

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<sub>2</sub> fluxes

**IPCC TFI TSU** 



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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
  - $\succ$  Either an annual cycle [Growth  $\rightarrow$  Harvest&Consumption or Decay to dead organic matter]
  - Or a multiyear cycle [Growth in plant perennial tissues (wood)] and thus stores Carbon across years

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Dead organic matter, 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**

- $\succ$  CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O
- > NH<sub>3</sub>/NH<sub>4</sub><sup>+</sup>, NO<sub>X</sub>
- $\succ$  H<sub>2</sub>O, N<sub>2</sub>





### **Chemicals**

#### **Nitrogen fertilizers**

#### => N<sub>2</sub>O emissions

#### **Carbonaceous mineral amendments**

=> CO<sub>2</sub> emissions

#### □ Nitrogen/Carbonaceous fertilizers (Urea) => N<sub>2</sub>O + CO<sub>2</sub> emissions





### Notations

- Nitrogen content of N<sub>2</sub>O is indicated as N<sub>2</sub>O-N, and emissions of N<sub>2</sub>O-N are converted to N<sub>2</sub>O emissions multiplying by 44/28 (proportion of the atomic weight of the two molecules)
- □ **Carbon** content of **CH**<sub>4</sub> **is** indicated as **CH**<sub>4</sub>-**C**, and emissions of **CH**<sub>4</sub>-**C** are **converted** to **CH**<sub>4</sub> emissions multiplying **by 16/12** (proportion of the atomic weight of the two molecules)
- □ **Carbon** content of **CO**<sub>2</sub> **is** indicated as **CO**<sub>2</sub>-**C**, and emissions of **CO**<sub>2</sub>-**C** are **converted** to **CO**<sub>2</sub> 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<sub>2</sub> 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**<sub>2</sub> net **emission/removal** requires to multiplying the net C stock **by -44/12**, given that the sign is to be changed

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### **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<sub>2</sub> removals from land use**



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### **AFOLU anthropogenic GHG Emissions and Removals**

#### **AFOLU sources/sinks**

- Plant biomass is the sink of CO<sub>2</sub> removal from the atmosphere. Of the CO<sub>2</sub> 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 CO₂, although the annual net C stock change can be positive depending on systems' phases, management practices and disturbances
- ➢Non-CO₂ emissions are largely a product of microbiological processes (i.e., within soils, animal digestive tracts and manure) and combustion of organic matter





### **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<sub>2</sub> emissions and subsequent removals- are excluded from the NGHGI). However, C can be released as CH<sub>4</sub>, instead of CO<sub>2</sub>; further, annual biomass decay releases N, including as N<sub>2</sub>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)

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- ✓ [3.C.1 categories\*] Annual biomass is burnt to  $CO_2$ ,  $CH_4$  and  $N_2O$
- ✓ **[3.A categories\*]** Annual biomass as feed for livestock:
  - Fermentation [digestion], CH<sub>4</sub>
  - Metabolism [respiration], CO<sub>2</sub>
  - Manure [Management], CH<sub>4</sub> & N<sub>2</sub>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).

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### **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<sub>2</sub> emissions and removals from C pools, is based on the fact that changes in ecosystem C stocks are predominately (but not exclusively\*) through CO<sub>2</sub> exchange between the land surface and the atmosphere
  - 2. Directly as flux rates to(/from) the atmosphere (used for estimating non-CO<sub>2</sub> emissions, CO<sub>2</sub> emissions not sourced from C pools and those CO<sub>2</sub> 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 <u>fully equivalent</u> methodologies to estimate the annual net C stock change in any C pool

- □ The Gain and Loss methodology, which estimates the <u>annual net C</u> <u>stock change in a C pool</u> 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 <u>annual</u> <u>net C stock change in a C pool in a managed land</u> 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—

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> 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
2 D 4	Forestland	3.B.1a Forest land Remaining Forest land	
J.D. I	Forestiand	3.B.1b Land converted to Forest land	
2	Creational	3.B.2a Cropland Remaining Cropland	
J.D.Z	Cropiand	3.B.2b Land Converted to Cropland	
2 🗆 2	Creecland	3.B.3a Grassland Remaining Grassland	
3.0.3	Grassiand	3.B.3b Land Converted to Grassland	
2 🗆 4	Watlanda	3.B.4a Wetlands Remaining Wetlands	
3.0.4	vvetianus	3.B.4b Land Converted to Wetlands	
205	Sattlamanta	3.B.5a Settlements Remaining Settlements	
3.0.3	Settlements	3.B.5b Land Converted to Settlements	
3. <b>B.</b> 6	Other land	3.B.5b Land Converted to Other land	
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### **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

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□ AFOLU sector Guidebook – version 1 under development



#### 

2006 IPCC Categories

3.A - Livestock

2 - Industrial Processes and Product Use
3 - Agriculture, Forestry, and Other Land Use

3.B.1.a - Forest land Remaining Forest I
3.B.1.b - Land Converted to Forest land
3.B.1.b.i - Cropland converted to Fo
3.B.1.b.ii - Grassland converted to F
3.B.1.b.iii - Wetlands converted to F
3.B.1.b.iv - Settlements converted t
3.B.1.b.v - Other Land converted to

3.B.2.a - Cropland Remaining Cropland

3.B.3.a - Grassland Remaining Grassla
3.B.3.b - Land Converted to Grassland
3.B.3.b.i - Forest Land converted to

3.B.4.a - Wetlands Remaining Wetland
3.B.4.a.i - Peat Extraction remaining
3.B.4.a.ii - Flooded Land remaining
3.B.4.a.iii - Other Wetlands Remaini
3.B.4.b - Land Converted to Wetlands
3.B.4.b.i - Land converted for Peat
3.B.4.b.ii - Land converted to Flood

3.B.3.b.ii - Cropland converted to Gr
3.B.3.b.iii - Wetlands converted to G
3.B.3.b.iv - Settlements converted t
3.B.3.b.v - Other Land converted to

3.B.2.b - Land Converted to Cropland
3.B.2.b.i - Forest Land converted to
3.B.2.b.ii - Grassland converted to
3.B.2.b.iii - Wetlands converted to C
3.B.2.b.ii - Settlements converted t

B 3.B.1 - Forest land

B- 3.B.2 - Cropland

B 3.B.3 - Grassland

⊡ 3.B.4 - Wetlands

### 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.

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### **Calculation Worksheets**

For each C pool, depending on methodology to calculate C stock changes or CO<sub>2</sub> 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)

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### Case Study for Land – 3.B: CSCs and CO<sub>2</sub> 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<sub>2</sub> 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<sub>4</sub> and N<sub>2</sub>O emissions:**

- > Aboveground Biomass
- Dead Organic Matter DOM (Dead Wood + Litter)
- Soil Organic Matter [Organic soils only], limited to CH<sub>4</sub>

#### **Estimate CO<sub>2</sub> 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	BCEFI	BCEFs	BCEF <sub>R</sub>	SOC <sub>REF</sub>	F <sub>LU</sub>
	1	Forest land	Managed	Secondary forest			0.220	0.470		unspecified						0.670		63.000	1.000
		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	Unmanaged	Mangroves forest	192		0.490	0.451		unspecified									
		Cropland	Annual	Maize	5.8		0.220					ļ						80	0.690
	3	Cropland	Annual	Rice	3.8		0.160					ļ						80	0.690
	5	Cropland	Perennial	Poplar (5)	35	7	0.310							5				80	1.000
		Cropland	Perennial	Poplar (10)	130	13	0.190							10				80	1.000
		Cropland	Annual	Lotus (long-term)	3.57*		0.000											68	1.000
	2	Cropland	Annual	Lotus (converted)	3.57*		0.000					ļ						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												
	2	Wetlands	Unmanaged	Tidal marshes	33.4*		0.500												
	2	Settlements	Treed	Urban park	67		0.330	0.470				30	4						
	4	Settlements	Other	Harbor															
	1	Settlements	Other	Buildings	13.5		0.340	0.470										63	0.800
* annual average including belowground																			
	** Herbac	eous biomas	s																





### **3.B categories: C stock changes and CO<sub>2</sub> 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:

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- 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<sub>2</sub> fluxes selected in the Land Representation Manager, the *Software* maps each unit of land to the relevant TAB

Reg	on R	legion 1 V	Region area (ha)	3,000.000	Discrepancy (ha)	2020: OK; 2000: O	К	Approach 1	C pools / Methods Biomass change	Stock difference	~	
		Land use category		Area (2020) (ba)		A (20	rea 000) 1a)		DOM - Deadwood	Stock difference	~	
<b>P</b> ·	Fores	st Land		(	960		100	0	DOM - Litter	Stock difference	~	
		Land use subcategory		Area (2020) (ha)		Area (2000) (ha)		SOM - Mineral	Default	~		
6	) <mark>.</mark>	lanaged Forest Land				960		1000				
			Current Land us	e subdivision				Remar	k			
	÷.	Secondary forest							Europe I	and second second	a ta a	where the second s
	Land unit code (Automatic)		Land unit code (User defined)		Area (2020) (ha)	Area (2000) (ha)	From L	and represent	ation	i, unit IVIFL_1 is mapped to		
		MFL-SF-NF-OB-1		MFL_1			960 (~> (~>	100				



TAB SOM mineral – Eq. 2.25 Formulation A



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### **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)*

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### **Forest land**





### **Forest land Data**

	Forest Inventory												
	1990	1995	2000	2005	2010	2015	2020	Cr					
C pool				m <sup>3</sup>				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					





### **Forest land remaining Forest land - Biomass**

SOM Mineral - E	M Mineral - Eq. 2.25 Formulation B SOM (SD - Approach 1) SOM (SD - Approaches 2&3) SOM Organic Drained SOM Organic Reveated Total Net CO2 Emission / Removal														
Biomass gains (( Worksheet	omass gains (G&L 1/4) Biomass loss (G&L 2/4) Biomass loss (G&L 3/4) Biomass loss (G&L 4/4) Biomass (G&L - Abrupt Biomass (SD - Approaches 2&3) DOM (G&L) DOM (SD - Approach 1) DOM (SD - Approaches 2&3) SOM Mineral - Eq. 2.25 Formulation A														ion A
Sector: Category: Subcategory: Sheet: Data	Kainedt Agriculture, Forestry and Other Land Use 2020   egory: Forest Land 2020   scategory: 3.B.1.a - Forest land Remaining Forest land 2020   eet: Annual net C stock change in biomass - Stock difference method - Approach 1 1														
Region Re	egion 1	Approact	h 1												
Land	Land use category Equation 2.8 - Approach 1														
		Biomass conversion and expansion factor from merchantable growing stock volume to above- ground biomass (t d.m. / m3 volum	Biomass expansion factor from growing stock volume (including bark) to above-ground biomass volume	Basic wood density (t d.m. / m3 fresh volume)	Total merchantable growing stock volume at the end of the inventory period (m3)	Total final above- ground biomass (t d.m.)	Total merchantable growing stock volume at the beginning of the inventory period (m3)	Total initial above- ground biomass (t d.m.)	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.)	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	BCEFs = BEF2 * D or specified	Table 3A.1.10 - Annex 3A.10 of the Good Practice Guidance for Land Use, Land-use Change, and Fore	Tables 4.13 / 4.14 / 4.6 WS	National statistics or international data sources	AB(final) = V(t2) * BCEFs	National statistics or international data sources	AB(initial) = V(t1) * BCEFs	Table 4.4 / 4.5 WS	Table 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	
V		BCEFs	BEF2	D	V(t2)	AB(final)	V(t1)	AB(initial)	R	CF	CB(final)	CB(initial)	Т	ΔCB	
MFL_1	Manage Second	0.67			181.500	121.605	177.500	118.925	0.22	0.470	69.728	68.192	5.000	0.307	
l otal											69.728	68.192		0.307	





### **Forest land remaining Forest land - DOM**

SOM Mineral - Eq. 2.25 Formulation B SOM (SD - Approach 1) SOM (SD - Approaches 2&3) SOM Organic Drained SOM Organic Rewetted Total Net CO2 Emission / Removal														
Biomass gains (G&L 1/4) Biomass loss (G&L 2/4) Biomass loss (G&L 3/4) Biomass loss (G&L 3/4) Biomass (G&L 4/4) 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														
Sector:   Agriculture, Foresty and Other Land Use   2020     Category:   Forest Land   2020     Subcategory:   3.B.1.a - Forest land Remaining Forest land   2020     Sheet:   Annual net C stock change in dead organic matter (Stock difference method) - Approach 1   2020     Data   Region   Region 1   - Approach 1														
Li	and use category					Equation 2.19 - App	roach 1							
			DOM C pool	Total Dead Wood/Litter stock at the end of the inventory period (t d.m.)	Total Dead Wood/Litter stock at the beginning of the inventory period (t d.m.)	Carbon fraction of dry matter (tonnes C / tonne d.m.)	Total final Dead Wood/Litter C stock (tonnes C)	Total initial Dead Wood/Litte C stock (tonnes C)	er Time period between two inventories (Year)	Annual change in carbon stocks in dead wood/litter (tonnes C / yr)				
Land unit code	Land unit code Land use during reporting yea			National statistics or international data sources	National statistics or international data sources	for litter IPCC default is 0.37	CDOM(final) = DOM(t2) * CF	CDOM(initial) = DOM(t1) * CF	T = t2 - t1	∆C(DOM) = (CDOM(final) - CDOM(initial)) / T				
2	Z 🗸 🗸	Δ <sub>7</sub>	v 7	DOM(t2)	DOM(t1)	CF	CDOM(final)	CDOM(initial)	т	ΔC(DOM)				
MFL_1	Managed For	Secondary for	Dead wood	81.600 79.800		0.490	39.984	39.10	5.000	0.176				
			Litter	17.300	16.900	0.37	6.401	6.25	5.000	0.030				
lotal										0.206				
										0.200				





### Mineral soil SOC change – Equation 2.25



The Software applies to each unit of land the formulation associated with the approach for **DCC** 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:

