representation (Region/Country) in the inventory year and 20 years before the inventory year
 - ✓ The Land Representation Manager requires for each unit of land to input the area in the inventory year as well as the area of 20 years before
- Any Unit of land is an area homogenous per
 - ✓ physical conditions *-climate/vegetation zone and soil type-* and
 - ✓ current and historical socio-economic functions *-land use & management type-*

LRM – Regions Tab

- A country can be represented in a single set of National data or in a number of Regions
- For each Region the land representation approach is to be selected

Land Representation Manager

Regions | Land representation table | Annual land representation matrix (Approach 2 & 3)

Whole country area (ha) 4,000,000

Region name	Area (ha)	Approach	Remark
GFOI example	4,000	Approach 2	
*			
Total	4000.000		

Land use category		Area (2025) (ha)		Remark					
Forest Land		2,160							
Land use subcategory		Area (2025) (ha)		Remark					
Managed Forest Land		1,320							
Current Land use subdivision				Remark					
Managed Natural				✗					
Land unit code (Automatic)	Land unit code (User defined)	Previous Land use subcategory	Previous Land use subdivision	Transition Period (D) (years)	Year of conversion	Area (2025) (ha)	Remark	P	M
MFL-MN-NF-UD-2	U2	Managed Forest Land	Managed Natural	NA	NA	740 ↔			✗
MFL-MN-NF-UD-6<UFL-UN-NF-UD-C15	U2.11	Unmanaged Forest Land	Unamanged Natural	20	2010	20 ↔			✗
MFL-MN-NF-UD-7<MFL-P-PL-P-C15	U2.21	Managed Forest Land	Plantation	20	2010	5 ↔			✗
MFL-MN-NF-UD-11<UFL-UN-NF-UD-C10	U2.12	Unmanaged Forest Land	Unamanged Natural	20	2015	40 ↔			✗
MFL-MN-NF-UD-12<MFL-P-PL-P-C10	U2.22	Managed Forest Land	Plantation	20	2015	10 ↔			✗
MFL-MN-NF-UD-16<UFL-UN-NF-UD-C5	U2.13	Unmanaged Forest Land	Unamanged Natural	20	2020	27 ↔			✗
MFL-MN-NF-UD-17<MFL-P-PL-P-C5	U2.23	Managed Forest Land	Plantation	20	2020	7 ↔			✗
MFL-MN-NF-UD-22<UFL-UN-NF-UD-C0	U2.14	Unmanaged Forest Land	Unamanged Natural	20	2025	20 ↔			✗
MFL-MN-NF-UD-24<MFL-P-PL-P-C0	U2.24	Managed Forest Land	Plantation	20	2025	5 ↔			✗
*						↔			
Current Land use subdivision				Remark					
Plantation				✗					
Land unit code (Automatic)	Land unit code (User defined)	Previous Land use subcategory	Previous Land use subdivision	Transition Period (D) (years)	Year of conversion	Area (2025) (ha)	Remark	P	M
MFL-P-PL-P-3	U3	Managed Forest Land	Plantation	NA	NA	73 ↔			✗
MFL-P-PL-P-8<MFL-MN-NF-UD-C15	U3.11	Managed Forest Land	Managed Natural	20	2010	30 ↔			✗
MFL-P-PL-P-9<MGL-MR-SA-C15	U3.21	Managed Grassland	Managed Rangeland	20	2010	40 ↔			✗
MFL-P-PL-P-13<MFL-MN-NF-UD-C10	U3.12	Managed Forest Land	Managed Natural	20	2015	60 ↔			✗
MFL-P-PL-P-14<MGL-MR-SA-C10	U3.22	Managed Grassland	Managed Rangeland	20	2015	80 ↔			✗
MFL-P-PL-P-18<MFL-MN-NF-UD-C5	U3.13	Managed Forest Land	Managed Natural	20	2020	40 ↔			✗
MFL-P-PL-P-19<MGL-MR-SA-C5	U3.23	Managed Grassland	Managed Rangeland	20	2020	53 ↔			✗
MFL-P-PL-P-25<MFL-MN-NF-UD-C0	U3.14	Managed Forest Land	Managed Natural	20	2025	30 ↔			✗
MFL-P-PL-P-26<MGL-MR-SA-C0	U3.24	Managed Grassland	Managed Rangeland	20	2025	40 ↔			✗
*						↔			
Current Land use subdivision				Remark					
*									
Land use subcategory		Area (2025) (ha)		Remark					
Unmanaged Forest Land		840							
Current Land use subdivision				Remark					
Unamanged Natural				✗					
Land unit code (Automatic)	Land unit code (User defined)	Previous Land use subcategory	Previous Land use subdivision	Transition Period (D) (years)	Year of conversion	Area (2025) (ha)	Remark	P	M
UFL-UN-NF-UD-1	U1	Unmanaged Forest Land	Unamanged Natural	NA	NA	840 ↔			✗

LRM Land Representation Tab

LRM – Land Representation Tab – Functionalities

- To each C pool the methodology to estimate C stock changes is to be assigned through the functionality “P” (*Pools*), where the icon is to be clicked to open a dialogue box to selected between the **IPCC Default method** and the **Stock-Difference method**

Land unit code (Automatic)	Land unit code (User defined)	Previous Land use subcategory	Previous Land use subdivision	Transition Period (D) (years)	Year of conversion	Area (2005) (ha)	Remark	P	M
MFL-MN-NF-UD-2	U2	Managed Forest Land	Managed Natural	NA	NA	900 <-->			

Land Unit Parameters

C pools / Methods

Biomass change: Gain & Loss

DOM - Deadwood: Gain & Loss / Stock difference

DOM - Litter: Gain & Loss

SOM - Mineral: Default

Save Cancel

- By default, **Gain&Loss** is selected for Biomass and **Stock Difference** for DOM

LRM – Land Representation Tab – Functionalities

- For each unit of land, the time period to which the area input applies is to be assigned through the functionality “<>” (double arrows), where the icon is to be clicked to open a dialogue box to selected between 4 options:

Land unit code (Automatic)	Land unit code (User defined)	Previous Land use subcategory	Previous Land use subdivision	Transition Period (D) (years)	Year of conversion	Area (2005) (ha)	Remark	P	M
MFL-MN-NF-UD-2	U2	Managed Forest Land	Managed Natural	NA	NA	900	<->		

Area update mode

Current inventory year only

Current inventory year and all subsequent inventory years

Current inventory year and all previous inventory years

All inventory years

- By default, **Current inventory Year & all subsequent inventory years** is selected

