# IPCC Inventory Software Guide to Land Representation

Draft as of 6 June 2023

## Contents

Introduction	
Land Use Manager (LUM)	4
Land use subdivision mask, top section	
Land use subdivision name	9
Soil Type	
Soil Status	11
Climate Region	
Land use subdivision mask, bottom section	
Forest land	14
Unmanaged Forest land	15
Managed Forest land	
Cropland	
Annual Cropland	19
Perennial Cropland	
Grassland	21
Unmanaged Grassland	
Managed Grassland	23
Wetlands	
Unmanaged Wetlands	
Managed Wetlands	
Settlements	
Settlements (Treed)	
Settlements (Other)	
Other land	
Unmanaged Other land	
Managed Other land	
Reporting requirement for C pools at Tier 1 and Tier 2	
Land Representation Manager (LRM)	
Regions Tab	
Land representation table Tab	
1 <sup>st</sup> level	41
2 <sup>nd</sup> level	
3 <sup>rd</sup> level	
4 <sup>th</sup> level	44
Data input guidance to create a new unit of land	
First step	
Second step	
Third step	
Automatic unit of land codes	

## Guide to Land Representation

Fourth step	
Fifth step	53
Sixth step	54
Seventh step	55
Eighth step	56
Ninth step	57
Data input guidance to add/modify information of a unit of land	
5 <sup>th</sup> level	62
Annual land representation matrix Tab	64
1	

This Guide was prepared by the Technical Support Unit (TSU) of the IPCC Task Force on National Greenhouse Gas Inventories (TFI) to help users of the IPCC Inventory Software.

It has not been subject to formal IPCC review processes.

## Introduction

Data Input in the IPCC Inventory Software -hereafter *Software*- to estimate GHG emissions and removals from Land (3.B) categories in a National Greenhouse Gas Inventory (NGHGI)<sup>1</sup> follows these steps:

- Step 1. Input in the Land Use Manager all land-use subdivisions
- Step 2. Input in the Land Representation Manager all Regions that compose the territory to which the GHG inventory applies
- Step 3. For each Region, input a consistent and independent time-series of activity data in the Land Representation Manager
- Step 4. For each C pool, input C stock gains and losses or C stocks at different points in time (depending on methods selected)

In this **Guide** to Land Representation, guidance to implement Steps 1 to 3 is provided by the Technical Support Unit of the IPCC Task Force on National Greenhouse Gas Inventories (TFI TSU).

Software users must be familiar with the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (2006 IPCC Guidelines) methods and read the Software manual (downloadable from the Help menu) before going through this guide. This guide does not replace guidance provided in the 2006 IPCC Guidelines.

Throughout this guide, text entered in lilac color represents category information taken from the 2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands - (Wetlands Supplement)

<sup>&</sup>lt;sup>1</sup> Same guidance applies to the use of the *Software* for sub-national entities.

## Guide to Land Representation

## Land Use Manager (LUM)

Land Use Manager is a tabbed dialog window. The user can open it from Administrate main menu, AFOLU submenu

IPCC Inventory Software - sandro - [Worksheets]				
💀 Application Database Inventory Year Worksheets	Reports	Tools Export/Import	Administrate Window Help	
2006 IPCC Categories	<b>→</b> ‡	SOM Mineral (SD) SOM	Users	
🐵 1 - Energy	^	Biomass increase (G&L 1/4	Country/Territory	G&L 3/4) Biomass loss (G&L 4/4) Biomass cha
2 - Industrial Processes and Product Use		Worksheet	CO2 Equivalents	
⊞ 1 - Energy     Biomass increase (G&L 1/4     Country/Territory     G&L 3/4     Biomass loss (G&L 4/4)     Biomass       ⊞ 2 - Industrial Processes and Product Use     Workneet     CO2 Equivalents     CO2 Equivalents       ⊞ 3 - Agriculture, Forestry, and Other Land Use     Sector: Agricult     Delete Inventory     Energy       ⊞ 3.8 - Lorest land     Subcategory: 3.B.1.a     Energy     Marcell				
III-3.A - Livestock		Category: Forest I		
Er 3.B - Land		Subcategory: 3.8.1.a	Energy	
3.B.1 - Forest land		Sheet: Annual	AFOLU +	Land Use Manager
3.8.1.a - Forest land Remaining Forest land		Data	Waste	Land Representation Manager
		Region GFOI example	Guidelines Information Texts	Livestock Manager
- 3.B.1.b.ii - Grassland converted to Forest Land		Land	use category	

or from the bottom of any worksheets of 3.B categories

SOM Mineral (SD) SOM Org Biomass increase (G&L 1/4)	anic Drained SOM Org Biomass loss (G&L 2/4)	anic Rewetted Biomass loss (G&L 3/4)	Biomass loss (G&L 4/4)	Biomass change (SD)	Biomass change (Abrupt)	DOM (G&L 1/1)	DOM (SD 1/	1) SOI	M mineral - For	mulation A - IPCC Eq 2	25 (Information Item)	SOM Mineral (App	roaches 2 and 3
Land Use Manager						-	- 0	×					1990
Land use structure  Forest Land  Managed Forest Land Unmanaged Forest Land Cropland Cropland Annual Crops Cropland Perennial Crop	<b>9</b> 1 29										Equa	5on 2.9	
Grassland Managed Grassland Ummanged Grassland Wetlands Managed Wetlands Ummanged Wetlands Settlements Settlements Settlements (Treed)									to of below- nd biomass to ove-ground biomass ig d.m. / t ag d.m.)	Average annual biomass growth above- and below- ground (tonnes d.m. / (ha * yr))	Carbon fraction of dry matter (tonnes C / tonne d m.)	Annual increase in biomass carbon stocks due to biomass growth (tonnes C / yr)	
Settlements (Other) Other Land Managed Other Land Unmanaged Other Land			No	Item Select	ed				o (0) or Table 474.5 WS7 onal statistics international ita sources	Gtotal = Gw * (1+R)	0.47 / Table 4.3 / 0.451 WS mangroves	∆CG =A*Gtotal * CF	
									R	Gtotal	CF	۵CG	
Í										0		0	
											- 19		
1									Land L	Ise Manager	and Hepresentation N	tanager Ur	iceitambés

On the left-hand side, the Land Use Manager shows the 6 IPCC land use categories

- ➢ Forest land
- > <u>Cropland</u>
- ➢ <u>Grassland</u>
- Wetlands
- > <u>Settlements</u>
- > <u>Other land</u>

## and 12 subcategories (2 for each Land use category)

Land Use Manager
Land use structure 🛛 👻 👎
- Forest Land
Managed Forest Land
Unmanaged Forest Land
Cropland
Cropland Annual Crops
Cropland Perennial Crops
Grassland
Managed Grassland
Unmanaged Grassland
- Wetlands
Managed Wetlands
Unmanaged Wetlands
Settlements
Settlements (Treed)
Settlements (Other)
Other Land
Managed Other Land
Unmanaged Other Land

#### Guide to Land Representation

While Forest land, Grassland, Wetlands and Other land categories are disaggregated in subcategories depending on whether those are managed<sup>2</sup> or unmanaged<sup>3</sup> lands -since GHG emissions and removals from unmanaged land are excluded from the NGHGI- while Cropland and Settlements are disaggregated depending on the presence of perennial biomass stocks -since the IPCC methodological approach to estimate GHG emissions and removals from perennial biomass significantly differ from that applied to annual biomass.

To add a land subdivision, select the relevant subcategory and click the add button at the bottom of the window.



Doing so a window mask opens where to input those data that the *Software* requires, at minimum, to estimate C stock changes in relevant C pools at selected Tier level. As for instance:

Land use subdivision - Managed Forest Land specific parameters  Ecological zone Species Specied Specied Specified Specif	Land use subdivision name Soil Type Soil Status	I Satural Satural	Country/ Climate	/Territory Continent e Region	Italy Europe		+~ &
Land mass Unspecified Age class (vr) Above-ground biomass stock (t d.m. / ha) Above-ground biomass stock (t d.m. / ha) Above-ground biomass growth (G) (t d.m. / ha / yr) Ratio of below-ground biomass to above-ground biomass (R) (t root d.m. / ha / yr) Biomass carbon fraction (t C / t d.m.) Growing stock level (v) (m3 / ha) Growing stock level (v) (m3 / ha)	Land use subdivision - Managed Fo	rest Land specific parameters	[	v 😢 Na	atural Forest ( Plantation (	•	Abandoned r
Age class (yr)       Image: Class (yr)         Above-ground biomass stock (t d.m. / ha)         Above-ground biomass stock (t d.m. / ha / yr)         Ratio of below-ground biomass to above-ground biomass (R) (t root d.m. / t shoot d.m.)         Biomass carbon fraction (t C / t d.m.)         Growing stock level (V) (m3 / ha)       Image: Class (Vr)         Average net annual increment of growing stock (lov) (m3 / ha / yr)         Biomass conversion and expansion factor for increment (BCEFr) (t d.m. / m3 wood volume)       Specified         Biomass conversion and expansion factor for standing stock (BCEFr) (t d.m. / m3 wood volume)       Specified         Biomass conversion and expansion factor for wood and fuelwood removal (BCEFr) (t d.m. / m3 wood volume)       Specified         Biomass conversion and expansion factor for wood and fuelwood removal (BCEFr) (t d.m. / m3 wood volume)       Specified					Land mass	Unspecif	ied
Above-ground biomass stock (t d.m. / ha)         Above-ground biomass growth (G) (t d.m. / ha / yr)         Ratio of below-ground biomass to above-ground biomass (R) (t root d.m. / t shoot d.m.)         Biomass carbon fraction (t C / t d.m.)         Growing stock level (V) (m3 / ha)         V         Average net annual increment of growing stock (lv) (m3 / ha / yr)         Biomass conversion and expansion factor for increment (BCEFr) (t d.m. / m3 wood volume)         Specified         Biomass conversion and expansion factor for standing stock (BCEFr) (t d.m. / m3 wood volume)         Specified         Biomass conversion and expansion factor for wood and fuelwood removal (BCEFr) (t d.m. / m3 wood volume)         Specified			Age class (yr)		~	3	
Above-ground biomass growth (G) t d.m. / ha / yr) Ratio of below-ground biomass to above-ground biomass (R) t root d.m. / ha / yr) Biomass carbon fraction (t C / t d.m.) Growing stock level (V) (m3 / ha) Growing stock level (V) (m3 / ha / yr) Biomass conversion and expansion factor for increment (BCEFr) (t d.m. / m3 wood volume) Specified Biomass conversion and expansion factor for standing stock (BCEFr) (t d.m. / m3 wood volume) Specified Biomass conversion and expansion factor for wood and fuelwood removal (BCEFr) (t d.m. / m3 wood volume) Specified			Above-ground b	oiomass stoc	k (t.d.m. /ha)	)	
Ratio of below-ground biomass to above-ground biomass (R) (t root d.m./t shoot d.m.) Biomass carbon fraction (t C / t d.m.) Growing stock level (V) (m3 / ha) Average net annual increment of growing stock (Iv) (m3 / ha / yr) Biomass conversion and expansion factor for increment (BCEFr) (t d.m. / m3 wood volume) Biomass conversion and expansion factor for standing stock (BCEFs) (t d.m. / m3 wood volume) Biomass conversion and expansion factor for wood and fuelwood removal (BCEFr) (t d.m. / m3 wood volume) Specified Biomass conversion and expansion factor for wood and fuelwood removal (BCEFr) (t d.m. / m3 wood volume) Specified		Ab	ove-ground biomass g	prowth (G) (t	d.m. /ha /yr	)	
Biomass carbon fraction (t C / t d m.) Growing stock level (V) (m3 / ha)  Growing stock level (V) (m3 / ha)  Average net annual increment of growing stock (Iv) (m3 / ha / yr)  Biomass conversion and expansion factor for increment (BCEFi) (t d m. / m3 wood volume)  Biomass conversion and expansion factor for standing stock (BCEFs) (t d m. / m3 wood volume)  Specified  Biomass conversion and expansion factor for wood and fuelwood removal (BCEFr) (t d m. / m3 wood volume)  Specified  V		Ratio of below-ground biomass to abo	ve-ground biomass (R	) (t root d.m.	/t shoot d.m.	)	
Growing stock level (V) (m3 / ha)			Biomass ca	arbon fractio	n (tC/td.m.)	)	
Average net annual increment of growing stock (Iv) (m3 / ha / yr) Biomass conversion and expansion factor for increment (BCEFi) (t d.m. / m3 wood volume) Biomass conversion and expansion factor for standing stock (BCEFs) (t d.m. / m3 wood volume) Biomass conversion and expansion factor for wood and fuelwood removal (BCEFr) (t d.m. / m3 wood volume) Specified		Growing stock le	vel (V) (m3 / ha)		~ (	3	
Biomass conversion and expansion factor for increment (BCEF) (t d.m. / m3 wood volume) Specified  Biomass conversion and expansion factor for standing stock (BCEFs) (t d.m. / m3 wood volume) Specified  Biomass conversion and expansion factor for wood and fuelwood removal (BCEFr) (t d.m. / m3 wood volume) Specified  C		Average net anni	ual increment of growin	ng stock (lv)	(m 3 / ha / yr	)	
Biomass conversion and expansion factor for standing stock (BCEFs) (t d.m. / m3 wood volume) Specified > Biomass conversion and expansion factor for wood and fuelwood removal (BCEFr) (t d.m. / m3 wood volume) Specified >	Bion	ass conversion and expansion factor for increment (BCE	Fi) (t. d.m. / m3 wood v	olume) Sp	ecified ~		
Biomass conversion and expansion factor for wood and fuelwood removal (BCEFr) (t d.m. / m3 wood volume) Specified V	Biomass of	onversion and expansion factor for standing stock (BCEF	s) (t.d.m. ∕m 3 wood v	olume) Sp	ecified v		
< >>	Biomass conversion an	d expansion factor for wood and fuelwood removal (BCE)	Fr) (t. d.m. / m3 wood v	olume) Sp	ecified ~	•	
	<						>

The Land use subdivision mask is composed of 2 parts:

✓ the Top, which contains parameters common to any subcategory [with labels in **bold**]:

Land use subdivision - common parameters								
Land use subdivision name	Organic	Country/Territory	Country X					
Soil Type	Inland Organic soil	Continent	Europe					
Soil Status	Natural	Climate Region	Cool Temperate Moist + ~					
Nutrient content	Poor							
It is not possible to change some of	the parameters since subdivision is already being used in Land Representation	Manager						

✓ the Bottom, which contains subcategory specific information:

<sup>&</sup>lt;sup>2</sup> Managed land is land where human interventions and practices have been applied to perform production, ecological or social functions.

<sup>&</sup>lt;sup>3</sup> Unmanaged land is a land not qualified as managed.