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

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

**IDCC** 

INTERGOVERNMENTAL PANEL ON Climate change

<u>Consequently, the net annual SOC change is calculated</u> as:  $\Delta C_{\text{Mineral}} = \frac{\text{SOC}_0 - \text{SOC}_{0-D}}{D}$ 


# 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:

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

 $\checkmark \quad SOC_{0-T} = \left( SOC_{\text{REF}_{c,s,p}} \bullet F_{\text{LU}_{c,i,p}} \bullet F_{\text{MG}_{c,i,p}} \bullet F_{\text{I}_{c,i,p}} \right)_{0-T}$ 

in the the year before the conversion occurred, Y = 0-T; t C ha<sup>-1</sup>

INTERGOVERNMENTAL PANEL ON Climate change

**IDCC** 

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



# Equation 2.25 – Formulation B – Approach 3



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**:

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

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<sup>-1</sup>



<u>Consequently, the net annual SOC change is calculated</u> as:  $\Delta C_{Mineral} = \frac{SOC_0 - SOC_{@conversion_{(0-T)}}}{D} * A$  **INTERGOVERNMENTAL PANEL ON CLIMATE CHANCE** 

## **Forest land remaining Forest land - SOM**

SOM Mineral - Eq. 2.25 For	mulation B SOM (SD - A	Approach 1) SOM (SD	- Approaches 2&3) SOM Organic Draine	ed SOM Organic Rewetted Total Net C	CO2 Emission / Removal		_			
Biomass gains (G&L 1/4) Worksheet	Biomass loss (G&L 2/4)	Biomass loss (G&L 3/4	) Biomass loss (G&L 4/4) Biomass (Ge	&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 - Eo	q. 2.25 Formulation	n A
Sector: Agricultu	ire, Forestry and Other Land	d Use								2020
Category: Forest La	and									
Subcategory: 3.B.1.a	Forest land Remaining For	rest land								
Sheet: SUM Mir	neral – Eq. 2.25 Formulation	nΑ								
Data										
Region Region 1	Aç	pproach 1								
	Land use category				Equation 2.25 Formulation A					
Land unit code Land use during reporting year Soil organic carbon stock in mineral soils in year 2020 (tonnes C) (tonnes C)										
2	7 ▲ 🏹	$\Delta \nabla$	SOC(2020)	SOC(2000)		∆Cmineral = ((SOC(2020) - SOC(20	00)) / 20			
MFL_1	Managed Forest Land	Secondary forest	60,480.000	63,000.000				-126.000		
Total										
			60,480.000	63,000.000				-126.000		





## **Forest land remaining Forest land - Summary**

Biomass gains	s (G&L 1/4	<ol><li>Biomas</li></ol>	s loss (G&L)	2/4) Bior	mass loss (G&L 3/4	) Biomass loss (	G&L 4/4) Biomas	is (G&L - Abrupt)	Biomass (SD	(1) Di	(60 4,,	es 2&3) DOM (G	&L) DOM (SD - A	pproach 1) DOI	M (SD - Approaches	s 2&3) SOM Mir	neral - Eq. 2.25 Formulation A
SOM Mineral	- Eq. 2.25	Formulation	B SOM (	SD - Appro	ach 1) SOM (SD	- Approaches 2&3	) SOM Organic [	Drained SOM Org	anic Rewetted	Fotal Net CO2 Emis	ssion/Removal						
Worksheet Sector: Category: Subcategory Sheet: Data	Agric Lanc y: 3.B. Tota	iculture, Fore d .1.a - Forest I al Net CO2 E	stry and Othe and Remainir mission / Rei	er Land Use ng Forest la moval	nd												2020
Region	(AII)		~	- All App	proaches												
Equation 2.2, 2.3																	
Land unit Net carbon stock change (tonnes C / yr)																	
	Lan	nd use cate <u>c</u>	jory		Ar (h	ea a)	Biomas	s gain	Biomas	ss loss	Biomas	ss total	Dead orga	nic matter	Soil orgai	nic matter	
Land unit code	Initia	il land use	Land us reportin	e during ng year	Mineral soil	Organic soil	Above-ground	Below-ground	Above-ground	Below-ground	Above-ground	Below-ground	Dead wood	Litter	Mineral soil	Organic soil	Total Net CO2 Emission / Removal (Gg CO2)
2	7 🛆		7 47	۵V				в	с	D	E = A + C	F = B + D	G				K = ((E + F + G + H + I + J) * - (44/12)) / 1000
MFL_1	NA	NA	Manag	Secon	960.000		0.252	0.055	0.000	0.000	0.252	0.055	0.176	0.030	-126.000		0.460
MFL-M	. Manag.	Forest		Forest		2,000.000	17,578.000	0.000	0.000		17,578.000	0.000					-64.453
UFL-M		Forest		Forest		85.000	747.065	0.000	0.000		747.065	0.000					-2.739
UFL-M	Unman	n Primar	_	Forest		600.000	5,273.400	0.000	0.000		5,273.400	0.000					-19.336
UFL-M	-	Primar	_	Forest		350.000	3,076.150	0.000	0.000		3,076.150	0.000					-11.279
UFL-M		Primar		Forest		175.000	1,538.075	0.000	0.000		1,538.075	0.000					-5.640
U						5,210.000		0.000	0.000	0.000		0.000	0	0.000	.20.000	0.000	102.000





#### Grassland





#### **Grassland Data**

Grassland															
Cincol	Stock <sub>longterm</sub>	R(a)	CE	т	1990	1995	2000	2005	2010	2015	2020				
C 9001	t d.m. ha <sup>-1</sup>	K(a)	CI	<u> </u>	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**

SOM (SD - Approaches 2&3) SOM Organic Device 1 Source Total Net CO2 Emission / Removal													
Biomass change	(G&L) Bior	nass (G&L - Abru	up) Biomass (SD - Approach	<ol> <li>Biomass (SD - Approaches</li> </ol>	s 2&3) DOM (SD - Appr	roach 1) DOM (G&L)	DOM (SD - Approaches	2&3) SOM (SD - Appro	ach 1) SOM Mineral -	Eq. 2.25 Formulation A	SOM Mineral - Eq	1. 2.25 Formulation B	
Worksheet Sector: Category: Subcategory: Sheet: Data	Agriculture Grassland 3.B.3.a - G Annual net	Forestry and Oth assland Remainin C stock change in	er Land Use ng Grassland n biomass - Stock difference met	nod - Approach 1									2020
Region 1 · Approach 1													
Land use category     Equation 2.8 - Approach 1													
			C pool	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 cod	e 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	∆CB = (CB(final) - CB (initial)) / T	
	7 🛆	V 7	7	U	AB(final)	AB(initial)	R	CF	CB(final)	CB(initial)	Т	ΔCB	
MGL_1	Managed.	Grazed	Herbaceous	d.m.	25,110.000	25,110.000	4	0.500	62,775.000	62,775.000	5.000	0.000	2 🖬 🍠
MGL_1		Grazed	Woody	d.m.	0	0	θ	0.470			0		
Total													
									62,775.000	62,775.000		0.000	





## **Grassland remaining Grassland - DOM**

SOM (SD - Approaches 2&3) SOM Organic Drained SOM Organic Rewetted Total Net CO2 Emission / Remove Source S												
Biomass change (G&	L) Biomass (G	&L - Abrupt) Bio	mass (SD - Approach 1) Bioma	ss (SD - Approaches 2&3) DOM	(SD - Approach 1) DOM (G8	L) DOM (SD - Approaches	2&3) SOM (SD - Approach 1	<ol> <li>SOM Mineral - Eq. 2.25 Form</li> </ol>	mulation A SOM Mi	neral - Eq. 2.25 Formulation B		
Worksheet Sector: A Category: G Subcategory: 3. Sheet: A Data Region Region	griculture, Forestry irassland .B.3.a - Grassland innual net C stock	and Other Land U Remaining Grassla change in dead on Change - Appr	lse ind ganic matter (Stock difference meth <b>pach 1</b>	od) - Approach 1							2020	
Land use category Equation 2.19 - Approach 1												
Land Use category       Description       Total Dead Wood/Litter stock at the end of the inventory period (t d.m.)       Total Dead Wood/Litter stock at the beginning of the inventory period (t d.m.)       Total Dead Wood/Litter matter (tonnes C / tonne d.m.)       Total final Dead Wood/Litter C stock (tonnes C)       Total initial Dead Wood/Litter C stock (tonnes C)       Time period between two inventories (Year)       Annual change in carbon stocks in dead wood/litter (tonnes C / yr)												
Land unit code	Land use durin	ng reporting year		National statistics or international data sources	National statistics or international data sources	for litter IPCC default is 0.37	CDOM(final) = DOM(t2) * CF	CDOM(initial) = DOM(t1) * CF	T = t2 - t1	∆C(DOM) = (CDOM(final) - CDOM(initial)) / T		
V	7 A 🖓	Δ.Δ.Δ.Δ.Δ.Δ.Δ.Δ.Δ.Δ.Δ.Δ.Δ.Δ.Δ.Δ.Δ.Δ.Δ.	7	∀ DOM(t2)	DOM(t1)	CF	CDOM(final)	CDOM(initial)	т	ΔC(DOM)		
MGL_1	Managed Gra	Grazed	Dead wood	0	0	θ			θ			
Litter 1,451.000 1,451.000 0.37 536.870 530.870 0.000 2 a												
Total												
										0.000		





### **Grassland remaining Grassland - SOM**

SOM (SD - Approaches 2&3)         SOM Organic Drained         SOM Of           Biomass change (G&L)         Biomass (G&L - Abrupt)         Biomass (S           Worksheet         Sector:         Agriculture, Forestry and Other Land Use           Category:         Grassland           Subcategory:         3.B.3.a - Grassland Remaining Grassland           Sheet:         SOM Mineral – Eo. 2.25 Formulation A	Organic Rewetted 6D - Approach 1)	Total Net CO2 Emission / Removal Biomass (SD - Approaches 2&3) D	OM (SD - Approach 1) DOM (G&L) DO	DM (SD - Approaches 2&3) SOM (SD - Approach 1)	SOM Mineral - Eq. 2.25 Formulation A SOM Mineral - Eq. 2.25 Form	ulation B
Data Region Region 1  Approach 1 Land use category				Equation 2.25 Formulation A		
Land unit code Land use during reporting	) year	il organic carbon stock in mineral soils in year 2020 (tonnes C)	Soil organic carbon stock in mineral soils in year 2000 (tonnes C)	Annual change	e in carbon stocks in mineral soils (tonnes C / yr)	
▼         △▼	ΔΥ	SOC(2020)	SOC(2000)	∆Cmineral =	: ((SOC(2020) - SOC(2000)) / 20	
MGL_1 Managed Grassland Grazed		130,069.800	132,167.700		-104.895	
		130,069.800	132,167.700		-104.895	





### **Grassland remaining Grassland - Summary**

Biomass change (	(G&L) Biomass (	G&L - Abrupt) Biom	ass (SD - Approach	1) Piomana (SI	Approaches 283	) DOM (SD - Ap	proach 1) DOM (	G&L) DOM (SD	Approaches 2&3)	SOM (SD - Appr	oach 1) SOM Mir	neral - Eq. 2.25 For	mulation A SON	M Mineral - Eq. 2.25	Formulation B
SOM (SD - Approa	aches 2&3) SOM	1 Organic Drained S	OM Organic Rewe	tter Total Net CO	02 Emission / Rem	oval									
Worksheet		tay and Other Land Line													2020
Category:	Agriculture, Fores	iry and Other Land Ose	;												2020
Subcategory:	3.B.3.a - Grasslan	nd Remaining Grassland	ł												
Sheet:	Total Net CO2 En	nission / Removal													
Data															
Region (All)		All App	proaches												
								Equation 2.2, 2.3							
	Land unit Net carbon stock change (tonnes C / yr)														
	Land use catego	ory	Ar (h	ea a)	Bioma	ss gain	Bioma	ss loss	Biomas	ss total	Dead orga	nic matter	Soil orga	nic matter	
Land unit code	Initial land use	Land use during reporting year	Mineral soil	Organic soil	Above-ground	Below-ground	Above-ground	Below-ground	Above-ground	Below-ground	Dead wood	Litter	Mineral soil	Organic soil	Total Net CO2 Emission / Removal (Gg CO2)
V					А	В	с	D	E = A + C	F = B + D	G	н	I	J	K = ((E + F + G + H + I + J) * - (44/12)) / 1000
MGL_1 N	IA NA	Manag Grazed	1,860.000		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-104.895		0.385
Total			4 000 000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	101.005	0.000	0.005
			1,860.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	-104.895	0.000	0.385





#### **Settlements**





#### **Settlements Data**

City Tree Inventory												
Creel	1990	1995	2000	2005	2010	2015	2020					
C pool				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 Occasile Bauetted Total Net CO2 Emission / Removal												
Biomass change (G&	L) Biomass (G&L - Abrup	Biomass (SD - Approach 1) Bio	mass (SD - Approaches 2&3)	) DOM (G&L) DOM (SE	) - Approach 1) DOM (SD	- Approaches 2&3) SOM	Mineral - Eq. 2.25 Formulati	on A SOM Mineral - Eq. 2	2.25 Formulation B	SOM (SD - Approach 1)		
Worksheet												
Sector: A	Agriculture, Forestry and Other La	nd Use									2020	
Category: S	Settlements											
Subcategory: 3	3.B.5.a - Settlements Remaining S	Settlements										
Sheet: /	Annual net C stock change in bior	mass - Stock difference method - App	proach 1									
Data												
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		
<b>∀</b>		U	AB(final)	AB(initial)	R	CF	CB(final)	CB(initial)	т	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**