LRM – Land Representation – *Transition Period*

- Once the unit of land has been reported in a land-under-conversion category for a number of years equivalent to the Transition Period, the Software shows the unit in a blue color and the previous land use subcategory and subdivisions are set equal to the current ones
- Thus, the user can merge those units that are not anymore undergoing the Transition Period with the any unit within the same stratification (*climate, soil, land use category/subcategory/subdivision*) that is not under conversion

LRM – Land Representation Tab

- Each unit of land that underwent the entire Transition Period can be merged with any other unit with the same stratification (climate, soil, land use category/subcategory/subdivision) through the functionality “M” (Merge), where the icon is to be clicked to open a dialogue box

Land unit code (Automatic)	Land unit code (User defined)	Previous Land use subcategory	Previous Land use subdivision	Transition Period (D) (years)	Year of conversion	Area (2030) (ha)	Remark	P	M
ACL-GAC-4	U4	Cropland Annual Crops	Generic Annual Cropland	NA	NA	1,000 <-->			
ACL-GAC-10	U4.11	Cropland Annual Crops	Generic Annual Cropland	NO	NO	10 <-->			
ACL-GAC-15	U4.12	Unmanaged Forest Land	Unmanaged Natural	20	2015	20			

Merge Land Unit

Source Land Unit

Land use subcategory: Cropland Annual Crops

Land use subdivision: Generic Annual Cropland

Land unit: U4.11

Area [ha]: 10

Target Land Unit

Land use subcategory: Cropland Annual Crops

Land use subdivision: Generic Annual Cropland

Land unit: U4

Area [ha]: 1000 +10 [ha]

Merge Cancel

Land Representation Manager

Regions Land representation table Annual land representation matrix (Approach 2 & 3)

Region GFOI example Region area (ha) 4,000,000 Discrepancy (ha) OK Approach 2 2030

Land use category		Area (2030) (ha)		Remark					
Forest Land		2,225							
Land use subcategory		Area (2030) (ha)		Remark					
Managed Forest Land		1,450							
Current Land use subdivision		Remark							
Managed Natural									
Land unit code (Automatic)	Land unit code (User defined)	Previous Land use subcategory	Previous Land use subdivision	Transition Period (D) (years)	Year of conversion	Area (2030) (ha)	Remark	P	M
MFL-MN-NF-UD-2	U2	Managed Forest Land	Managed Natural	NA	NA	675			
MFL-MN-NF-UD-6	U2.11	Managed Forest Land	Managed Natural	NO	NO	20			
MFL-MN-NF-UD-7	U2.21	Managed Forest Land	Managed Natural	NO	NO	5			
MFL-MN-NF-UD-11<UFL-U...	U2.12	Unmanaged Forest Land	Unmanaged Natural	20	2015	40			
MFL-MN-NF-UD-12<MFL-...	U2.22	Managed Forest Land	Plantation	20	2015	10			
MFL-MN-NF-UD-16<UFL-...	U2.13	Unmanaged Forest Land	Unmanaged Natural	20	2020	30			
MFL-MN-NF-UD-17<MFL-...	U2.23	Managed Forest Land	Plantation	20	2020	7			
MFL-MN-NF-UD-22<UFL-...	U2.14	Unmanaged Forest Land	Unmanaged Natural	20	2025	30			
MFL-MN-NF-UD-24<MFL-...	U2.24	Managed Forest Land	Plantation	20	2025	8			
MFL-MN-NF-UD-28<UFL-...	U2.15	Unmanaged Forest Land	Unmanaged Natural	20	2030	30			
MFL-MN-NF-UD-29<MFL-...	U2.25	Managed Forest Land	Plantation	20	2030	7			
Current Land use subdivision		Remark							
Plantation									
Land unit code (Automatic)	Land unit code (User defined)	Previous Land use subcategory	Previous Land use subdivision	Transition Period (D) (years)	Year of conversion	Area (2030) (ha)	Remark	P	M
MFL-P-PL-P-3	U3	Managed Forest Land	Plantation	NA	NA	63			
MFL-P-PL-P-8	U3.11	Managed Forest Land	Plantation	NO	NO	30			
MFL-P-PL-P-9	U3.21	Managed Forest Land	Plantation	NO	NO	40			
MFL-P-PL-P-13<MFL-MN-...	U3.12	Managed Forest Land	Managed Natural	20	2015	60			
MFL-P-PL-P-14<MGL-MR-...	U3.22	Managed Grassland	Managed Rangeland	20	2015	80			
MFL-P-PL-P-18<MFL-MN-...	U3.13	Managed Forest Land	Managed Natural	20	2020	45			
MFL-P-PL-P-19<MGL-MR-...	U3.33	Managed Grassland	Managed Rangeland	20	2020	60			
MFL-P-PL-P-25<MFL-MN-...	U3.14	Managed Forest Land	Managed Natural	20	2025	45			
MFL-P-PL-P-26<MGL-MR-...	U3.34	Managed Grassland	Managed Rangeland	20	2025	60			
MFL-P-PL-P-30<MFL-MN-...	U3.15	Managed Forest Land	Managed Natural	20	2030	45			
MFL-P-PL-P-31<MGL-MR-...	U3.35	Managed Grassland	Managed Rangeland	20	2030	60			
Current Land use subdivision		Remark							
Unmanaged Forest Land									
Land use subcategory		Area (2030) (ha)		Remark					
Unmanaged Forest Land		775							
Current Land use subdivision		Remark							
Unmanaged Natural									
Land unit code (Automatic)	Land unit code (User defined)	Previous Land use subcategory	Previous Land use subdivision	Transition Period (D) (years)	Year of conversion	Area (2030) (ha)	Remark	P	M
UFL-UN-NF-UD-1	U1	Unmanaged Forest Land	Unmanaged Natural	NA	NA	775			

Save Undo Close

Land Representation Manager

Regions Land representation table Annual land representation matrix (Approach 2 & 3)

Region GFOI example Region area (ha) 4,000,000 Discrepancy (ha) OK Approach 2 2030

