Use of the IPCC Inventory Software to Establish the National GHG inventory in the Agriculture, Forestry and Other Land Use (AFOLU) sector

Land Carbon Stock Changes and CO$_2$ fluxes

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INTERGOVERNMENTAL PANEL ON climate change
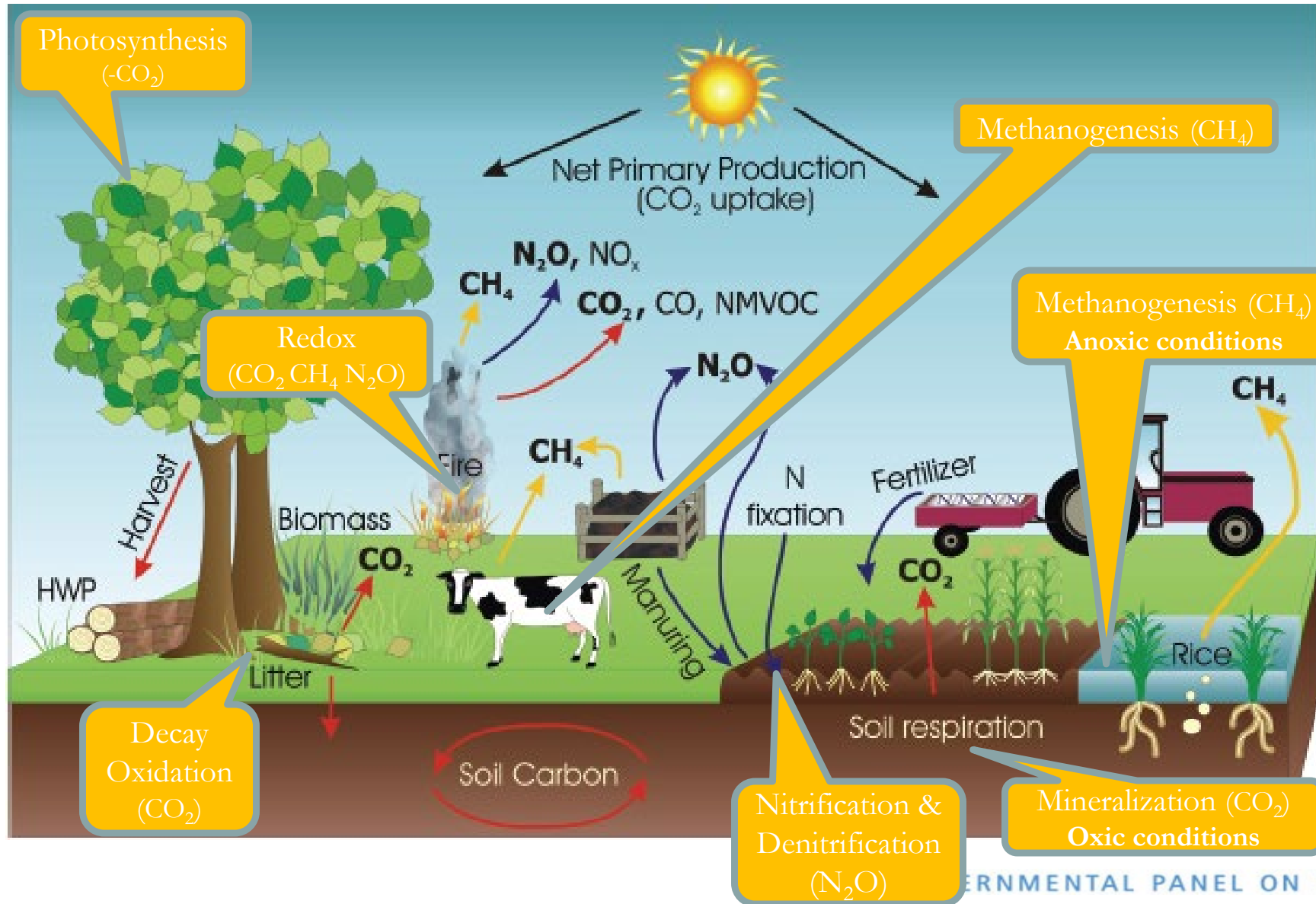
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IPCC Guidelines

□ **Volume 4 (AFOLU)**, Chapters 2, 4, 5, 6, 7, 8, 9

 ✓ **2006 IPCC Guidelines**

 ✓ **2019 Refinement**

□ **Wetlands Supplement**, Chapters 2, 3, 4, 5

Processes covered by IPCC Guidance on AFOLU

Organic Matter

❑ **Organic matter is heterogeneous very complex compound. Generally, as weight, is**

  ➢ 45–55% Carbon

  ➢ 35–45% Oxygen

  ➢ 3–5% Hydrogen

  ➢ 1–4% Nitrogen

❑ **Organic matter is the component of**

  ➢ <u>Biomass</u>, living organic matter, which can have

    ➢ Either an annual cycle [Growth → Harvest&Consumption or Decay to dead organic matter]

    ➢ Or a multiyear cycle [Growth in plant perennial tissues (wood)] and thus stores Carbon across years

  ➢ <u>Dead organic matter</u>, dead wood, litter, soil organic matter, harvested wood products which stores Carbon across years

Organic Matter

❑ **Organic matter redox/decay processes timescale**

  ➢ *hours*

  ➢ *within a year*

  ➢ *years/centuries*

  ➢ *centuries/millennia*

❑ **Organic matter redox/decay results in**

  ➢ CO_2, CH_4, N_2O

  ➢ NH_3/NH_4^+, NO_X

  ➢ H_2O, N_2

Chemicals

❑ **Nitrogen fertilizers** => N_2O emissions

❑ **Carbonaceous mineral amendments** => CO_2 emissions

❑ **Nitrogen/Carbonaceous fertilizers (Urea)** => $N_2O + CO_2$ emissions

Notations

❑ **Nitrogen** content of N_2O **is** indicated as $N_2O\text{-}N$, and emissions of $N_2O\text{-}N$ are **converted** to N_2O emissions multiplying **by 44/28** (proportion of the atomic weight of the two molecules)

❑ **Carbon** content of CH_4 **is** indicated as $CH_4\text{-}C$, and emissions of $CH_4\text{-}C$ are **converted** to CH_4 emissions multiplying **by 16/12** (proportion of the atomic weight of the two molecules)

❑ **Carbon** content of CO_2 **is** indicated as $CO_2\text{-}C$, and emissions of $CO_2\text{-}C$ are **converted** to CO_2 emissions multiplying **by 44/12** (proportion of the atomic weight of the two molecules)

❑ Emissions have a positive sign, while CO_2 removals have a negative sign. *This is because the "point of view" of an NGHGI is the atmosphere, so a positive sign means an addition of GHG to the atmosphere, while a negative sign means a subtraction of CO_2 from the atmosphere*

❑ Carbon stock gains have a positive sign, while Carbon stock losses have a negative sign. *This is because the "point of view" is the C pool to which the C stock pertains, so a positive sign means an addition of Carbon to the C pool, while a negative sign means a subtraction of C stock from the C pool*

❑ Thus, **converting** a net **C stock** change **to CO_2** net **emission/removal** requires to multiplying the net C stock **by -44/12**, *given that the sign is to be changed*

Stratification of Activity Data

❑ **Stratification of activity data promotes accuracy and precision since**:

  ✓ Subdivisions are more homogenous than the whole population, *and thus associated EF are more accurate and precise*

  ✓ Propagation of random error, as it occurs summing up subdivisions' estimates, tends to cancel those out *-Systematic Errors instead DO NOT cancel out across propagation-*

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 zeroed!-*.