#### Guide to Land Representation

Land use subdivision - Managed Fore	t Land specific parameters
Ecological zone Temperate	ceanic forest 🔍 Species Tectona grandis 🔍 Natural Forest 🔿 Abandoned managed land 🗌
	Plantation ()
	Land mass Unspecified
	Age class (yr) ≤20 y
	Above-ground biomass stock (t d.m. / ha) 0.300 🗸
	Above-ground biomass growth (G) (t d.m. / ha / yr) 10.000 🗸
	Ratio of below-ground biomass to above-ground biomass (R) (t root d m./t shoot d.m.) 0.370 🗸
	Biomass carbon fraction (t C / t d.m.) 0.470 🗸
	Growing stock level (V) (m3 / ha) <20
	Average net annual increment of growing stock (Iv) (m3 / ha / yr)
	Biomass conversion and expansion factor for increment (BCEFi) (t d.m. / m3 wood volume) Specified 🗸
	Biomass conversion and expansion factor for standing stock (BCEFs) (t d.m. / m3 wood volume) Specified 🗸
Biomass	conversion and expansion factor for wood and fuelwood removal (BCEFr) (t d.m. / m3 wood volume) Specified 🗸 0.100 🗸
	Basic wood density (D) (t d.m. / m3 fresh volume)
	Biomass expansion factor for conversion of annual net increment to above-ground biomass increment (BEF1)
	Biomass expansion factor for conversion of merchantable volume to above-ground biomass (BEF2)

Labels in blue are applied to information relevant for the implementation of IPCC Tier 2 methods.

Where the subdivision to add is a variation of a subdivision already entered (e.g. a different age class) a speedy way, which also minimizes potential errors, is to make a copy of the selected subdivision and then change the information according to the new subdivision that is to be entered. This is done by clicking the *Copy* button at the bottom of the *Land use structure* window, as shown below:

Land Use Manager			- D >				
Land use subdivision - common p	parameters						
Land use subdivision name	Copy of Plantation	Country/Territory	Italy				
Soil Type	High Activity Clay Mineral + 🗸	Continent	Europe				
Soil Status	Natural	Climate Region	Warm Temperate Dry + 🗸				
Land use subdivision - Managed	Forest Land specific parameters	-					
Ecological zone User-d	efined Species Pinus Natural Forest Abando	ned managed land					
mounter							
Land use structure		Land mass	Unspecified 🗸				
Managed Forest Land	Age class (y	r) ≤20 y 🗸					
- Managed Natural	Above-g	round biomass stock (t d.m. / ha)	212.000 ~				
Plantation	Above-ground bix	mass growth (G) (t d.m. / ha / yr)					
Cropland	Ratio of below-ground biomass to above-ground bior	nass (R) (t root d.m./t shoot d.m.)	0.220 🗸				
Grassland     Wetlands	Bio	Biomass carbon fraction (t C / t d m					
Settlements     Other Land	Growing stock level (V) (m3 / hi	a) >80 🗸	400				
as outer cana	Average net annual increment of	f growing stock (lv) (m3 / ha / yr)	14.600				
	Biomass conversion and expansion factor for increment (BCEFi) (t d.m. / m3	wood volume) Specified ~	0.530 🗸				
	Biomass conversion and expansion factor for standing stock (BCEFs) (t d.m. / m3	wood volume) Specified ~	0.530 ~				
	Biomass conversion and expansion factor for wood and fuelwood removal (BCEFr) (t d.m. / m3	wood volume) Specified ~	0.610 ~				
	Basic wood der	sity (D) (t d.m. / m3 fresh volume)	0.530				
	Biomass expansion factor for conversion of annual net increment to above-	round biomass increment (BEF1)					
	Biomass expansion factor for conversion of merchantable volume	to above-ground biomass (BEF2)					
	Reference soil organic	carbon stock (SOCref) (t C / ha)	45.200 🗸				
	Relative C stock change factors						
	Land use (FLU) 1.000 Ma	magement (FMG) 0.7	50 Input (FI) 1.000				
Add Carry Dalata							
Mud Copy Delete			Save Undo Close				

Subdivisions are generally used to distinguish different types of vegetation, as well as different management systems and/or age classes; although those are a stratification that can be applied to any other user's need.

Tip: to record info input in the DataBase (DB) press the button Save.

Tip: Once the subdivision is applied to one or more units of land in the land representation manager, the following fields:

- ✓ Soil type
- ✓ Soil Status
- ✓ Climate Region

## Guide to Land Representation

cannot be changed anymore. Where an error is identified in any of those fields, the Land subdivision (and its data) is to be deleted -to do so click on the button Delete at the bottom of the window:

Land Use Manager						n x
Land use structure 🗸 🗣	Land use subdivision - common para	meters				
Forest Land     Managed Forest Land	Land use subdivision name	Managed Natural		Country/Territory	Italy	
Managed Natural	Soil Type	High Activity Clay Mineral	+ ~	Continent	Europe	
Flantation     Unmanaged Forest Land	Soil Status	Natural		Climate Region	Warm Temperate Dry	+ ~
Cropland     Grassland     Grassland     Wetlands     Settlements     Other Land	t is not possible to change some of t Land use subdivision - Managed For Ecological zone Subtropical	he parameters since subdivision is alread est Land specific parameters I dry forest V Species	ly being used in Land Representation Man User-defined Mix	ager Natural Forest	andoned managed land	
				Land mass	Unspecified	~
			Age clas	ss (yr) Unspecified		_
			Abo	ve-ground biomass stock (t d.m. / ha)		40 🗸
			Above-groun	d biomass growth (G) (t d.m. / ha / yr)		64 🗸
		Ratio	of below-ground biomass to above-ground	biomass (R) (t root d.m./t shoot d.m.)	0.3	30 🗸
				Biomass carbon fraction (t C / t d.m.)	0.4	70 ~
			Growing stock level (V) (m3	/ha) >80 🗸		401
			Average net annual increme	ent of growing stock (Iv) (m3 / ha / yr)		4.600
		Biomass conversion and expa	ansion factor for increment (BCEFi) (t d.m. /	m3 wood volume) Specified ~	0.8	40 🗸
		Biomass conversion and expansion	factor for standing stock (BUEFs) (t.d.m. /	m3 wood volume) Specified ~	0.8	40 🗸
	Biomass	a conversion and expansion factor for wo	od and fuelwood removal (BCEFr) (t d.m. /	m3 wood volume) Specified ~	0.9	50 🗸
			Basic wood	density (D) (t d.m. / m3 fresh volume)		0.670
		biomass expansion factor for	conversion of annual net increment to abo	ove-ground biomass increment (BEFT)		
		Biomass expansion	a factor for conversion of merchantable voli	ume to above-ground biomass (BEF2)		
			Reference soil org	ganic carbon stock (SOCref) (t C / ha)	45.2	00 🗸
		Relative	e C stock change factors			
		La	nd use (FLU) 1.000	Management (FMG) 0.8-	40 Input (FI)	1.000
Add Copy Delete					Save Undo	Close

then information is to be input again.

Land Use Manager					– 🗆 X
Land use structure 👻 📮	Land use subdivision - common para	ameters			
Forest Land	Land use subdivision name	Managed Secondary		Country/Territory	Italy
Copy of Managed Secondary	Soil Type	Low Activity Clay Mineral	+ ~	Continent	Europe
Managed Secondary Plantation	Soil Status	Natural	~	Climate Region	Warm Temperate Dry + 🗸
Unmanaged Forest Land     Cropland     Grassland					
Wetlands     Settlements	Land use subdivision - Managed For	rest Land specific parameters			
Other Land	Ecological zone Subtropica	al dry forest Species	User-defined V Mix	Natural Forest  Plantation	Abandoned managed land
				Land mass	Unspecified
			Age class	s (yr) Unspecified 🗸	
			Abov	e-ground biomass stock (t d.m. / ha)	336.840 🗸
			Above-ground	biomass growth (G) (t d.m. / ha / yr)	3.864 🗸
		Ratio of be	low-ground biomass to above-ground b	iomass (R) (t root d.m./t shoot d.m.)	0.330 🗸
			1	Biomass carbon fraction (t C / t d.m.)	0.470 🗸
			Growing stock level (V) (m3	(ha) >80 🗸	401
			Average net annual increment	nt of growing stock (lv) (m3 / ha / yr)	4.600
		Biomass conversion and expansion	n factor for increment (BCEFi) (t d.m. / r	n3 wood volume) Specified ~	0.840 🗸
		Biomass conversion and expansion fact	or for standing stock (BCEFs) & d.m. / r	n3 wood volume) Specified ~	0.840 🗸
	Biomass c	conversion and expansion factor for wood a	nd fuelwood removal (BCEFr) & d.m. / r	n3 wood volume) Specified ~	0.950 🗸
			Basic wood o	density (D) (t.d.m. / m3 fresh volume)	0.670
		Biomass expansion factor for con-	version of annual net increment to above	ve-ground biomass increment (BEF1)	
		Biomass expansion fact	or for conversion of merchantable volu	me to above-ground biomass (BEF2)	
			Reference soil orga	anic carbon stock (SOCref) (t C / ha)	0.000 🗸
		Relative C st	ock change factors		
		Land us	ie (FLU) 1.000	Management (FMG) 0.8	40 Input (FI) 1.000
Add Copy Delete					Save Undo Close

## Guide to Land Representation

## Land use subdivision mask, top section

Land use subdivision - common parameters								
Land use subdivision name	Organic		Country/Territory	Country X				
Soil Type	Inland Organic soil	$+$ $\vee$	Continent	Europe				
Soil Status	Natural		Climate Region	Cool Temperate Moist	+ ~			
Nutrient content	Poor							
It is not possible to change some of	the parameters since subdivision is already being used in Land	d Representation Manager						

The top section contains up to 7 fields. 5 fields are present in each and every subdivision -<u>Land use subdivision</u> <u>name, Soil Type, Country/Territory, Continent, Climate Region</u>- while other 2 are provided for some of the subdivisions -<u>Soil Status</u>, Nutrient content.

#### Guide to Land Representation

## Land use subdivision name

This is a field where unique information is to be input -i.e. 2 subdivisions cannot have the same alphanumerical combination in the name. Given that in the land representation manager subdivisions are listed by the name, it is suggested to provide in the name information that can easily recall the characteristics specific of that subdivision.

## Guide to Land Representation

## Soil Type

The *Software* provides in a dropdown menu the complete list of IPCC soil types listed in Chapter 2 of the AFOLU Volume, plus Coastal Wetlands soil (Chapter 4, *Wetlands Supplement*<sup>4</sup>). Namely:

## > Mineral soils:

- ✓ High Activity Clay (HAC)
- ✓ Low Activity Clay (LAC)
- ✓ Volcanic
- ✓ Spodic
- ✓ Sandy
- ✓ Inland mineral Wetland

## > Organic soils:

- ✓ Inland Organic
- > Mixed soils:
  - ✓ Coastal Wetlands

		+ V 😵 Cont
FullName	Composition	Remark
High Activity Clay Mineral	Mineral	Soils with high activity (also (HAC) minerals are lightly to moderately weathered soils, which are dominated by 2.1 silicate (also minerals (in the World Reference Base for Soil Resources (WRB) classification these include Leptools, Vertisols, Kastanoczens, Chernoczens, Phaeoczems, Lurisols, Albelurisols, Solonetz, Calcisols, Gryosiosi, Jurhisols, Albelurisols, Solonetz, Calcisols, Gryosiosi, Jurhisols, Cambriols, Reposols, in USDA classification includes Mollisols, Vertisols, high- base status Alfacis, Aridisols, Inceptisols).
Low Activity Clay Mineral	Mineral	Soils with low activity clay (LAC) minerals are highly weathered soils, dominated by 1:1 clay minerals and amorphous iron and aluminium oxides (in VHB classification includes Acrisols, Lixisols, Nitisols, Ferralsols, Durisols; in USDA classification includes Ultisols, Oxisols, acidic Alfisols).
Volcanic Mineral	Mineral	Soils derived from volcanic ash with allophanic mineralogy (in WRB classification Andosols; in USDA classification Andisols)
Spodic Mineral	Mineral	Soils exhibiting strong podzolization (in WRB classification includes Podzols; in USDA classification S
Sandy Mineral	Mineral	Includes all soils (regardless of taxonomic classification) having > 70% sand and < 8% clay, based on standard textural analyses (in WRB classification includes Arenosols; in USDA classification includes Psamments).
Wetland Mineral	Mineral	Soils with restricted drainage leading to periodic flooding and anaerobic conditions (in WRB classification Gleysols; in USDA classification Aquic suborders).
Inland Organic soil	Organic	Soils classified as histosols. See glossary of IPCC GPG 2003 for additional details.
Coastal Wetlands soil	Mixed	Table 4.11 WS

In addition, by clicking on the symbol <sup>1</sup> the user opens a dialog tab where user-specific soil types can be input:

5	ioil Type		* V 🔇 Continent	Europe			
Soil	Type Manager		- 0	×			
	Soll Type Name A	Composition V	Bemark				
	Coastal Wetlands soil	Mixed	Table 4.11 WS				
	High Activity Clay Mineral	Mineral	Solis with high activity day (HAC) minerels are lightly to moderately usethered solis, which are dominated by 21 silicities of ymmanis (in the World Reference Base for Soli Resources (WRB) classification these include lacitosis. Verticols, Kastanceres, Oternozens, These exerces, Luviceds, Nisles, Halbeirvices, Solvetz, Calicolas, Cyssisols, Umbracks, Cambiaols, Regosols, in USDA classification includes Mollisols, Verticols, high-base status Affacis, Articols, Inceptisol).				
	Inland Organic soil	Organic	Soils classified as histosols. See glossary of IPCC GPG 2003 for additional details.				
	Low Activity Clay Mineral	Mineral	Soils with low activity clay (LAC) minerals are highly weathered soils, dominated by 1:1 clay minerals and emorphous iron and aluminium oxides (in WRB classification includes Acrisole, Lixisole, Nitsole, Ferralsole, Durisole; in USDA classification includes Ultisole, Oxisole, actic Alfisole).				
	Sandy Mineral	Mineral	Calleday, Jacker Presentary, Includes all soils (regardless of taxonomic classification) having > 70% sand and < 8% clay, based on standard textural analyses (in WRB classification includes Arenosols; in USDA classification includes Pearments).				
	Spodic Mineral	Mineral	Soits exhibiting strong podzolization (in WRB classification includes Podzols: in USDA classification Spodosols)	Π.			
	Volcanic Mineral	Mineral	Soils derived from volcanic ash with allophanic mineralogy (in WRB classification Andosols; in USDA classification Andisols)	П			
	Wetland Mineral	Mineral	Soils with restricted drainage leading to periodic flooding and anaerobic conditions (in WDD electrification Classele, in UCDA electrification Aquia suborders)	Ц			
	user type	Mixed	limited to XYZ	x			
				×			
De	fault soil types as well as soil type	s already used in any Land Us	e Subhrein cannt be charged nor deleted. Save Undo Occe				

The input and subsequent selection of user-specific soil types prevents IPCC default values to be present in the dropdown menu of parameters.