SOM (SD - Approaches 2&3) SOM Organic Drained SOM Organic Rewetted Total Net CO2 Emission / Removal 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)												
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 dead organic matter (Stock difference method) - Approach 1         Data												
Region 1 · Approach 1												
Land use category     Equation 2.19 - Approach 1												
		DOM C pool	Total Dead Wood/Litter stock at the end of the inventory period (t d.m.)	Total Dead Wood/Litter stock at the beginning of the inventory period (t d.m.)	Carbon fraction of dry matter (tonnes C / tonne d.m.)	Total final Dead Wood/Litter C stock (tonnes C)	Total initial Dead Wood/Litter C stock (tonnes C)	Time period between two inventories (Year)	Annual change in carbon stocks in dead wood/litter (tonnes C / yr)			
Land unit code	Land use during reporting year		National statistics or international data sources	National statistics or international data sources	for litter IPCC default is 0.37	CDOM(final) = DOM(t2) * CF	CDOM(initial) = DOM(t1) * CF	T = t2 - t1	ΔC(DOM) = (CDOM(final) - CDOM(initial)) / T			
V	7 47 47	7 7	DOM(t2)	DOM(t1)	CF	CDOM(final)	CDOM(initial)	т	ΔC(DOM)			
OSL_1	Settlements ( Buildings	Dead wood	θ	0	0			0				
		Litter	9	0	0			0				
Total 0.000												





## **Settlements remaining Settlements - SOM**

SOM (SD - Approaches 2&3	) SOM Organic Drained SOM Organic Rewe	tted Total Net CO2 Emission / Removal			
Biomass change (G&L) Bi	omass (G&L - Abrupt) Biomass (SD - Approac	n 1) Biomass (SD - Approaches 2&3) D	OM (G&L) DOM (SD - Approach 1) DO	DM (SD - Approaches 2&3) SOM Mineral - Eq. 2.25 Formulation A SOM Mineral - Eq. 2.25 Formulation B SOM (SD - Appr	oach 1)
Worksheet Sector: Agricultu Category: Settleme Subcategory: 3.B.5.a - Sheet: SOM Mir Data	re, Forestry and Other Land Use nts Settlements Remaining Settlements ieral – Eq. 2.25 Formulation A				2020
Region Region 1	<ul> <li>✓ - Approach 1</li> </ul>				
	Land use category			Equation 2.25 Formulation A	
Land unit code	Land use during reporting year	Soil organic carbon stock in mineral soils in year 2020 (tonnes C)	Soil organic carbon stock in mineral soils in year 2000 (tonnes C)	Annual change in carbon stocks in mineral soils (tonnes C / yr)	
7		SOC(2020)	SOC(2000)	∆Cmineral = ((SOC(2020) - SOC(2000)) / 20	
OSL_1	Settlements (Other) Buildings	11,340.000	6,930.000	220.500	
Total					
		11,340.000	6,930.000	220.500	





## **Settlements remaining Settlements - Summary**

Biomass chang	ge (G&L) Biomass	(G&L - Abrupt) Biom	ass (SD - Approach	1) Piomase (SE	Approaches 283	) DOM (G&L)	DOM (SD - Approa	ich 1) DOM (SD	- Approaches 2&3)	SOM Mineral - E	q. 2.25 Formulation	n A SOM Mineral	I - Eq. 2.25 Formula	ation B SOM (SE	) - Approach 1)
SOM (SD - App	oroaches 2&3) SO	M Organic Drained	OM Organic Rewet	Total Net CO	02 Emission / Rem	oval									
Worksheet Sector: Category: Subcategory: Sheet: Data	Agriculture, Fore Land : 3.B.5.a - Settlen Total Net CO2 F	stry and Other Land Use nents Remaining Settlem Emission / Removal	ents												2020
Region	Ali)	⊻ - Ali Apj	proaches												
								Equation 2.2, 2.3							
	Land unit Net carbon stock change (tonnes C / yr)														
	Land use cate	gory	Are (ha	ea 1)	Bioma	ss gain	Bioma	ss loss	Biomas	ss total	Dead orga	anic matter	Soil orgar	nic matter	
Land unit code	Initial land use	Land use during reporting year	Mineral soil	Organic soil	Above-ground	Below-ground	Above-ground	Below-ground	Above-ground	Below-ground	Dead wood	Litter	Mineral soil	Organic soil	Total Net CO2 Emission / Removal (Gg CO2)
V					А	В	С	D	E = A + C	F = B + D	G	н		J	K = ((E + F + G + H + I + J) * - (44/12)) / 1000
OSL_1	NA NA	Settlem Buildin	180.000		45.308	15.405	0.000	0.000	45.308	15.405			220.500		-1.031
TSL-T	Settlem Urban	Settlem Urban		100.000			0.000		0.000	0.000					0.000
lotal			180.000	100.000	45 308	15 405	0.000	0.000	45 308	15 405	0.000	0.000	220 500	0.000	-1.031
			100.000	100.000	40.000	10.400	0.000	0.000	40.000	10.400	0.000	0.000	220.000	0.000	-1.001











# **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**





Region	Category	Subcategory	Subdivision	R	CF	D	Growing stock level	Net Annual Increment	BCEF1	BCEFs	BCEF <sub>R</sub>
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	





COM Mineral En	2.25 Formul	ation B SO	M (SD - Appro	ach 1) SOI	M (SD - Approaches 2&	3) SOM Organic Drai	ned SOM Organic R	ewetted Total Net CO	2 Emission / Removal								
Biomass gains (G	&L 1/4) Bio	mass loss (G	&L 2/4) Bior	mass loss (Gé	&L 3/4) Biomass loss	(G&L 4/4) Biomass (G	G&L - Abrupt) Biomas	ss (SD - Approach 1)	Biomass (SD - Approac	hes 2&3) DOM (G&I	.) DOM (SD - Approac	ch 1) DOM (SD - App	roaches 2&3) SOM M	ineral - Eq. 2.25 Formula	ation A		
Sector: Category: Subcategory: Sheet:	Agriculture, Forest Land 3.B.1.a - For 1 of 4 Annua	Forestry and O est land Rema al increase in c	ther Land Use ining Forest la arbon stocks i	nd in biomass (inc	cludes above-ground and	d below-ground biomass)									:	202	0
Region Reg	ion 2		- Approa	ach 2													
	Land	l use categor	Ŷ		Equation 2.9				Equation 2.10				Equati	on 2.9			
					Area (ha)	Mean annual increment of growing stock (m3 / ha / yr)	Biomass expansion factor for conversion of annual net increment to above- ground biomass increment	Basic wood density (t d.m. / m3 fresh volume)	Biomass conversion and expansion factor for increment (t d.m. / m3 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 * yri))	Carbon fraction of dry matter (tonnes C / tonne d.m.)	Annual increase in biomass carbon stocks due to biomass growth (tonnes C / yr)			
Land unit code	Initial la	and use	Land us reportir	e during ng year	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			
V	Δγ	Δ7	Δγ	ΔV	A	lv	BEF1	D	BCEFi	Gw	R	Gtotal	CF	ΔCG			
MFL-MFL	Managed	Forest pla	Managed	Forest pla	2,000.000	16.600			0.850	14.110	0.000	14.110	0.470	13,263.400			2
UFL-MFL	Unmanag	Primary F		Forest pla	600.000	16.600			0.850	14.110	0.2	16.932	0.470	4,774.824			
UFL-MFL		Primary F		Forest pla	350.000	16.600			0.850	14.110	0.2	16.932	0.470	2,785.314	2		
UFL-MFL		Primary F		Forest pla	175.000	16.600			0.850	14.110	0.2	16.932	0.470	1,392.657			
UFL-MFL		Primary F		Forest pla	85.000	16.600			0.850	14.110	0.2	16.932	0.470	676.433			
Total																	
					3,210.000							81.838		22,892.628			

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



#### Harvesting

ID	]	Harvest (	m <sup>3</sup> ) - Ind	ustrial Ro	oundwood	d		Ha	rvest (m <sup>3</sup>	) - Fuelw	ood	
ID	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





#### **Harvesting: Industrial Roundwood**

SOM Mineral - Eq. 2 Biomass gains (G&I	.25 Formulation P 1/4) Biomass Ic	SOM (SD App oss (G&L 2/4) R	proach 1) SOM	(SD - Approaches	s 2&3) SOM Organic Draine	d SOM Organic Rewetted	Total Net CO2 Emission / Re	moval	DOM (SD - Approach 1)	DOM (SD - Approaches 283)	SOM Mineral - Eq. 2.25 Fe	ormulatio	on A	
Worksheet Sector: // Category: / Subcategory: Sheet: 2 Data Region Region	Agriculture, Forestry Forest Land 8.B.1.a - Forest land 2 of 4 Loss of carbo	and Other Land U I Remaining Forest n from wood remov	Jse t land vals		000 (042 #4) Divinuos (00		pproden i) _ biointidas (OP 7	, pprocenter 2007 - Donn (Co					20	20
	La	nd use category						Equation 2.12						
					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)			
Land unit code	Initial I	and use	Land use during	g reporting year	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			
7	7 47	ΔV	۵V	۵V	н	BEF2	D	BCEFr	R	CF	Lwr			
MFL-MFL_1	Managed For	Forest plantat	Managed For	Forest plantat	13,280.000			1.05	0.000	0.470	6,553.680			2
UFL-MFL_20	Unmanaged	Primary Forest		Forest plantat	0					0.470				
UFL-MFL_20	· _	Primary Forest		Forest plantat	0					0.470				
UFL-MFL_20	-	Primary Forest		Forest plantat	0					0.470			$ \rightarrow $	
UFL-MFL_20.		Primary Forest		Forest plantat	<del>0</del>					0.470				
lotal					12 200 000						C 550 C00			
					13,280.000						6,003.680			

Belowground biomass is estimated only in conversions between different forest subdivisions



INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE

#### **Harvesting: Fuelwood**

SOM Mineral - Eq Biomass gains (G	. 2.25 Formulat &L 1/4) Biom	ion B SOM ( ass loss (G&L)	SD Approach 2/4) Biomas	1)COM (CI s loss (G&L 3/4	+ opproaches 2&3) SC Biomass loss (G&L 4)	M Organic Drained SC (4) Biomass (G&L - Abi	DM Organic Rewetted 1 rupt) Biomass (SD - Ap	Total Net CO2 Emission / proach 1) Biomass (SI	Removal D - Approaches 2&3) D0	DM (G&L) DOM (SD - A	Approach 1) DOM (SD	- Approaches 2&3) SOM	1 Mineral - Eq. 2.25 Form	ulation	A	
Worksheet Sector: Category: Subcategory: Sheet: Data	Agriculture, Fo Forest Land 3.B.1.a - Fores 3 of 4 Loss of	prestry and Othe st land Remainir carbon from fue	er Land Use ng Forest land elwood removal:	s											202	.0
Region Reg	ion 2	~	- Approach	2												
	Lan	d use category	ý						Equation 2.13							
					Annual volume of fuelwood removal of whole trees (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.)	Annual volume of fuelwood removal as tree parts (m3/yr)	Basic wood density (t d.m. / m3 fresh volume)	Carbon fraction of dry matter (tonnes C / tonne d.m.)	Annual carbon loss due to fuelwood removal (tonnes C / yr)			
Land unit code	Initial I	and use	Land use dur ye	ring reporting ear	FAO Statistics	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	FAO Statistics	Tables 4.13 / 4.14 / 4.6 WS / National statistics or international data sources	0.47 / Table 4.3 / 0.451 WS mangroves	Lfw = [FGtrees * BCEFr * (1+R) + FGpart * D] * CF			
2		ΔV	Δγ	ΔV	FGtrees	BEF2	D	BCEFr	R	FGpart	D	CF	Lfw			
MFL-MFL	Managed	Forest plan	Managed	Forest pla	0			1.050	0.000	335,552.000	0.555	0.470	87,528.739			2
UFL-MFL	Unmanage	Primary Fo		Forest pla	0			1.050		0	0.555	0.470			$ \rightarrow $	
UFL-MFL	-	Primary Fo		Forest pla	<del>0</del>			1.050		<del>0</del>	0.555	0.470			-+	
UFL-MFL		Primary Fo		Forest pla	A			1.050		A	0.555	0.4/0			-+	
Total		r mary r 0		r oreat pid	•			1.050		•	0.000	0.470				=
					0.000					335,552.000			87,528.739			

Fuelwood collected from part of trees only

Salvage logging in unit of land MFL-MFL



INTERGOVERNMENTAL PANEL ON Climate change

**IDCC** 

### Forest land remaining Forest land – DOM

**Disturbances: Wildfire** 

ID				D	isturk	oances
ID	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<sub>2</sub> emissions are estimated in category 3.C.1



INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE

#### **Disturbances: Wildfire**

SOM Mineral - E	q. 2.25 For	mulation B	SOM (SD	- Approach	1) SOM (SD - Appr	oaches 283) SON	1 Organic Drained	SOM Organic Rew	etted Total Net CO	2 Emission / Remov	al						
Biomass gains (	G&L 1/4)	Biomass los	s (G&L 2/4)	Biomass	loss (G&L 3/4 Bid	omass loss (G&L 4/4)	Biomass (G&L -	Abrupt) Biomass	(SD - Approach 1)	Biomass (SD - Appr	baches 2&3) DOM	I (G&L) DOM (SD	- Approach 1) DO	M (SD - Approaches	2&3) SOM Minera	I - Eq. 2.25 Formulati	ion A
Worksheet Sector: Category: Subcategory: Sheet: Data	Agricultu Forest La 3.B.1.a - 4 of 4 Lo	re, Forestry a and Forest land oss of carbon	and Other La Remaining F I from disturb	orest land orest land oance													2020
Region Re	gion 2		×	Approach	2												
	Land	use catego	ry							Equation 2.14						Equation 2.11	
					Area (ha)	Area affected by disturbances (ha / 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 standing stock (t d.m. / m3 wood volume)	Growing stock level (m3 / ha)	Above-ground biomass stock (t d.m. / ha)	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.)	Fraction of biomass lost in disturbance	Annual other losses of carbon (tonnes C / yr)	Annual decrease in carbon stocks due to biomass loss (tonnes C / yr)	
Land unit code	Initial Ia	and use	Land us reporti	e during ng year	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	BCEFs = BEF2 * D / Specified	National statistics or international data sources	Bw = BCEFs * V / 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	National statistics or international data sources	Ldisturb = Adisturb * Bw * (1+R) * CF * fd	∆CL = Lwr + Lfw + Ldisturb	
$\nabla$	V	V	V	V	A	Adisturb	BEF2	D	BCEFs	V	Bw	R	CF	fd	Ldisturb	ΔCL	Δ
MFL-M	Manage	Forest p	Manage	Forest p	2,000.000	1,000.000			0.990	166.000	164.340	0.000	0.470	0.600	46,343.880	141,676.518	2 🖬 🄈
UFL-MF	Unmana	Primary		Forest p	600.000	0			0.990	166.000	164.340	0.000	0.470	θ		0.000	
UFL-MF		Primary		Forest p	350.000	0			0.990	166.000	164.340	0.000	0.470	0		0.000	
UFL-MF		Primary		Forest p	175.000	0			0.990	166.000	164.340	0.000	0.470	0		0.000	
UFL-MF		Primary		Forest p	85.000	0			0.990	166.000	164.340	0.000	0.470	0		0.000	
Total					0.040.555	4 000 555									10.010.000	4 44 070 5 45	
					3,210.000	1,000.000									46,343.880	141,676.518	