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

GHG emissions and CO$_2$ removals from land use
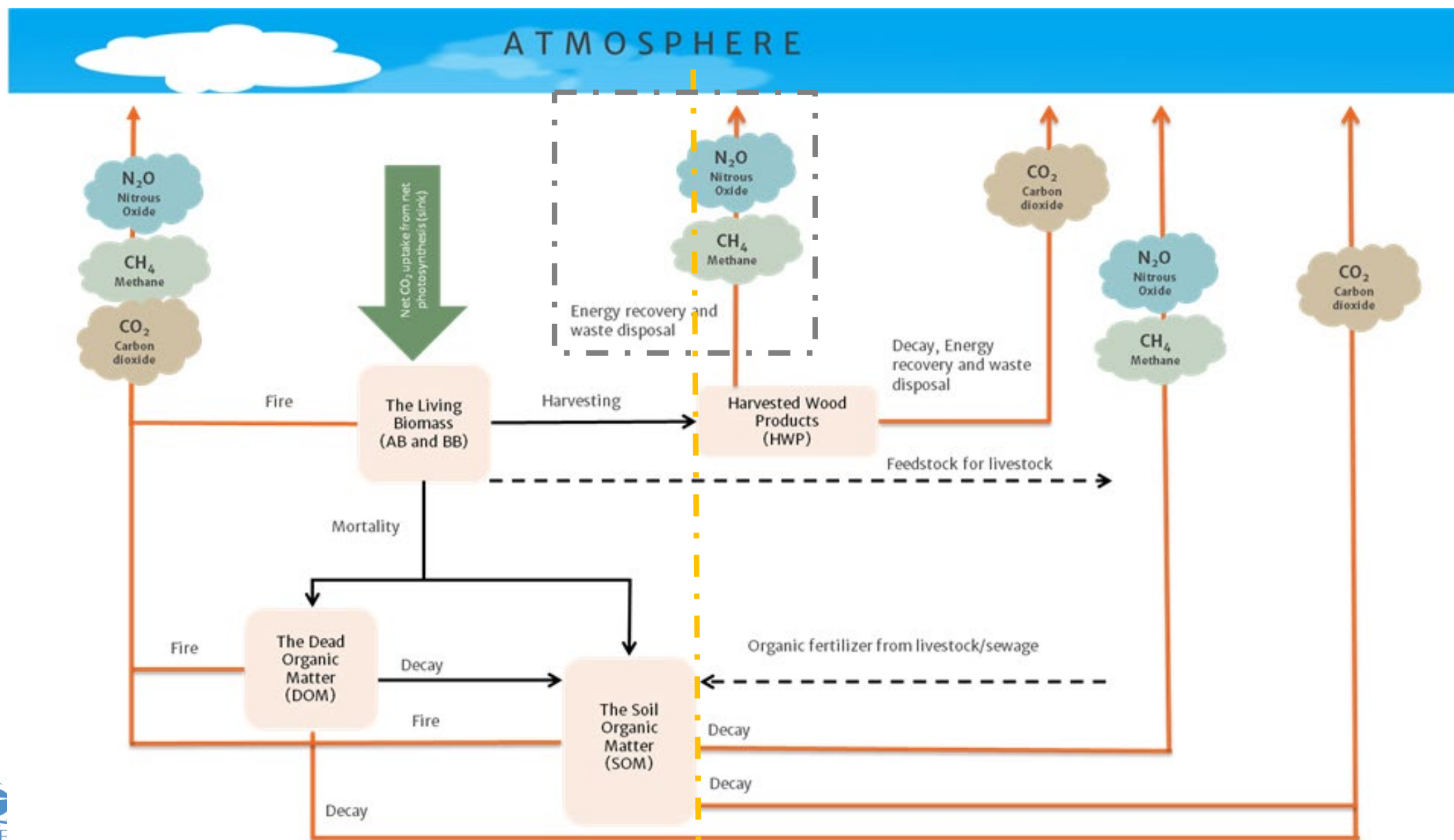
AFOLU anthropogenic GHG Emissions and Removals

❑ **AFOLU sources/sinks**

➢ **Plant biomass is the sink of CO_2 removal from the atmosphere**. Of the CO_2 annual net absorption (*photosynthesis minus respiration - NPP*):

✓ A fraction is stored, and in managed land is reported as a **perennial biomass** accumulation

✓ A fraction is transferred to other C pools (DOM, SOM, HWP) as C stocks

➢ DOM and SOM C stocks decays across time to CO_2, although the annual net C stock change can be positive depending on systems' phases, management practices and disturbances

➢ Non-CO_2 emissions are largely a product of microbiological processes (i.e., within soils, animal digestive tracts and manure) and combustion of organic matter

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Annual Biomass in AFOLU

❑ **Within the annual time-frame of a National GHG Inventory (NGHGI)**

➤ C stored in Annual biomass is up-taken and subsequently released (**thus, both fluxes** *-CO$_2$ emissions and subsequent removals-* **are excluded from the NGHGI**). However, C can be released as CH$_4$, instead of CO$_2$; further, annual biomass decay releases N, including as N$_2$O

➤ Various decay patterns occur:

    ✓ **[3.B categories]** Annual biomass decays to DOM and SOM *(given that C accumulation is physically limited, the long-term annual average C stock in each C pool tends to stabilize at a level in which C inputs equal C losses so that the annual net C-stock change can be assumed equal to 0; unless the long-term annual average C stock changes)*

    ✓ **[3.C.1 categories*]** Annual biomass is burnt to CO$_2$, CH$_4$ and N$_2$O

    ✓ **[3.A categories*]** Annual biomass as feed for livestock:
- Fermentation *[digestion]*, CH$_4$
- Metabolism *[respiration]*, CO$_2$
- Manure [Management], CH$_4$ & N$_2$O

AFOLU C pools in managed land

Resident C pools

❑ **Biomass, aboveground and belowground**

✓ **Perennial** – C sequestration and accumulation, C stock losses caused by any driver (*anthropogenic and natural*)

✓ **Annual** – C sequestration and subsequent C stock loss caused by any drivers (*anthropogenic and natural*) are assumed to occur in the same year, resulting in a zero net C stock change

❑ **Dead Organic Matter (DOM)**

✓ **Litter** – all non-living biomass with a size greater than the limit for SOM (*suggested 2 mm*) and less than the minimum diameter chosen for dead wood (*e.g. 10 cm*), lying dead, in various states of decomposition above or within the mineral or organic soil.

✓ **Dead wood** – all non-living woody biomass not contained in the litter, either standing, lying on the ground, or in the soil than or equal to 10 cm in diameter (*or the diameter specified by the inventory compiler*).

❑ **Soil Organic Matter (SOM)**

✓ **Mineral soils** – Includes organic carbon to a specified depth (*30 cm as IPCC default*) chosen by the country and applied consistently through the time series. Live and dead fine roots and DOM within the soil, that are less than the minimum diameter limit (*suggested 2 mm*) for roots and DOM, are included with SOM where these cannot be distinguished from it empirically.

non-Resident C pools

❑ **Harvested Wood Products**: wood and paper products; include i) wood products in use; ii) wood biomass used for energy purposes and iii) wood biomass in solid waste disposal sites.

Organic soils

C stocks in organic soils are not explicitly computed using IPCC methods (which estimate only annual C flux from/to organic soils).

AFOLU anthropogenic GHG Emissions and Removals

❑ **Emission and Removal Processes -** GHG fluxes in the AFOLU Sector are estimated in two alternative ways

1. **Indirectly, as net change in C stock in a C pool**. *The use of C stock changes to infer CO_2 emissions and removals from C pools, is based on the fact that changes in ecosystem C stocks are predominately (but not exclusively*) through CO_2 exchange between the land surface and the atmosphere*

2. Directly as flux rates to(/from) the atmosphere *(used for estimating non-CO_2 emissions, CO_2 emissions not sourced from C pools and those CO_2 emissions and removals from SOM for which the C stock is not quantifiable in an operational way, e.g. drainage/rewetting of organic soils)*.

    * (i.e. processes of lateral C transfer, not to the atmosphere, such as leaching are assumed to be negligible)

CSCs methods – C pools physical limits for C stock storage

As per the Population Ecology:

❑ C stocks dynamic tends to approach the physical limit of the C pool –i.e. its carrying capacity–
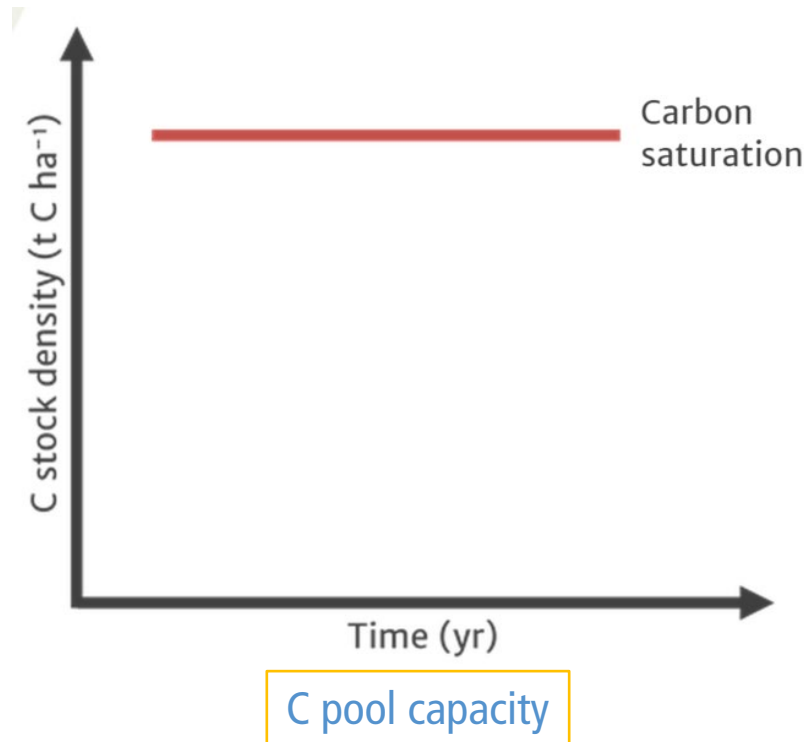
CSCs methods – long-term average C stock