<sup>4 2013</sup> Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands

## Guide to Land Representation

## **IPCC** Inventory Software

## Soil Status

The *Software* provides in a dropdown menu 3 options. **Natural** -this is the default option applied by the *Software*-, **Drained**, **Rewetted**:



According to the soil status, the *Software* populates with the units of land of the relevant subdivisions the calculation worksheets of AFOLU categories for drainage and rewetting as:

## For CO<sub>2</sub>:

## > 3.B Land Use Categories:

- ✓ SOM Organic Drained
  - ✓ SOM Organic Rewetted

## For N<sub>2</sub>O:

## 3.C.4 Managed soils:

- ✓ Drainage of managed organic soils
- ✓ Rewetting of managed organic soils

## For CH<sub>4</sub>:

- > 3.C.8 Drained Organic Soils
- > 3.C.9 Drainage Ditches
- > 3.C.10 Rewetting of Organic Soils
- > 3.C.11 Rewetting of Mangroves and Tidal marshes
- > 3.C.11 Rewetted and Created Wetlands in Inland Wetland Mineral Soils

Tip: Soil Status field is not present for subdivisions of category Other land.

#### Guide to Land Representation

#### **IPCC** Inventory Software

## **Climate Region**

The *Software* provides in a dropdown menu the complete list of IPCC Climate Regions listed in Chapter 2 of the AFOLU Volume. Namely:

Domain	Region
6 H 1 H H 1	Warm Temperate Moist
Subtropical (Mediterranean)	Warm Temperate Dry
÷	Cool Temperate Moist
Temperate	Cool Temperate Dry
	Boreal Moist
Boreal	Boreal Dry
	Polar Moist
Polar	Polar Dry

The selection of the climate zone determines the IPCC default values that the *Software* populates in the dropdown menus of the parameters.

By clicking on the symbol 📑 the user opens a dialog tab where user-specific climate zones can be input:

Climate Region 🛛 🖉	5 Remark				
/arm Temperate Dry	Mean Annual Temperature >10°C and ≤18°C; Mean Annual Precipitation lower than Potential Evapo-Transpiration				
/arm Temperate Moist	Mean Annual Temperature >10°C and ≤18°C; Mean Annual Precipitation higher than Potential Evapo-Transpiration				
ool Temperate Dry	Mean Annual Temperature >0°C and ≤10°C: Mean Annual Precipitation lower than Potential Evapo-Transpiration				
ool Temperate Moist	Mean Annual Temperature >0°C and ∠10°C; Mean Annual Precipitation higher than Potential Evapo-Transpiration				
oreal Dry	Mean Annual Temperature c0°C: Each Month Mean Tempearature 210°C: Mean Annual Precipitation lower than Potential Evapo-Transpiration				
oreal Moist	Mean Annual Temperature ≤0°C; Each Month Mean Tempearature ≥10°C; Mean Annual Precipitation bioters than Potential Evano-Transmission				
olar Dry	Mean Annual Temperature <0°C; Each Month Mean Tempearature <10°C; Mean Annual Precipitation lower than Potential Evapo-Transpiration				
olar Moist	Mean Annual Temperature (0°C: Each Month Mean Tempearature <10°C: Mean Annual Precipitation higher than Potential Evano-Transmittion				
Vestern Mediterranean					
	arm Temperate Moist oil Temperate Dry oil Temperate Moist real Dry ereal Moist far Moist far Moist astern Medteranean				

The input and subsequent selection of user-specific climate zones prevents IPCC default values to be present in the dropdown menu of parameters.

#### Guide to Land Representation

## Land use subdivision mask, bottom section

Hereafter the bottom section of the mask for each land use subcategory is shown with guidance for the data compilation. As a general rule, where applicable, the *Software* provides in a dropdown menu the IPCC default values applicable to the subdivision, while the user can always input its own user-specific values regardless the provision by the *Software* of the IPCC default value.

Parameters populating the mask are limited to those needed to estimate C stock change, parameters to estimate non- $CO_2$  emissions are generally input directly in the calculation worksheets. Further, not necessarily all parameters needed to estimate C stock changes are populated in the mask, while need instead to be input directly into the calculation worksheets. This is to allow more flexibility to deal with rapidly changing parameters of units of land.

#### Guide to Land Representation

#### Forest land

Forest land subdivisions have 3 specific parameters to be input:

**Ecological zone**, the dropdown menu presents the IPCC default zones, as shown in the 2006 IPCC Guidelines figure 4.1, relevant for the climate zone selected. The user can input a user-specific species by selecting User-defined, see below.

User-defined	~
Lauretum	
	User-defined Lauretum

**Species**, the dropdown menu presents the list of species for which IPCC provides default values for parameters to be input in the mask. The user can input a user-specific species by selecting *User-defined*, see below.



This parameter does not necessarily require the input of a tree species, it can more likely be used to input forest types e.g. *Laurisilva*.

Land mass is active only for Asian countries since the 2006 IPCC Guidelines tables 4.7 and 4.9 provides different default values for Asia (Continental) vs Asia (Insular); thus, accordingly to the territory to be inventoried user shall select among *Insular* or *Continental* or *Unspecified*. The selection of *Insular* or *Continental* determines that the *Software* provides associated IPCC default values in the dropdown of parameters <u>Aboveground biomass stock</u> and <u>Aboveground biomass growth</u>. The selection of *Unspecified* prevents IPCC default values to be present in the dropdown menu of those parameters.

#### Guide to Land Representation

## **IPCC** Inventory Software

#### **Unmanaged Forest land**

Land use subdivision - common par	ameters					
Land use subdivision name			8	Country/Territory	Italy	
Soil Type	High Activity Clay Mineral	+ ~		Continent	Europe	
Soil Status	Natural	~		<b>Climate Region</b>	+	~ 😢
Land use subdivision - Unmanaged Ecological zone	Forest Land specific parameters		× 3			
				Land mass	Unspecified	<u>_</u>
	Ratio of be	elow-ground biomass to above-ground	l biomass (R) (t re	oot d.m./t shoot d.m.)	0.000	~
			Biomass carbo	n fraction (t C / t d.m.)	0.470	~
		Growing stock level (V) (m3	3/ha)	~ 8		٦
	Biomass conversion and expansion fact	or for standing stock (BCEFs) (t d.m. /	/m3 wood volun	e) Specified ~		~
		Basic wood	d density (D) (t d.	m. / m3 fresh volume)		
	Biomass expansion fact	tor for conversion of merchantable vo	lume to above-g	ound biomass (BEF2)		
		Reference soil or	ganic carbon sto	ck (SOCref) (t C / ha)	p.000	~

Since C stock changes in unmanaged land are considered not anthropogenic, parameters to be input in the bottom portion of the land use subdivision mask defines the biomass C stock that, in case of conversion to other land uses can be lost. Thus, the **Land mass** parameter is greved, and no data can be input.

Parameters in black ink are needed for Tier 1, although can be used at higher tiers too, while parameters in blue ink are needed for Tier 2, either in substitution of Tier 1 parameters or additionally:

- Aboveground biomass stock, the dropdown menu provides IPCC default value, if available, although user can input its own data. It applies to Tier 1 only, thus in case a value is input in *Growing stock level* then this parameter is greyed, and no input is allowed; although the *Software* calculates the *Aboveground biomass stock* as the product of the *Growing stock level* by the *Biomass conversion and expansion factor for standing stock* or by *BEF2\*D*.
- Ratio of below-ground biomass to above-ground biomass, the dropdown menu provides IPCC default value, if available, although user can input its own data. It applies to all tiers.
- Biomass carbon fraction, the dropdown menu provides IPCC default value, although user can input its own data. It applies to all tiers.
- Growing stock level, the dropdown menu provides IPCC default value, although user can input its own data in the next box. The *Growing stock level* is also used by the *Software* to select the relevant BCEF value to present in the dropdown menu, if available.
- Biomass conversion and expansion factor for standing stock, the dropdown menu provides IPCC default value, if available, although user can input its own dat. It can be either *Specified*, and in such a case the value is input in the next box, or *Calculated* as *BEF2\*D* and consequently values of *Basic wood density* and of *Biomass expansion factor of merchantable volume to above-ground biomass* are to be input.
- Basic wood density, if BEF2\*D is selected for Biomass conversion and expansion factor for standing stock, then a value is to be input by the user; otherwise is left blank.
- Biomass expansion factor of merchantable volume to above-ground biomass, if BEF2\*D is selected for Biomass conversion and expansion factor for standing stock, then a value is to be input by the user; otherwise is left blank.
- Reference soil organic carbon stock, the dropdown menu provides the IPCC default value for the combination of mineral soil type and climate zone selected, and for unmanaged forests the SOC<sub>REF</sub> is not further adjusted through stock-change factors since no management occurs. This parameter is not provided for subdivisions that have instead *organic soils*; while for *Coastal wetlands soils* the parameter is instead labelled as *Soil Carbon Stock*, and it refers to the total SOC without any further adjustment through stock change factors.

Tier 3, depending on data used, is to be accommodated in the above listed variables.

#### Guide to Land Representation

#### **IPCC** Inventory Software

#### Managed Forest land

Land use subdivision - common para	meters				
Land use subdivision name		8	Country/Territory	Italy	
Soil Type	High Activity Clay Mineral			Europe	
Soil Status	Natural	~	Climate Region	+ ~	
Land use subdivision - Managed Fo	est Land specific parameters		_		
Ecological zone	Species	Natural Fore Vantatio	st.⊛ Abar on.⊖	ndoned managed land	
			Land mass	Unspecified ~	
		Age class (yr)	<ul> <li>✓</li> </ul>		
		Above-ground bio	mass stock (t d.m. / ha)	0.000 🗸	
		Above-ground biomass gro	wth (G) (t d.m. / ha / yr)	0.000 🗸	
	Ratio of below-ground	biomass to above-ground biomass (R) (	root d.m./t shoot d.m.)	0.000 🗸	
		Biomass carb	oon fraction (t C / t d.m.)	0.470 🗸	
	G	irowing stock level (V) (m3 / ha)	~ 🤇		
	A	verage net annual increment of growing	stock (lv) (m3 / ha / yr)		
	Biomass conversion and expansion factor for i	ncrement (BCEFi) (t.d.m. / m3 wood vol	ume) Specified ~	✓	
	Biomass conversion and expansion factor for standi	ng stock (BCEFs) (t.d.m. / m3 wood volu	ume) Specified ~	×	
Bior	ass conversion and expansion factor for wood and fuelwood	d removal (BCEFr) (t.d.m. / m3 wood vol	ume) Specified ~	0.000 🗸	
		Basic wood density (D) (t	d.m. / m3 fresh volume)		
	Biomass expansion factor for conversion of a	nnual net increment to above-ground bio	omass increment (BEF1)		
	Biomass expansion factor for conve	ersion of merchantable volume to above	-ground biomass (BEF2)		
		Reference soil organic carbon s	stock (SOCref) (t C / ha)	0.000 🗸	
	Relative C stock change	e factors			
	Land use (FLU)	1.000 Managemer	nt (FMG) 1.0	00 Input (FI) 1.000	

Natural Forest vs Plantation given that the 2006 IPCC Guidelines provide different default values for Plantations for the following parameters: Above-ground biomass, Above-ground net biomass growth, Above-ground net volume growth, Average net annual increment; selecting the forest typology allows the Software to populate the dropdowns of those parameters with relevant IPCC default values.

Abandoned managed land, is relevant for reporting under the UNFCCC with non-Annex I Reporting Tables 1 and 2 (<u>Decision 17/CP.8</u>). Thus, it is to be checked if the subdivision is a formerly managed land and only if the user wishes to use such reporting tables; otherwise, just leave it unchecked.

Additionally to parameters described for <u>Unmanaged Forest land</u>, <u>Managed Forest land</u> requires the following parameters. Parameters in black ink are needed for Tier 1, although can be used at higher tiers too, while parameters in blue ink are needed for Tier 2, either in substitution of Tier 1 parameters or additionally:

Age class, the dropdown menu provides IPCC default age classification in *older than 20-year* and *from 0 to 20 years*, which selection determines the IPCC default values that the *Software* populates in the dropdown menus of the biomass stand and biomass growth parameters.



In addition, the user can select Unspecified or User-defined range. For the latter, the user is to input, in the next box, the user defined range, e.g.:

Age class (yr) User-defined range 🗸 61-80 year

The selection of a non-IPCC age class prevents IPCC default values to be present in the dropdown menu of parameters. It applies to all tiers.

<u>Aboveground biomass growth</u>, the dropdown menu provides IPCC default value, if available, although user can input its own data. It applies to Tier 1 only, thus in case a value is input in *Average net annual increment of growing*.

#### Guide to Land Representation

stock then this parameter is greyed, and no input is allowed; although the Software calculates the Aboveground biomass growth as the product of the Average net annual increment of growing stock by the Biomass conversion and expansion factor for increment or by BEF1\*D.

- Average net annual increment of growing stock, the value to input is the increment<sup>5</sup>, either the current increment, the average current increment, or the mean increment, where all correspond to the gross increment minus the natural background mortality<sup>6</sup>.
- Biomass conversion and expansion factor for increment, the dropdown menu provides IPCC default value, if available, although user can input its own data. It can be either *Specified*, and in such a case the value is input in the next box, or *Calculated* as *BEF1\*D* and consequently values of *Basic wood density* and of *Biomass expansion factor of annual net increment to above-ground biomass increment* are to be input.
- Biomass expansion factor of annual net increment to above-ground biomass increment, if BEF1\*D is selected for Biomass conversion and expansion factor for standing stock, then a value is to be input by the user; otherwise is left blank.
- Biomass conversion and expansion factor for wood and fuelwood removal, the dropdown menu provides IPCC default value, if available, although user can input its own data. It can be either *Specified*, and in such a case the value is input in the next box, or *Calculated* as *BEF2\*D* and consequently values of *Basic wood density* and of *Biomass expansion factor of merchantable volume to above-ground biomass* are to be input.
- <u>Relative C stock change factors</u>, at Tier 1 are by IPCC default all equal to 1; since forest SOC is considered to be the reference for all other land use categories. Users can input a user-specific value according to data collected.

Note: In Forest land the  $F_{LU}$  stock-change factor is used to adjust SOC by the natural disturbance regime i.e.  $F_D$ .

Tier 3, depending on data used, is to be accommodated in the above listed variables.

<sup>&</sup>lt;sup>5</sup> The type of increment likely depends on the breadth of age class

<sup>&</sup>lt;sup>6</sup> This does not include mortality/losses caused by disturbances

#### Guide to Land Representation

#### **Cropland**

Cropland methods provided by IPCC significantly differs depending on the type of biomass present in the land. Thus, Cropland is subdivided in 2 subcategories dealing with that land with annual biomass only and that land with perennial biomass, although the latter subcategory may also include an annual biomass component.