Non-CO<sub>2</sub> 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		DC	OM C s	tocks	in & ot	ıt d.m.	(Dead	Wood)	) - CF (	).49				DOM	C sto	:ks in 8	e out d	.m. (lit	ter) - C	F 0.37		
ID	1995	20	00	20	005	20	)10	20	)15	20	)20	1995	20	000	20	005	20	10	20	15	20	20
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									<b>9</b> 7	6,417	<b>9</b> 7	
UFL-MFL_2020-1										94	6,233										47	3,117

Non-CO<sub>2</sub> emissions are estimated in category 3.C.1





### Forest land remaining Forest land – DOM

SOM Mineral -	Eq. 2.25 F	ormulation B	SOM (SD - Appro	oach 1) SOM (S	D - Approaches	2&3) SOM Organic Drained SC	OM Organic Rewetted Total	Net CO2 Emission / Remova							
Biomass gains	(G&L 1/4)	Biomass loss	(G&L 2/4) Bior	mass loss (G&L 3	<li>Hold Biomass Io</li>	ss (G&L 4/4) Biomass (G&L - Abr	rupt) Biomass (SD - Approa	ch 1) Biomass (SD - Appro	aches 2&3) DOM (G&L)	DOM (SD - Approach 1)	DOM (SD - Approaches 2&3)	SOM Mineral - Eq. 2.25 Fo	ormulati	on A	
Worksheet Sector: Category: Subcategory Sheet: Data	Agricu Forest 3.B.1. Annua	ulture, Forestry an Land a - Forest land Re al net C stock cha	d Other Land Use emaining Forest la ange in dead orga	e Ind Inic matter (Gain &	Loss method)									20	20
Region	Region 2		Approa	ach 2											
_		Land	d use category						Equation 2.18						
						DOM C pool	Area (ha)	Average annual transfer of biomass into the dead wood or litter pool due to annual processes and disturbances (t d.m. or C / ha / yr)	Average annual decay and disturbance carbon loss out of dead wood or litter pool (t d.m. or C / ha / yr)	DOM Unit	Carbon fraction of dry matter (tonnes C / tonne d.m.)	Annual change in carbon stocks in dead wood/litter (tonnes C / yr)			
Land uni	it code	Initial I	and use	Land use durin	g reporting year		National statistics or international data sources	See Chapter 2. Section 2.3.2.1	See Chapter 2. Section 2.3.2.1		for litter IPCC default is 0.37	ΔC(DOM) =A* (DOMin - DOMout) * CF			
	V	Δγ	ΔV	Δ		۲ ۲	A	DOMin	DOMout		CF	ΔC(DOM)			
MFL-MFL	L_1	Managed Fo	Forest planta	Managed Fo	Forest planta	Dead wood	2,000.000	0	0	(t d.m./ha/yr)	0				
			Forest planta			Litter		0	0	(t d.m./ha/yr)	9				
UFL-MFL	L_2005_1	Un managed	Primary Forest			Dead wood	600.000	664.000	0	(t d.m./ha/yr)	0.490				
			Primary Forest			Litter		332.000	0	(t d.m./ha/yr)	0.37				
UFL-MFL	L_2010_1		Primary Forest			Dead wood	350.000	387.000	0	(t d.m./ha/yr)	0.490				
			Primary Forest			Litter		194.000	0	(t d.m./ha/yr)	0.37				
UFL-MFL	L_2015-1		Primary Forest			Dead wood	175.000	194.000	0	(t d.m./ha/yr)	0.490				
			Primary Forest			Litter		97.000	0	(t d.m./ha/yr)	0.37				2
UFL-MFL	L_2020-1		Primary Forest			Dead wood	85.000	94.000	6,233.000	(t d.m./ha/yr)	0.490	-255,689.350			
			Primary Forest			Litter		47.000	3,117.000	(t d.m./ha/yr)	0.37	-96,551.500			
Total															
												-352,240.850			

Non-CO<sub>2</sub> emissions are estimated in category 3.C.1

ipcc



## **Forest land remaining Forest land – SOM Drained**

ID	SOM Drained
MFL-MFL_1	
UFL-MFL_2000-1	FF(as) DOC(flue) ADOC Frag(DOC)
UFL-MFL_2005-1	EP(0s) = DOC(II0x) = DOC(-PTAC(DOC))
UFL-MFL_2010-1	IPCC Default values for Temperate elimete region
UFL-MFL_2015-1	II CC Delatat values for Temperate cumate region
UFL-MFL_2020-1	

Non-CO<sub>2</sub> emissions are estimated in categories 3.C.4, .8, .9



## **Forest land remaining Forest land – SOM Drained**

Biomass gains (Ga	&L 1/4) Biom	ass loss (G&L	2/4) Biomas	s loss (G&L 3/4	) Biomass loss (G21.4	(4) Piomaco (G81 Abr	upt) Biomass (SD - Ap	proach 1) Biomass (SD	- Approaches 2&3) DO	DM (G&L) DOM (SD - A	Approach 1) DOM (SD -	Approaches 2&3) SO	M Mineral - Eq. 2.25 Form	ulation A
SOM Mineral - Eq. Worksheet Sector:	2.25 Formulati Agriculture, Fo	ion B SOM (	(SD - Approach er Land Use	1) SOM (SD	) - Approaches 2&3)	OM Organic Drained	M Organic Rewetted 1	Total Net CO2 Emission / I	Removal					2020
Category: Subcategory: Sheet:	Forest Land 3.B.1.a - Fores Annual net C s	st land Remainir stock change in	ng Forest land n soil organic ma	atter of drained o	organic soils									
Region Regi	ion 2	~	- Approach	2										
	Lan	d use categor						Eq	uation 2.2, 2.3, 2.4, 4.8 V	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 and nutrient status of p in drain (tonnes CO	n factor for climate type eat and drainage class ed soils 2-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 I	and use	Land use du y	ring reporting ear	National statistics or international data sources	Table 4.6 / 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 V or nationa	NS / Eq. 2.5 al statistics	From 3.C.1	CO2-C(d) = A(d) * (EF (os) + EF(DOC)) + L (fd)	
V	ΔV	ΔV			A(d)	EF(os)	DOC(flux)	ΔDOC	Frac(DOC)		EF(DOC)	L(fd)	CO2-C(d)	
MFL-MFL	Managed	Forest plan	Managed	Forest plan	2,000.000	2.6	0.210	0.600	0.900	Calculated	0.302		5,804.800	
UFL-MFL	Unmanage	Primary Fo	-	Forest plan	600.000	2.6	0.210	0.600	0.900	Calculated	0.302		1,741.440	
UFL-MFL	-	Primary Fo	-	Forest plan	350.000	2.6	0.210	0.600	0.900	Calculated	0.302		1,015.840	
UFL-MFL		Primary Fo	-	Forest plan	1/5.000	2.6	0.210	0.600	0.900	Calculated	0.302		507.920	
UFL-MFL		Primary Fo		Forest plan	85.000	2.6	0.210	0.600	0.900	Calculated	0.302		246./04	
lotal					2 210 000								0.010 704	
					3,210.000								9,316.704	





## Cropland





## **Cropland Remaining Cropland – Biomass (Gain&Losses)**

	u	nit 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





# **Cropland Remaining Cropland – Biomass (Gain&Losses)**

SOM (SD_Assessed as 383) SOM Organic Drained SOM Organic Rewetted Total Net CO2 Emission / Removal													
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)													
Sector:     Agriculture, Forestry and Other Land Use     20       Category:     Cropland       Subcategory:     3.B.2.a - Cropland Remaining Cropland       Sheet:     Annual net C stock change in biomass - Gain & Loss method       Data											2020		
Region 2 - Approach 2													
	Land use cate	gory					Equat	ion 2.7					
			Area (ha)	Average area- specific annual accumulation rate of above-ground biomass (perennial) (tonnes C / ha / yr) or (tonnes d.m. / ha / yr)	Average annual growth of perennial above-ground biomass (tonnes C / yr)	Area with perennial biomass that is disturbed/cleared in the year (ha)	Above-ground biomass in the area disturbed/cleared (tonnes C / yr) or (tonnes d.m. / yr)	Fraction of biomass lost	Perennial biomass loss (tonnes C / yr)	Ratio of below- ground biomass to above-ground biomass (t bg d.m. / t ag d.m.) or (t bg C / t ag C)	Carbon fraction of perennial biomass dry matter (tonnes C / tonne d.m.)	Annual change in carbon stocks in biomass (tonnes C / yr)	
Land unit code	Initial land use	Land use during reporting year	National statistics or international data sources	National statistics or international data sources	ΔCg=A*G*(1+R)*CF	National statistics or international data sources	IPCC default or national/international data	National data	ΔCI=AI*B*fd*(1+R) *CF	IPCC default or national/international data	IPCC default or national/international data	∆Cb = ∆Cg - ∆Cl	
7			V A	G	ΔCg	Al	В	fd	ΔCI	R	CF	∆Cb	
PCL-ACL	Cropland Oil Paln	Cropland Lotus (co.	. 5.000				3.570			0	1.000	0.000	
PCL-PCL	Oil Palm	Cropland Oil Palm	2,970.000	2.400	7,128.000	114.000	0.000	1.000	0.000	0.000	1.000	7,128.000	2 🖬 🎐
Total													
2,975.000 7,128.000 114.000 0.000 7,128.000													

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



INTERGOVERNMENTAL PANEL ON Climate change

DCC

# **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)**

SOM (SD - Approaches 282) SOM Organic Beniged SOM Organic Rewetted Total Net CO2 Emission / Removal														
Biomass (G&L - Abrupt) Biomass (SD - Approach 1) Biomass (SD - Approaches 2&3) DOM (G&L) 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: Cropland														
Subcategory: 3.B.2.a - Cropland Remaining Cropland														
Sheet: Initial change in biomass carbon stocks on land converted to another land category (abrupt change)														
Data														
Region 2 · Approach 2														
	Land use catego	ry						Equation 2.16						
			Area (ha)	Unit	Above-ground biomass before the conversion (t U / ha)	Above-ground biomass after the conversion (t U / ha)	Ratio of below- ground biomass to above-ground biomass before the conversion (t bg U / t ag U)	Biomass carbon fraction before the conversion (tonnes C / tonne U)	Biomass C stocks before the conversion (tonne C / ha)	Ratio of below- ground biomass to above-ground biomass after the conversion (t bg U / t ag U)	Biomass carbon fraction after the conversion (tonnes C / tonne U)	Biomass C stocks after the conversion (tonne C / ha)	Annual change in carbon stocks in biomass (tonnes C / yr)	
Land unit code	Initial land use	Land use during reporting year	National statistics or international data sources	d.m. or C			National data	IPCC default or national/internation al data	CB(b) = AB(b) * (1+R(b)) * CF(b)	National data	IPCC default or national/internation al data	CB(a) = AB(a) * (1+R(a)) * CF(a)	∆CB = (CB(a) - CB (b)) *∆A	
V			ΔΑ		AB(b)	AB(a)	R(b)	CF(b)	CB(b)	R(a)	CF(a)	CB(a)	ΔCB	
PCL-AC	Cropland Oil Palm	Cropland Lotus (c	5.000	С	60.000	3.570	0.190	1.000	71.400	0.000	1.000	3.570	-339.150	2 2 2
Total														
									71.400			3.570	-339.150	

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 <i>Lotus</i> , in the first year only										
variables	1995	2000	2005	2010	2015	2020				
A (ha)			5	15	5	5				
[converted to <i>Lotus</i> in the year]			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 <i>Lotus</i> , 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**