As per the Population Ecology:

❑ C stocks contained in C pools at any given time is a function of the type and duration of the use of lands, as well as of the disturbances occurred

❑ With a constant rate of activities and disturbances C stocks in a C pool tend to approach a so-called long-term average C stock
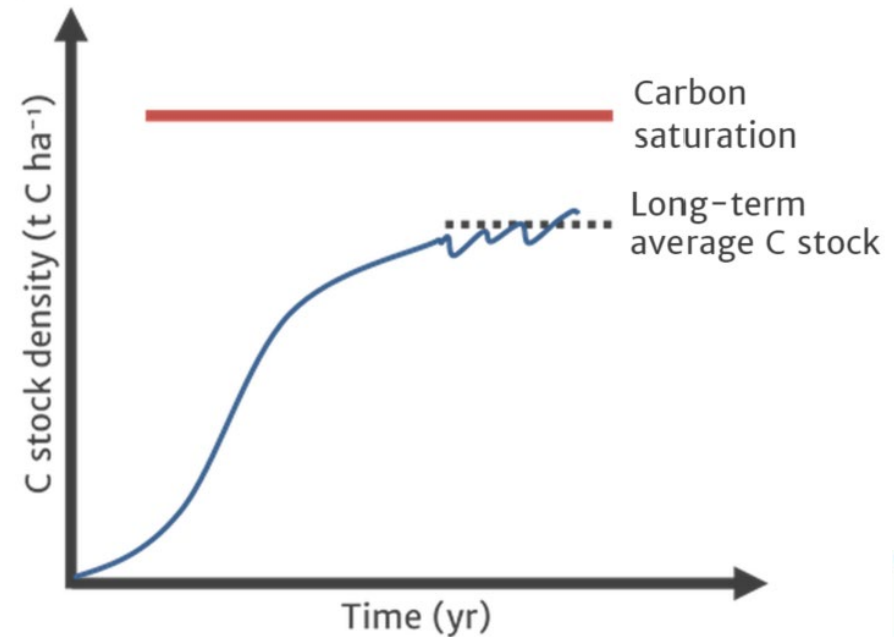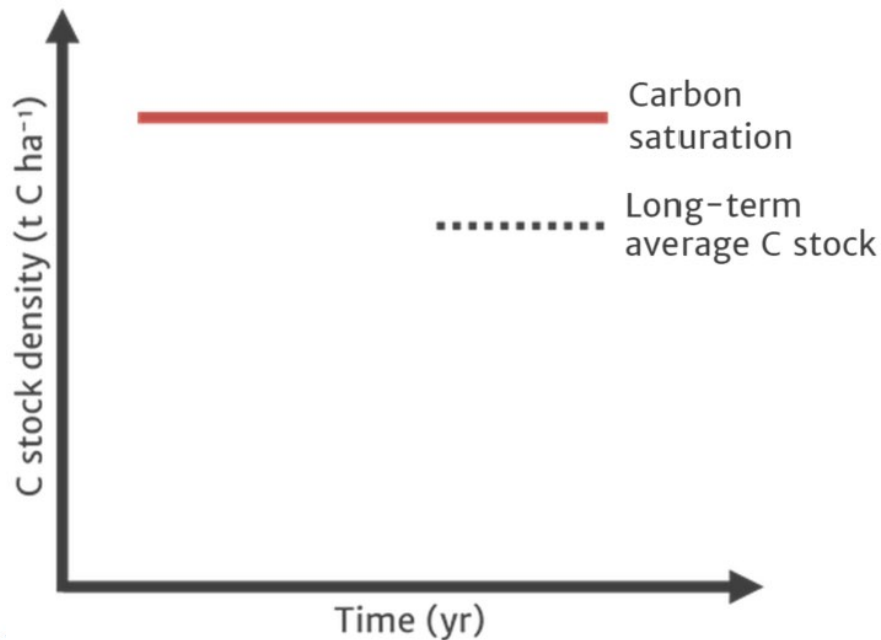
IPCC Methodological approaches to estimate C stock changes

IPCC provides 2 different **fully equivalent** methodologies to estimate the **annual net C stock change** in any C pool

❑ The **Gain and Loss** methodology, which estimates the annual net C stock change in a C pool by summing up **ALL**

  ✓ Annual C stock gains (inflow in the C pool)

  ✓ Annual C stock losses (outflow from the C pool)

in a managed land, **regardless of drivers** of such C stock changes

❑ The **Stock Difference** methodology, which estimates the annual net C stock change in a C pool in a managed land as the difference in the resident C stock between two points in time
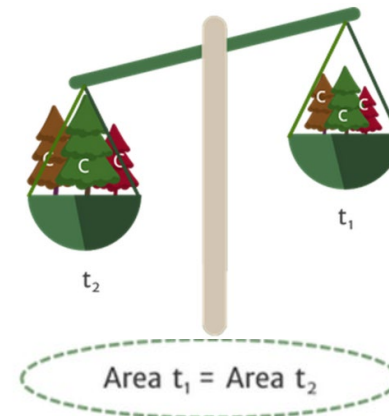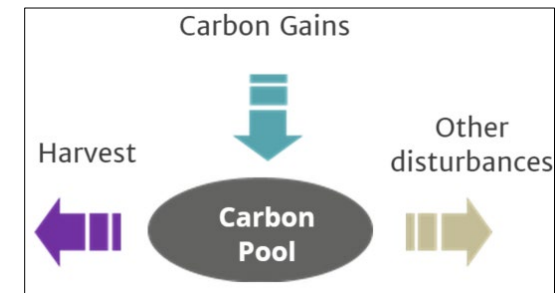
IPCC Methodological approaches to estimate C stock changes

❑ C stock changes in resident C pools are estimated and reported in an NGHGI according to 6 IPCC land categories:

- ✓ Forest land
- ✓ Cropland
- ✓ Grassland
- ✓ Wetlands
- ✓ Settlements
- ✓ Other land

❑ National-specific categorization shall be reconciled to the 6 IPCC default categories while ensuring that:

- ➢ no national-specific category* overlaps 2 or more IPCC categories –i.e. every national-specific category fully corresponds to 1 IPCC category, although it may be just a subset of it–
- ➢ The entire territory is classified –i.e. no land is left uncategorised–

* Lowest layer of stratification i.e. land subdivision

3.B – Land

Category		Activity	GHGs
3.B.1	**Forest land**	**3.B.1a** **Forest land Remaining Forest land**	
		3.B.1b **Land converted to Forest land**	
3.B.2	**Cropland**	**3.B.2a** **Cropland Remaining Cropland**	
		3.B.2b **Land Converted to Cropland**	
3.B.3	**Grassland**	**3.B.3a** **Grassland Remaining Grassland**	**CO$_2$-C**
		3.B.3b **Land Converted to Grassland**	
3.B.4	**Wetlands**	**3.B.4a** **Wetlands Remaining Wetlands**	
		3.B.4b **Land Converted to Wetlands**	
3.B.5	**Settlements**	**3.B.5a** **Settlements Remaining Settlements**	
		3.B.5b **Land Converted to Settlements**	
3.B.6	**Other land**	**3.B.5b** **Land Converted to Other land**	

The IPCC Inventory Software

❑ **All methods in the 2006 IPCC Guidelines and its Wetlands Supplement are implemented in the IPCC Inventory Software**

Thus, needed flexibility to deal with any national circumstances, as per IPCC tiered approach, is ensured

❑ **Subnational disaggregation (Geographical Zone)**

Thus, tracking of specific activities/projects, and associated emission level & trend, within a national GHG inventory is allowed

❑ **Interoperability with UNFCCC ETF reporting tool** allows to export a complete set of CRTs and upload it in the UNFCCC ETF reporting tool

User-specific Tier 3 estimates to be accommodated in Tier 1 methodological approach worksheets