Land use category		Area (2030) (ha)		Remark					
Forest Land		2,225							
Land use subcategory		Area (2030) (ha)		Remark					
Managed Forest Land		1,450							
Current Land use subdivision		Remark							
Managed Natural									
Land unit code (Automatic)	Land unit code (User defined)	Previous Land use subcategory	Previous Land use subdivision	Transition Period (D) (years)	Year of conversion	Area (2030) (ha)	Remark	P	M
MFL-MN-NF-UD-2	U2	Managed Forest Land	Managed Natural	NA	NA	700			
MFL-MN-NF-UD-11<UFL-U...	U2.12	Unmanaged Forest Land	Unmanaged Natural	20	2015	40			
MFL-MN-NF-UD-12<MFL-P...	U2.22	Managed Forest Land	Plantation	20	2015	10			
MFL-MN-NF-UD-16<UFL-U...	U2.13	Unmanaged Forest Land	Unmanaged Natural	20	2020	30			
MFL-MN-NF-UD-17<MFL-P...	U2.23	Managed Forest Land	Plantation	20	2020	7			
MFL-MN-NF-UD-22<UFL-U...	U2.14	Unmanaged Forest Land	Unmanaged Natural	20	2025	30			
MFL-MN-NF-UD-24<MFL-P...	U2.24	Managed Forest Land	Plantation	20	2025	8			
MFL-MN-NF-UD-28<UFL-U...	U2.15	Unmanaged Forest Land	Unmanaged Natural	20	2030	30			
MFL-MN-NF-UD-29<MFL-P...	U2.25	Managed Forest Land	Plantation	20	2030	7			
Current Land use subdivision		Remark							
Plantation									
Land unit code (Automatic)	Land unit code (User defined)	Previous Land use subcategory	Previous Land use subdivision	Transition Period (D) (years)	Year of conversion	Area (2030) (ha)	Remark	P	M
MFL-P-PL-P-3	U3	Managed Forest Land	Plantation	NA	NA	133			
MFL-P-PL-P-13<MFL-MN-...	U3.12	Managed Forest Land	Managed Natural	20	2015	60			
MFL-P-PL-P-14<MGL-MR-S...	U3.22	Managed Grassland	Managed Rangeland	20	2015	80			
MFL-P-PL-P-18<MFL-MN-...	U3.13	Managed Forest Land	Managed Natural	20	2020	45			
MFL-P-PL-P-19<MGL-MR-S...	U3.33	Managed Grassland	Managed Rangeland	20	2020	60			
MFL-P-PL-P-25<MFL-MN-...	U3.14	Managed Forest Land	Managed Natural	20	2025	45			
MFL-P-PL-P-26<MGL-MR-S...	U3.34	Managed Grassland	Managed Rangeland	20	2025	60			
MFL-P-PL-P-30<MFL-MN-...	U3.15	Managed Forest Land	Managed Natural	20	2030	45			
MFL-P-PL-P-31<MGL-MR-S...	U3.35	Managed Grassland	Managed Rangeland	20	2030	60			
Current Land use subdivision		Remark							
Unmanaged Forest Land									
Land use subcategory		Area (2030) (ha)		Remark					
Unmanaged Forest Land		775							
Current Land use subdivision		Remark							
Unmanaged Natural									
Land unit code (Automatic)	Land unit code (User defined)	Previous Land use subcategory	Previous Land use subdivision	Transition Period (D) (years)	Year of conversion	Area (2030) (ha)	Remark	P	M
UFL-UN-NF-UD-1	U1	Unmanaged Forest Land	Unmanaged Natural	NA	NA	775			

Save Undo Close

Annual land representation matrix

Land Representation Manager

Regions | Land representation table | Annual land representation matrix (Approach 2 & 3)

Region: GFOI example | Region area (ha): 4,000,000 | Approach 2 | 2035

Final	Initial	Forest Land		Cropland		Grassland		Wetlands		Settlements		Other Land		Final Area (ha)	Net change (ha)
		Managed Forest Land	Unmanaged Forest Land	Cropland Annual Crops	Cropland Perennial Crops	Managed Grassland	Unmanaged Grassland	Managed Wetlands	Unmanaged Wetlands	Settlements (Treed)	Settlements (Other)	Managed Other Land	Unmanaged Other Land		
Forest Land	Managed Forest Land	1,450	30			60								1,540	90
	Unmanaged Forest Land		730											730	-45
Cropland	Cropland Annual Crops		15	1,075										1,090	15
	Cropland Perennial Crops													0	0
Grassland	Managed Grassland					640								640	-60
	Unmanaged Grassland													0	0
Wetlands	Managed Wetlands													0	0
	Unmanaged Wetlands													0	0
Settlements	Settlements (Treed)													0	0
	Settlements (Other)													0	0
Other Land	Managed Other Land													0	0
	Unmanaged Other Land													0	0
	Initial Area (ha)	1,450	775	1,075	0	700	0	0	0	0	0	0	0	4,000	0

Close

Actual matrix

		initial 2030												730								
		Unmanaged				Forest land				Cropland					Grassland							
		natural				Managed				Annual generic					Managed rangeland							
final 2035	Forest land	Unmanaged	U1				U2				U3				U4				685			
			U2.13	U2.14	U2.15	U2.16	U2.12	U2.22	U2.23	U2.24	U2.25	U2.26	U4.13	U4.14	U4.15	U4.16						
	Managed	natural	730				655				125				1,010				640			
			30	30	30	30	40	10	7	8	7	8	15	15	15	15						
	Managed	plantation	-----				45				60				20				640			
45			45	45	45	60	80	60	20	60	60	60	60									
		910				885				295				1,030				880				4,000
																						4,000

AFOLU anthropogenic GHG Emissions and Removals

□ **Emission and Removal Processes** - GHG fluxes in the AFOLU Sector can be estimated in two ways

1. Indirectly, as net changes in C stocks in C pools over time [*C stock changes are used to estimate CO₂ emissions and removals from C pools since changes in biogenic C stocks are predominately through CO₂ exchange between the land surface and the atmosphere (including HWP, excluding other C transfer process such as leaching)*]

Used for most CO₂ fluxes

2. Directly, as gas flux rates to and from the atmosphere

Used for non-CO₂ emissions, CO₂ emissions not sourced from C pools and some CO₂ emissions/removals from C pools when C stocks are not quantifiable in an operational way

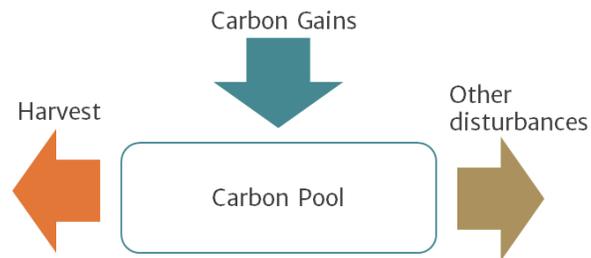
The IPCC Inventory Software has capacity to estimate each and every source and sink of GHG by applying both IPCC methodologies. **This exercise focus on way 1 only**

IPCC methodological approaches to estimate C stock changes

- IPCC provides 2 methodological approaches to estimate C stock changes as:
 - ✓ **The Gain and Loss method:** all C stock gains and C stock losses in a C Pool are identified and estimated individually
 - ✓ **The Stock Difference method:** C stocks are measured across time and changes estimated through difference of C stock at two point in time