SOM (SD - Approac	ches 2&3	3) SOM Orga	nic Drained SC	M Organic Rewe	tted Total Ne	et CO2 Emission / Remo								
Biomass change (G	6&L) Bi	iomass (G&L -	Abrupt) Biomas	ss (SD - Approac	h 1) Biomass	(SD - Approaches 2&3 DOM (G&	&L) DOM (SD - Approact	h 1) DOM (SD - Approache	s 2&3) SOM Mineral - E	q. 2.25 Formulation A	60M Mineral - Eq. 2.25 Formul	ation B SOM (SD - Approa	ch 1)	
Worksheet Sector: Category: Subcategory: Sheet: Data	Agricultu Cropland 3.B.2.a - Annual n	rre, Forestry and I Cropland Rema net C stock char	Other Land Use aining Cropland nge in dead organi	ic matter (Gain & l	.oss method)									2020
Region Regio	on 2		Approace	ch 2										
		Land	use category						Equation 2.18					
						DOM C pool	Area (ha)	Average annual transfer of biomass into the dead wood or litter pool due to annual processes and disturbances (t d.m. or C / ha / yr)	Average annual decay and disturbance carbon loss out of dead wood or litter pool (t d.m. or C / ha / yr)	DOM Unit	Carbon fraction of dry matter (tonnes C / tonne d.m.)	Annual change in carbon stocks in dead wood/litter (tonnes C / yr)		
Land unit co	de	Initial I	and use	Land use dur ye	ing reporting ar		National statistics or international data sources	See Chapter 2. Section 2.3.2.1	See Chapter 2. Section 2.3.2.1		for litter IPCC default is 0.37	ΔC(DOM) = A* (DOMin - DOMout) * CF		
	V	Δγ	Δγ	Δγ	Δγ	· ۲	А	DOMin	DOMout		CF	ΔC(DOM)		
ACL-ACL_1	0	Cropland An	Lotus (long-t	Cropland An	Lotus (long	Dead wood	10.000	θ	θ	(t d.m./ha/yr)	θ		2	
			Lotus (long-t			Litter		θ	θ	(t d.m./ha/yr)	0			
PCL-ACL_200	05-1 (	Cropland Per	Oil Palm		Lotus (conv	Dead wood	5.000	θ	0	(t d.m./ha/yr)	0			
			Oil Palm	1		Litter		θ	θ	(t d.m./ha/yr)	0			
PCL-ACL_20	10-1		Oil Palm	1		Dead wood	15.000	θ	θ	(t d.m./ha/yr)	0			
			Oil Palm	1		Litter		0	0	(t d.m./ha/yr)	0			
PCL-ACL_20	15-1		Oil Palm	1		Dead wood	5.000	0	0	(t d.m./ha/yr)	9			
			Oil Palm			Litter		9	0	(t d.m./ha/yr)	9			
PCL-ACL_202	20-1		Oil Palm	1		Dead wood		0.000	6.122	(t d.m./ha/yr)	0.490	-14.999		
			Oil Palm	1		Litter		0.000	4.054	(t d.m./ha/yr)	0.37	-7.500		
PCL-PCL_1			Oil Palm	Cropland Per	Oil Palm	Dead wood	2,970.000	0	0	(t d.m./ha/yr)	9			
•			Oil Palm			Litter		0	0	(t d.m./ha/yr)	0			a 🤊
Total														
												-22.499		



# **Cropland Remaining Cropland – SOM**

SOM (SD - Approache	es 2&3) S	OM Organic D	rained SC	M Organic	Rewetted Total Ne	t CO2 Emission / Re	moval										
Biomass change (G&l	L) Biomas	s (G&L - Abrup	pt) Bioma	ss (SD - App	roach 1) Biomass	(SD - Approaches 2	&3) DOM (G	&L) DOM (SD - A	pproach 1) DOM (	SD - Approaches 28	3) SOM Mineral -	Eq. 2.25 Formulatio	n A SOM Minera	I - Eq. 2.25 Formulat	ion B SOM (SD -	Approach 1)	
Worksheet Sector: Ag Category: Cr Subcategory: 3. Sheet: Ar Data	griculture, Fo ropland .B.2.a - Cropla nnual net C s	estry and Othe and Remaining tock change in	er Land Use Cropland a soil organic	matter of mir	ieral soils - Approach	2 and Approach 3 (D	efault method)										2020
Region Region	2	~	- Approa	ch 2													
	Land u	se category								Equat	ion 2.25 - B						
					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 tim	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)	
Land unit code	Initi	al land use	Land us reporti	e during ing year	National statistics or international data sources	Tables 2.3 / 5.2 WS	Default value is 20	National statistics or international data sources	National statistics or international data sources	National statistics or international data sources	SOC(0) = SOCref * Flu(0) * Fmg(0) * Fi(0)	IPCC defaults or country-specific	IPCC defaults or country-specific	IPCC defaults or country-specific	SOC(c) = SOCref *Flu(c) *Fmg(c) *Fi(c)	∆Cmineral = ((SOC(0) - SOC (c)) *A ) / D	
	7 4	V 47	7 47	Z ∆ ⊽	А	SOCref	D	Flu(0)	Fmg(0)	Fi(0)	SOC(0)	Flu(c)	Fmg(c)	Fi(c)	SOC(c)	∆Cmineral	
PCL-ACL_2005-	-1 Cropla	n Oil Palm	Croplan	Lotus (c	5.000	68.000	20.000	0.800	1.220	1.110	73.668	1.010	1.000	1.000	68.680	1.247	23
PCL-ACL_2010-	-1	Oil Palm		Lotus (c	15.000	68.000	20.000	0.800	1.220	1.110	73.668	1.010	1.000	1.000	68.680	3.741	2
PCL-ACL_2015-	-1	Oil Palm		Lotus (c	5.000	68.000	20.000	0.800	1.220	1.110	73.668	1.010	1.000	1.000	68.680	1.247	2
PCL-ACL_2020-	-1	Oil Palm		Lotus (c	5.000	68.000	20.000	0.800	1.220	1.110	73.668	1.010	1.000	1.000	68.680	1.247	
Total																	
					30.000											7.483	

CH<sub>4</sub> 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 change ( Worksheet Sector: Category: Subcategory: Sheet: Data	(G&L) Bio Agriculture Wetlands 3.B.4.b.iii Initial char	mass (G&L-) e, Forestry and Land convert nge in biomass	Abrupt) Bid Other Land I ed to Other V carbon stock	omass (SD - 4 Use Vetlands ks on land cor	Approaches 2&3) DOM (	G&L) DOM (SD - Appro	oaches 283) SOM Miner	al - Eq. 2.25 Formulatio	n B SOM (SD - Appr	oaches 2&3) SOM C	Organic Rewetted To	otal Net CO2 Emission.	/ Removal		2020
Region Reg	gion 2		Арр	roach 2											
	Lan	d use catego	ry						Equation 2.1	1 <del>6</del>					
					C pool	Area (ha)	Unit	Above-ground biomass before the conversion (t U / ha)	Above-ground biomass after the conversion (t U / ha)	Ratio of below- ground biomass to above-ground biomass (R) (t bg U / t ag U)	Biomass carbon fraction (tonnes C / tonne d.m.)	Biomass C stocks before the conversion (tonne C / ha)	Biomass C stocks after the conversion (tonne C / ha)	Annual change in carbon stocks in biomass (tonnes C / yr)	
Land unit code	Initial	land use	Land u report	se during ing year		National statistics or international data sources	d.m. or C	National statistics or international data sources	National statistics or international data sources	Zero (0) or Table 4.4 / 4.5 WS / Vational statistics or international data sources	0.47 / Table 4.3 / 0.451 WS mangroves	CB(b) = AB(b) * (1+R) * CF	CB(a) = 0	∆CB = (CB(a) - CB (b)) *∆A	
$\nabla$	Δ	Z ∆ ∑	Δ7	7 47		7 ΔΑ	U	AB(b)	AB(a)	R	CF	CB(b)	CB(a)	ΔCB	
► OSL-MW	Settleme	Urban pa	Managed	Tidal mar	Class 1	100.000	d.m.	67.000	0.000	0.330	0.470	41.882	0.000	-4,188.170	
Total															
												41.882	0.000	-4,188.170	

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



#### **Settlements**





## **Settlements Remaining Settlements – Biomass**





## **Settlements Remaining Settlements – Biomass**

				unit of	land TSL-	TSL_1 (B	iomass)								
	19	95	20	00	20	05	20	10	20	15	20	20			
variables	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 al	l trees with	h age > AG	GP												
All Classes apply eq	l Classes apply equation 8.3														
All Classes disaggre	gate abov	eground a	nd belowg	round bio	nass estim	ates									





## **Settlements Remaining Settlements – Biomass**

CON (CD A)	<b>28</b> 3) 5	OM Organio	c Drained	SOM Organic Rew	etted Total Net CO2	Emission/	Removal											
Biomass chang	ge (G&L) Bioma	s (G&L - Ab	orupt) Bion	nass (SD - Approac	h 1) Biomass (SD -	Approache	s 2&3) DOM (G	i&L) DON	1 (SD - Approach 1	) DOM (SD - Approa	ches 2&3) SOM	Mineral - Eq. 2.25 I	ormulation A	SOM Mineral - Eq.	2.25 Formulation E	3 SOM (SD - Ap	oroach 1)	
Sector: Category: Subcategory Sheet: Data	Agriculture, Fo Settlements 3.B.5.a - Settl Annual net C	restry and O ements Rema tock change	ther Land Us aining Settlen e in biomass ·	e nents - Gain & Loss metho	d													2020
Region F	Region 2		Appro	ach 2														
				Land use categ	ory					Equation 8.2	(Tier 2a)			Equation 8	8.3 (Tier 2b)			
				Area (ha)	Class	Age older than active growing period (AGP)	Method	Disaggr egate in above- ground and below- ground biomass	Total crown cover area of class i (ha)	Crown cover area- based growth rate of class i (tonnes C / ha / yr)	Ratio of below- ground biomass to above-ground biomass (t bg C / t ag C)	Annual net accumulation in biomass carbon stocks based on total crown cover area (tonnes C / yr)	Number of individuals of class i	Annual average carbon accumulation per class i (tonnes C / yr)	Ratio of below- ground biomass to above-ground biomass (t bg C / t ag C)	Annual net accumulation in biomass carbon stocks based on individual plants (tonnes C / yr)	Annual change in carbon stocks in biomass (tonnes C / yr)	
Land unit code	Initial land us	Land u repor	use during rting year	National statistics or international data sources					National statistics or international data sources	Table 8.1 or National data		∆CB(T2a) = A(i) * CRW(i) * (1+R)	National statistics or internation al data sources	Table 8.2 or National data		∆CB(T2b) = N(i) * C(i) * (1+R)	ΔCB=ΔCB(T2a) or ΔCB(T2b)	
V		Υ <u>Δ</u>	V 47	A	i V	V	v ک	V V	A(i)	CRW(i)	R	∆CB(T2a)	N(i)	C(i)	R	ΔCB(T2b)	ΔСВ	
TSL-T	Settle Urbar	Settle	Urban	100.000	Class 1		Eq. 8.3						2,000.000	0.007	0.330	18.620	18.620	2 2 7
TSL-T	Urbar				Class 2		Eq. 8.3						2,000.000	0.01	0.330	26.600	26.600	
TSL-1	Urbar				Class 3		Eq. 8.3	<u>~</u>					12,000.000	0.005	0.330	/9.800	/9.800	
Total	Urbar				Class 4													
												0.000				125.020	125.020	





#### **Settlements Remaining Settlements – DOM**

Negligible





## **Settlements remaining Settlements – SOM Drained**

ID	SOM Drained
TSI TSI 2000 1	$EF(os) - DOC(flux) - \Delta DOC - Frac(DOC)$
13L-13L_2000-1	IPCC Default values for Temperate climate region

Non-CO<sub>2</sub> emissions are estimated in categories 3.C.4, .8, .9



#### **Forest land converted to Settlements – SOM Drained**





## **Forest land converted to Settlements – SOM Drained**

Biomass change	(G&L) Biogenee (C&L Albert	H) Birghass (SD - Approach	n 1) Biomass (SD - App	roaches 2&3) DOM (G	&L) DOM (SD - Approa	ch 1) DOM (SD - Appro	aches 2&3) SOM Mine	eral - Eq. 2.25 Formulation	A SOM Mineral - Eq.	2.25 Formulation B SO	M (SD - Approach 1)	
SOM (SD - Appro	aches 2&3) SOM Organic D	Irained SOM Organic Rewe	tted Total Net CO2 Em	ission / Removal								
Worksheet Sector: Category: Subcategory: Sheet: Data	Agriculture, Forestry and Othe Settlements 3.B.5.a - Settlements Remain Annual net C stock change ir	er Land Use ing Settlements n soil organic matter of drained o	organic soils									2020
Region Re	gion 2 $\sim$	- Approach 2										
	Land use categor	у				Eq	uation 2.2, 2.3, 2.4, 4.8 V	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 and nutrient status of p in drain (tonnes CO	factor for climate type eat and drainage class ed soils 2-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	e 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 V or nationa	VS / Eq. 2.5 al statistics	From 3.C.1	CO2-C(d) = A(d) * (EF (os) + EF(DOC)) + L (fd)	
	7 ΔΥ ΔΥ		A(d)	EF(os)	DOC(flux)	ΔDOC	Frac(DOC)		EF(DOC)	L(fd)	CO2-C(d)	
TSL-TSL_1	Settlement Urban park	Settlement Urban park	100.000	7.9	0.210	0.600	0.900	Calculated	0.302		820.240	222
Total			100.000								010 000	
			100.000	1							620.240	



## Forest land converted to Settlements – Biomass & DOM

				unit of lar	nd UFL-TS	SL_2000-1	(Biomass)							
	19	95	20	00	20	05	20	10	20	15	20	20		
variables	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														
Class 4* (51-80 y) 0 0 0 0 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 eq	uation 8.3													
All Classes disaggre	Il Classes disaggregate aboveground and belowground biomass estimates													
Aboveground bioma	uss at the e	end of the	first year o	of conevrsi	on is $= 0.0$	07 * 100 /	0.47 = 1.4	89						





## **Forest land converted to Settlements – Biomass (Abrupt)**

Biomass change	(G&L) Biomass (G&L -	Abrupt) Biomass (SD	- Approaches 2&3)	DOM (G&L) DOM (SE	) - Approaches 2&3)	SOM Mineral - Eq. 2.	25 Formulation B	60M (SD - Approaches	s 2&3) SOM Organ	ic Drained SOM Or	ganic Rewetted T	Total Net CO2 Emission	/ Removal	
Sector: Category:	Agriculture, Forestry and Settlements	d Other Land Use												2000
Subcategory: Sheet:	3.B.5.b.i - Forest Land o Initial change in biomas	converted to Settlements s carbon stocks on land c	converted to another la	and category (abrupt chan	pe)									
Data														
Region Re	gion 2	✓ - Approach 2												
	Land use categor	у						Equation 2.16						
			Area (ha)	Unit	Above-ground biomass before the conversion (t U / ha)	Above-ground biomass after the conversion (t U / ha)	Ratio of below- ground biomass to above-ground biomass before the conversion (t bg U / t ag U)	Biomass carbon fraction before the conversion (tonnes C / tonne U)	Biomass C stocks before the conversion (tonne C / ha)	Ratio of below- ground biomass to above-ground biomass after the conversion (t bg U / t ag U)	Biomass carbon fraction after the conversion (tonnes C / tonne U)	Biomass C stocks after the conversion (tonne C / ha)	Annual change in carbon stocks in biomass (tonnes C / yr)	
Land unit code	Initial land use	Land use during reporting year	National statistics or international data sources	d.m. or C	National statistics or international data sources	National statistics or international data sources	Zero (0) or Table 4.4 / 4.5 WS / National statistics or international data sources	0.47 / Table 4.3 / 0.451 WS mangroves	CB(b) = AB(b) * (1+R(b)) * CF(b)	Zero (0) or Table 4.4 / 4.5 WS / National statistics or international data sources	0.47 / Table 4.3 / 0.451 WS mangroves	CB(a) = AB(a) * (1+R(a)) * CF(a)	ΔCB = (CB(a) - CB (b)) *ΔA	
7			ΔΑ	U	AB(b)	AB(a)	R(b)	CF(b)	CB(b)	R(a)	CF(a)	CB(a)	ΔCB	
UFL-TF	Unmana   Mangrov	Settleme   Urban p	100.000	d.m.	192.000	1.489	0.490	0.451	129.022	0.330	0.47	0 0.931	-12,809.131	227
									129.022			0.931	-12,809.131	