❑ **AFOLU sector Guidebook – version 1 under development**
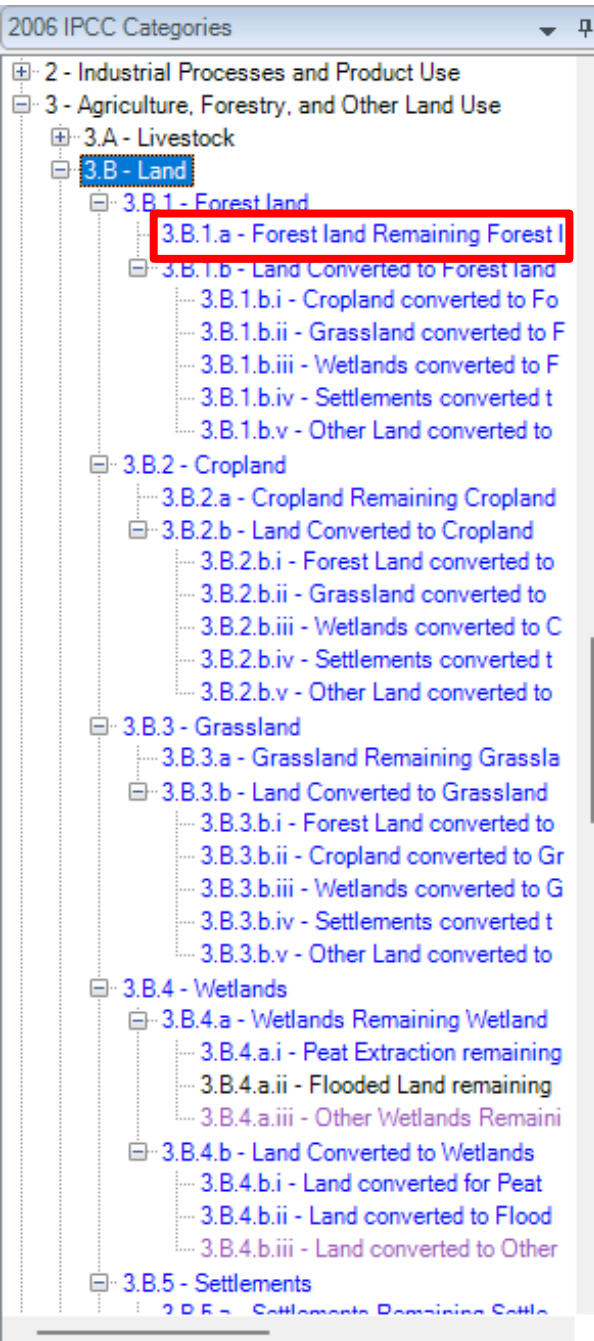
Open the Calculation Worksheets

❑ Clicking on **blue categories** opens the relevant calculation worksheets where to enter parameters and Carbon-Stock-Change Factors.

❑ Each category is populated with the worksheets needed according to the units of land entered in the land representation as well as with the selection of the methodology to apply in each of the C pools.

Calculation Worksheets

❑ For each C pool, depending on methodology to calculate C stock changes or CO_2 fluxes selected in the Land Representation Manager, the *Software* maps each unit of land to the relevant TAB

❑ Although land categories are shown in blue ink -e.g. 3.B.1 Forest land-, calculation worksheets are limited to subcategories -e.g. 3.B.1.a Forest land remaining Forest land-.

❑ Although land conversion categories are shown in blue ink -e.g. 3.B.1.b Land converted to Forest land-, calculation worksheets are limited to subcategories -e.g. 3.B.1.b.i Cropland converted to Forest land-.

Case Study for Land – Land dynamic

❑ **Region 1:**

➤ Forest land is first expanded on Grassland, and then deforested likely for Settlements

➤ Settlements is expanded likely on Grassland, and then likely on Forest land

➤ Grassland is subject to prescribed burning

❑ **Region 2:**

➤ Primary forest converted to Forest plantation; area converted is affected by a wildfire event in 2020

➤ Mangrove forest is deforested to urban park, and a fraction subsequently abandoned to Tidal marsh

➤ Oil Palm plantation is converted to Lotus cultivation; thus, land is rewetted

➤ Tidal marshes excavated and converted to Harbor

❑ **Region 3:**

➤ Rotation Rice (1y) – Maize (1y) – Poplar (5y) established (1996-2005) on land cultivated at rice for long-term; then replaced (2006 onward) with a rotation Rice (2y) – Maize (2y) – Poplar (10y)

Case Study for Land – 3.B: CSCs and CO$_2$ fluxes

❑ **Estimate annual net C stock changes in:**

  ➢ **Aboveground Biomass**

  ➢ **Belowground Biomass**

  ➢ **Dead Wood**

  ➢ **Litter**

  ➢ **Soil Organic Matter (mineral soils, coastal wetlands*)**

❑ **Estimate annual net CO$_2$ fluxes in**

  ➢ **Organic Soils [Drained and Rewetted]**

  ➢ **Coastal Wetlands [Drained and Rewetted]**

* Limited to Extraction

Case Study for Land – 3.C.1: GHG Emissions

❑ **Estimate CH_4 and N_2O emissions:**

  ➢ **Aboveground Biomass**

  ➢ **Dead Organic Matter - DOM** (Dead Wood + Litter)

  ➢ **Soil Organic Matter [Organic soils only]**, limited to CH_4

❑ **Estimate CO_2 emissions from peat fires**

  ➢ **Organic Soils [Drained]**

Case Study – Data

Region	Category	Subcategory	Subdivision	Aboveground biomass stock	Aboveground biomass net growth	R	CF	D	Growing stock level	Net Annual Increment	AGP	N classes	Harvest cycle	$BCEF_I$	BCEFs	$BCEF_R$	SOC_{REF}	F_{LU}
1	Forest land	Managed	Secondary forest			0.220	0.470		unspecified						0.670		63.000	1.000
2	Forest land	Managed	Forest plantation			0.200	0.470	0.555	166	16.6				0.850	0.990	1.050		
	Forest land	Unmanaged	Primary forest			0.200	0.470		232						0.950			
	Forest land	Unmanaged	Mangroves forest	192		0.490	0.451		unspecified									
3	Cropland	Annual	Maize	5.8		0.220											80	0.690
	Cropland	Annual	Rice	3.8		0.160											80	0.690
	Cropland	Perennial	Poplar (5)	35	7	0.310							5				80	1.000
	Cropland	Perennial	Poplar (10)	130	13	0.190							10				80	1.000
2	Cropland	Annual	Lotus (long-term)	3.57*		0.000											68	1.000
	Cropland	Annual	Lotus (converted)	3.57*		0.000											68	0.800
	Cropland	Perennial	Oil palm	60	2.4	0.190	0.445						25				68	1.010
1	Grassland	Managed	Grazed	13.5**		4.000	0.500										63	1.000
2	Wetlands	Managed	Tidal marshes	8.6*		0.500												
	Wetlands	Unmanaged	Tidal marshes	33.4*		0.500												
2	Settlements	Treed	Urban park	67		0.330	0.470				30	4						
	Settlements	Other	Harbor															
1	Settlements	Other	Buildings	13.5		0.340	0.470										63	0.800

* annual average including belowground

** Herbaceous biomass

3.B categories: C stock changes and CO_2 emissions/removals

Tool:

Land Representation

3.B Calculation Worksheets

IPCC Inventory Software - Worksheets

3.B categories have 2 series of worksheets for each C pool

❑ TABs where to enter data for the **IPCC default method**

  ✓ **Biomass C pool**, 5 tabs: *Biomass G&L 1/4, 2/4, 3/4, 4/4*; + in the year of conversion only *Biomass G&L-Abrupt*

  ✓ **DOM C pool**, 1 tab: *DOM G&L*

  ✓ **SOM Mineral C pool**, 2 tabs: *Formulation A*, *Formulation B*

  ✓ **SOM organic soils**, 2 tabs: *Drained*, *Rewetted (including Coastal Wetlands soils)*

❑ TABs where to enter data for the **Stock Difference method**, for which 2 set of worksheets are provided depending on the Land representation approach applied to the unit of land:

  I. Approach 1:

    ✓ **Biomass C pool**, 1 tab: *Biomass SD-Approach 1*

    ✓ **DOM C pool**, 1 tab: *DOM SD-Approach 1*

    ✓ **SOM**, 1 tab: *SOM SD-Approach 1*

  I. Approaches 2 & 3:

    ✓ **Biomass C pool**, 1 tab: *Biomass SD-Approaches 2&3*

    ✓ **DOM C pool**, 1 tab: *DOM SD-Approaches 2&3*

    ✓ **SOM**, 1 tab: *SOM SD-Approaches 2&3*

Calculation Worksheets

For each C pool, depending on methodology to calculate C stock changes or CO_2 fluxes selected in the Land Representation Manager, the *Software* maps each unit of land to the relevant TAB