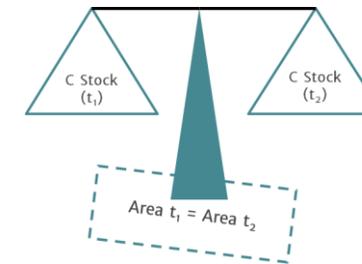
Method 1 (IPCC Default)

The Gain & Loss Method is a process-based approach, which estimates the net balance of C stock additions to and removals from a carbon pool



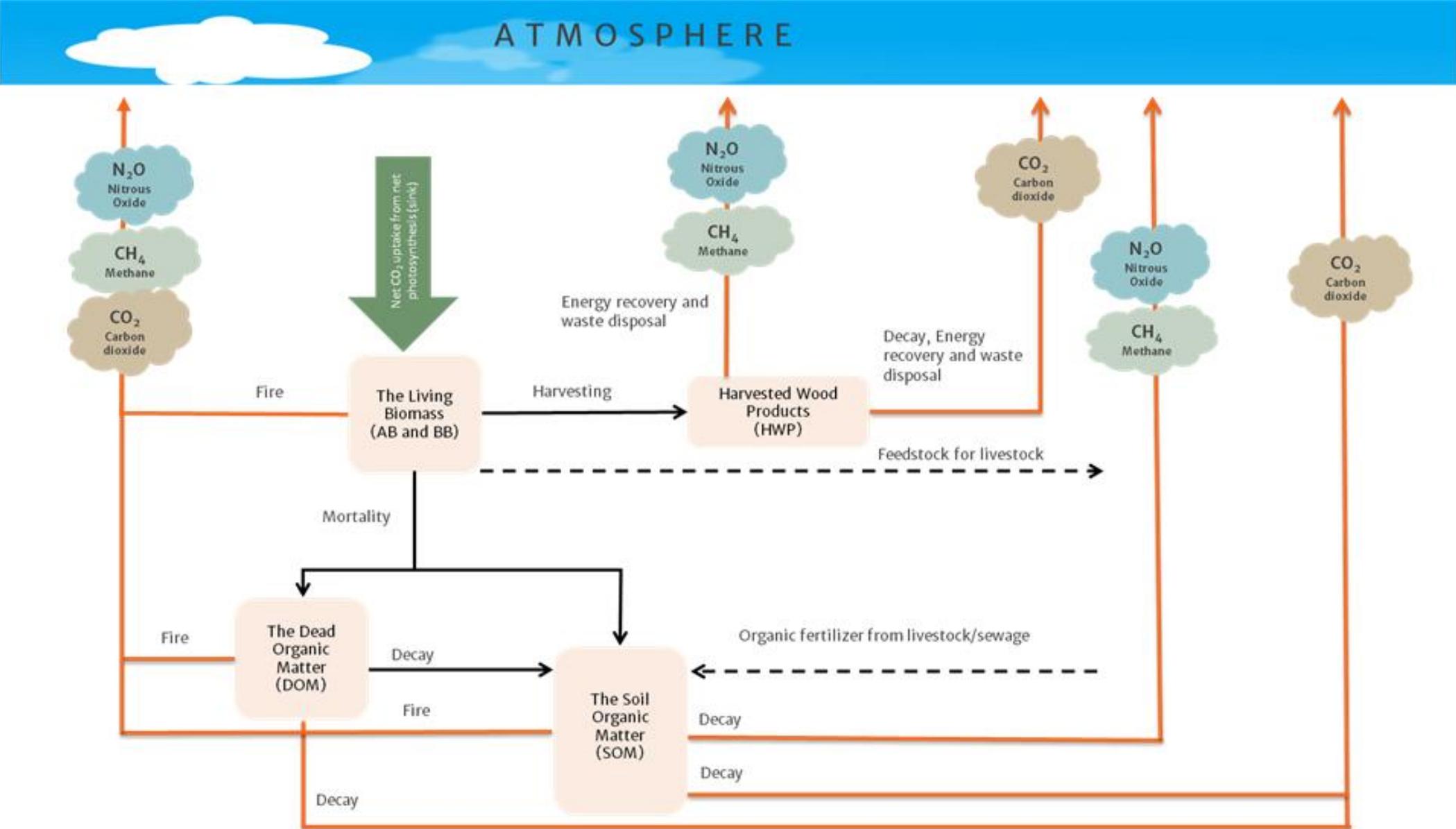
Method 2

The Stock Difference Method is a stock-based approach, which estimates the difference in C stocks at two points in time



The IPCC Inventory Software allows to estimate each C Pool in each Unit of Land either with the IPCC default or with the Stock-Difference approach

Land C pools, processes & associated GHG emissions and CO₂ removals



Reporting on C Pools

- Using C stock changes as a proxy, to estimate CO₂ emissions and removals require that, for a C Pool, annual estimates of C stock changes are reported:
 - ✓ All C stock gains and C stock losses are to be estimated in that C pool
 - ✓ Each C stock gain in a C pool is to be paired by an equivalent C stock loss from the C pool from which the C stock has been transferred, or by a removal of CO₂ from the atmosphere (*aboveground biomass pool only*)
 - ✓ Each C stock loss in a C pool is to be paired by an equivalent C stock gain in the C pool(s) to which the C stock has been transferred, or by an emission of CO₂ to the atmosphere

The IPCC Inventory Software allows to estimate each C stock gain and loss in each C pool, thus the user can ensure mass balance in C stocks and symmetry in C pools reporting

IPCC Category	Worksheets Number
	Total
3.A. – Livestock	158
3.A.1 – Enteric fermentation	44
3.A.2 – Manure management	114
3.B. – Land	292
3.B.1 – Forest land	73
3.B.2 – Cropland	55
3.B.3 – Grassland	55
3.B.4 – Wetlands	28
3.B.5 – Settlements	61
3.B.6 – Other land	20
3.C. – Aggregated Sources and non-CO₂ emissions sources on land	38
3.C.1 – Biomass burning	12
3.C.2 – Liming	1
3.C.3 – Urea application	1
3.C.4 – Direct N ₂ O emissions	10
3.C.5 – Indirect N ₂ O emissions from managed soils	2
3.C.6 – Indirect N ₂ O emissions from manure management	4
3.C.7 – Rice cultivation	1
3.C.8 – CH ₄ emissions from drained inland organic soils	1
3.C.9 – CH ₄ from drainage ditches on organic soils	1
3.C.10 – CH ₄ from rewetting of inland organic soils	1
3.C.11 – CH ₄ from rewetting of mangroves and tidal marshes	1
3.C.12 – N ₂ O emissions from aquaculture	1
3.C.13 – CH ₄ from rewetted and created Wetlands in inland wetland mineral soils	1
3.C.14 – Other	1
3.D. - Other	14
3.D.1 – Harvested Wood Products	13
3.D.2. – Other	1
TOTAL AFOLU SECTOR	502