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

Biomass chang	e (G&L) Biomass	(G&L - Abrupt)	Biomass (SD - Approa	aches 2&3) DOM (G&	L) DOM	(SD - Approaches	2&3) SC	DM Mineral - Eq. 2	.25 Formulation B S	DM (SD - Approach	es 2&3) SOM O	rganic Drained	SOM Organic Rewe	tted Total Net C	CO2 Emission / Rer	noval	
Sector: Category: Subcategory: Sheet: Data	Agriculture, Fore Settlements 3.B.5.b.i - Fores Annual net C sto	stry and Other Lar Land converted t ock change in bior	nd Use o Settlements nass - Gain & Loss meth	nod													2015
Region F	egion 2	× - A	pproach 2														
			Land use cate	gory					Equation 8.	2 (Tier 2a)			Equation 8	.3 (Tier 2b)			
			Area (ha)	Class	Age older than active growing period (AGP)	Method	Disaggr egate in above- ground below- ground biomass	Total crown cover area of class i (ha)	Crown cover area- based growth rate o class i (tonnes C / ha / yr)	Ratio of below- f ground biomass to above-ground biomass (t bg C / t ag C)	Annual net accumulation in biomass carbon stocks based on total crown cover area (tonnes C / yr)	Number of individuals of class i	Annual average carbon accumulation per class i (tonnes C / yr)	Ratio of below- ground biomass to above-ground biomass (t bg C / t ag C)	Annual net accumulation in biomass carbon stocks based on individual plants (tonnes C / yr)	Annual change in carbon stocks in biomass (tonnes C / yr)	
Land unit code	Initial land use	Land use dur reporting ye	National ing statistics or international data sources					National statistics or international data sources	Table 8.1 or Nationa data		ΔCB(T2a) = A(i) * CRW(i) * (1+R)	National statistics or internation al data sources	Table 8.2 or National data		ΔCB(T2b) = N(i) * C(i) * (1+R)	ΔCB=ΔCB(T2a) or ΔCB(T2b)	
V		7 47	ΔV A	i V	V V	<u>م</u>	V V	A(i)	CRW(i)	R	ΔCB(T2a)	N(i)	C(i)	R	ΔCB(T2b)	ΔCB	
VFL-T	Unman Mangr	Settle Urb	an 100.00	0 Class 1		Eq. 8.3		-				10,000.000	0.007	0.330	93.100	93.100	237
UFL-T	Mangr	-		Class 2		Eq. 8.2		0	0								
UEL-T	Mangr	-				Eq. 8.2		A	<b>A</b>								
Total	mangr			01000 4		Lq. 0.2		•	•								
											0.000				93.100	93.100	





#### 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<sup>-1</sup> respectively

DOM in Urban Park is Negligeable





#### **Forest land converted to Settlements – DOM**

Biomass change (G	&L) Biomass (G	i&L - Abrupt) B	iomass (SD - App	roaches 2&3)	DOM (G&L) DOM (SD - Approache	s 2&3) SOM Mineral - Eq. 2	2.25 Formulation B SOM (S	D - Approaches 2&3) SOM	1 Organic Drained SOM O	rganic Rewetted Total Net C	CO2 Emission / Removal	
Worksheet Sector: Category: Subcategory: Sheet: Data	Agriculture, Forestr Settlements 3.B.5.b.i - Forest La Annual net C stock	y and Other Land and converted to change in dead	Use Settlements organic matter (Ga	in & Loss method)								2000
Region Regio	n 2	<u> </u>	proach 2		1							
	La	nd use category	·					Equation 2.18				
					DOM C pool	Area (ha)	Average annual transfer of biomass into the dead wood or litter pool due to annual processes and disturbances (t d.m. or C / ha / yr)	Average annual decay and disturbance carbon loss out of dead wood or litter pool (t d.m. or C / ha / yr)	DOM Unit	Carbon fraction of dry matter (tonnes C / tonne d.m.)	Annual change in carbon stocks in dead wood/litter (tonnes C / yr)	
Land unit code	Initial I	and use	Land use durin	g reporting year		National statistics or international data sources	See Chapter 2. Section 2.3.2.1	See Chapter 2. Section 2.3.2.1		for litter IPCC default is 0.37	ΔC(DOM) = A* (DOMin - DOMout) * CF	
7	7 47	Δ7	✓ Δ ¬		V	А	DOMin	DOMout		CF	ΔC(DOM)	
UFL-TFL_20	Unmanaged	Mangroves f	Settlements (	Urban park	Dead wood	100.000	0.000	10.700	(t C/ha/yr)	1.000	-1,070.000	
		Mangroves f			Litter		0.000	0.700	(t C/ha/yr)	1.000	-70.000	
Total											1 140 000	
d											-1,140.000	





## **Forest land converted to Settlements – SOM Drained**

ID	SOM Drained
	$EF(os) - DOC(flux) - \Delta DOC - Frac(DOC)$
OFL-13L_2000-1	IPCC Default values for Temperate climate region

Non-CO<sub>2</sub> emissions are estimated in categories 3.C.4, .8, .9



#### **Forest land converted to Settlements – SOM Drained**

Biomass change	e (G&L)	Biomass (G&L-	Abrupt)	) Biomass (	SD - Approach	es 2&3) DOM (G&L)	DOM (SD - Approaches 2	2&3) SOM Mineral - Ec	q. 2.25 Formulation B	60M (SD - Approaches 28	(3) SOM Organic Drain	ed SOM Organic Rewe	tted Total Net CO2 En	nission / Removal	
Sector: Category: Subcategory: Sheet: Data	Agricu Settle 3.B.5. Annua	ulture, Forestry and ments .b.i - Forest Land c al net C stock cha	d Other converte	Land Use ed to Settlemen soil organic mat	nts ter of drained o	rganic soils									2015
Region R	egion 2		~	- Approach 2	2										
		Land use ca	tegory							quation 2.2, 2.3, 2.4, 4.8 V					
						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 and nutrient status of p in drain (tonnes CO)	factor for climate type eat and drainage class ed soils 2-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 cod	de	Initial land use		Land use duri yea	ng reporting ar	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 V or nationa	VS / Eq. 2.5 Il statistics	From 3.C.1	CO2-C(d) = A(d) * (EF (os) + EF(DOC)) + L (fd)	
	V	ΔV	ΔV	ΔV	ΔV	A(d)	EF(os)	DOC(flux)	ΔDOC	Frac(DOC)		EF(DOC)	L(fd)	CO2-C(d)	
UFL-TFL	Unma	anage Mangro	ves	Settlement	Urban park	100.000	7.9	0.210	0.600	0.900	Calculated	0.302		820.240	
lotal						100.000								820.240	





#### **Wetlands converted to Settlements**





## Wetlands converted to Settlements – Biomass (Abrupt)

*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<sup>-1</sup>

All SOC is extracted to convert to Harbor





#### Wetlands converted to Settlements – SOM Extracted

Biomass change (G&L) Worksheet Sector: Agricul Category: Settler Subcategory: 3.B.5.b Sheet: Annual Data Region Region 2	Biomass (G&L - Abrupt) Biomass (SD - Ap ture, Forestry and Other Land Use ents .iv - Wetlands converted to Settlements net stock change in soil organic matter (Stock	pproaches 2&3) DOM (G&L) DOM (SD - «-Difference) - Approaches 2&3	Approaches 2&3) SOM Mineral - E	q. 2.25 Formulation B SOM (SD - A	SOM Organic Drain	ad SOM Organic Rewetter	d Total Net CO2 Emission / Remova	2020
	Land use category				quation 2.5 - Approach 2 or 3			
			Area (ha)	SOC at at the end of the time period (tonnes C / ha)	SOC at the beginning of the time period (tonnes C / ha)	Number of years over a single inventory time period (Year)	Annual SOC change (tonnes C / yr)	
Land unit code	Initial land use	Land use during reporting year	National statistics or international data sources	National statistics or international data sources	National statistics or international data sources		ΔSOC = [(SOC(t2) - SOC(t1)) / T] * Α	
V			A	SOC(t2)	SOC(t1)	т	ΔSOC	
UWL-OSL_2020_1	Unmanaged Wetl Tidal marshes (un	Settlements (Other) Harbor	50.000	0.000	255.000	1.000	-12,750.000	
Total			50.000				10 750 000	
			50.000				-12,750.000	











## 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	BCEFI	BCEFs	BCEF <sub>R</sub>	SOC <sub>REF</sub>	F <sub>LU</sub>
1	Forest land	Managed	Secondary forest			0.220	0.470		unspecified						0.670		63.000	1.000
	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	Unmanaged	Mangroves forest	192		0.490	0.451		unspecified									
	Cropland	Annual	Maize	5.8		0.220											80	0.690
 3	Cropland	Annual	Rice	3.8		0.160											80	0.690
 5	Cropland	Perennial	Poplar (5)	35	7	0.310							5				80	1.000
	Cropland	Perennial	Poplar (10)	130	13	0.190							10				80	1.000
	Cropland	Annual	Lotus (long-term)	3.57*		0.000											68	1.000
 2	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												
2	Wetlands	Unmanaged	Tidal marshes	33.4*		0.500												
2	Settlements	Treed	Urban park	67		0.330	0.47				30	4						
	Settlements	Other	Harbor								L							
1	Settlements	Other	Buildings	13.5		0.340	0.47										63	0.800
* annual a	verage includ	ing belowground	d															
** Herbao	ceous biomas	S																





# **Cropland remaining Cropland – Biomass (G&L)**

Biomass change		M (SD - Appro	aches 2&3)	SOM Organi	c Drained SOM Organ	nic Rewetted		D - Approach 1) DOM	1/SD - Approzohen 283	) Total Not CO2 Emi	anion / Removal SOI	Mineral - Eq. 2.25 For	nulation A SOM Min	aral - Ea. 2.25 Earmulati	on P	
Sector: Category: Subcategory: Sheet: Data	Agriculture, Cropland 3.B.2.a - Cro Annual net	Forestry and C ppland Remain C stock chang	ottipty Bioth Other Land Use ning Cropland je in biomass -	Gain & Loss m	ethod	- Approacties 2003		D - Approach I)   DOM	n (3D - Approaches zoc		SSIGH HEHOVAL SO	4 Millerun - Eq. 2.29 For		erar Eq. 2.23 Formulau	2	)20
Region Reg	gion 3		- Арргоа	ach 3												
	Lan	d use categor	ſy						Equat	ion 2.7						
					Area (ha)	Average area- specific annual accumulation rate of above-ground biomass (perennial) (tonnes C / ha / yr) or (tonnes d.m. / ha / vr)	Average annual growth of perennial above-ground biomass (tonnes C / yr)	Area with perennial biomass that is disturbed/cleared in the year (ha)	Above-ground biomass in the area disturbed/cleared (tonnes C / yr) or (tonnes d.m. / yr)	Fraction of biomass lost	Perennial biomass loss (tonnes C / yr)	Ratio of below- ground biomass to above-ground biomass (t bg d.m. / t ag d.m.) or (t bg C / t ag C)	Carbon fraction of perennial biomass dry matter (tonnes C / tonne d.m.)	Annual change in carbon stocks in biomass (tonnes C / yr)		
Land unit code	Initial I	and use	Land us reporti	e during ng year	National statistics or international data sources	National statistics or international data sources	ΔCg=A*G*(1+R)*CF	National statistics or international data sources	IPCC default or national/international data	National data	ΔCI=AI*B*fd*(1+R) *CF	IPCC default or national/international data	IPCC default or national/international data	$\Delta Cb = \Delta Cg - \Delta CI$		
V	Δγ	Δ7	ΔV	ΔV	A		ΔCg	AI	В	fd	ΔCI	R	CF	∆Cb		
CL-CL_41	Cropland	Maize	Cropland	Poplar (1	50.000	13.000	650.000		130.000			0.000	1.000	650.000		
CL-CL_71		Maize		Poplar (1	50.000	13.000	650.000		130.000			0.000	1.000	650.000		
CL-CL_21		Maize		Poplar (1	50.000	13.000	650.000		130.000			0.000	1.000	650.000		
CL-CL_11		Rice		Poplar (1	50.000	13.000	650.000		130.000			0.000	1.000	650.000		
CL-CL_31		Rice	-	Poplar (1	50.000	13.000	650.000		130.000			0.000	1.000	650.000		+
CL-CL_51	Coordinated	Rice	Coordinat	Poplar (1	50.000	13.000	650.000		130.000			0.000	1.000	650.000		+
CL-CL_50	Cropland	Popiar (1	Cropiand	Maize	50.000				5.800			0.000	1.000	0.000		+-
		Poplar (1	-	Piece	50.000				5.800			0.000	1.000	0.000		+
		Poplar (1	-	Rice	50.000				3.800			0.000	1.000	0.000		+-
Total				1400	50.000			1	5.000	1		0.000	1.000	0.000		
					500.000		3,900.000	0.000			0.000			3,900.000		