From Land representation, unit MFL_1 is mapped to

TAB SOM mineral – Eq. 2.25 Formulation A

Region 1

Calculation Worksheets

I. Forest land remaining Forest land:

- ✓ Biomass (SD – Approach 1) – *Forest Inventory Data*
- ✓ DOM (SD – Approach 1) – *Forest Inventory Data*
- ✓ SOM Mineral – Eq. 2.25 Formulation A – *IPCC default data (auto-compiled by the Software)*

II. Grassland remaining Grassland

- ✓ Biomass (SD – Approach 1) – *long-term biomass stock from literature*
- ✓ DOM (SD – Approach 1) – *long-term biomass stock from literature*
- ✓ SOM Mineral – Eq. 2.25 Formulation A – *IPCC default data (auto-compiled by the Software)*

III. Settlements remaining Settlements

- ✓ Biomass (SD – Approach 1) – *City Inventory Data*
- ✓ DOM (SD – Approach 1) – *City Inventory Data*
- ✓ SOM Mineral – Eq. 2.25 Formulation A – *IPCC default data (auto-compiled by the Software)*

Forest land

Forest land Data

C pool	Forest Inventory							CF
	1990	1995	2000	2005	2010	2015	2020	
	m³							t C / t d.m.
Biomass (woody)	134,640	140,310	162,200	165,330	168,462	172,175	174,240	0.47
t d.m.								
Dead Wood	60,480	63,090	72,900	74,349	75,754	77,406	78,336	0.49
Litter	12,780	13,320	15,400	15,741	16,072	16,393	16,608	0.37

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Forest land remaining Forest land - Biomass

Forest land remaining Forest land - DOM

Mineral soil SOC change – Equation 2.25

The *Software* applies to each unit of land the formulation associated with the approach for land representation selected for the *Region* to which the unit of land belongs

Equation 2.25 – Formulation A

$$\Delta C_{Mineral} = \frac{\left(SOC_{0\_GHGI} - SOC_{(0-T)\_GHGI}\right)}{D}$$

$$= \frac{\left[\sum_{c,s,i,}\left(SOC_{REF_{c,s}} \bullet F_{LU_{c,i}} \bullet F_{MG_{c,i}} \bullet F_{I_{c,i}} \bullet A_{c,s,i}\right)\right]_0 - \left[\sum_{c,s,i,}\left(SOC_{REF_{c,s}} \bullet F_{LU_{c,i}} \bullet F_{MG_{c,i}} \bullet F_{I_{c,i}} \bullet A_{c,s,i}\right)\right]_{(0-D)}}{D}$$

Where, **D** is the **transition period** *(IPCC default is 20 years)*, and **c** *(climate)*, **s** *(soil)*, **i** *(management system)* correspond to **variables** according to which the **unit of land** is **stratified**

According to such variables, **SOC at equilibrium,** in any inventory year, for each unit of land **c,s,i**, is calculated according to the subdivision in Year:

✓ $SOC_0 = \left(SOC_{REF_{c,s}} \bullet F_{LU_{c,i}} \bullet F_{MG_{c,i}} \bullet F_{I_{c,i}} \bullet A_{c,s,i}\right)_0$ *in the current inventory year, Y = 0; t C*

✓ $SOC_{0-D} = \left(SOC_{REF_{c,s}} \bullet F_{LU_{c,i}} \bullet F_{MG_{c,i}} \bullet F_{I_{c,i}} \bullet A_{c,s,i}\right)_{0-D}$ *in D years (20-year) before the current inventory year, Y = 0 – D; t C*

Consequently, the net annual SOC change is calculated as: $\Delta C_{Mineral} = \frac{SOC_0 - SOC_{0-D}}{D}$

Equation 2.25 – Formulation B – Approach 2

$$\Delta C_{Mineral} = \frac{\left(SOC_{0\_GHGI} - SOC_{(0-T)\_GHGI}\right)}{T}$$

$$= \frac{\sum_{c,s,i,p}\left\{\left[\left(SOC_{REF_{c,s,p}} \bullet F_{LU_{c,i,p}} \bullet F_{MG_{c,i,p}} \bullet F_{I_{c,i,p}}\right)_0 - \left(SOC_{REF_{c,s,p}} \bullet F_{LU_{c,i,p}} \bullet F_{MG_{c,i,p}} \bullet F_{I_{c,i,p}}\right)_{0-T}\right] \bullet A_{c,s,i,p}\right\}}{D}$$

Where, **D** is the **transition period** *(IPCC default is 20 years)*, and **c** *(climate)*, **s** *(soil)*, **i** *(management system)* correspond to **variables** according to which the **unit of land** is **stratified**

According to such variables, **SOC at equilibrium,** in any inventory year, for each unit of land ***c,s,i***, is calculated according to the subdivision in Year:

✓ $SOC_0 = \left(SOC_{REF_{c,s,p}} \bullet F_{LU_{c,i,p}} \bullet F_{MG_{c,i,p}} \bullet F_{I_{c,i,p}}\right)_0$ *in the current inventory year, Y = 0; t C ha⁻¹*

✓ $SOC_{0-T} = \left(SOC_{REF_{c,s,p}} \bullet F_{LU_{c,i,p}} \bullet F_{MG_{c,i,p}} \bullet F_{I_{c,i,p}}\right)_{0-T}$ *in the the year before the conversion occurred, Y = 0–T; t C ha⁻¹*

Consequently, the net annual SOC change is calculated as: $\Delta C_{Mineral} = \frac{SOC_0 - SOC_{0-T}}{D} * A$

Equation 2.25 – Formulation B – Approach 3

$$\Delta C_{Mineral} = \frac{(SOC_{0\_GHGI} - SOC_{(0-T)\_GHGI})}{T}$$

$$= \frac{\sum_{c,s,i,p}\left\{\left[\left(SOC_{REF_{c,s,p}} \bullet F_{LU_{c,i,p}} \bullet F_{MG_{c,i,p}} \bullet F_{I_{c,i,p}}\right)_0 - SOC_{@conversion_{c,s,i,p_{(0-T)}}}\right] \bullet A_{c,s,i,p}\right\}}{D}$$

Where, **D** is the **transition period** *(IPCC default is 20 years)*, and **c** *(climate)*, **s** *(soil)*, **i** *(management system)* correspond to **variables** according to which the **unit of land** is **stratified**

According to such variables, **SOC at equilibrium,** in the **current inventory year**, for each unit of land **c,s,i**, is calculated according to the **current subdivision**:

✓ $SOC_0 = \left(SOC_{REF_{c,s,p}} \bullet F_{LU_{c,i,p}} \bullet F_{MG_{c,i,p}} \bullet F_{I_{c,i,p}}\right)_0$ *in the current inventory year Y = 0; t C ha⁻¹*

While the **SOC just before the conversion** $(SOC_{@conversion_{0-T}})$ **is NOT calculated as SOC at equilibrium** of the subdivision in the latest year before the conversion Y = 0-T , *it is calculated with Eq 2.25 Formulation B and according to the number of years passed from any previous conversion*

✓ $SOC_{@conversion_{(0-T)}}$ is instead the actual SOC of the unit of land in the latest year *0-T* before the conversion; t *C ha⁻¹*

Consequently, the net annual SOC change is calculated as: $\Delta C_{Mineral} = \frac{SOC_0 - SOC_{@conversion_{(0-T)}}}{D} * A$

Forest land remaining Forest land - SOM

Forest land remaining Forest land - Summary

Grassland

Grassland Data

C pool	Stock$_{longterm}$ t d.m. ha^{-1}	R(a)	CF	T	Grassland						
					1990	1995	2000	2005	2010	2015	2020
					t d.m.						
Biomass (herbaceous)	13.5	4	0.5	5	27,000	27,000	25,515	25,380	25,245	25,110	25,110
Biomass (woody)			0.47	5							
dead wood			0.49	5							
litter	0.78		0.37	5	1,560	1,560	1,474	1,466	1,459	1,451	1,451

Grassland remaining Grassland - Biomass

Grassland remaining Grassland - DOM

Grassland remaining Grassland - SOM

Grassland remaining Grassland - Summary

Settlements

Settlements Data

C pool	City Tree Inventory						
	1990	1995	2000	2005	2010	2015	2020
				t d.m.			
Biomass (woody)	1,390	1,510	1,793	2,275	2,855	3,496	3,978
Dead Wood	0	0	0	0	0	0	0
Litter	0	0	0	0	0	0	0

Settlements remaining Settlements - Biomass

SOM (SD - Approaches 2&3)   SOM Organic Drained   SOM Organic Rewetted   Total Net CO2 Emission / Removal