Data & Calculation Tabs in the AFOLU sector of the IPCC Software

3.B.1 – Forest land - Worksheets map

IPCC Category	Number of Worksheets			
	Total	IPCC Tier (Equations)		
		Tier 1	Tier 2	Tier 3
3.B.1 – Forest land	73			
3.B.1.a – Forest land remaining Forest land	13	4 B + (1**)		
		1* SOM 2.25A +1 +1		
			1** SOM 2.25B	3 SD
		1 DOM G&L		
3.B.1.b – Land converted to Forest land	60			
3.B.1.b.i – Cropland converted to Forest land	12	4 B + (1)		
		1 SOM 2.25B +1 +1		3 SD
			1 DOM G&L	
		4 B + (1)		
3.B.1.b.ii – Grassland converted to Forest land	12	4 B + (1)		
		1 SOM 2.25B +1 +1		3 SD
			1 DOM G&L	
		4 B + (1)		
3.B.1.b.iii – Wetlands converted to Forest land	12	4 B + (1)		
		1 SOM 2.25B +1 +1		3 SD
			1 DOM G&L	
		4 B + (1)		
3.B.1.b.iv – Settlements converted to Forest land	12	4 B + (1)		
		1 SOM 2.25B +1 +1		3 SD
			1 DOM G&L	
		4 B + (1)		
3.B.1.b.v – Other land converted to Forest land	12	4 B + (1)		
		1 SOM 2.25B +1 +1		3 SD
			1 DOM G&L	
		4 B + (1)		

The IPCC Default –Gain and Loss– method (for which default values are provided by IPCC) applies to all Tiers, while the Stock-Difference method applies to Tier 3 only

Worksheets map *[notes]*

- () for biomass and in the year of change only
- +1 for drained organic soils only
- +2 on-site and off-site emissions associated with extracted peat decay
- +1 for rewetted organic soils only
- +2 for rewetted organic soil or for SOM excavation in Wetlands
- * for regions where Approach 1 of land representation is applied only
- ** for management changes only
- *** IPCC generic methodology [ADxEF] applies, but no IPCC default values are provided for EF

Forest Land: C Stock Changes – Biomass

- 4 Tabs for biomass Gain and Loss method:
 - ✓ 1 Tab Gain (annual net increment) [natural mortality included]
 - ✓ 3 Tabs Losses [natural mortality excluded]:
 - Industrial Roundwood removal *in this example assumed to occur in land NOT undergoing conversion only*
 - Fuelwood removal (as entire tree or part of tree) *in this example assumed to occur as part of tree only and thus already included in losses of industrial roundwood through $BCEF_R$*
 - Disturbance *in this example disturbances are assumed NOT to occur*
- 1 Tab for Stock-Difference method, *where the time-dependency is to be input*

Biomass C Stock Changes – Gain and Loss [Gains]

Biomass increase (G&L 1/4) Biomass loss (G&L 2/4) Biomass loss (G&L 3/4) Biomass loss (G&L 4/4) Biomass change (SD) Biomass change (Abrupt) DOM (G&L 1/1) DOM (SD 1/1) SOM mineral - Formulation A - IPCC Eq 2.25 (Information Item) SOM Mineral (Approaches 2 and 3) SOM Mineral (SD) SOM Organic Drained SOM Organic Rewetted

Worksheet
 Sector: Agriculture, Forestry and Other Land Use
 Category: Forest Land
 Subcategory: 3.B.1.a - Forest land Remaining Forest land
 Sheet: 1 of 4 Annual increase in carbon stocks in biomass (includes above-ground and below-ground biomass)
 Data

Region: GFOI example - Approach 2

Land use category					Equation 2.9	Equation 2.10						Equation 2.9		
Land unit code	Initial land use	Land use during reporting year			Area (ha)	Average net annual increment of growing stock (m ³ / ha / yr)	Biomass expansion factor for conversion of annual net increment to above-ground biomass increment	Basic wood density (t d.m. / m ³ fresh volume)	Biomass conversion and expansion factor for increment (t d.m. / m ³ wood volume)	Average annual above-ground biomass growth (tonnes d.m. / (ha * yr))	Ratio of below-ground biomass to above-ground biomass (t bg d.m. / t ag d.m.)	Average annual biomass growth above- and below-ground (tonnes d.m. / (ha * yr))	Carbon fraction of dry matter (tonnes C / tonne d.m.)	Annual increase in biomass carbon stocks due to biomass growth (tonnes C / yr)
					National statistics or international data sources	National statistics or international data sources	Table 3.A.1.10 / National statistics or international data sources	Tables 4.13 / 4.14 / 4.6 WS / National statistics or international data sources	BCEFI = BEF1 * D / Specified	Gw = Iv * BCEFI / Specified	Zero (0) or Table 4.4 / 4.5 WS / National statistics or international data sources	Gtotal = Gw * (1+R)	0.47 / Table 4.3 / 0.451 WS mangroves	ΔCG = A * Gtotal * CF
					A	Iv	BEF1	D	BCEFI	Gw	R	Gtotal	CF	ΔCG
U2	Managed Forest Land	Managed Natural	Managed Forest Land	Managed Natural	705	4.6			0.84	3.864	0.33	5.139	0.47	1,702.847
U3.13		Managed Natural		Plantation	45	14.6			0.53	7.738	0.22	9.44	0.47	199.664
U3.14		Managed Natural		Plantation	45	14.6			0.53	7.738	0.22	9.44	0.47	199.664
U3.15		Managed Natural		Plantation	45	14.6			0.53	7.738	0.22	9.44	0.47	199.664
U3.16		Managed Natural		Plantation	45	14.6			0.53	7.738	0.22	9.44	0.47	199.664
U2.23		Plantation		Managed Natural	7	4.6			0.84	3.864	0.33	5.139	0.47	16.908
U2.24		Plantation		Managed Natural	8	4.6			0.84	3.864	0.33	5.139	0.47	19.323
U2.25		Plantation		Managed Natural	7	4.6			0.84	3.864	0.33	5.139	0.47	16.908
U2.26		Plantation		Managed Natural	8	4.6			0.84	3.864	0.33	5.139	0.47	19.323
U3		Plantation		Plantation	265	14.6			0.53	7.738	0.22	9.44	0.47	1,175.797
U2.13	Unmanaged Forest Land	Unmanaged Natural		Managed Natural	30	4.6			0.84	3.864	0.33	5.139	0.47	72.462
U2.14		Unmanaged Natural		Managed Natural	30	4.6			0.84	3.864	0.33	5.139	0.47	72.462
U2.15		Unmanaged Natural		Managed Natural	30	4.6			0.84	3.864	0.33	5.139	0.47	72.462
U2.16		Unmanaged Natural		Managed Natural	30	4.6			0.84	3.864	0.33	5.139	0.47	72.462
Total					1,300							93.454		4,039.607