#### Guide to Land Representation

## Annual Cropland

Land use subdivision - common para Land use subdivision name Soil Type Soil Status	meters High Activity Clay Mineral Natural		* ×	Country/Territory Continent Climate Region	Italy Europe	+ V X
Land use subdivision - Annual Crops Rice ecosystem	specific parameters	Herbaceous biomass Ratio of belo	t C / ha v	ground biomass (R) (t root C	C fraction (t C / t d	l.m.) 1.000
			Reference soil o	rganic carbon stock (SOCr Relative C stock cha Lan Ti	ef) (t C / ha) inge factors d use (FLU) Ilage (FMG) Input (FI)	0.000 v 1.000 v 1.000 v

**Rice ecosystem** is to be checked in order to instruct the *Software* to report units of land with the rice ecosystem subdivision in relevant worksheets for 3.C.7 (*Rice Cultivation*).

Herbaceous biomass can be input either in *tonne of C*, and in such a case the IPCC default value can be selected from the drop-down menu -although a user-specific value can either be input-, or in *tonne of dry matter*.



In the latter case, there is not an IPCC default value and the C fraction of dry matter is to be input, see below:

Herbaceous biomass td.m. / ha v Cfraction tt C / td.m.)

For all other parametes see Managed Forest land.

Tier 3, depending on data used, is to be accommodated in the above listed variables.

#### Guide to Land Representation

#### **Perennial Cropland**

<ul> <li>Land use subdivision - common para</li> </ul>	neters	
Land use subdivision name	Country/Territory Ital	ły
Soil Type	High Activity Clay Mineral + 🗸 Continent Eu	лоре
Soil Status	Natural V Climate Region	+ ~ 😢
- Land use subdivision - Perennial Cro	os specific parameters	
Cropland type	V 3	
	Woody biomass t C / ha V 0.000 C fr	fraction (t C / t d.m.) 1.000
	Ane class for Unspecified	Value
	Personal historica and an analysis of a second and a second and a second and a second a secon	(ha (u)
	Perennia biolitass carbon accumulation rate (d) (jointes C /	
	Hatio of below-ground woody biomass to above-ground woody biomass (R) (t root C / t s	shoot C)
	Harvest / Maturity c	ycle (yr) 0.000 ~
	Amforsetry Herbaceous biomase IC/ba	fraction A C (t d m) 1000
	Ratio of below-ground herbaceous biomass to above-ground herbaceous biomass (R) (t root C/ t s	shoot C)
	Reference soil organic carbon stock (SOCref) (t	t C / ha) 0.000 🗸
	Relative C stock change	efactors
	Land us	зе (FLU) 1.000
	Tillage	e (FMG) 1.000
	Ir	nput (FI) 1.000

**Cropland type** provides IPCC default types of perennial crop systems. The user can input a user-specific species by selecting *User-defined*, see below.

Land use subdivision ·	Perennial Crops specific parameter	ers		
Cropland type	User-defined	~	olive trees	

Woody biomass can be input either in *tonne of C* or in *tonne of dry matter*.

Woody biomass	tC∕ha ∨		0.000	C fraction (t C /	t d.m.) 1.000
	t C / ha t d.m. / ha	Unspecified	$\mathbf{\vee}$	Value	

In the latter case, the C fraction of dry matter is to be input as well, see below:

Woody biomass t d.m. / ha V 0.000 C fraction (t C / t d.m.)

The value to be input as *woody biomass* is the total biomass at maturity (i.e. before the final harvest).

Parameters specific for this subdivision are:

- Age class, if input makes the Woody biomass automatically calculated (and thus its box is greyed and no data input allowed) as the Age class multiplied by the Perennial biomass carbon accumulation rate.
- Perennial biomass carbon accumulation rate requires an input from the user. To ensure mass conservation, it is to be calculated as *Woody biomass* divided by *Harvest cycle*.
- Harvest/Maturity cycle, the dropdown menu provides IPCC default value, if available, although the user can input its own data

Agroforestry is to be checked if an annual biomass component is to be added to the estimates. For parameters of annual biomass component see <u>Annual Cropland</u>.

For all other parametes see Managed Forest land.

Tier 3, depending on data used, is to be accommodated in the above listed variables.

## Guide to Land Representation

#### **Grassland**

Different types of vegetation can be classified under Grassland, ranging from land covered by grass only and managed, e.g. pastures, to land with significant woody vegetation that, although does not meet the forest thresholds, largely determines the C dynamic of the land.

#### Guide to Land Representation

#### **Unmanaged Grassland**

Land use subdivision name	Country/Territor	r taly	
Soil Type	High Activity Clay Mineral  Continen	Europe	
Soil Status	Natural Climate Region	n	+ ~
Land use subdivision - Unmanaged	Grassland specific parameters		
Vegetation type			
	Herbaceous biomas	(t d.m. / ha)	0.000 🗸
	Ratio of below-ground herbaceous biomass to above-ground herbaceous biomass (R) (t root d m./	t shoot d.m.)	
	Carbon fraction of herbaceous biomass dry matter	(t C / t d.m.)	0.470
	Woody biomas	(t.d.m. / ha)	0.000
	Ratio of below-ground woody biomass to above-ground woody biomass (R) (t root d.m./	t shoot d.m.)	
	Carbon fraction of woody biomass dry matter	¢C/td.m.)	0.470 🗸

Vegetation type is to be selected from a dropdown menu containing IPCC default types corresponding to the climate zone selected.

Vegetation type	~	8		
	Vegetation type	Ratio BGB to AGB (R) (t d.m. BGB / t d.m. AGB)		Error
	Woodland	0.500	19.000	±80%
	Savannah	0.500	19.000	±80%
	Shrubland	2.800	9.000	±144%

The selection of the vegetation type determines the value of the *root-to-shoot ratio* the software shows in the relevant boxes (either for *annual biomass* or for *perennial biomass*), although the user can overwrite that default value with its own data.

For all other parametes for annual biomass see <u>Annual Cropland</u>, while for those of woody biomass see <u>Perennial Cropland</u>. Tier 3, depending on data used, is to be accommodated in the above listed variables.

Note: likewise <u>Unmanaged Forest land</u>, the Reference soil organic carbon stock (SOC<sub>REF</sub>) is not further adjusted through stockchange factors since no management occurs.

#### Guide to Land Representation

#### Managed Grassland

Land use subdivision name	Country/Territory Italy		1
Soil Type	High Activity Clay Mineral + V Continent Euro	pe	ĺ
Soil Status	Natural V Climate Region	+	8
Land use subdivision - Managed Gr Vegetation type	assiand specific parameters           Improved grassiand         Abandoned managed land		
	Herbaceous biomass (); d.m	/ha) 0.000 🗸	
	Hatio of below-ground herbaceous biomass to above-ground herbaceous biomass (r/) it root d.m./t shoot Carbon fraction of herbaceous biomass dry matter (t C / t e	d.m.) 0.470	
	Woody biomass (t d.m	/ha) 0.000	
	Age class (yr) Unspecified V Woodv biomass accumulation rate (G) ft d m. / ha	/alue	
	Ratio of below-ground woody biomass to above-ground woody biomass (R) (t root d.m./t shoot (	d.m.)	
	Carbon fraction of woody biomass dry matter (t C / t $\alpha$	d.m.) 0.470 🗸	
	Reference soil organic carbon stock (SOCref) (t C	/ha) 0.000 🗸	
	Relative C stock change fai	ctors	
	Land use (	FLU) 1.000 ~	
	Management (F	MG) 1.000 ~	
	Inpu	t (FI) 0.000 🗸	

**Improved grassland** is to be checked if the subdivision is subject to additional input of organic matter, e.g. manure and/or sludge application. Otherwise, FI is greyed and any input from the user is not allowed.

Abandoned managed land, is relevant for reporting under the UNFCCC with non-Annex I Reporting Tables 1 and 2 (<u>Decision 17/CP.8</u>). Thus, it is to be checked if the subdivision is a formerly managed land and only if the user wishes to use such reporting tables; otherwise, just leave it unchecked.

Parameters specific for this subdivision are:

Age class and Woody biomass accumulation rate is the annual net gain<sup>7</sup> of woody biomass and it is not to be compiled for Tier 1 estimates. Given that unlimited accumulation of biomass is not possible, this parameter is an active parameter only if the *Age-class* is input:

Age class (yr)	User-defined value 🗸	Value	8
Woody biom	nass accumulation rate (G) (t d.	8	

Where *Age class* and *Woody biomass accumulation rate* are input, the *Woody biomass* is automatically calculated (and thus its box is greyed, and no data input allowed) as the *Age class* multiplied by the *Woody biomass accumulation rate*. Further, the user shall also estimate C stock losses in the relevant worksheets to avoid counting for endless C accumulation in the land subdivision.

Where *Age class* is left *Unspecified*, the box is greyed and any input from the user is not allowed, and *Woody biomass* is input by the user:



For all other parametes for annual biomass see <u>Annual Cropland</u>, while for those of perennial biomass see <u>Perennial</u> <u>Cropland</u>.

Tier 3, depending on data used, is to be accommodated in the above listed variables.

<sup>7</sup> Gross increment minus mortality

## Guide to Land Representation

## **Wetlands**

IPCC disaggregates *Wetlands* in three types:

- Peatlands under peat extraction
- ➢ Flooded land
- ➢ Other Wetlands

While *Peatlands under peat extraction* and *Flooded land* are always managed systems, *Other Wetlands* may include unmanaged and managed land.

#### Guide to Land Representation

#### **Unmanaged Wetlands**

Land use subdivision - common para	neters		
Land dae adourvator Communication			
Land use subdivision name		Country/Territory	Italy
Soil Type	Inland Organic soil	Continen	Europe
Soil Status	Natural	V Climate Region	+ ~ 🔇
Nutrient content	Unspecified	$\sim$	
and use subdivision - Unmanaged	Vetlands specific parameters		
Туре			
Other Wetlands			
		Above-ground biomass s	tock (t.d.m. / ha)
	Ratio of below-ground bio	nass to above-ground biomass (R) (t root d	.m./t shoot d.m.)
		Carbon fraction of biomass dry m	atter (t C / t d.m.)
and the sub-distance and an			
and use subdivision - common par-	neters		
and use subdivision name		Country/Territor	y Italy
Soil Type	High Activity Clay Mineral	+ V Continen	t Europe
Soil Status	Natural	Climate Region	n 🛛 🛨 📢
and use subdivision - Unmanaged	Vetlands specific parameters		
Туре			
Other Wetlands			
		Above ground biomage a	andrá dun (ba)
		Poove-ground biomass a	ROCK (t d.m. / na)
	Ratio of below-ground bio	nass to above-ground biomass (H) (t root d	.m./t shoot d.m.)
		Carbon fraction of biomass dry m	atter (t C / t d.m.)
		Reference soil organic carbon stock (	SOCref) (t.C. / ha) 0.000 🗸
and use subdivision - common par	neters		
and use subdivision name		Country/Territor	v Italy
	Coastal Wetlands soil	Continen	t Fumne
Soli Type	Coastal Wellahds son	Climate Region	
Soil Status	Natural		
and use subdivision - Unmanaged	Vetlands specific parameters		
Type			
Other Wetlands			
		Above-ground biomass s	tock (t.d.m. / ha)
	Ratio of below-around bio	nass to above-ground biomass (R) (t root d	m /t shoot d m )
	· · · · · · · · · · · · · · · · · · ·	Color for the other sector	
		Carbon fraction of biomass dry m	atter (t C / t d.m.)
		Soil carbo	n stock (t C / ha) 🗸 🗸

For parametes for biomass see Unmanaged Forest land.

Depending on the soil type selected the mask shows a different parameter.

For Inland Organic soils no Reference SOC is needed.

For *Wetland Mineral soils* the *Reference SOC* that, likewise <u>Unmanaged Forest land</u>, is not further adjusted through stockchange factors since no management occurs.

For Coastal Wetlands soils:

Soil carbon stock, the dropdown menu provides IPCC default values, as sourced from the Wetlands Supplement if available, although user can input its own data. Coastal Wetlands soils include a mix of mineral and organic soils and depending on the activity to which the land is subject (see Excavated soil status in Settlements - Other) the total SOC is needed to estimate associated SOC losses.

Type is not to be selected since there is only 1 wetlands type in Unmanaged Wetlands.

Tier 3, depending on data used, is to be accommodated in the above listed variables.

#### Guide to Land Representation

#### **IPCC** Inventory Software

#### Managed Wetlands

Depending on the Wetlands type selected the mask shows a different set of parameters.

**Type** is to be selected from the dropdown menu among 4 IPCC types. Type selection determines what type of activities is reported and thus what relevant parameters are provided in the mask.

Peatlands under extraction where the 2 parameters relevant are mutually exclusive (the user has to compile only one of the two):

Land use subdivision - common para	meters					
Land use subdivision name			Country/Territor	Japan		
Soil Type	Inland Organic soil	+ ~	Continen	t Asia		
Soil Status	Drained	~	Climate Region	1	+ ~	Ø
Nutrient content		~	8			
Land use subdivision - Managed We	tlands specific parameters					
Iype     Postlands under extraction						
Peatlands abandoned former e	extraction)					
Flooded land	And deteriny					
O Other Wetlands						
			Carbon fraction of air-dry peat by w	eight (t C / t peat)	~	0
		C	arbon fraction of air-dry peat by volur	ne (t C / m3 peat)	~	0

- ✓ <u>Carbon fraction of air-dry peat by weight</u>, the dropdown menu provides IPCC default values, if available, although user can input its own data.
- ✓ <u>Carbon fraction of air-dry peat by volume</u>, the dropdown menu provides IPCC default values, if available, although user can input its own data.
- Peatlands abandoned (former extraction) where 4 relevant parameters are provided to be compiled only if the user wishes to estimate vegetation re-installment after abandonment:

				(		
Land use subdivision name			Country/Territory	Italy		
Soil Type	Inland Organic soil	+ ~	Continent	Europe		
Soil Status	Drained	$\sim$	Climate Region		+ ~	8
Nutrient content		✓ 8				
Land use subdivision - Managed W	etlands specific parameters					
Туре						
Peatlands under extraction						
Peatlands abandoned former	extraction)					
Flooded land						
O Other Wetlands						
			Above-ground biomass sto	ck (td.m. /ha)	0.000	
						0
		Age cl	ass (yr)	✓ 😢 Value		w
		Age cl Above c	ass (yr)	✓ 🥸 Value [ ate (t.d.m. /ha) [		Ű
		Age cl Above⊰ Ratio of below-ground biomass to above	ass (yr) round biomass accumulation r -ground biomass (R) (t root d.m	✓ Solue Value ate (t.d.m. / ha) n./t shoot d.m.)		v

✓ <u>Age class</u> and <u>Above-ground biomass accumulation rate</u> is the annual net gain<sup>8</sup> of biomass and it is not to be compiled for Tier 1 estimates. Given that unlimited accumulation of biomass is not possible, this parameter is an active parameter only if the *Age-class* is input:

Abo	ve-ground biomass stock (t)	d.m. / ha)	45.000
Age class (yr)	User-defined value ~	Value	15
Above-ground bi	iomass accumulation rate (t	d.m. / ha)	3.000

<sup>&</sup>lt;sup>8</sup> Gross increment minus mortality

#### Guide to Land Representation

Where *Age class* and *Above-ground biomass accumulation rate* are input, the *Above-ground biomass stock* is automatically calculated (and thus its box is greyed, and no data input allowed) as the *Age class* multiplied by the *Above-ground biomass accumulation rate*. Further, the user shall also estimate C stock losses in the relevant worksheets to avoid counting for endless C accumulation in the land subdivision.