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

**DCC** 



# **Cropland remaining Cropland – Biomass (Abrupt)**

SOM (SD - Appro Biomass change Worksheet	ach (1) - S (G&) Bi	omass (G&L·	- Abrupt)	) SOM O iomass (SD	rganic Drained SOM - Approach 1) Biom	I Organic Rewetted ass (SD - Approaches 2&	3) DOM (G&L) D(	DM (SD - Approach 1)	) DOM (SD - Appro	aches 2&3) Total N	et CO2 Emission / Re	moval SOM Minera	al - Eq. 2.25 Formulati	ion A SOM Mineral	I - Eq. 2.25 Formulation	B 2020
Category: Subcategory: Sheet: Data	Cropland 3.B.2.a - Initial cha	Cropland Rem ange in biomas	naining Cropla ss carbon sto	nd cks on land c	converted to another lar	nd category (abrupt change	ə)									2020
Region Reg	gion 3		✓ - Ap	proach 3												
	Land	d use catego	гу							Equation 2.16						
					Area (ha)	Unit	Above-ground biomass before the conversion (t U / ha)	Above-ground biomass after the conversion (t U / ha)	Ratio of below- ground biomass to above-ground biomass before the conversion (t bg U / t ag U)	Biomass carbon fraction before the conversion (tonnes C / tonne U)	Biomass C stocks before the conversion (tonne C / ha)	Ratio of below- ground biomass to above-ground biomass after the conversion (t bg U / t ag U)	Biomass carbon fraction after the conversion (tonnes C / tonne U)	Biomass C stocks after the conversion (tonne C / ha)	Annual change in carbon stocks in biomass (tonnes C / yr)	
Land unit code	Initial I	land use	Land us reportir	e during ng year	National statistics or international data sources	d.m. or C			National data	IPCC default or national/internation al data	CB(b) = AB(b) * (1+R(b)) * CF(b)	National data	IPCC default or national/internation al data	CB(a) = AB(a) * (1+R(a)) * CF(a)	ΔCB = (CB(a) - CB (b)) *ΔA	
V	Δγ	Z ∆ V	ΔV	ΔV	ΔA	U	AB(b)	AB(a)	R(b)	CF(b)	CB(b)	R(a)	CF(a)	CB(a)	ΔCB	
CL-CL	Cropland	Maize	Cropland	Poplar (1	50.000	С	5.800	13.000	0.220	1.000	7.076	0.310	1.000	17.030	497.700	
		Maize		Poplar (1	50.000	C	5.800	13.000	0.220	1.000	7.076	0.310	1.000	17.030	497.700	
		Rice		Poplar (1	50.000	C	3.800	13.000	0.160	1.000	4.408	0.310	1.000	17.030	631.100	
	Cropland	Poplar (1	Cropland	Maize	50.000	C	130.000	5.000	0.160	1.000	4.408	0.310	1.000	7.030	-8 161 200	
CL-CL_	or op and	Poplar (1	and plana	Maize	50.000	c	130.000	5.800	0.310	1.000	170.300	0.220	1.000	7.076	-8,161.200	
CL-CL		Poplar (1		Rice	50.000	С	130.000	3.800	0.310	1.000	170.300	0.160	1.000	4.408	-8,294.600	2
CL-CL		Poplar (1		Rice	50.000	С	130.000	3.800	0.310	1.000	170.300	0.160	1.000	4.408	-8,294.600	2 🖬 🄈
Total																
											704.168			91.088	-30,654.000	

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**

SOM Organic Draine	ed SOM Orga	anic Rewetted	Total Net CO2	Emission / Ren	noval					_					
Biomass change (G	&L) Biomass	(G&L - Abrupt)	Biomass (SD	) - Approach 1)	Biomass (SD - Approache	es 2&3) DOM (G&L) [	OOM (SD - Approach	1) DOM (SD - Approac	hes 2&3) SOM Mineral -	Eq. 2.25 Formulation A	SOM Mineral - Eq. 2.25 Fo	rmulation B SOM (SD - )	Approach 1) SOM (SD - A	pproach	ies 2&3)
Worksheet Sector	Agriculture Fore	stry and Other I	and Use												2020
Category:	Cropland		dilu Use												2020
Subcategory:	3.B.2.a - Croplar	nd Remaining Cr	opland												
Sheet:	Annual net C sto	ock change in so	oil organic matte	r of mineral soils ·	- Approach 2 and Approach 3	3 (Default method)									
Data															
Region Region	n 3	~ -	Approach 3												
	Lan	id use category							Equation 2.25 - B						
					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)	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)		
Land unit code	Initial I	and use	Land use du y	ring reporting ear	National statistics or international data sources	Tables 2.3 / 5.2 WS	Default value is 20	National statistics or international data sources	National statistics or international data sources	National statistics or international data sources	SOC(0) = SOCref * Flu (0) * Fmg(0) * Fi(0)		ΔCmineral = ((SOC(0) - SOC(c)) *A ) / D		
V	ΔV	ΔV	Δ7	ΔV	A	SOCref	D	Flu(0)	Fmg(0)	Fi(0)	SOC(0)	SOC(c)	ΔCmineral		
CL-CL_10	Cropland A	Maize	Cropland P	Poplar (10	50.000	80.000	20.000	1.000	1.000	1.000	80.000	78.657	3.357		
CL-CL_30		Maize		Poplar (10	50.000	80.000	20.000	1.000	1.000	1.000	80.000	78.657	3.357		
CL-CL_41		Maize		Poplar (10	50.000	80.000	20.000	1.000	1.000	1.000	80.000	78.529	3.677		
CL-CL_71		Maize	-	Poplar (10	50.000	80.000	20.000	1.000	1.000	1.000	80.000	78.529	3.677		
CL-CL_21		Maize	-	Poplar (10	50.000	80.000	20.000	1.000	1.000	1.000	80.000	78.785	3.038		
CL-CL_11		Rice	-	Poplar (10	50.000	80.000	20.000	1.000	1.000	1.000	80.000	87.948	-19.870		
CL-CL_20		Rice	-	Poplar (10	50.000	80.000	20.000	1.000	1.000	1.000	80.000	80.948	-2.370		
CL-CL_31		Rice	-	Poplar (10	50.000	80.000	20.000	1.000	1.000	1.000	80.000	87.948	-19.870		
CL-CL_51		Rice	-	Poplar (10	50.000	80.000	20.000	1.000	1.000	1.000	80.000	87.692	-19.231		
CL-CL_/0		Rice		Poplar (10	50.000	80.000	20.000	1.000	1.000	1.000	80.000	80.756	-1.890		
CL-CL_50	Cropland P	Poplar (10	Cropland A	Maize	50.000	80.000	20.000	0.690	1.000	0.920	50.784	83.846	-82.656		
CL-CL_61		Poplar (10	-	Maize	50.000	80.000	20.000	0.690	1.000	0.920	50.784	80.453	-/4.172		
CL-CL_40		Poplar (10	-	Rice	50.000	80.000	20.000	1.100	1.080	0.920	8/.43/	/9.265	20.431		
Tatal		- Popiai' (10		Rice	50.000	80.000	20.000	1.100	1.080	0.920	87.437	80.453	17.461		
I OTAI					700.000								-165.060		
					, 00.000								133.000		





Tool:

#### Land Representation

#### 3.C.1 Calculation Worksheets





#### **Forest land**





# 3.C.1.a Burning in Forest Land – Data

CO<sub>2</sub> emissions are expected to be estimated as C stock losses in 3.B.1 – Forest land

ID				D	istur	oances
ID	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 bo	th Bio	mass &	& DO	мср	ool	
Biomass stock (d.r	n.) = 1	64.34				
Combustion factor	= 0.5	9				
DOM stock (d.m.)	) = 11.	07 + 5	.53 = <b>1</b>	6.60		
Combustion factor	= 0.6	1				
SOM stock (d.m.)	= 353					
EF = IPCC defaul	t value	es for l	Ггоріс	al Clin	nate	



INTERGOVERNMENTAL PANEL ON Climate change

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

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

Fire types and are	as burnt Emissions from burning (1 of 2	Emissions from burning (2 of 2)											
Subcategory: Subcategory: Data Region (All)	Agriculture, Forestry and Other Land Use Burning 3.C.1.a - Burning in Forest Land Fire types and areas burnt												2020
Land unit	Initial land use	Land use during reporting year	Prescribed burning of savannas	Fire type	Fire type subdivision	Area burnt (ha)		Avai	lable C pools			CO2 Emissions Reporting	
7	Δ.Υ		V	FT ∆⊽	FTS ∆⊽	А	Biomass+DOM ∨	Biomass perennial ∀	Biomass annual ⊽	ООМ ∨	SOM (peat)	Biomass perennial ⊽ DOM ⊽	
MFL-MFL_1 *	Managed Forest Land Forest plantation	n Managed Forest Land Forest plantation	U Wi	/ildfires	Wildfire	1,000.000							

✓ CO<sub>2</sub> emissions from <u>Biomass</u> and <u>DOM</u> are expected to be estimated as C stock losses
 Thus, CO<sub>2</sub> emissions reporting for <u>Biomass</u> as well as for <u>DOM</u> is left unchecked



INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE

# 3.C.1.a Burning in Forest land – CO<sub>2</sub>

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

Fire types and are Worksheet Sector: Category: Subcategory: Sheet: Data Region (All)	eas burnt Emissions f Agriculture, Forestry ar Burning 3.C.1.a - Burning in Fo Sheet 1 of 2 - Emission	rom burning nd Other Lar rest Land ns from burni	g (1 of 2) nd Use ing in Forest Gas CARB	Emissions f Land (Fores 30N DIOXIE	trom burning st land remain DE (CO2)	) (2 of 2) ning Forest land)										20	)20
	Land	use categor	гу						Equation 2.27 of the 20	06 IPCC Guidelines	and Equation 2.8 of the	Wetlands Supplem	ient				
						Fire type	Fire type subdivision	Area burnt (ha)	Mass of fuel availab (tonnes d.	le for combustion m. / ha)	Combustion factor	Mass of fue (tonnes	el consumed d.m. / ha)	CO2 Emission Factor (g/kg dm burnt)	CO2 Emissions from fire (tonnes)		
L	and unit	Initial I	and use	Land us reporti	se during ng year	FT	FTS	А	Mb		Cf		FC = Mb*Cf or specified	Gef	Lfire		
	V	۵Ţ	× ۵۷	۵v		v V	V		C pool 🛛 🖓	Stock	Table 2.6		Table 2.4 WS Table 2.6	Table 2.5 WS Table 2.7	A*FC*Gef/ 1000		
MFL-MFL_1	1	Manage	Forest p	Manage	Forest p	Wildfires	Wildfire	1,000.000	Biomass perennial	164.340	0.59	Calculated	96.961	1,580	153,197.748	7	
MFL-MFL_1	1								DOM	16.600	0.61	Calculated	10.126	1,580	15,999.080	2	
MFL-MFL_1	1								Peat (SOM)	353.000	1.000	Calculated	353.000	464	163,792.000		
Total													460.087		332,988.828		

**CO<sub>2</sub> emissions** from <u>Biomass</u> and <u>DOM</u> are expected to be **estimated as C stock losses** Thus, **CO<sub>2</sub> emissions reporting** for <u>Biomass</u> as well as for <u>DOM</u> is **left unchecked** 



INTERGOVERNMENTAL PANEL ON Climate change

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### 3.C.1.a Burning in Forest land – CH<sub>4</sub>

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

Fire types and are Worksheet Sector: Category: Subcategory: Sheet:	eas burn Emissions fr Agriculture, Forestry an Burning 3.C.1.a - Burning in For Sheet 1 of 2 - Emission	om burning d Other Land est Land s from burnin	(1 of 2) d Use ng in Forest	Emissions fr Land (Forest	om burning : land remair	(2 of 2) hing Forest land)										2020
Region (All)	1	~ G	ias METH	HANE (CH4)		~										
	Land u	se category	/						Equation 2.27 of the 20	06 IPCC Guidelines	and Equation 2.8 of the	Wetlands Supplem	ient			
						Fire type	Fire type subdivision	Area burnt (ha)	Mass of fuel availab (tonnes d	le for combustion .m. / ha)	Combustion factor	Mass of fue (tonnes	el consumed d.m. / ha)	CH4 Emission Factor (g/kg dm burnt)	CH4 Emissions from fire (tonnes)	
La	and unit	Initial Ia	nd use	Land us reportir	e during ng year	FT	FTS	A	Mb		Cf		FC = Mb*Cf or specified	Gef	Lfire	
	V	۵V	۵Ţ	۵V	۵Ţ	V	V		C pool 🛛 🖓	Stock	Table 2.6		Table 2.4 WS Table 2.6	Table 2.5 WS Table 2.7	A * FC * Gef / 1000	
MFL-MFL_1	1	Manage	Forest p	Manage	Forest p	Wildfires	Wildfire	1,000.000	Biomass perennial	164.340	0.59	Calculated	96.961	6.8	659.332	2
MFL-MFL_1	1								DOM	16.600	0.61	Calculated	10.126	6.8	68.857	2
MFL-MFL_1	1								Peat (SOM)	353.000	1.000	Calculated	353.000	21	7,413.000	22)
Total													460.087		8,141.189	





# 3.C.1.a Burning in Forest land – N<sub>2</sub>O

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

Fire types and are Worksheet Sector: Category: Subcategory: Sheet: Data	Agriculture, Forestry an Burning 3.C.1.a - Burning in For Sheet 1 of 2 - Emission	rom burning Id Other Lan rest Land Is from burnin	i (1 of 2) id Use ng in Forest	Emissions f Land (Fores	rom burning t land remair	(2 of 2) ning Forest land)										2020
Region (AI)		~ G	ias NITR	OUS OXIDE	E (N2O)	$\sim$										
	Land u	ise categor	у						Equation 2.27 of the 200	6 IPCC Guidelines	and Equation 2.8 of the	Wetlands Supplem	ent			
						Fire type	Fire type subdivision	Area burnt (ha)	Mass of fuel availabl (tonnes d.)	e for combustion n. / ha)	Combustion factor	Mass of fue (tonnes	el consumed d.m. / ha)	N2O Emission Factor (g/kg dm burnt)	N2O Emissions from fire (tonnes)	
La	and unit	Initial Ia	and use	Land us reporti	e during ng year	FT	FTS	А	Mb		Cf		FC = Mb*Cf or specified	Gef	Lfire	
	Ą	۵Ţ	۵v	۵v	۵Ţ	₽	V		C pool 🛛 🏹	Stock	Table 2.6		Table 2.4 WS Table 2.6	Table 2.5 WS Table 2.7	A * FC * Gef / 1000	
MFL-MFL_1		Manage	Forest p	Manage	Forest p	Wildfires	Wildfire	1,000.000	Biomass perennial	164.340	0.59	Calculated	96.961	0.2	19.392	2
MFL-MFL_1									DOM	16.600	0.61	Calculated	10.126	0.2	2.025	
MFL-MFL_1									Peat (SOM)	353.000	1.000	Calculated	353.000	0.000	0.000	2 🖬 🄈
Total													460.087		21.417	