Biomass C Stock Changes – Gain and Loss [Loss - Harvest]

2035

Biomass increase (G&L 1/4) | Biomass loss (G&L 2/4) | Biomass loss (G&L 3/4) | Biomass loss (G&L 4/4) | Biomass change (SD) | Biomass change (Abrupt) | DOM (G&L 1/1) | DOM (SD 1/1) | SOM mineral - Formulation A - IPCC Eq 2.25 (Information Item) | SOM Mineral (Approaches 2 and 3) | SOM Mineral (SD) | SOM Organic Drained | SOM Organic Rewetted

Worksheet
 Sector: Agriculture, Forestry and Other Land Use
 Category: Forest Land
 Subcategory: 3.B.1.a - Forest land Remaining Forest land
 Sheet: 2 of 4 Loss of carbon from wood removals
 Data

Region: GFOI example - Approach 2

Land use category				Equation 2.12						
Land unit code	Initial land use	Land use during reporting year	Annual wood removal (m3/yr)	Biomass expansion factor for conversion of merchantable volume to above-ground biomass	Basic wood density (t d.m. / m3 fresh volume)	Biomass conversion and expansion factor for wood and fuelwood removal (BCEFr) (t d.m. / m3 wood volume)	Ratio of below-ground biomass to above-ground biomass (t bg d.m. / t ag d.m.)	Carbon fraction of dry matter (tonnes C / tonne d.m.)	Annual carbon loss due to biomass removals (tonnes C / yr)	
			National statistics or international data sources	Table 3.A.1.10 / National statistics or international data sources	Tables 4.13 / 4.14 / 4.6 WS / National statistics or international data sources	BCEFr = BEF2 * D / Specified	Zero (0) or Table 4.4 / 4.5 WS / National statistics or international data sources	0.47 / Table 4.3 / 0.451 WS mangroves	Lwr = H * BCEFr * (1+R) * CF	
			H	BEF2	D	BCEFr	R	CF	Lwr	
U2	Managed Forest La..	Managed Forest La..	2,862			0.95	0.33	0.47	1,699.584	
U3.13	Managed Natural	Managed Natural	0			0.61	0.22	0.47	0	
U3.14	Managed Natural	Managed Natural	0			0.61	0.22	0.47	0	
U3.15	Managed Natural	Managed Natural	0			0.61	0.22	0.47	0	
U3.16	Managed Natural	Managed Natural	0			0.61	0.22	0.47	0	
U2.23	Plantation	Managed Natural	0			0.95	0.33	0.47	0	
U2.24	Plantation	Managed Natural	0			0.95	0.33	0.47	0	
U2.25	Plantation	Managed Natural	0			0.95	0.33	0.47	0	
U2.26	Plantation	Managed Natural	0			0.95	0.33	0.47	0	
U3		Plantation	1,945			0.61	0.22	0.47	680.31	
U2.13	Unmanaged Forest..	Unmanaged Natural	0			0.95	0.33	0.47	0	
U2.14		Unmanaged Natural	0			0.95	0.33	0.47	0	
U2.15		Unmanaged Natural	0			0.95	0.33	0.47	0	
U2.16		Unmanaged Natural	0			0.95	0.33	0.47	0	
Total			4,807						2,379.895	

Forest Land: C Stock Changes – Dead Organic Matter (DOM)

- **DOM estimate disaggregated in its 2 components:**
 - ✓ Dead Wood
 - ✓ Litter
- **1 Tab for Gain and Loss method**, *no IPCC default values*
- **1 Tab for Stock-Difference method**, *where, for the sake of easy calculation, the time-dependency is input as 20-year*

DOM C Stock Changes – Stock-Difference

Biomass increase (G&L 1/4) | Biomass loss (G&L 2/4) | Biomass loss (G&L 3/4) | Biomass loss (G&L 4/4) | Biomass change (SD) | Biomass change (Abrupt) | DOM (G&L 1/1) | **DOM (SD 1/1)** | SOM mineral - Formulation A - IPCC Eq 2.25 (Information Item) | SOM Mineral (Approaches 2 and 3) | SOM Mineral (SD) | SOM Organic Drained | SOM Organic Rewetted

Worksheet
Sector: Agriculture, Forestry and Other Land Use
Category: Forest Land
Subcategory: 3.B.1.a - Forest land Remaining Forest land
Sheet: Annual net C stock change in dead organic matter (Stock difference method)

Region: GFOI example - Approach 2

Land use category				Equation 2.19									
Land unit code	Initial land use	Land use during reporting year	DOM C pool	Area (ha)	Dead wood/litter stock at the end of the time period (t2) (t d.m. / ha)	Carbon fraction of dry matter (t2) (tonnes C / tonne d.m.)	Dead wood/litter stock at the beginning of the time period (t1) (t d.m. / ha)	Carbon fraction of dry matter (t1) (tonnes C / tonne d.m.)	Time period between two dead organic matter carbon stock inventories (Year)	Annual change in carbon stocks in dead wood/litter (tonnes C / yr)			
			National statistics or international data sources		National statistics or international data sources	for litter IPCC default is 0.37	National statistics or international data sources	for litter IPCC default is 0.37	T = t2 - t1	$\Delta C(DOM) = A * (DOM(t2)*CF(t2) - DOM(t1)*CF(t1)) / T$			
			A		DOM(t2)	CF(t2)	DOM(t1)	CF(t1)	T	$\Delta C(DOM)$			
U3.13	Managed Forest..	Managed Natural	Managed Forest..	Plantation	Dead wood	10.9	1	13.2	1	20	-5.175		
		Managed Natural			Litter	6.8	1	8.7	1	20	-4.275		
U3.14		Managed Natural			Dead wood	10.9	1	13.2	1	20	-5.175		
		Managed Natural			Litter	6.8	1	8.7	1	20	-4.275		
U3.15		Managed Natural			Dead wood	10.9	1	13.2	1	20	-5.175		
		Managed Natural			Litter	6.8	1	8.7	1	20	-4.275		
U3.16		Managed Natural			Dead wood	10.9	1	13.2	1	20	-5.175		
		Managed Natural			Litter	6.8	1	8.7	1	20	-4.275		
U2.23		Plantation		Managed Natural	Dead wood	13.2	1	10.9	1	20	0.805		
		Plantation			Litter	8.7	1	6.8	1	20	0.665		
U2.24		Plantation			Dead wood	13.2	1	10.9	1	20	0.92		
		Plantation			Litter	8.7	1	6.8	1	20	0.76		
U2.25		Plantation			Dead wood	13.2	1	10.9	1	20	0.805		
		Plantation			Litter	8.7	1	6.8	1	20	0.665		
U2.26		Plantation			Dead wood	13.2	1	10.9	1	20	0.92		
		Plantation			Litter	8.7	1	6.8	1	20	0.76		
U2.13	Unmanaged Fore..	Unmanaged Natu..			Dead wood	13.2	1	24.1	1	20	-16.35		
		Unmanaged Natu..			Litter	8.7	1	15.5	1	20	-10.2		
U2.14		Unmanaged Natu..			Dead wood	13.2	1	24.1	1	20	-16.35		
		Unmanaged Natu..			Litter	8.7	1	15.5	1	20	-10.2		
U2.15		Unmanaged Natu..			Dead wood	13.2	1	24.1	1	20	-16.35		
		Unmanaged Natu..			Litter	8.7	1	15.5	1	20	-10.2		
U2.16		Unmanaged Natu..			Dead wood	13.2	1	24.1	1	20	-16.35		
		Unmanaged Natu..			Litter	8.7	1	15.5	1	20	-10.2		
Total										-137.7			