Where *Age class* is left *Unspecified*, the box is greyed and any input from the user is not allowed, and *Above-ground biomass stock* is input by the user:



Flooded land does not entail calculation of C stock changes, so no parameters are needed:

Land use subdivision - common paran	neters				
Land use subdivision name			Country/Territory	Japan	]
Soil Type	High Activity Clay Mineral	+ ~	Continent	Asia	]
Soil Status	Not applicable	~	Climate Region	+ ~	8
Land use subdivision - Managed Wet	lands specific parameters				
Туре					
<ul> <li>Peatlands under extraction</li> </ul>					
<ul> <li>Peatlands abandoned (former ex</li> </ul>	draction)				
Flooded land					
Other Wetlands					

#### ▶ <u>Other Wetlands</u>:

Land use subdivision name Soil Type Soil Status High Activity Clay Mineral Continer Encope En						
Land use subdivision name       Country/Tentory       Haly         Soil Type       Halyh Activity Clay Mineral       Continent       Europe         Soil Status       Natural       Climate Region       Image: Country/Tentory       Haly         Land use subdivision - Managed Wetlands specific parameters       Image: Country/Tentory       Haly       Image: Country/Tentory       Image: Country       Image: Country </th <th>Land use subdivision - common par</th> <th>ameters</th> <th></th> <th></th> <th></th> <th></th>	Land use subdivision - common par	ameters				
Soil Type       High Activity Clay Mineral       Continent       Europe         Soil Status       Natural       Climate Region       Image: Climate Region         Land use subdivision - Managed Wetlands specific parameters       Type       Image: Climate Region       Image: Climate Region       Image: Climate Region         Image: Peatlands under estraction       Peatlands abandoned former estraction)       Relatinds abandoned former estraction       Image: Climate Region	Land use subdivision name		3	Country/Territory	Italy	
Soil Status       Natural       Climate Region         Land use subdivision - Managed Wetlands specific parameters       Image: Climate extraction       Image: Climate extraction         Petalands abandoned (former extraction)       Petalands abandoned (former extraction)       Above ground biomass stock (f d.m. / ha)       45.000         Age class (yr)       Unspecified       Value       Image: Climate extraction       Image: Climate extraction         Petalands abandoned (former extraction)       Reference sol organic carbon stock (f d.m. / ha)       45.000         Age class (yr)       Unspecified       Value       Image: Climate extraction         Ratio of below-ground biomass to above ground biomass accumulation rate (f d.m. / ha)       Image: Climate extraction       Image: Climate extraction         Ratio of below-ground biomass to above ground biomass (R) (troot d.m. / t shoot d.m.)       Image: Climate extraction       Image: Climate extraction         Reference sol organic carbon stock (SOCref) (f C./ ha)       0.000 v       Image: Climate extraction       Image: Climate extraction         Relative C stock change factors       Image: Climate extraction       Image: Climate extraction       Image: Climate extraction         Relative C stock change factors       Image: Climate extraction       Image: Climate extraction       Image: Climate extraction         Relative C stock change factors       Image: Climate extraction	Soil Type	High Activity Clay Mineral	+ ~	Continent	Europe	
Land use subdivision - Managed Wetlands specific parameters Type Peatlands under extraction Potatinds shandoned former extraction) Potentials shandoned former extraction Potentials shandoned former extraction Above-ground biomass stock (t d.m. / ha) 45.000 Age class (yr) Unspecified Value Above-ground biomass accumulation rate (t d.m. / ha) Ratio of below-ground biomass to above-ground biomass (R) (t not d.m. / t shoot d.m.) Carbon fraction of biomass dy matter (t C / t d.m.) Reference soil organic carbon stock (SOCref) (t C / ha) Reference soil organic carbon stock (t C / ha) Reference soil organic carbon stock (ha) Reference soil organic carbon stock (ha) Reference soil organic carbon stock	Soil Status	Natural		Climate Region		+ ~ (
Land use subdivision - Managed Wetlands specific parameters  Type Pealands under extraction Potentiands abandoned former extraction) Potentiands abandoned former extraction Potentiands  Above-ground biomass stock (t d.m. / ha) 45.000 Age class (y) Unspecified Value Above-ground biomass accumulation rate (t d.m. / ha) Ratio of below-ground biomass to above-ground biomass (t) (t d.m. / t shoot d.m.) Carbon fraction of biomass dy matter (t C / t d.m.)  Reference soil organic carbon stock (SOCer) (t C / ha) Relative C stock change factors Land use (FLU) Inou Management (FMG) Inou Parameter (FMG) Inou Parameter (FMG) Inou Parameter (FMG) Parameter (FM						
Land use subdivision - Managed Wetlands specific parameters  Type Petiands under extraction Petiands abandoned former extraction) Potentiands abandoned former extraction Potentiands abandoned biomass stock (t dm, /ha) Potentiands  Above-ground biomass stock (t dm, /ha) Age class (yr) Unspecified Value Above-ground biomass accumulation rate (t dm, /ha) Ratio of below-ground biomass to above-ground biomass (t dm, /ha) Carbon fraction of biomass dy matter (t C / t dm,)  Reference soil organic carbon stock (SOCer) (t C / ha) Relative C stock change factors Land use (FLU) Inou Management (FMG) Inou Petition						
Type       Petatinds under extraction         Petatinds abandoned former extraction)       Petatinds abandoned former extraction)         Proveduation       Revergenced biomass stock it dm. / ha)         45:000       Age class (yi)         Unspecified       Value         Ratio of below-ground biomass to above-ground biomass accumulation rate it dm. / ha)       Image: Carbon fraction of biomass dy matter it C / td m.)         Carbon fraction of biomass dy matter it C / td m.)       Image: Carbon stock (SOCref) it C / ha)       0.000         Reference soil organic carbon stock (SOCref) it C / ha)       0.000       Image: Carbon stock (SOCref) it C / ha)       0.000         Netarive C stock change factors       Land use (FLU)       1.000       Image: Media         Image: C stock change factors       Land use (FLU)       1.000         Image: Media       1.000       Image: Media       1.000	Land use subdivision - Managed W	etlands specific parameters				
Petitands under extraction Petitands abandoned former extraction) Provided land © Other Wellands Above-ground biomass stock t d.m. / ha) 45000 Age class (y) Unspecified ♥ Value Above-ground biomass accumulation rate t d.m. / ha) Ratio of below-ground biomass to above ground biomass (g) throat d.m. / t shoot d.m.	Туре					
Petitinds abandoned (former extraction) Provided land © Other Welands Above-ground biomass atock (t dm. / ha) 45.000 Age class (y) Unspecified ♥ Value Above-ground biomass accumulation rate (t dm. / ha) Ratio of below-ground biomass to above ground biomass accumulation rate (t dm. / ha) Ratio of below-ground biomass to above ground biomase ground biomass to above ground biomass to a	Peatlands under extraction					
○ Rooded land             Other Wetlands                  Above ground biomass stock £ d.m. / ha)                  Age class (y)             Unspecified                  Above ground biomass accumulation rate £ d.m. / ha)                 Ratio of below-ground biomass to above ground biomass accumulation rate £ d.m. / ha)                 Ratio of below-ground biomass to above ground biomass accumulation rate £ d.m. / ha)                 Ratio of below-ground biomass to above ground biomass accumulation rate £ d.m. / ha)                 Retain of below-ground biomass to above ground biomass accumulation rate £ d.m. / ha)                 Retain of below-ground biomass to above ground biomass dy matter £ C / t d.m.)                 Reference soil organic carbon stock (SOCref) £ C / ha)                 Relative C stock change factors                 Land use (FLU)                 Indiangement (FMo)                 Indiangement (FMo)                 Indiangement (FMo)	Peatlands abandoned (former	extraction)				
Other Wetlands      Above-ground biomass stock (t d.m. / ha)     Ads 000 Age class (yr) Unspecified Value      Above-ground biomass accumulation rate (t d.m. / ha)     Ratio of below ground biomass to above-ground biomass (R) (t not d.m. / t shoot d.m.)      Carbon fraction of biomass dy matter (t C / t d.m.)      Reference soil organic carbon stock (SOCref) (t C / ha)     Outing      Reference soil organic carbon stock (SOCref) (t C / ha)     Relative C stock change factors     Land use (FLU)     1000     Management (FM6)     1000     Input (F)     1000	Flooded land					
Above-ground biomass stock it d.m. / ha)       45.000         Age class (yr)       Unspecified       Value         Above-ground biomass accumulation rate it d.m. / ha)       Image: Class (ground biomass (ground biomass)))))))))))        Reference s	Other Wetlands					
Above-ground biomass stock it dm. /ha)       45.000         Age class (yr)       Unspecified       Value         Above-ground biomass accumulation rate it dm. /ha)          Ratio of below-ground biomass to above-ground biomass dry matter it C / t dm.)          Carbon fraction of biomass dry matter it C / t dm.)          Reference soil organic carbon stock (SOCref) it C / ha)       0.000          Relative C stock change factors          Land use (FLU)       1.000         Management (FMG)       1.000         Input (FI)       1.000						
Age class (yr)       Unspecified       Value         Above-ground biomass accumulation rate it dm. / ha)				Above-ground biomass sto	ock (t.d.m. / ha)	45.000
Above-ground biomass accumulation rate (t d.m. / ha)         Ratio of below-ground biomass to above-ground biomass (R) (t root d.m./t shoot d.m.)         Carbon fraction of biomass dry matter (t C / t d.m.)         Carbon fraction of biomass dry matter (t C / t d.m.)         Reference soil organic carbon stock (SOCref) (t C / ha)         Reference soil organic carbon stock (SOCref) (t C / ha)         Relative C stock change factors         Land use (FLU)         Management (FMG)         Input (F)			Age cla	ss (yr) Unspecified	✓ Value	
Ratio of below-ground biomass to above-ground biomass (R) & root dm./t shoot d.m./         Carbon fraction of biomass dry matter & C / t d.m.)         Carbon fraction of biomass dry matter & C / t d.m.)         Reference soil organic carbon stock (SOCref) & C / ha)         Relative C stock change factors         Land use (FLU)         Management (FMG)         Inou         Input (F)			Above-g	ound biomass accumulation r	ate (t.d.m. / ha)	
Carbon fraction of biomass dry matter (t C / t d m.)          Reference soil organic carbon stock (SOCref) (t C / ha)       0.000          Relative C stock change factors          Land use (FLU)       1.000         Management (FMG)       1.000         Input (F)       1.000			Ratio of below-ground biomass to above	ground biomass (R) (t root d.r	n./t shoot d.m.)	
Reference soll organic carbon stock (SOCref) ≵ C / ha) 0.000 ✓ Relative C stock change factors Land use (FLU) 1.000 Management (FMG) 1.000 Input (F) 1.000			Carb	on fraction of biomass dry ma	ter (t C / t d.m.)	~
Reference soil organic carbon stock (SOCref) ‡ C / ha) 0.000 Relative C stock change factors Land use (FLU) 1.000 Management (FMG) 1.000 Input (F) 1.000						
Reference soil organic carbon stock (SOCref) ∉ C / ha) 0.000 ↓ Relative C stock change factors Land use (FLU) 1.000 Management (FMG) 1.000 Input (FI) 1.000						
Reference soil organic carbon stock (SOCref) t C / ha) 0.000 ↓ Relative C stock change factors Land use (FLU) 1.000 Management (FMG) 1.000 Input (FI) 1.000						
Reference soil organic carbon stock (SOCref) (t C / ha) 0.000 v Relative C stock change factors Land use (FLU) 1.000 Management (FMG) 1.000 Input (FI) 1.000						
Relative C stock change factors Land use (FLU) 1.000 Management (FMG) Input (F) 1.000			Reference	soil organic carbon stock (S	DCref) (t C / ha)	0.000 ~
Land use (FLU) 1.000 Management (FMG) 1.000 Input (FI) 1.000				Relative C stock	change factors	
Management (FMG) 1.000 Input (F) 1.000					Land use (FLU)	1.000
Input (FI) 1.000				Man	agement (FMG)	1.000
					Input (FI)	1.000

If a mineral soil is selected, the SOC stock change factors have to be input. IPCC does not provide default values for <u>Managed Wetlands</u>, although guidance for land under conversions is provided in Chapter 5 of the Wetlands Supplement.

**Note:** Chapter 5 of the *Wetlands Supplement* provides refined SOC<sub>REF</sub> values for *Inland Wetland mineral soil*. For biomass parametes see <u>*Peatlands abandoned (former extraction)*</u>.

## Guide to Land Representation

## **Settlements**

IPCC provides methodological guidance to estimate biomass C stock changes at Tier 2 only (<u>Equations 8.2 and 8.3</u>). While SOC change estimates, at Tier 1 and 2, depend on the proportion of land that is:

- ▶ paved
- covered by turfgrass
- ➤ cultivated
- ➤ treed

Thus, the *Software* has 2 subcategories for *Settlements*:

- Settlements (Treed)
- Settlements (Other)

<u>Settlements (Treed)</u> encompasses the portion covered by trees only<sup>9</sup>, while <u>Settlements (Other)</u> encompasses the other 3 land cover types.

Thus, users shall share the total area of settlement between the 2 subcategories and for the subcategory <u>Settlements</u> (<u>Other</u>) users shall further estimate the proportion of area covered by each of the non-tree cover types.

<sup>&</sup>lt;sup>9</sup> It does not include other land cover types mixed within trees.

#### Guide to Land Representation

## **IPCC** Inventory Software

#### Settlements (Treed)

Lariu use subuivision - common par	dilleters			
Land use subdivision name		Country/	Territory Italy	
Soil Type	High Activity Clay Mineral	+ ~	Continent Europe	
Soil Status	Natural	Climate	Region	+~
Land use subdivision - Treed Settle	ments specific parameters			
		Above-ground b	iomass stock (t.d.m. / ha)	
		Ratio of below-ground biomass to above-ground biomass (R	(t root d.m./t shoot d.m.)	
		Carbon fraction of bioma	ss dry matter (t C / t d.m.)	
			Age class (yr)	Unspecified 🗸
		Active	growing period (AGP) (yr)	
		Number of crown cover classes or indiv	idual woody plant classes	1
		Priorana cal arazzia antar	stock (SOCorf) & C (ba)	0.000
		Nererence soil organic carbor	i stock (SOCier) (LC / Ha)	0.000 🗸
		Kelativ	e C stock change factors	1 000
			Land use (FLO)	1.000
			Management (FMG)	1.000
			Input (FI)	1.000

Parameters specific for this subdivision are:

Age class intends to distinguish those treed land where trees are still in an active growing period (AGP), parameter for which IPCC assumes a 20-years default, and those that are not. For those that are in an active growing period -i.e. Age class  $\leq$  AGP- the net growth is to be estimated in the relevant worksheet, for those that are not -i.e. Age class > AGP- no biomass changes are to be estimated.