Biomass change (G&L)   Biomass (G&L - Abrupt   **Biomass (SD - Approach 1)**   Biomass (SD - Approaches 2&3)   DOM (G&L)   DOM (SD - Approach 1)   DOM (SD - Approaches 2&3)   SOM Mineral - Eq. 2.25 Formulation A   SOM Mineral - Eq. 2.25 Formulation B   SOM (SD - Approach 1)

Worksheet

Sector: Agriculture, Forestry and Other Land Use   **2020**
Category: Settlements
Subcategory: 3.B.5.a - Settlements Remaining Settlements
Sheet: Annual net C stock change in biomass - Stock difference method - Approach 1

Data

Region | Region 1 | **- Approach 1**

Land use category			Equation 2.8 - Approach 1								
		Unit	Total above-ground biomass at the end of the inventory period (tonnes U)	Total above-ground biomass at the beginning of the inventory period (tonnes U)	Ratio of below-ground biomass to above-ground biomass (t bg U / t ag U)	Biomass carbon fraction (tonnes C / tonne U)	Total final biomass C stock (tonne C)	Total initial biomass C stock (tonne C)	Time period between two inventories (Year)	Annual change in carbon stocks in biomass (tonnes C / yr)	
Land unit code	Land use during reporting year	d.m. or C	National statistics or international data sources	National statistics or international data sources	Table 4.4 / 4.5 WS	Tables 4.3	CB(final) = AB(final) * (1+R) * CF	CB(initial) = AB(initial) * (1+R) * CF	T = t2 - t1	ΔCB = (CB(final) - CB (initial)) / T	
		U	AB(final)	AB(initial)	R	CF	CB(final)	CB(initial)	T	ΔCB	
OSL_1	Settlements... Buildings	d.m.	3,978.000	3,496.000	0.34	0.470	2,505.344	2,201.781	5.000	60.713	
Total											
							2,505.344	2,201.781		60.713	

Settlements remaining Settlements - DOM

Settlements remaining Settlements - SOM

Settlements remaining Settlements - Summary

Region 2

Calculation Worksheets

I. **Forest land remaining Forest land**

✓ Biomass, DOM: – *IPCC Default (G&L)*, SOM Drained

II. **Cropland remaining Cropland**

✓ Biomass, DOM: – *IPCC Default (G&L)*, SOM Rewetted

III.A **Wetlands remaining Wetlands**

✓ Biomass, DOM: – *IPCC Default (G&L)*, SOM Rewetted

III.B **Settlements converted to Wetlands**

✓ Biomass, DOM: – *IPCC Default (G&L)*, SOM Rewetted

IV.A **Settlements remaining Settlements**

✓ Biomass, DOM: – *IPCC Default (G&L)*, SOM Drained

IV.B **Forest land converted to Settlements**

✓ Biomass, DOM: – *IPCC Default (G&L)*, SOM Drained

IV.C **Wetlands converted to Settlements**

✓ Biomass, DOM: – *IPCC Default (G&L)*, SOM Extracted

Forest land

Forest land remaining Forest land – Biomass (Losses)

Region	Category	Subcategory	Subdivision	R	CF	D	Growing stock level	Net Annual Increment	BCEF$_I$	BCEFs	BCEF$_R$
2	Forest land	Managed	Forest plantation	0.200	0.470	0.555	166	16.6	0.850	0.990	1.050
2	Forest land	Unmanaged	Primary forest	0.200	0.470		232			0.950	

Forest land remaining Forest land – Biomass (Gains)

Belowground biomass is estimated only in units of land under conversions from unmanaged forest

Forest land remaining Forest land – Biomass (Losses)

Harvesting

ID	Harvest (m³) - Industrial Roundwood						Harvest (m³) - Fuelwood					
	1995	2000	2005	2010	2015	2020	1995	2000	2005	2010	2015	2020
MFL-MFL_1	13,280	13,280	13,280	13,280	13,280	13,280	3,320	3,353	3,420	3,486	3,552	335,552
UFL-MFL_2000-1		IE						IE	IE	IE	IE	
UFL-MFL_2005-1			IE						IE	IE	IE	IE
UFL-MFL_2010-1				IE						IE	IE	IE
UFL-MFL_2015-1					IE						IE	IE
UFL-MFL_2020-1						IE						IE
	13,280	13,280	13,280	13,280	13,280	13,280	3,320	3,353	3,420	3,486	3,552	335,552

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Forest land remaining Forest land – Biomass (Losses)

Harvesting: Industrial Roundwood

Belowground biomass is estimated only in conversions between different forest subdivisions

Forest land remaining Forest land – Biomass (Losses)

Harvesting: Fuelwood

Fuelwood collected from part of trees only

Salvage logging in unit of land MFL-MFL

Forest land remaining Forest land – DOM

Disturbances: Wildfire

ID	Disturbances					
	1995	2000	2005	2010	2015	2020
MFL-MFL_1						wildfire over 1,000 ha, Fd=0.6
UFL-MFL_2000-1						
UFL-MFL_2005-1						
UFL-MFL_2010-1						
UFL-MFL_2015-1						
UFL-MFL_2020-1						

Non-CO$_2$ emissions are estimated in category 3.C.1

Forest land remaining Forest land – Biomass (Losses)

Disturbances: Wildfire

Non-CO_2 emissions are estimated in category 3.C.1

Forest land remaining Forest land – DOM

C stock losses in red, C stock gains in green

ID	DOM C stocks in & out d.m. (Dead Wood) - CF 0.49												DOM C stocks in & out d.m. (litter) - CF 0.37												
	1995	2000		2005		2010		2015		2020		1995	2000		2005		2010		2015		2020	
MFL-MFL_1																						
UFL-MFL_2000-1		1,107	73,333	1,107		1,107		1,107					553	36,667	553		553		553			
UFL-MFL_2005-1				664	44,000	664		664		664					332	22,000	332		332		332	
UFL-MFL_2010-1						387	25,667	387		387							194	12,833	194		194	
UFL-MFL_2015-1								194	12,833	194									97	6,417	97	
UFL-MFL_2020-1										94	6,233										47	3,117

Non-CO$_2$ emissions are estimated in category 3.C.1

Forest land remaining Forest land – DOM

Non-CO$_2$ emissions are estimated in category 3.C.1

Forest land remaining Forest land – SOM Drained

ID	SOM Drained
MFL-MFL_1	
UFL-MFL_2000-1	$EF_{(os)}$ - $DOC_{(flux)}$ - ΔDOC - $Frac_{(DOC)}$
UFL-MFL_2005-1	
UFL-MFL_2010-1	IPCC Default values for Temperate climate region
UFL-MFL_2015-1	
UFL-MFL_2020-1	

Non-CO_2 emissions are estimated in categories 3.C.4, .8, .9

Forest land remaining Forest land – SOM Drained

Cropland

Cropland Remaining Cropland – Biomass (Gain&Losses)

variables	unit of land PCL-PCL_1					
	1995	2000	2005	2010	2015	2020
Ai (harvested) ha	120	120	115	104	114	114
fd	1	1	1	1	1	1
R	0	0	0	0	0	0

Cropland Remaining Cropland – Biomass (Gain&Losses)

Although regrowth is to be estimated here, it was estimated TAB Biomass (G&L – Abrupt)

Cropland Remaining Cropland – Biomass (Abrupt)

	unit of land PCL-PCL_1					
variables	1995	2000	2005	2010	2015	2020
Ai (harvested) ha	120	120	115	104	114	114
fd	1	1	1	1	1	1
R	0	0	0	0	0	0

	units of land in conversion to *Lotus*					
variables	1995	2000	2005	2010	2015	2020
AB(a), t C			3.57	3.57	3.57	3.57
R(a)*	0	0	0	0	0	0
CF(a)**	1	1	1	1	1	1

* included in AB(a)

* AB(a) is in t C

Cropland Remaining Cropland – Biomass (Abrupt)

Although regrowth is to be estimated in TAB Biomass change (G&S), it was estimated here

Cropland Remaining Cropland – DOM

DOM is only estimated as a net loss in conversion to *Lotus*

DOM(out), estimated in conversion to *Lotus*, in the first year only						
variables	1995	2000	2005	2010	2015	2020
A (ha) [converted to *Lotus* in the year]			5	15	5	5
Dead wood (t d.m)			6.122	6.122	6.122	6.122
Litter (t.d.m.)			4.054	4.054	4.054	4.054
CF dead wood	0.49					
CF litter	0.37					
DOM(in), estimated in conversion to *Lotus*, in the first year only						
variables	1995	2000	2005	2010	2015	2020
Dead wood (t d.m)			0.000	0.000	0.000	0.000
Litter (t.d.m.)			0.000	0.000	0.000	0.000

DOM in *Lotus* is included in the Biomass C pool estimates

DOM in *Oil palm* is assumed to have zero net annual C stock changes *(inputs and outputs average out across the time series)*

Cropland Remaining Cropland – DOM

Cropland Remaining Cropland – SOM

CH$_4$ emissions are estimated in category 3.C.14

Wetlands

Wetlands remaining Wetlands

No area in the NGHGI time series

Settlements Converted to Wetlands – Biomass (Abrupt)

Biomass after conversion constrained to zero. [To be removed!]