Forest Land: C Stock Changes – Soil Organic Matter (SOM)

- **2 Tabs for IPCC default method [Equation 2.25]**
 - ✓ Formulation A [Approach 1 for Land Representation]
 - ✓ Formulation B [Approaches 2 or 3 for Land Representation], *in this example Formulation B [Approach 2] is applied*
- **1 Tab for Stock-Difference method**, *where the time-dependency is to be input*

SOC Changes – Equation 2.25, Formulation B

Biomass increase (G&L 1/4) | Biomass loss (G&L 2/4) | Biomass loss (G&L 3/4) | Biomass loss (G&L 4/4) | Biomass change (SD) | Biomass change (Abrupt) | DOM (G&L 1/1) | DOM (SD 1/1) | SOM mineral - Formulation A - IPCC Eq 2.25 (Information Item) | SOM Mineral (Approaches 2 and 3) | SOM Mineral (SD) | SOM Organic Drained | SOM Organic Rewetted

2035

Worksheet
Sector: Agriculture, Forestry and Other Land Use
Category: Forest Land
Subcategory: 3.B.1.a - Forest land Remaining Forest land
Sheet: Annual net C stock change in soil organic matter of mineral soils - Approach 2 and Approach 3 (Default method)

Data

Region - Approach 2

Land use category				Equation 2.25 - B												
Land unit code	Initial land use	Land use during reporting year	National statistics or international data sources	Area (ha)	Reference carbon stock for the climate and soil combination (tonnes C / ha)	Time dependence of stock change factors (D) or number of years over a single inventory time period (T) (yr)	Stock change factor for land-use system for the subdivision in the current inventory year (-)	Stock change factor for management regime for the subdivision in the current inventory year (-)	Stock change factor for C input for the subdivision in the current inventory year (-)	Soil organic carbon stock in mineral soils at equilibrium for the current subdivision (tonnes C / ha)	Stock change factor for land-use system at conversion (-)	Stock change factor for management regime at conversion (-)	Stock change factor for C input at conversion (-)	Soil organic carbon stock in mineral soils for the subdivision at conversion (tonnes C / ha)	Annual change in carbon stocks in mineral soils (tonnes C / yr)	
				A	SOCref	D	Flu(0)	Fmg(0)	Fi(0)	SOC(0) = SOCref * Flu(0) + Fmg(0) * Fi(0)	Flu(c)	Fmg(c)	Fi(c)	SOC(c) = SOCref * Flu(c) + Fmg(c) * Fi(c)	$\Delta C_{\text{mineral}} = ((SOC(0) - SOC(c)) * A) / D$	
U3.13	Managed Forest Land	Managed Natural	Managed Forest Land	Plantation	45	45.2	20	1	0.75	1	33.9	1	0.84	1	37.968	-9.153
U3.14		Managed Natural		Plantation	45	45.2	20	1	0.75	1	33.9	1	0.84	1	37.968	-9.153
U3.15		Managed Natural		Plantation	45	45.2	20	1	0.75	1	33.9	1	0.84	1	37.968	-9.153
U3.16		Managed Natural		Plantation	45	45.2	20	1	0.75	1	33.9	1	0.84	1	37.968	-9.153
U2.23		Plantation		Managed Natural	7	45.2	20	1	0.84	1	37.968	1	0.75	1	33.9	1.424
U2.24		Plantation		Managed Natural	8	45.2	20	1	0.84	1	37.968	1	0.75	1	33.9	1.627
U2.25	Unmanaged Forest Land	Plantation	Unmanaged Natural	Managed Natural	7	45.2	20	1	0.84	1	37.968	1	0.75	1	33.9	1.424
U2.26		Plantation		Managed Natural	8	45.2	20	1	0.84	1	37.968	1	0.75	1	33.9	1.627
U2.13		Unmanaged Natural		Managed Natural	30	45.2	20	1	0.84	1	37.968	1	1	1	45.2	-10.848
U2.14		Unmanaged Natural		Managed Natural	30	45.2	20	1	0.84	1	37.968	1	1	1	45.2	-10.848
U2.15		Unmanaged Natural		Managed Natural	30	45.2	20	1	0.84	1	37.968	1	1	1	45.2	-10.848
U2.16		Unmanaged Natural		Managed Natural	30	45.2	20	1	0.84	1	37.968	1	1	1	45.2	-10.848
Total					330											-73.902

Comparison area of each land subdivision: *Reference* vs *Actual*

subdivision	Area (ha)				
	Reference		Actual		
	2020	2025	2020	2025	
Primary Forest [un]	[unR un]	865	820	870	840
Secondary Forest [mn]	[mnR mn]	765	720	770	740
Forest plantation [fp]	[fpR fp]	78	70	78	73
Primary Forest to Secondary Forest	[unC mn]	90	120	87	107
Secondary Forest to Forest Plantation	[mnC fp]	135	180	130	160
Forest Plantation to Secondary Forest	[fpC mn]	22	30	22	27
Grassland to Forest Plantation	[mgC mp]	180	240	173	213
Primary and Secondary Forest Land Total		1,742	1,690	1,748	1,713
Generic crop [gc]	[gcR gc]	1,000	1,000	1,000	1,000
Primary Forest to Cropland	[unC gc]	45	60	43	53
Rangeland [mg]	[mgR mg]	820	760	827	787
Reducing Deforestation					
Reducing Degradation					
Sustainable Forest Management					
Conservation					
Enhancement of C stocks					