Age class (vr)	Unspecified ~	ΔCG(T2b)
riod (AGP) (vr)	Age class (yr)	Remark
	Unspecified	
y plant classes	>AGP	
	≰AGP	

Where Unspecified is selected, the Software allows an unlimited carbon accumulation in the biomass C pool for the Gaine's Loss method, thus Unspecified is to be selected only if the Stock-Difference method is applied to the biomass C pool to the unit of land under this land subdivision.

- > <u>Active growing period</u> is to be input by the user. IPCC default value is 20 years.
- Number of crown cover or individual woody plant classes both IPCC equations -8.2 and 8.3) calculate biomass C stock changes as the sum of stock changes occurring on subset of the tree population i.e. the class. The use of classes deals with variability in growth rates among different sub-population (e.g. different age for same tree species) or differences in the tree species or group of species.

The user has three variables: *land subdivision, age class, number of crown cover or individual woody plant classes* to deal with variability in the net accumulation rate, although the *Gain&Loss* method allows to estimate net C gain only and only till the vegetation achieve its long-term biomass C stock. Thus, where losses are to be estimated the *Stock-Difference* method is to be applied between C stock estimates at time 1 and a time 2, where C stock at time 2 is calculated as C stock at time 1 plus C stock gains between time 1 and 2 minus C stock gains between time 1 and 2; however, the current version of the *Software* does not implement such calculation of C stock at time 2.

▶ For <u>Settlements (Treed)</u> the Tier 1 value for all Relative SOC change factors is equal to 1.

For all other parametes for biomass see Managed Wetlands.

Tier 3, depending on data used, is to be accommodated in the above listed variables.

#### Guide to Land Representation

#### **Settlements (Other)**

Land use subdivision - common para	meters			
Land use subdivision name			Country/Territory	Italy
	High Activity Clay Minoral		Continent	Fumpe
	Network	· · ·	Climate Basian	
Soil Status	Natural	~		L V V
Land use subdivision - Other Settlem	ents specific parameters			
			Above-ground biomass stor	ж (td.m. / na)
		Ratio of below-ground biomass t	o above-ground biomass (R) (t root d.m	/t shoot d.m.)
			Carbon fraction of biomass dry matt	er (t C / t d.m.)
		R	leference soil organic carbon stock (SO	Cref) (t C / ha) 0.000 🗸
Cultivated				
			Proportion of the area that is	cultivated (%)
		Relative C stock change factors		
		Land use (FLU) 1.000 🗸	Management (FMG) 1.000	<ul> <li>Input (FI) 1.000</li> </ul>
Turforass				
			Proportion of the area covered t	v turfarass (%)
		Relative C stock change factors		
		Land use (FLU) 1.000 V	Management (FMG) 1.000	✓ Input (FI) 1.000 ✓
Paved				
1 divid			Proportion of the a	rea naved (%)
		Relative C stock change factors	riopolitori or tile a	
		Land use (FLU) 1.000	Management (FMG) 1.0	00 Input (FI) 1.000

Parameters specific for this subdivision are:

Proportion of the area that is cultivated, Proportion of the area covered by turfgrass, Proportion of the area paved input shall sum up to 100%.

The user may instead share the area of non-treed settlements among three subdivisions each of one dealing with a single land cover, and thus assign 100% to the proportion of the relevant land cover.

- ▶ For <u>Settlements (Other)</u> the IPCC Tier 1 values of the Relative SOC change factors are:
  - ✓ For *Cultivated*, are those for *Cropland*<sup>10</sup>, with no-till  $F_{MG}$  values and  $F_{I}$  equal to 1
  - ✓ For Turfgrass, are those for Improved Grassland,<sup>11</sup> with no-till FMG values and FI equal to 1
  - ✓ For Paved, the product of F<sub>LU</sub>, F<sub>MG</sub> and F<sub>I</sub> is 0.8 times the corresponding product for the previous land use/management (i.e., 20% of SOC of previous land use/management will be lost as a result of disturbance, removal or relocation of soil).

The current version of the Software has not capacity to compile the Relative SOC change factors as 0.8 of those of the previous land subdivision. To deal with this, the only option currently available is to create *land-conversion-specific* subdivisions for *Paved* areas in <u>Settlements (Other)</u>, in such a way the  $F_{LU}$ ,  $F_{MG}$  and  $F_{I}$  can be input as 80% of the value of the previous subdivision. For example, a subdivision named *forest land converted to paved land* has the value of 0.8 for each of the 3 *Relative SOC change factors*.

For all other parametes for biomass see Managed Wetlands.

Where the *soil type* selected is *Coastal Wetlands*, an additional *soil status* option -i.e. *Excavated*- is available in the dropdown menu:

Soil Type	Coastal Wetlands soil	• ~
Soil Status	Natural	~
Land use subdivision - Other S	Natural	
	Drained	
	Rewetted	
	er Settleme Excavated	

This is to deal with conversion of *Coastal Wetlands* to infrastructures -e.g. port, harbour and marina construction, aquaculture ponds, salt production ponds-. Accordingly, when *Excavated* is selected, no C stock parameters are needed to be input since the excavated land is without any resident C stocks.

<sup>&</sup>lt;sup>10</sup> AFOLU Table 5.5

<sup>&</sup>lt;sup>11</sup> AFOLU Table 6.2

Tier 3, depending on data used, is to be accommodated in the above listed variables.

### Guide to Land Representation

#### Other land

It includes all land without significant C stocks. This means that *Other land remaining Other land* has not any significant C stock changes and thus the software does not provide any calculation worksheets for category 3.B.6.a.; furthermore, every conversion to *Other land* determines the complete loss of C stocks resident in the land according to its previous use/management.

## Guide to Land Representation

## Unmanaged Other land

Land use subdivision name Soil Type	High Activity Clay Mineral	<b>⊗</b> +∨	Country/Territory Continent Climate Region	Italy Europe
Land use subdivision - Unmanaged C	ther Land specific parameters			

Given that Other land has not significant resident C stocks, no C stock parameters are present in the Unmanaged Other land mask.

## Guide to Land Representation

## Managed Other land

Land use subdivision - common parar	neters				
Land use subdivision name			Country/Territory	Italy	
Soil Type	High Activity Clay Mineral	+ ~	Continent	Europe	
			Climate Region	+ ~	3
Land use subdivision - Managed Oth	er Land specific parameters				

Given that Other land has not significant resident C stocks, no C stock parameters are present in the Mmanaged Other land mask.

#### Guide to Land Representation

#### **IPCC** Inventory Software

	Crocol		Forest land		Cropland		Grassland		Wetlands		Settlements		r land
C	poor	R	С	R	С	R	С	R	С	R	С	R	С
D:	Aboveground	Х	Х	X3	Х	X	Х		Х	Х	Х		Х
Diomass	Belowground	X1	Х	X3	Х	Х	Х		Х	Х	Х		Х
DOM	Dead Wood	Х	$\mathbf{X}^2$	X	<b>X</b> <sup>2</sup>	X	<b>X</b> <sup>2</sup>		<b>X</b> <sup>2</sup>	Х	X2		<b>X</b> <sup>2</sup>
DOM	Litter	Х	$\mathbf{X}^2$	X	<b>X</b> <sup>2</sup>	X	$\mathbf{X}^2$		$\mathbf{X}^2$	Х	X <sup>2</sup>		<b>X</b> <sup>2</sup>
Soil Organic	mineral	Х	Х	Х	Х	Х	Х			Х	Х		Х
Matter	organic <sup>5,6</sup>	Х	Х	Х	Х	Х	Х	$X^4$	X4,7	Х	Х		Х
Harvested Wood Product		X											

## Reporting requirement for C pools at Tier 1 and Tier 2

C	pools for which	C stock changes	are to be estimated	according to	Tier 1 or	r 2 of the 200	6 IPCC Guidelines
		0		()			

A **black X** indicates that according to Tier 1 C stock changes in the relevant C pool are to be estimated, and a **blue X** indicates those C stock changes to be additionally estimated according to Tier 2. Tier 3 applied to any C pool in any land use category requires users to estimate annual C stock changes in that C pool (either as net change between times or as a sum of all gains and losses). **R** indicates subcategories where land is not undergoing a change in use, while **C** indicates those where land is undergoing a change.

Notes: 1. although IPCC provides default values of  $\mathbf{R}$  (root:to:shoot ratio) and so user may estimate changes in belowground biomass at Tier 1 too; 2. Given that the 2006 IPCC Guidelines do not provide default values for DOM user estimates changes in DOM at Tier 2 or 3 only; 3. limited to perennial biomass; 4. including due to peat extraction; 5. where organic soils are drained, IPCC default method applies; 6. the Wetlands Supplement extends IPCC default methodology to rewetted soils; 7. the Wetlands Supplement extends to those soils in Coastal Wetlands that are a mix of mineral and organic origin

#### Guide to Land Representation

## Land Representation Manager (LRM)

Land Use Representation. Manager is a tabbed dialog window containing 3 tabs:

- ✓ <u>Regions</u>,
- ✓ Land Representation table,
- ✓ <u>Annual land representation matrix</u> (limited<sup>12</sup> to Approaches 2 ♂ 3 for land representation).

The user can open it from Administrate main menu, AFOLU sub-menu



or from the bottom of any worksheets of 3.B categories



All information shown in the 3 tabs is relative to currently chosen inventory year.

<sup>&</sup>lt;sup>12</sup> Given Approach 1 for Land Representation does not identify land use changes the matrix cannot be built.

## Guide to Land Representation

## **Regions Tab**

This tab allows subnational representation of land by stratifying the national territory in subnational units, here defined as **Regions**. It requires inputting the total area of the country, although apportioned among Regions, as well as selecting for each Region the approach for the land representation.

Land Representation Manager			-		×
Regions   Land representation table   Annual land representation	on matrix (Approach 2 & 3)				
Whole country area (ha) 6,000.000					
Region name	Area (ha)	Approach	Remark		
Region 1	1.000	Approach 1			
Region 2	2,000	Approach 2			+
Region 3	3,000	Approach 3			×
*					
Total	6000.000				
Define single region in case you wish to report for the whole country					
			Save	Cha	
			Jave Undo	CIUS	30

The user can either input a single Region that covers the entire territory, for which the GHG inventory is prepared, or a number of Regions. In the latter case, for each Region an independent and consistent time series of activity data is to be input by the user [section on 'Land representation table tab''].

Whole country area: User must enter total area of the territory for which the GHG inventory is prepared.

The area value input is saved automatically (no need to press Save) and can be changed through a new input.

The field has a background color that indicates:

- Green sum of areas across defined regions matches whole country area.
- Orange sum of areas across defined regions is less than whole country area.
- Red sum of areas across defined regions is greater than whole country area.

Tip: In case of Orange/Red color, placing mouse pointer over the field shows tooltip with a warning and the area difference between the total and the sum of areas input in the Regions fields.

Table: User can define one or more regions with the following attributes:

- ✓ **Region name** to be input.
- $\checkmark$  Area area of the region in ha to be input.
- ✓ Approach -1, 2, 3 for land representation to be selected.
- Remark user can input here notes relevant for the row of data (information is neither transferred to reporting tables nor can be printed)

## Guide to Land Representation

Tip: to record info input in the DataBase (DB) press the button Save. Once saved the information cannot be changed anymore. Where an error is identified in information input, the Region (and its data) is to be deleted -to do so click the red **x** on the right hand of the table- and input again with the correct information.

#### Guide to Land Representation

## Land representation table Tab

Allows defining units of land for the selected Region according to Region's defined Approach for land representation.



The Land representation Tab requires user to input a consistent land representation. Where a consistent land representation is a time series of annual area estimates of units of land, as disaggregated according to stratification, that:

- $\checkmark$  reports the total area of the territory constant across the entire time series
- classifies land using a consistent methodology across the entire time-series (no artifact land conversions caused by changes in the classification method/background-data)
- ✓ in each year Y, all units of land under conversion are reported within the *Land converted to* relevant category until the end of the transition period (D)
- ✓ in each year Y, all units of land that did not undergo a conversion in the last Y-D years are reported within the Land remaining relevant category.

Being **A** the first year of a time series and **T** the last one, a Time series of activity data consists of annual area (ha), for each of the units of land, for each year of the inventory time period (**A**-**T**) plus for a number of years, previous than year **A**, equivalent to the transition period (**D**) applied to conversions of land use/management i.e. **A-D**. For example, **A** is the year 2005, **T** is the year 2024 and **D** is a 20-year period, then the time series of activity data needed is from **A**-**D** (2005-20=1985) to **T** (2024).



**Region** – dropdown menu for choosing one of the defined regions to work with. By choosing region, region's area is filled in automatically together with info on Approach defined for that region in the tab *Regions*. Multi-level table below is automatically filled with data on IPCC land use categories and associated area (as the sum of areas input for the units of land belonging to the category/sub-category).

Region can be any level of stratification of the territory the user wishes to apply, e.g. administrative regions, ecological zones, parks, land subject to specific project activities, as well as a mix of those. *Nevertheless, it is suggested to use the stratification in "Regions" to aggregate all that land that has same soil type and climate zone while subject to different land use/management.* Other levels of disaggregation -e.g. administrative, ownership, management systems- can be managed through the use of land-use subdivisions as well as of units of land<sup>13</sup>. For each Region the *Software* requires an independent<sup>14</sup> and consistent Land Representation.

<sup>13</sup> A unit of land is an area homogenous per climatic and pedologic characteristic as well as per current and past use/management.

<sup>14</sup> No land transfer allowed among different Regions

#### Guide to Land Representation

Region area - background color meaning:

- Green sum of areas across land use subcategories equals region's total area.
- Orange sum of areas across land use subcategories is less than region's total area.
- Red sum of areas across land use subcategories is greater than region's total area.

**Discrepancy** – In case of Orange/Red color, shows the area difference between Region's total area and area input in the *Land representation table* for that Region. Negative value means that the area input in the *Land representation table* is larger than the area input for the Region in the <u>Regions tab</u>; a positive value vice versa indicates that the area input in the *Land representation table* is smaller than the area input for the Region in the <u>Regions tab</u>; a positive value vice versa indicates that the area input in the <u>Land representation table</u> is smaller than the area input for the Region in the <u>Regions tab</u>. Otherwise, the zero value means no discrepancy.

Current inventory year is indicated on the right-hand side.