# 3.C.1.a Burning in Forest land – SOM

Biomass gains (G&L SOM Mineral - Eq. 2 Worksheet Sector: Category: F Subcategory: S Sheet: A Data	1/4) Biomas 25 Formulation Agriculture, Fores Forest Land 8.B.1.a - Forest Ia Annual net C sto	s loss (G&L 2/4 B SOM (SD stry and Other L and Remaining ck change in so	<ul> <li>Biomass k</li> <li>Approach 1)</li> <li>and Use</li> <li>Forest land</li> <li>organic matter</li> </ul>	oss (G&L 3/4) SOM (SD - er of drained org	Biomass loss (G21 4/4) Approaches 283) SOM anic soils	Pierros (C.8) Organic Drained	ot) Biomass (SD - Appr I Organic Rewetted To	oach 1) Biomass (SD tal Net CO2 Emission / R	- Approaches 2&3) DO lemoval	M (G&L) DOM (SD - A	pproach 1) DOM (SD -	Approaches 2&3) SOM	1 Mineral - Eq. 2.25 Form	ulation A
Region Region	12	~ -	Approach 2											
	Land	use category						Eq	uation 2.2, 2.3, 2.4, 4.8 V	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 and nutrient status of p in drain (tonnes CO	factor for climate type eat and drainage class ed soils 2-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 I	and use	Land use du yı	ring reporting ear	National statistics or international data sources	Table 4.6 / 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 V or nationa	VS / Eq. 2.5 Il statistics	From 3.C.1	CO2-C(d) = A(d) * (EF (os) + EF(DOC)) + L (fd)	
7	7 47	ΔV	Δ7	A∆	A(d)	EF(os)	DOC(flux)	ΔDOC	Frac(DOC)		EF(DOC)	L(fd)	CO2-C(d)	
MFL-MFL_1	Managed	Forest plan	Managed	Forest pla	2,000.000	2.6	0.210	0.600	0.900	Calculated	0.302	44,670.545	50,475.345	200
UFL-MFL_20	Unmanag	Primary Fo	-	Forest pla	600.000	2.6	0.210	0.600	0.900	Calculated	0.302		1,741.440	
UFL-MFL_20	· _	Primary Fo	-	Forest pla	350.000	2.6	0.210	0.600	0.900	Calculated	0.302		1,015.840	
UEL-MEL 20	· _	Primary Fo	-	Forest pla	1/5.000	2.6	0.210	0.600	0.900	Calculated	0.302		246 704	
Total		rinnary ro		r orost più	05.000	2.0	0.210	0.000	0.500	Calculated	0.502		240.704	
					3,210.000								53,987.249	

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



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# Cropland





# **3.C.1.b Burning in Cropland – Data**

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### **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
  - ✓  $CH_4 EF = 3.7$
  - $\checkmark \ N_2 O \ EF = 0.25$



# **3.C.1.b Burning in Cropland**

Fire types and are Worksheet Sector: Category: Subcategory: Sheet: Data Region (All)	as burnt Emiss Agriculture, Fore Burning 3.C.1.b - Burning Sheet 1 of 2 - E	ions from l stry and Ot in Croplan nissions fro	burning (1 her Land I d m burning <b>Gas</b>	of 2) En Use in Cropland	nissions fr I (Cropland ANE (CH4)	rom burning (2 of 2)												2020
	Land	use catego	ry						Equation 2	2.27 of the 2006	PCC Guidelines and	Equation 2.8 of t	he Wetlands Suppler	ment				
						Crop category	Crop subcategory	Fire type	Fire type subdivision	Area burnt (ha)	Mass of fuel av combus (tonnes d.r	vailable for tion m. / ha)	Combustion factor	Mass of fu (tonnes	el consumed d.m. / ha)	CH4 Emission Factor (g/kg dm burnt)	CH4 Emissions from fire (tonnes)	
Land	d unit	Initial I	and use	Land us reporti	e during ng year	Cc	Cs	FT	FTS		Mb		Cf		FC = Mb*Cf or specified	Gef	Lfire	
	7	ν <b>Δ</b> γ	ΔŢ		۵Ţ		A	V	V		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_20	)20-1	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	230
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	2
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															000 070		E1 E00	
1															278.800		01.028	

re types and area orksheet ector: ategory: ubcategory: heet: )ata egion (All)	Agriculture Burning 3.C.1.b - I Sheet 1 o	Emissio re, Forest Burning in of 2 - Emis	ns from b ry and Oth n Cropland ssions fron	ner Land U ner Land U n burning i Gas	of 2) Er Ise n Cropland NITRO	nissions fr d (Cropland US OXIDE	rom burning (2 of 2) I remaining Cropland) E (N2O) ~												2020
		Land us	e catego	ry						Equation 2	2.27 of the 2006 li	PCC Guidelines and	Equation 2.8 of	the Wetlands Supple	ment				
							Crop category	Crop subcategory	Fire type	Fire type subdivision	Area burnt (ha)	Mass of fuel a combus (tonnes d.	vailable for stion m. / ha)	Combustion factor	Mass of fu (tonnes	el consumed d.m. / ha)	N2O Emission Factor (g/kg dm burnt)	N2O Emissions from fire (tonnes)	
Land	unit		Initial la	and use	Land us reporti	e during ng year	Cc	Cs	FT	FTS	A	Mb		Cf		FC = Mb*Cf or specified	Gef	Lfire	
		V	ΔŢ	ΔŢ	۵v		م	V	V	V		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_20	20-1		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	2 🖬 🤈
PCL-PCL_1					Cropla	Oil Pal					114.000	Biomass+DOM	54.000	0.850	Calculated	45.900	0.250	1.308	2
CL-CL_50				Poplar	Cropla	Maize	poplar	poplar			50.000	Biomass+DOM	55.000	0.850	Calculated	46.750	0.220	0.514	2
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	2
												Biomass+DOM	55.000	0.850	Calculated	46.750	0.220	0.514	
otal																278 800		3 123	

WMC

### Grassland





# **3.C.1.c Burning in Grassland – Data**

CO<sub>2</sub> emissions are expected to be estimated as C stock losses in 3.B.3 – Grassland

ID		Disturbance	s - Prescribed	l burning of s	avannas (ha)									
ID	1995	2000	2005	2010	2015	2020								
MGL-1	200	189	188	187	186	186								
Every year 1/10 <sup>th</sup> of grazed land is burnt for regeneration (bad practice!)														
Every year 1/10 <sup>th</sup> 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 = $0.0$	57													
DOM stock (d.m.) = 0	+ 0.78 = 0.78													
Combustion factor = $0.9$	95													
EF = IPCC default valu	es for Tempera	te Climate												





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

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

Fire types and	areas burnt Emissions from bu	rning (1 of 2) Emissions from bu	rning (2 of 2)									
Sector: Category: Subcategory Sheet: Data	Agriculture, Forestry and Othe Burning : 3.C.1.c - Burning in Grassland Fire types and areas burnt	er Land Use										2020
Region	(III) ~											
Land unit	Initial land use	Land use during reporting year	Burning of agricultural residue	Crop category	Crop subcategory	Prescribed burning of savannas	Fire type	Fire type subdivision	Area burnt (ha)	Available C pools	CO2 Emissions Reporting	
<b>▽</b>			7	Cc V	Cs 🗸	V		FTS △▽	А	Biomass +DOM ∀ Biomass perennial ∀ Biomass ∀ DOM ∀ SOM , (peat)	, Biomass perennial ▽ DOM ▽	
₩ MGL_1 ₩	Managed Grassland Grazed	Managed Grassland Grazed					Control	Prescribed fire (surf	186.000			2 🖬 🄊 🗙 2

✓ Given Grazed land contains annual biomass only, no CO<sub>2</sub> emissions from biomass are reported

✓ **CO<sub>2</sub> emissions** from <u>DOM</u> are expected to be **estimated as C stock losses** 

Thus, **CO<sub>2</sub> emissions reporting** for <u>DOM</u> is **left unchecked** 



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# 3.C.1.a Burning in Grassland – CO<sub>2</sub>

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

Fire types and a Worksheet Sector: Category: Subcategory: Sheet: Data Region (A	Agriculture, Forestr Burning 3.C.1.c - Burning i Sheet 1 of 2 - Emis	ns from burning (1 of 2 y and Other Land Use n Grassland ssions from burning in Gi	Emissions from bu rassland (Grassland rem CARBON DIOXIDE (CO	nrning (2 of 2) Naining Grassland) 2) v											2020
	Land use category Equation 2.27 of the 2006 IPCC Guidelines and Equation 2.8 of the Wetlands Supplement														
			Crop category	Crop subcategory	Fire type	Fire type subdivision	Area burnt (ha)	Mass of fuel availabl (tonnes d.i	e for combustion m. / ha)	Combustion factor	Mass of fue (tonnes	el consumed d.m. / ha)	CO2 Emission Factor (g/kg dm burnt)	CO2 Emissions from fire (tonnes)	
Land unit	Initial land use	Land use during reporting year	Cc	Cs	FT	FTS		Mb		Cf		FC = Mb*Cf or specified	Gef	Lfire	
V			V	V	V	V		C pool 오	Stock	Table 2.6		Table 2.4 WS Table 2.6	Table 2.5 WS Table 2.7	A*FC*Gef/ 1000	
MGL_1	Manag Grazed	Manag Grazed			Controlled Bur	Prescribed fire (sur	186.000	DOM	0.780	0.67	Calculated	0.523	1,613	156.789	
MGL_1								Biomass annual	13.500	0.95	Calculated	12.825	1,613	3,847.731	2 🖬 🄈
Total															
												13.348		4,004.520	

✓ 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



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## **3.C.1.a Burning in Grassland – CH<sub>4</sub>**

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

Fire types and area Worksheet Sector: Category: Subcategory: Sheet: Data	Agriculture, Fore Burning 3.C.1.c - Burning Sheet 1 of 2 - E	sions from estry and Ot g in Grassla missions fro	burning (1 ther Land U and om burning i	of 2) En Ise n Grasslan	nissions fro d (Grasslan	om burning (2 of 2) d remaining Grassland	d)											2020
Region (All)			Gas	METHA	NE (CH4)	~												
	Land	use catego	ory						Equation 2	2.27 of the 2006 I	PCC Guidelines and	Equation 2.8 of t	the Wetlands Supple	ment				
						Crop category	Crop subcategory	Fire type	Fire type subdivision	Area burnt (ha)	Mass of fuel av combusi (tonnes d.r	vailable for tion m. / ha)	Combustion factor	Mass of fu (tonnes	el consumed d.m. / ha)	CH4 Emission Factor (g/kg dm burnt)	CH4 Emissions from fire (tonnes)	
Land	d unit	Initial	land use	Land us reportin	e during ng year	Cc	Cs	FT	FTS	А	Mb		Cf		FC = Mb*Cf or specified	Gef	Lfire	
	7	7 47	Z _ ∆ \	۵V	۵V	V	V	V	V		C pool 🛛 🖓	Stock	Table 2.6		Table 2.4 WS Table 2.6	Table 2.5 WS Table 2.7	A* FC * Gef / 1000	
MGL_1		Mana	Grazed	Manag	Grazed			Controlled B	Prescribed fire (s	186.000	DOM	0.780	0.67	Calculated	0.523	2.3	0.224	
MGL_1											Biomass annual	13.500	0.95	Calculated	12.825	2.3	5.487	227
Total															13.348		5.710	





# 3.C.1.a Burning in Forest land – N<sub>2</sub>O

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

Fire types and area Worksheet Sector: Category: Subcategory: Sheet: Data Besige (All)	Agriculture, Fore Burning 3.C.1.c - Burning Sheet 1 of 2 - E	sions from estry and O g in Grassla missions fro	burning (1) ther Land U and om burning i	of 2) Em Jse in Grassland	issions fro d (Grasslan	om burning (2 of 2) nd remaining Grassland	d)											2020
	Land	use catego	ory Cas		JS ONIDE	(1120) 🔍			Equation 2	2.27 of the 2006 I	PCC Guidelines and	Equation 2.8 of t	he Wetlands Supple	ment				
						Crop category	Crop subcategory	Fire type	Fire type subdivision	Area burnt (ha)	Mass of fuel av combus (tonnes d.t	vailable for tion m. / ha)	Combustion factor	Mass of fu (tonnes	el consumed ; d.m. / ha)	N2O Emission Factor (g/kg dm burnt)	N2O Emissions from fire (tonnes)	
Land	d unit	Initial	land use	Land use reportir	e during ng year	Cc	Cs	FT	FTS	А	Mb		Cf		FC = Mb*Cf or specified	Gef	Lfire	
		7 47	✓ Δ ▽	ΔV	ΔŢ	 7	V	 7	7		C pool 🛛 🖓	Stock	Table 2.6		Table 2.4 WS Table 2.6	Table 2.5 WS Table 2.7	A*FC*Gef/ 1000	
MGL_1		Mana	Grazed	Manag	Grazed			Controlled B	Prescribed fire (s	186.000	DOM	0.780	0.67	Calculated	0.523	0.21	0.020	
MGL_1											Biomass annual	13.500	0.95	Calculated	12.825	0.21	0.501	237
Total															13.348		0.521	



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# Thank you

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