NOT in the IPCC Inventory Software

Comparison C balance of each land subdivision: *Reference* vs *Actual*

subdivision			2020 (Mg C)						2025 (Mg C)						
			Biomass		DOM		SOM		Biomass		DOM		SOM		
			<i>R</i>	<i>A</i>	<i>R</i>	<i>A</i>	<i>R</i>	<i>A</i>	<i>R</i>	<i>A</i>	<i>R</i>	<i>A</i>	<i>R</i>	<i>A</i>	
Primary Forest [un]		[unR un]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Secondary Forest [mn]		[mnR mn]	0.3	0.5	NE	NE	NE	NE	0.3	0.5	NE	NE	NE	NE	
Forest plantation [fp]		[fpR fp]	1.9	-1.6	NE	NE	NE	NE	-0.4	-1.7	NE	NE	NE	NE	
Primary Forest to Secondary Forest			[unC mn]	-2,885.9	-2,582.8	-79.7	-77.0	-32.5	-31.5	-2,813.4	-1,810.4	-106.2	-94.7	-43.4	-38.7
Secondary Forest to Forest Plantation			[mnC fp]	-8,876.2	-7,845.5	-28.4	-27.3	-27.5	-26.4	-8,676.5	-5,606.8	-37.8	-33.6	-36.6	-32.5
Forest Plantation to Secondary Forest			[fpC mn]	-797.8	-797.8	4.6	4.6	4.5	4.5	-900.0	-542.6	6.3	5.6	6.1	5.5
Grassland to Forest Plantation			[mgC mp]	145.0	190.2	98.1	94.3	-101.7	-97.7	411.2	509.3	130.8	191.3	-135.6	-120.3
Generic crop [gc]			[gcR gc]	NE	NE	NE	NE	NE	0.0	NE	NE	NE	NE	NE	0.0
Primary Forest to Cropland			[unC gc]	-4,684.6	-4,060.0	-594.0	-514.8	-20.3	-19.4	-4,684.6	-3,123.1	-594.0	-396.0	-27.1	-14.9
Rangeland [mg]			[mgR mg]	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
FLrFL				-12,557.6	-11,227.2	-103.4	-99.7	-55.5	-53.4	-12,390.0	-7,961.1	-137.8	-122.7	-73.9	-65.7
LcFL				145.0	190.2	98.1	94.3	-101.7	-97.7	411.2	509.3	130.8	191.3	-135.6	-120.3
LcCL				-4,684.6	-4,060.0	-594.0	-514.8	-20.3	-19.4	-4,684.6	-3,123.1	-594.0	-396.0	-27.1	-14.9
ToT				-17,097.2	-15,097.0	-599.3	-520.2	-177.6	-170.6	-16,663.4	-10,574.8	-601.0	-327.4	-236.6	-201.0

NOT in the IPCC Inventory Software

Download it at <https://www.ipcc-nggip.iges.or.jp/software/index.html>

Inventory Software

New Version 2.85 – IPCC Inventory Software

This is the new version 2.85 of the IPCC Inventory Software released on March 14, 2023.

Please note that version 2.85 comes in 2 different files for installation. Thus, before downloading the file you shall check which one you actually need by using [this decision tree](#).

! [Ver. 2.85 IPCC Inventory Software - 64bit](#)

! [Ver. 2.85 IPCC Inventory Software - 32bit](#)

If you find any issues in the use of the IPCC Inventory Software, come back to us at ipcc-software@iges.or.jp.

Thank you very much for your support.

In coming months, according to the software development plan as well as to feedback from testing, new versions will be released until the work on interoperability is completed

Version 2.85 of the IPCC Inventory Software comes with 2 alternative installation packages –i.e. **64bit** vs **32bit**–.

Please support us through testing and reporting your findings at ipcc-software@iges.or.jp

A large, vibrant rainbow arches across a cloudy sky, spanning from the left side of the frame to the right. Below the rainbow, a street scene is visible, featuring lush green trees, a multi-story building with a yellowish facade, and a white van parked on the side of the road. The overall atmosphere is serene and hopeful, with the rainbow serving as a central focal point.

Thank you

Promoting Accuracy, Minimizing Uncertainty

□ Activity data statistical population and its stratification in subdivisions

- Stratification of activity data promotes accuracy since subdivisions are more homogenous than the whole population. Further, summing up subdivisions' estimates to a total reduces uncertainty because error propagation tends to cancel those out -*Systematic Errors instead DO NOT cancel out across propagation-*

Thus, GOOD PRACTICE is to always REMOVING any identified SYSTEMATIC ERROR -*a biased estimate is NOT acceptable in an NGHGI-*; while minimizing RANDOM ERRORS -*these indeed cannot be removed!-*.

Random errors do bias neither the level of emissions/removals estimated nor the estimated change across time (mitigation); while Systematic errors do.

Opening new stratum in the worksheet for data input

➤ On the right hand side:

- ✓ The symbol  indicates that there is a sub-layer to be compiled

Always click on it to open the sub-layer and input the information

Adding row of data input

➤ On the right hand side:

- ✓ The symbol  indicates that a row of data can be input

Once data input is completed a new row appears at the bottom to allow to input a further row of data, and so on

LRM – Land Representation Tab

Land use subcategory		Area (ha)		Remark						
Cropland annual crops										
Current Land use subdivision				Remark						
Organic 1 (A) rewetted										
Land unit code (Automatic)	Land unit code (User defined)	Previous Land use subcategory	Previous Land use subdivision	Transition period [T] (years)	Year of conversion	Area (ha)	Remark	P	C	M
ACL-O1AR-104<-MFL-...		Managed Forest land	Tectona grandis NF	20	1990	100 000				

Additional functionalities

Letter “C” (Conversion) to input a further conversion to a unit of land that is still undergoing a conversion (*no 20-year period passed since the previous conversion*)

New Land Unit Conversion

Current conversion status

From: Managed Forest land / Tectona grandis NF

To: Cropland annual crops / Organic 1 (A) rewetted

Transition period: 20 Year of conversion: 1990

New conversion to

Land use subcategory: Settlements (Treed)

Land use subdivision: Settlement 1 (T)

Transition period: 20

Year of conversion: 1995

Remark:

Save Cancel

It is available in Approach 3 land representation only

ipcc

INTERGOVERNMENTAL PANEL ON climate change