#### Table levels

The Multi-level table contains all 6 IPCC land use categories as well as all 12 land use subcategories, where the user can input 4 levels of information for each unit of land:

- $\blacktriangleright$  <u>1st level</u>, where to select the current land use category of the unit of land
- > 2nd level, where to select the current land use subcategory of the unit of land
- $\rightarrow$  <u>3<sup>rd</sup> level</u>, where to select the current land use subdivision of the unit of land
- 4<sup>th</sup> level, where to input all information that qualifies the unit of land conversion status, the area and the methods applied to estimate C stock changes in each C pool.

Finally, in the

 $\blacktriangleright$  <u>5th level</u>, information on historical conversions of the land is stored.

NOTE: Units of land SHALL be input from the first year of the inventory time series onwards

## Guide to Land Representation

## 1st level

Contains the 6 IPCC land use categories:

Land Representation Manager	– 🗆 X
Regions Land representation table Annual land representation matrix (Approach 2 & 3)	
Region Region III V Region area (ha) 1.000.000 Discrepancy (ha) OK Approach 3	1999
Area Land use category (1999) Remark (ha)	
Forest Land     0	
Cropland     1,000	
Grassland 0	
Wetlands     0	
Settlements	
De Other Land 0	

In **Remark**, the user can input notes relevant for the entire category *(information is neither transferred to reporting tables nor can be printed)* 

Clicking on 🕒 the lower level of the relevant category opens. So, to input a unit of land click on the 🕒 of its current use.

**Tip:** in case of Approach 3, in the first inventory year of the inventory time series i.e. year **A**, the land use category to be selected for a unit of land may not be the actual land use/management in the first inventory year; it could instead be the land use/management in the time period **A-D** to **A** if any use/management change occurred in that time period *[section on 5<sup>th</sup> level]*.

## 2nd level

Region	Region III ~	Region area (ha)	1,000.000 D	iscrepancy (ha)	ок	Approach 3	1999
	Land use category			Area (1999) (ha)		Remark	-
🖃 🕨 Fo	orest Land				0		
	Land use subc	ategory		Area (1999) (ha)		Remark	
•	Managed Forest Land				0		
÷	Unmanaged Forest Land				0		
				Area (1999) (ha)			
E Cr	ropland		-		1.000		
				Area (1999) (ha)			
•	Cropland Annual Crops				600		
	Cropiand Perennial Crops			Aroa	400		
	Land use category			Area (1999) (ha)		Remark	
E G	rassland				0		
	Land use subc	ategory		Area (1999) (ha)		Remark	
	Managed Grassland				0		
	ommanagea arabbiana			Area			
	Land use category			(1999) (ha)	0	Remark	
	enanus			Area			
	Land use subc	ategory		(1999) (ha)		Remark	
	Managed Wetlands				0		
	Land use category			Area (1999)		Remark	
e Se	ettlements			()	0		
	Land use subc	ategory		Area (1999) (ha)		Remark	
•	Settlements (Treed)				0		
•	Settlements (Other)				0		
				Area (1999) (ha)			
ė. <b>O</b>	ther Land				0		
		ategory		Area (1999) (ha)			
	Managed Other Land				0		

Contains 12 land use subcategories, 2 for each IPCC land use category:

Area – specified area of the subcategory for a chosen inventory year.

In **Remark**, the user can input notes relevant for the entire subcategory *(information is neither transferred to reporting tables nor can be printed)* 

Clicking on 🗈 the lower level of the relevant subcategory opens. So, to input a unit of land click on the 🗈 of its current use.

## Guide to Land Representation

## 3rd level

Contains all land use subdivisions input by the user in the Land Type Manager (LTM) for the relevant subcategory.

	Land use category		Remark				
For	est Land	remark upd					
	Land use subcategory	Area (ha)		Remark			
	Managed Forest land		300 000	rupd			
	Current Land use subdivision			Remark			
	Plantation 1						
	Plantation 2				_		
Ð	Plantation 3						
	Forest drained						
	Natural forest				_		
	Organic plantation						
	new forest custom type				_		
1	*						

In **Remark**, the user can input notes relevant for the entire subdivision *(information is neither transferred to reporting tables nor can be printed)* 

Clicking on 🕕 the lower level of table opens where information on previous use/management of the unit of land as well as its area is to be input. So, to input a unit of land click on the 🖿 of its current type.

Tip: placing mouse pointer over any subdivision shows tooltip with information on that subdivision as input in the Land Type Manager.

## Guide to Land Representation

#### 4th level

Allows inputting Units of land, according to the Approach for the Land Representation selected for the Region. The set of guidance to input information on units of land is subdivided in 2 subsets:

- ✓ Data input guidance to create a new unit of land. Note that some steps do not apply to all Approaches, as indicated
- ✓ Data input guidance to add/modify information of a unit of land

#### Data input guidance to create a new unit of land

For each unit of land at its first input, the following step-by-step procedure applies:

- first step selecting, from the dropdown menu, the previous land use subcategory. This does not apply to Approach 1
- second step selecting, from the dropdown menu, the previous land use subdivision. This does not apply to Approach 1
- third step adding the user-defined land unit code<sup>15</sup>
- fourth step adding the Transition period. This does not apply to Approach 1
- Fifth step adding the Year of conversion. This does not apply to Approach 1
- sixth step adding the Area. For Apporach 1 only, the area of the unit of land 20-year before is to be added too
- seventh step selecting, from the Land Unit Parameters table under column "P", the method to be applied to estimate C stock changes in each C pool
- eighth step adding any notes in the Remark field
- > ninth step save the unit of land by clicking the Save button

<sup>&</sup>lt;sup>15</sup> The user can insert an alphanumerical code to track, and so recognize, the unit of land across the entire inventory time series.

## Guide to Land Representation

*First step*, select, from the dropdown menu, the land use subcategory the unit of land had in the previous inventory year:



**Note**: In a consistent land representation, the time-series of land activity data needed begins **D** years before the first inventory year, where **D** is the transition period applied to land use/management conversions. Nevertheless, units of land are input in the *Software* from the first inventory year onwards only. Consequently, given the first year of an inventory time series **A**, where the user is adding a unit of land:

- When Approach 2 is applied: the information to be input as previous subcategory is the subcategory to which the unit of land belonged in the year A-D. Where the previous land use subcategory or previous land use subdivision is different than the current one, a conversion occurred and thus the users is required to input the length of the Transition period D [*Fourt step*] as well as the year of conversion [*Fifth step*]
- When Approach 3 is applied: the unit of land may have undergone multiple land use/management chanages in the period from year A-D to year A, and consequently multiple changes need to be input for the same unit of land. In such a case, moving from the year A-D onwards, the user shall select as current land use category/subcategory and subdivision the category/subcategory and subdivision the land had after the conversion, even if the land in the first inventory year has a different current land use; same applies for subsequent land use/management changes that occurred before the first inventory year. Where the previous land use subcategory or previous land use subdivision is different than the current one, a conversion occurred and thus the users is required to input the length of the Transition period D [Fourt step] as well as the year of conversion [Fifth step]. For example:

For an inventory time series from year **A** to year **A+20**, a times series of activity data for the period **A-D** to **A+20** is needed. The activity data time series of unit of land **X** shows a first conversion *-managed forest land to annual cropland-* in the year **A-(D/2)** and a second conversion *-annual cropland to managed grassland-* in the year **A-(D/4)**; no conversion in inventory year **A** and in any following inventory years occurred.



Given that:

- ✓ data input shall start from the first inventory year -i.e. year A- onwards, and
- ✓ data input of land use/management changes occurred before the first inventory year shall also be made be made from the first year of that period -i.e. year A-D- onwards,

the data input in the inventory year **A** in the *Software* land representation manager follows the following steps:

<u>first</u>, input the conversion from <u>managed forest land</u> to <u>annual cropland</u> occurred in the year A-(D/2), where <u>annual cropland</u> is the current land use subcategory and <u>managed forest land</u> is the previous land use subcategory:

#### Guide to Land Representation

Land Rep	ore	sentat	ion Manager													×		
Regions		Land	representation table	Annual land	d representation matrix (Approa	ch 2 & 3)												
Region		tre		~	Region area (ha)	1,000.000	Discrep	ancy (ha)	ОК			Approach	3			1990		
	Land use category							Area (1990) (ha)						k				
۰.	Forest Land									100								
	Cro	opland	1				1,000											
				Land us	e subcategory		Area (1990) Remark (ha)				ark							
e		Crop	land Annual Crops				1,000											
					Current Land use s	ubdivision							Remark					
	ė.	Т	es 1													×		
			Land unit code (Automatic)		Land unit code (User defined)	Previous L subcate	and use gory	Previousub	us Land use division	Transition ( (D) (years	eriod	Year of conversion	Area (1990) (ha)	Remark	P	ом		
			ACL-T1-2<-MFL-FC	1-PL-P		Managed Fores	t Land	FL Custom	1	20		1980	1,000 ↔		1	5 X		
		*	e				~		~				<->		2			

 second, input the conversion from <u>annual cropland</u> to <u>managed grassland</u> occurred in the year A-(D/4), where <u>managed grassland</u> is the current land use subcategory and <u>annual cropland</u> is the previous land use subcategory. This is

done by using the functionality for "further conversion" "<sup>[]</sup>" that is available when Approach 3 for land representation is applied [section on "Data input guidance limited to units of land under Approach 3 for land representation"]

New Land Unit Convers	ion	×
Current conversion state	2L	
From	Managed Forest Land / FL Custom 1	
То	Cropland Annual Crops / Tes 1	
Transition Period (D)	20 Year of conversion 1980	
New conversion to		
Land use subcategory	Managed Grassland	~
Land use subdivision	Test GL	$\sim$
Transition Period (D)	20	
Year of conversion	1985 🗸	
Remark	l	
	Save	Cancel

Thus, in the first inventory year A the unit of land is shown in the land representation manager as:



which means that the unit of land was first classified under cropland and finally classified under grassland; although information on first conversion remains associated with the unit of land, but shown in gray to indicate that such dynamic isn't anymore ongoing in the year **A**.

In case of **Approach 1** for land representation, this **first step** does not apply since land use/management changes are neither identified nor tracked.

## Guide to Land Representation

*Second step*, select, from the dropdown menu, the land use subdivision the unit of land had in the previous inventory year:



## Note: see Note at first step. Same applies here.

In case of **Approach 1** for land representation, this **second step** does not apply since land use/management changes are neither identified nor tracked.

Tip: Within each region, conversions from one subdivision to another subdivision is restricted by the following rules:

- ✓ cannot convert any subdivisions of managed subcategories -<u>Managed Forest land</u> [MFL], <u>Cropland</u> (both subcategories) [CL], <u>Managed Grassland</u> [MGL], <u>Managed Wetlands</u> [MWL], <u>Settlements</u> (both subcategories) [SL], <u>Managed Other land</u> [MOL]to any subdivisions of unmanaged subcategories -<u>Unmanaged Forest land</u> [UFL], <u>Unmanaged Grassland</u> [UGL], <u>Unmanaged Wetlands</u> [UWL], <u>Unmanaged Other land</u> [UOL]-
- ✓ soil type in previous and current land subdivision shall be the same [Land Use Manager]
- ✓ climate region in previous and current land subdivision shall be the same [Land Use Manager]
- ✓ for Forest land only, ecological zone in previous and current land subdivision shall be the same [Land Use <u>Manager</u>]

#### Guide to Land Representation

*Third step*, input the **user-defined land unit code**, while the *Software* compiles the **automatic land unit code** [section on "Automatic unit of land codes"].



Although this is not a mandatory information to input, it is recommended to do so in order to facilitate the data inputs in the calculation Worksheets for C stock changes and associated GHG emissions and removals. Indeed, in those worksheets a number of units of land are visualized together and the **land unit code** allows to distinguish among those when adding in the Worksheets required information.

## Guide to Land Representation

## **IPCC** Inventory Software

## Automatic unit of land codes

In any given point of time, the automatic code is generated from Current land use subdivision under which the unit of land is classified. In case there is an ongoing transition, automatic code also contains a code of the subdivision from which the unit of land is being converted together with indication of the age of conversion (using "Cx" suffix, which means  $x^{th}$  year in conversion (relative to current inventory year, see picture below):

	Land unit code (Automatic)	Land unit code (User defined)	Previous Land use Previous Land use Subcategory Subdivision		Transition Period (D) (years)	Year of conversion	Area (2010) (ha)	Remark			
	PCL-AP-UD-10	3	Cropland Perennial Crops	agroforestry - pepper	NA	NA	400 «>		2		×
•	PCL-AP-UD-15<-ACL-SI-C0	2	Cropland Annual Crops	soybean intensive	20	2010	100 💮		2		×
•	PCL-AP-UD-18<-ACL-SI-C	0	Cropland Annual Crops	soybean intensive	20	2000	100 ↔		2	U	×

Coding elements according to land use categories are shown hereafter:

## Forest land

[M,U]FL-NAMEabbr-[PL,NF]-FTabbr-LUID

[M,U] = either Managed or Unmanaged

NAMEabbr = Subdivision name abbreviation (automatically generated from Subdivision name)

[PL,NF] = either Plantation or Natural forest

FTabbr = Forest type name abbreviation (automatically generated from Forest type name)

LUID = unit of land database ID

## <u>Example</u>:

MFL-OP-PF-TG-48 = Managed Forest land - Organic plantation - planted forest - Tectona grandis - 48 DB ID

## Cropland

[P,A]CL-NAMEabbr-[CTp,RE]-LUID

[P,A] = either Perennial or Annual

NAMEabbr = Subdivision name abbreviation (automatically generated from Subdivision name)

[CTp,RE] = CTp – either crop type abbreviation (for perennial) or RE in case of rice ecosystem (for annual)

LUID = unit of land database ID

## <u>Example:</u>

PCL-BF-OP-62 = Perennial cropland – Belvedere Farm - Oil palm - 62 DB ID

## Grassland

[M,U]GL-NAMEabbr-VegType-[IMP]-LUID

[M,U] = either Managed or Unmanaged

NAMEabbr = Subdivision name abbreviation (automatically generated from Subdivision name)

VegType = vegetation type

IMP - only in case of improved grassland

LUID = land unit database ID

## <u>Example:</u>

MGL-TG-ST-IMP-67 = Managed GL - Test grassland - Steppe - improved - 67 DB ID

## Wetlands

[M,U]WL-NAMEabbr-[P,F,O]-LUID

[M,U] = either Managed or Unmanaged

NAMEabbr = Subdivision name abbreviation (automatically generated from Subdivision name)

[P,F,O] = either Peatlands (P) or Flooded land (F) or Other land (O)

LUID = unit of land database ID

#### <u>Example:</u>

MWL-P2-P-82 = Managed WL - Peatlands 2 - Peatlands - 82 DB ID

#### Settlements

[T,O]SL-NAMEabbr-LUID [T,O] – either Treed or Other NAMEabbr = Subdivision name abbreviation (automatically generated from Subdivision name) LUID = land unit database ID

<u>Example:</u>

TSL-S1-59 = Treed SL - Settlements 1 - 59 DB ID

## Other land

[M,U]OL-NAMEabbr-LUID

[M,U] = either Managed or Unmanaged

NAMEabbr = Subdivision name abbreviation (automatically generated from Subdivision name)

LUID = unit of land database ID

<u>Example:</u>

MOL-OL1-67 = Managed OL - Other land 1 - 67 DB ID

## Additional Suffix (Approach 2 and 3 only)

Relative to current inventory year: Cx (where x indicates the xth year in which the land is under conversion.