Settlements

Settlements Remaining Settlements – Biomass

Settlements Remaining Settlements – Biomass

variables	unit of land TSL-TSL_1 (Biomass)											
	1995		2000		2005		2010		2015		2020	
	N(i)	C(i)	N(i)	C(i)	N(i)	C(i)	N(i)	C(i)	N(i)	C(i)	N(i)	C(i)
Class 1 (1-20 y)	2,000	0.007	2,500	0.007	2,875	0.007	3,114	0.007	3,239	0.007	3,278	0.007
Class 2 (21-40 y)	2,000	0.010	2,000	0.010	2,125	0.010	2,313	0.010	2,513	0.010	2,694	0.010
Class 2 (41-50 y)	2,000	0.005	1,500	0.005	1,250	0.005	1,156	0.005	1,156	0.005	1,206	0.005
Class 4* (51-80 y)	6,000	0	6,000	0	5,750	0	5,417	0	5,092	0	4,822	0
	12,000		12,000		12,000		12,000		12,000		12,000	
*Class 4 includes all trees with age > AGP												
All Classes apply equation 8.3												
All Classes disaggregate aboveground and belowground biomass estimates												

Settlements Remaining Settlements – Biomass

Negligible

Settlements remaining Settlements – SOM Drained

ID	SOM Drained
TSL-TSL_2000-1	$EF(os)$ - $DOC(flux)$ - ΔDOC - $Frac(DOC)$ IPCC Default values for Temperate climate region

Non-CO$_2$ emissions are estimated in categories 3.C.4, .8, .9

Forest land converted to Settlements – SOM Drained

Forest land converted to Settlements – SOM Drained

Forest land converted to Settlements – Biomass & DOM

variables	unit of land UFL-TSL_2000-1 (Biomass)											
	1995		2000		2005		2010		2015		2020	
	N(i)	C(i)	N(i)	C(i)	N(i)	C(i)	N(i)	C(i)	N(i)	C(i)	N(i)	C(i)
Class 1 (1-20 y)	0	0.007	10,000	0.007	10,000	0.007	10,000	0.007	10,000	0.007	0	0.007
Class 2 (21-40 y)	0	0.010	0	0.010	0	0.010	0	0.010	0	0.010	0	0.010
Class 2 (41-50 y)	0	0.005	0	0.005	0	0.005	0	0.005	0	0.005	0	0.005
Class 4* (51-80 y)	0	0	0	0	0	0	0	0	0	0	0	0
	0		10,000		10,000		10,000		10,000		0	

*Class 4 includes all trees with age > AGP

All Classes apply equation 8.3

All Classes disaggregate aboveground and belowground biomass estimates

Aboveground biomass at the end of the first year of conevrsion is = 0.007 * 100 / 0.47 = 1.489

Forest land converted to Settlements – Biomass (Abrupt)

Forest land converted to Settlements – Biomass (G&L)

Forest land converted to Settlements – Biomass & DOM

unit of land UFL-TSL_2000-1 (DOM)
Dead wood & Litter C stocks in Mangroves before conversions were 10.7 and 0.7 t C ha^{-1} respectively
DOM in Urban Park is Negligeable

Forest land converted to Settlements – DOM

Forest land converted to Settlements – SOM Drained

ID	SOM Drained
UFL-TSL_2000-1	EF(os) - DOC(flux) - ΔDOC - Frac(DOC) IPCC Default values for Temperate climate region

Non-CO$_2$ emissions are estimated in categories 3.C.4, .8, .9

Forest land converted to Settlements – SOM Drained

| Biomass change (G&L) | Biomass (G&L - Abrupt) | Biomass (SD - Approaches 2&3) | DOM (G&L) | DOM (SD - Approaches 2&3) | SOM Mineral - Eq. 2.25 Formulation B | SOM (SD - Approaches 2&3) | **SOM Organic Drained** | SOM Organic Rewetted | Total Net CO2 Emission / Removal |

Worksheet

Sector:	Agriculture, Forestry and Other Land Use
Category:	Settlements
Subcategory:	3.B.5.b.i - Forest Land converted to Settlements
Sheet:	Annual net C stock change in soil organic matter of drained organic soils

2015

Data

Region [Region 2] **- Approach 2**

Land use category					Equation 2.2, 2.3, 2.4, 4.8 WS						
			Area (ha)	CO2 on-site emission factor for climate type and nutrient status of peat and drainage class in drained soils (tonnes CO2-C / ha / yr)	Flux of DOC from natural (undrained) organic soil (tonnes C / ha / yr)	Proportional increase in DOC flux from drained sites relative to undrained sites	Conversion factor for proportion of DOC converted to CO2 following export from site	CO2 off-site emission factor for climate type and nutrient status of peat and drainage class in drained soils (tonnes CO2-C / ha / yr)	CO2 emissions from peat fire in drained land (tonnes CO2-C / yr)	Annual carbon loss from drained organic soils (tonnes C / yr)	
Land unit code	Initial land use	Land use during reporting year	National statistics or international data sources	Table 5.6 / 2.1 WS / 4.13 WS or national statistics	Table 2.2 WS or national statistics	Table 2.2 WS or national statistics	Table 2.2 WS or national statistics	Table 2.2 WS / Eq. 2.5 or national statistics	From 3.C.1	CO2-C(d) = A(d) * (EF(os) + EF(DOC)) + L(fd)	
			A(d)	EF(os)	DOC(flux)	ΔDOC	Frac(DOC)	EF(DOC)	L(fd)	CO2-C(d)	
UFL-TFL_...	Unmanage...	Mangroves...	Settlement...	Urban park	100.000	7.9	0.210	0.600	0.900 Calculated	0.302		820.240
Total					100.000							820.240

Wetlands converted to Settlements

Software currently constrained to Tier 1. To be enhanced to higher Tiers!

Wetlands converted to Settlements – DOM

Software currently constrained to Tier 1. To be enhanced to higher Tiers!

Wetlands converted to Settlements – SOM Extracted

unit of land UWL-OSL_2020-1 (SOM)
SOC at unmanged Tidal marshes is 255 t C ha^{-1}
All SOC is extracted to convert to Harbor

Wetlands converted to Settlements – SOM Extracted

Region 3

Cropland

Calculation Worksheets

❑ **Cropland remaining Cropland**

  ✓ Biomass (G&L), for perennial cropland only

  ✓ Biomass (G&L – Abrupt)

  ✓ DOM (G&L)

  ✓ SOM Mineral – Eq. 2.25 Formulation B – *(auto-compiled by the Software)*

Cropland Data

Region	Category	Subcategory	Subdivision	Aboveground biomass stock	Aboveground biomass net growth	R	CF	D	Growing stock level	Net Annual Increment	AGP	N classes	Harvest cycle	BCEF$_I$	BCEFs	BCEF$_R$	SOC$_{REF}$	F$_{LU}$
1	Forest land	Managed	Secondary forest			0.220	0.470		unspecified						0.670		63.000	1.000
2	Forest land	Managed	Forest plantation			0.200	0.470	0.555	166	16.6				0.850	0.990	1.050		
	Forest land	Unmanaged	Primary forest			0.200	0.470		232						0.950			
	Forest land	Unmanaged	Mangroves forest	192		0.490	0.451		unspecified									
3	Cropland	Annual	Maize	5.8		0.220											80	0.690
	Cropland	Annual	Rice	3.8		0.160											80	0.690
	Cropland	Perennial	Poplar (5)	35	7	0.310							5				80	1.000
	Cropland	Perennial	Poplar (10)	130	13	0.190							10				80	1.000
2	Cropland	Annual	Lotus (long-term)	3.57*		0.000											68	1.000
	Cropland	Annual	Lotus (converted)	3.57*		0.000											68	0.800
	Cropland	Perennial	Oil palm	60	2.4	0.190							25				68	1.010
1	Grassland	Managed	Grazed	13.5**		4.000	0.5										63	1.000
2	Wetlands	Managed	Tidal marshes	8.6*		0.500												
	Wetlands	Unmanaged	Tidal marshes	33.4*		0.500												
2	Settlements	Treed	Urban park	67		0.330	0.47				30	4						
	Settlements	Other	Harbor															
1	Settlements	Other	Buildings	13.5		0.340	0.47										63	0.800

* annual average including belowground

** Herbaceous biomass

Cropland remaining Cropland – Biomass (G&L)

Although regrowth is to be estimated here, it was estimated TAB Biomass (G&L – Abrupt)

Cropland remaining Cropland – Biomass (Abrupt)

Although regrowth is to be estimated in TAB Biomass change (G&S), it was estimated here

Cropland remaining Cropland - DOM

Assumed negligeable

Cropland remaining Cropland - SOM

3.C.1 - Burning

Tool:

Land Representation

3.C.1 Calculation Worksheets

Forest land

3.C.1.a Burning in Forest Land – Data

CO$_2$ emissions are expected to be estimated as C stock losses in 3.B.1 – Forest land

ID	Disturbances					
	1995	2000	2005	2010	2015	2020
MFL-MFL_1						wildfire over 1,000 ha, Fd=0.6
UFL-MFL_2000-1						
UFL-MFL_2005-1						
UFL-MFL_2010-1						
UFL-MFL_2015-1						
UFL-MFL_2020-1						

Wildfire affects both Biomass & DOM C pool

Biomass stock (d.m.) = 164.34

Combustion factor = 0.59

DOM stock (d.m.) = 11.07 + 5.53 = 16.60

Combustion factor = 0.61

SOM stock (d.m.) = 353

EF = IPCC default values for Tropical Climate

3.C.1.a Burning in Forest land – C pools selection

Select **Region** in the toggle, **All** is suggested

✓ **CO₂ emissions** *from* <u>*Biomass*</u> *and* <u>*DOM*</u> *are expected to be* **estimated as C stock losses**

Thus, **CO₂ emissions reporting** *for* <u>*Biomass*</u> *as well as for* <u>*DOM*</u> *is* **left unchecked**

3.C.1.a Burning in Forest land – CO$_2$

Select the *GHG* in the toggle, and enter the relevant EFs

CO$_2$ emissions from <u>Biomass</u> and <u>DOM</u> are expected to be **estimated as C stock losses**

Thus, **CO$_2$ emissions reporting** for <u>Biomass</u> as well as for <u>DOM</u> is **left unchecked**

3.C.1.a Burning in Forest land – CH$_4$

Select the *GHG* in the toggle, and enter the relevant EFs

3.C.1.a Burning in Forest land – N₂O

Select the *GHG* in the toggle, and enter the relevant EFs

3.C.1.a Burning in Forest land – SOM

✓ **CO₂ emissions from fire in SOM organic soils** *are automatically mapped to worksheet* SOM Organic Drained *in the relevant 3.B land category*

Cropland

3.C.1.b Burning in Cropland – Data

Region 2

I.   Prescribed burning of Oil palm residues for clearing land to subsequent planting
II. Prescribed burning of residues for clearing land converted to *Lotus*

- ✓ Fuel (Biomass + DOM) t d.m. = 54
- ✓ Cf = 0.85
- ✓ CH_4 EF = 3.1
- ✓ N_2O EF = 0.22

Region 3

I.   Prescribed burning of residues for clearing land converted from poplar

- ✓ Poplar (5-y) Fuel (Biomass + DOM) t d.m. = 30
- ✓ Poplar (10-y) Fuel (Biomass + DOM) t d.m. = 55
- ✓ Cf = 0.85
- ✓ CH_4 EF = 3.7
- ✓ N_2O EF = 0.25

3.C.1.b Burning in Cropland

Sheet 1 of 2 — Emissions from burning in Cropland (Cropland remaining Cropland), Gas: METHANE (CH4), Year 2020.

Land unit	Initial land use	Land use during reporting year		Cc	Cs	FT	FTS	Area burnt (ha) A	Mass of fuel available for combustion (tonnes d.m. / ha) Mb		Combustion factor Cf	Mass of fuel consumed (tonnes d.m. / ha) FC = Mb*Cf or specified	CH4 Emission Factor (g/kg dm burnt) Gef	CH4 Emissions from fire (tonnes) Lfire
									C pool	Stock	Table 2.6	Table 2.4 WS Table 2.6	Table 2.5 WS Table 2.7	A * FC * Gef / 1000
PCL-ACL_2020-1	Cropla...	Oil Pal...	Cropla...	Lotus...	oil palm	oil palm	Controlled B...	Land clearing fire	5.000	Biomass+DOM	54.000	0.850 Calculated	45.900	3.100	0.711
PCL-PCL_1			Cropla...	Oil Pal...					114.000	Biomass+DOM	54.000	0.850 Calculated	45.900	3.100	16.221
CL-CL_50		Poplar...	Cropla...	Maize	poplar	poplar			50.000	Biomass+DOM	55.000	0.850 Calculated	46.750	3.700	8.649
CL-CL_61										Biomass+DOM	55.000	0.850 Calculated	46.750	3.700	8.649
CL-CL_40			Rice							Biomass+DOM	55.000	0.850 Calculated	46.750	3.700	8.649
CL-CL_60										Biomass+DOM	55.000	0.850 Calculated	46.750	3.700	8.649
Total													278.800		51.528

Sheet 1 of 2 — Emissions from burning in Cropland (Cropland remaining Cropland), Gas: NITROUS OXIDE (N2O), Year 2020.

Land unit	Initial land use	Land use during reporting year		Cc	Cs	FT	FTS	Area burnt (ha) A	Mass of fuel available for combustion (tonnes d.m. / ha) Mb		Combustion factor Cf	Mass of fuel consumed (tonnes d.m. / ha) FC = Mb*Cf or specified	N2O Emission Factor (g/kg dm burnt) Gef	N2O Emissions from fire (tonnes) Lfire
									C pool	Stock	Table 2.6	Table 2.4 WS Table 2.6	Table 2.5 WS Table 2.7	A * FC * Gef / 1000
PCL-ACL_2020-1	Cropla...	Oil Pal...	Cropla...	Lotus...	oil palm	oil palm	Controlled B...	Land clearing fire	5.000	Biomass+DOM	54.000	0.850 Calculated	45.900	0.250	0.057
PCL-PCL_1			Cropla...	Oil Pal...					114.000	Biomass+DOM	54.000	0.850 Calculated	45.900	0.250	1.308
CL-CL_50		Poplar...	Cropla...	Maize	poplar	poplar			50.000	Biomass+DOM	55.000	0.850 Calculated	46.750	0.220	0.514
CL-CL_61										Biomass+DOM	55.000	0.850 Calculated	46.750	0.220	0.514
CL-CL_40			Rice							Biomass+DOM	55.000	0.850 Calculated	46.750	0.220	0.514
CL-CL_60										Biomass+DOM	55.000	0.850 Calculated	46.750	0.220	0.514
Total													278.800		3.423

Grassland

3.C.1.c Burning in Grassland – Data

CO$_2$ emissions are expected to be estimated as C stock losses in 3.B.3 – Grassland

ID	Disturbances - Prescribed burning of savannas (ha)					
	1995	2000	2005	2010	2015	2020
MGL-1	200	189	188	187	186	186

Every year 1/10th of grazed land is burnt for regeneration (bad practice!)

Prescribed burning affects both Biomass & DOM C pool

Biomass stock (d.m.) = 13.5
Combustion factor = 0.67

DOM stock (d.m.) = 0 + 0.78 = 0.78
Combustion factor = 0.95

EF = IPCC default values for Temperate Climate

3.C.1.c Burning in Grassland – C pools selection

Select **Region** in the toggle, **All** is suggested

✓ *Given **Grazed** land contains **annual biomass** only, **no CO$_2$ emissions** from biomass are **reported***

✓ *CO$_2$ emissions from <u>DOM</u> are expected to be **estimated as C stock losses***

*Thus, **CO$_2$ emissions reporting** for <u>DOM</u> is **left unchecked***

3.C.1.a Burning in Grassland – CO₂

Select the *GHG* in the toggle, and enter the relevant EFs

✓ **CO₂ emissions** from _Biomass_, if any, and _DOM_ are expected to be **estimated as C stock losses**

Thus, **CO₂ emissions reporting** for _Biomass_ as well as for _DOM_ is **left unchecked**

3.C.1.a Burning in Grassland – CH₄

Select the *GHG* in the toggle, and enter the relevant EFs

3.C.1.a Burning in Forest land – N₂O

Select the *GHG* in the toggle, and enter the relevant EFs

Thank you

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