Note: the x<sup>th</sup> year in which the conversion occurs has number 1

#### Guide to Land Representation

#### Guide to Land Representation

Fourth step, input the Transition period, in years. By default the value of 20-year is used by the Software.

n hu common 1 Cross Tes 1 20 1990 1000 co	
	📝 🗙

The **Transition period** is the time period according to which the *Software* tracks the previous land use subcategory/subdivision of a unit of land undergoing a land use subcategory/subdivision conversion.

In case of **Approach 1** for land representation, this **fourth step** does not apply since land use/management changes are neither identified nor tracked.

## Guide to Land Representation

*Fifth step*, select the **Year of conversion** from a dropdown menu populated by the *Software* with all years of the time period **Y-D**:



By default the inventory year Y is used by the Software.

In case of **Approach 1** for land representation, this **fifth step** does not apply since land use/management changes are neither identified nor tracked.

desired option:

#### Guide to Land Representation

Sixth step, input the Area, in hectares (ha), of the unit of land in the relevant inventory year.

example 1 Cropland Annual Crops ∨ Tes 1 ∨ 20 1990 1.000 ↔ 2	Land unit code (Automatic)	Land unit code (User defined)	Previous Land use subcategory	Previous Land use subdivision	Transition Period (D) (years)	Year of conversion	Area (1990) (ha)	Remark	Р	с м	
	*	example 1	Cropland Annual Crops 🗸	Tes 1 🗸	20	1990	1.000 ‹>		2		×

Once the **area** is input, the user selects to which time period of the inventory timeseries the area value input applies. To do so, the user opens a dialog box by clicking on the "

Area update mode		×
Current inventory year only		
Current inventory year and all subset	quent inventory years	
O Current inventory year and all previo	us inventory years	
O All inventory years		
	Update	Cancel

The Dialog Box contains 4 options. By default the option **Current inventory year and all subsequent inventory years** applies, which means that if this is the option the user wishes to apply, no action will be needed.

#### Approach 1 specific rule

In case of **Approach 1** for land representation, this **sixth step** requires to add the area for a year equal to **Y-20**, where **Y** is the inventory year for which information is being input. For example data input for a unit of land in the year 1990 for an Approach 1 Land representation requires the input of the area that same unit had in 1970:



This information is critical to allow the *Software* to implement Formulation A of Equation 2.25 for the calculation of SOC changes

Note: even if the area of the unit of land area in a given year Y is 0 (zero) the area of 20 years before must be input

#### Guide to Land Representation

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*Seventh step*, select the methodology to be applied to each C pool to calculate the C stock changes. IPCC provides 2 methodological approaches to estimate C stock changes in C pools (*Section 2.2.1 - Overview of carbon stock change estimation*): the Gain & Loss method and the Stock-Difference method.

To do so, the user opens a dialog b	ox by clicking on	the " <b>Z</b> " symbo	l under the le	etter "P" (Pools):
	Land Unit Parameters		×	
	C pools / Methods Biomass change DOM - Deadwood DOM - Litter SOM - Mineral	Gain & Loss Gain & Loss Gain & Loss Default Default Stock difference Save	~ ~ Cancel	

The Dialog Box contains 4 Carbon pools: **Biomass, Dead Organic Matter – Deadwood, Dead Organic Matter – Litter, Soil Organic Matter – Mineral.** For each C Pool the methodology is to be selected between the IPCC default methodology<sup>16</sup>, which is the **Gain & Loss**, and the IPCC alternative methodology, which is the **Stock-Difference**. For each C pool, by default the option **Gain & Loss** applies, which means that if this is the option the user wishes to apply, no action will be needed.

<sup>&</sup>lt;sup>16</sup> To calculate SOC changes in mineral soils, IPCC default method applies equation 2.25, in Formulation A or B according to the Approach applied to the Land representation

.

## Guide to Land Representation

*Eighth step*, input any information on the unit of land the user wishes to recall or just to show to future users:

	Land unit code (Automatic)	Land unit code (User defined)	Previous Land use subcategory	Previous Land use subdivision	Transition Period (D) (years)	Year of conversion	Area (1990) (ha)	Remark	P	м	
*		example 4	Managed Grassland 🗸	Test GL 🗸 🗸	20	1990	1,000 ሩ )	abandoned land	1		×

In **Remark**, the user can input notes relevant for the entire subdivision *(information is neither transferred to reporting tables nor can be printed)* 

### Guide to Land Representation

*Ninth step*, save the information input by clicking on the **Save** button (bottom of the window). When saving, the *Software* record all information on the unit of land in the database and assign an **automatic land unit code**.



Once saved, information cannot be changed anymore with the exception of the following fields:

- ✓ user-defined land unit code
- ✓ area
- ✓ remark

In case an error is spot in any of the other fields, to correct it the entire row of information needs to be deleted -to do so click on the symbol "X" at the right hand side-, then all information on the unit of land is to be input again.

## Guide to Land Representation

## Data input guidance to add/modify information of a unit of land

Two additional functionalities are available to modify information input for a unit of land:

- button M, to merge it with another unit of land. This does not apply to Approach 1
- button <u>C</u>, to add a new conversion to a unit of land that is still undergoing a conversion. This applies to Approach 3 only

As noted: information input in the following fields:

- $\checkmark$  user-defined land unit code
- ✓ area
- ✓ remark

can be changed at any time. However, note that a change of the **user-defined land unit code** or of the **remark** input in any of the inventory years is automatically propagated by the *Software* to the entire time series, while for the area the user shall select the time period within the inventory time series to which the new value applies; where no sleection is made by default the option **Current inventory year and all subsequent inventory years** will apply.

In case an error is spotted in any of the other fields, to correct it the entire row of information needs to be deleted -to do so click on the symbol "**X**" at the right hand side-, then all information on the unit of land is to be input again.

#### Guide to Land Representation

Button "M" is to be clicked in case the user wishes to merge the unit of land with another unit of land -this makes the *Software* stop tracking the unit of land any further. This functionality applies only to units of land that have undergone completely the transition period of a conversion from one land use category/subdivision to another one, and are therefore shown in blue ink by the *Software*.

In the example below, the unit of land *MFL-PP-PL-P-25* has completed its conversion to *Managed Forest land – Pine plantation*. Accordingly, the *Software* has changed the associated **Transition period** and **Year of conversion** as NO.

					Area (1991) (ha)							
Ma	anaged Forest Land					120						
		Current Land use s	ubdivision				Ren	nark				
•	Pine plantation											×
	Land unit code (Automatic)	Land unit code (User defined)	Previous L subcate	and use egory	Previous Land use subdivision	Transition period [T] (years)	Year of conversion	Area (1991) (ha)	Remark	P	м	
	MFL-PP-PL-P-23		Managed Forest	t Land	Pine plantation	NA	NA	100 💮				×
	MFL-PP-PL-P-24<-MGL-P-P_		Managed Grass	land	Pasture	20	1990	10 💮				×
	MFL-PP-PL-P-25		Managed Forest	t Land	Pine plantation	NO	NO	10 <>			6	×

Thus, given that same values for parameters and emission factors apply to unit of land *MFL-PP-PL-P-25* and unit of land *MFL-PP-PL-P-23* the user may decide to merge the 2 units. In such a case, by clicking button "M" in the row of the unit of land *MFL-PP-PL-P-25* the following dialog window opens

inge cana on		
Source Land Unit		
Land use subcategory	Managed Forest Land	
Land use subdivision	Pine plantation	
Land unit	MFL-PP-PL-P-25	
Area [ha]	10	
Target Land Unit Land use subcategory	Managed Forest Land	
Land use subcategory	Managed Forest Land	
Land use subdivision	Pine plantation	- V
Land unit		~
Area [ha]	+10 [ha]	

Then, the user selects the unit of land to which the unit of land is to be merged (in this example, unit of land MFL-PP-PL-P-23)

Merge Land Unit		×
Source Land Unit Land use subcategory Land use subdivision Land unit Area [ha]	Managed Forest Land Prine plantation MFL-PP-PL-P-25 10	
Target Land Unit Land use subcategory Land use subdivision Land unit	Managed Forest Land Pine plantation MFL-PP-PL-P-23	> > >
Area [ha]	100 +10 [ha]	Cancel

Once merged, the unit of land *MFL-PP-PL-P-25* disappears and its area is added by the *Software* to the area of the unit of land *MFL-PP-PL-P-23* from the year in which the merging is made onward.

Land unit code (Automatic)	Land unit code (User defined)	Previous Land use subcategory	Previous Land use subdivision	Transition period [T] (years)	Year of conversion	Area (1991) (ha)		
MFL-PP-PL-P-23		Managed Forest Land	Pine plantation	NA	NA	110 ↔	2	x
MFL-PP-PL-P-24<-MGL-P-P		Managed Grassland	Pasture	20	1990	10 ↔	2	x
*		~	~			<->	2	

That means that the merging does not occur backward. The following picture is taken from the land representation of the previous year:

## Guide to Land Representation

Land unit code (Automatic)	Land unit code (User defined)	Previous Land use subcategory	Previous Land use subdivision	Transition period [T] (years)	Year of conversion	Area (1990) (ha)		
MFL-PP-PL-P-23		Managed Forest Land	Pine plantation	NA	NA	100 ↔	2	x
MFL-PP-PL-P-24<-MGL-P-P_		Managed Grassland	Pasture	20	1990	10 🚓	2	x
MFL-PP-PL-P-25<-MGL-P-P_		Managed Grassland	Pasture	30	1961	10 ->	2	x

In any case, merging is just an option; the user may wish to keep reporting the two units of land separated beyond the conversion period (e.g. since belonging to two different administrations). In such a case the previous subcategory/subdivision can still be examined after expanding the next level (conversion history), and it is shown in grey, as in the example below:

<u>.</u>	1	MFL-TGN-NF-TG-89	Managed Forest	Tectona grandis NF	NO	NO	15 0	00
		Previous Land use subcategory	Previous Land use subdivision	Transition period   (years)	[T] <sub>Year</sub>	of conversion	1 V	Remark
	-	Settlements (Treed)	Settlement 1 (T)	20	1971			

#### Guide to Land Representation

Button "C" is to be clicked in case the user wishes to input a new conversion for a land that is still under conversion, and thus it applies under Approach 3 for land representation only.

	Land unit code (Automatic)	Land unit code (User defined)	Previous Land use subcategory	Previous Land use subdivision	Transition Period (D) (years)	Year of conversion	Area (2010) (ha)	Remark	Р		м	
œ	PCL-AP-UD-10	3	Cropland Perennial Crops	agroforestry - pepper	NA	NA	400 💮		3			x
٠	PCL-AP-UD-15<-ACL-SI-C0	2	Cropland Annual Crops	soybean intensive	20	2010	100 💮		2			x
Œ	PCL-AP-UD-18<-ACL-SI-C	0	Cropland Annual Crops	soybean intensive	20	2000	100 ↔		Z	Ŭ		×

**Note:** the input of conversions for a unit of land is to be done from the first year of the inventory time series forward; trying to input in the reverse order -i.e. from the latest inventory year backward- is not possible.

By pressing the button C a new dialog box opens:

Current conversion state	15	
From	Cropland Annual Crops / soybean intensive	
То	Cropland Perennial Crops / agroforestry - pepper	
Transition Period (D)	20 Year of conversion 2010	
New conversion to		
Land use subcategory	Managed Forest Land	~
Land use subdivision	Restoration AB (AC 10)	~
Transition Period (D)	20	
Year of conversion	2020 ~	
Remark		

The dialog box is composed of 2 sections:

- > The upper section with information, on the *Current conversion status* of the unit of land, as compiled by the *Software*.
  - o Previous land subdivision,
  - o Current land use subdivision
  - o Transition Period
  - o Year of conversion
- > The lower section with information, on the New conversion to of the unit of land, to be input by the user:
  - o New Land subcategory,
  - o New Land subdivision,
  - o Transition Period
  - o Year of conversion<sup>17</sup>
  - o Remark (if any)

After pressing Save, the unit of land is automatically relocated under the subdivision input in the *New Conversion to* section and the previous subdivision assigned to the unit by the *Software* is the one that was in the *Current conversion* status. The *Software* navigates to the relocated unit of land automatically.

In this example a land under conversion to cropland is further converted to forest land; consequently, the *Software* relocate the subdivision under forest land:



The previous land conversion is shown at a lower lever (5th) in grey.

<sup>&</sup>lt;sup>17</sup> Year of conversion dropdown contains the list of years from: 'the year of conversion reported under the *Current conversion status* + 1 year' up to the *current inventory year*. In this example, being 2020 the inventory year, the dropdown menu includes the years 2011-2020

## Guide to Land Representation

## 5th level

It shows the complete history of transitions of the unit of land relative to the current inventory year, ordered by year of transition descending and shown in grey (picture below).



Indeed, the Land unit conversion in a given point of time -i.e. the chosen inventory year- is automatically presented considering current status of land unit together with its history of transitions. For example, a unit of land experiences multiple conversions within the time period analyzed for inventory purposes. Note that although the inventory period is 1990-2022, the inventory compiler has analyzed a time series of data starting in 1971 -i.e. 1971-2022- because of the transition period applied is of 20 years. Then,

in 1975, the unit of land transition from MGL/praire organic rewetted inland to ACL/maize organic drained



Note: this conversion occurred before the initial year of the inventory time series -i.e. 1990-2020; thus it is input in the year 1990

in 1983, the unit of land transition from ACL/maize organic drained to MFL/Tectona grandis Planted Forest



Note: this conversion occurred before the initial year of the inventory time series -i.e. 1990-2020; thus it is input in the year 1990

in 2002, the unit of land transition from MFL/Tectona grandis Planted Forest to TSL/urban



**Note:** this is the latest conversion of this unit of land and occurred in the inventory year visualized -i.e. Year of conversion = Inventory year = 2002-, thus the button "C" for intervening new conversion is NOT available.

#### Guide to Land Representation

in **2022**, the land unit has gone through the entire transition period (i.e. 20-year) since the last conversion; thus it has been reclassified by the *Software* as a remaining land -i.e. *NO* is applied by the *Software* for the *Transition period* [D] and for the *Year of Conversion*<sup>18</sup>- and colored in blue. History layer shows all the previous conversions:



Because in 2022 the unit of land is in a remaining category, it cannot intervene in any further conversion.

Note: Data input are written in the DB when pressing the **Save** button. Thus, the *Undo* button can be used to discard all changes made since the last save, it does not cancel information that was input before saving. In case of an input saved that is to be corrected, the only way to achieve it is to delete the wrong input (by clicking the red X on the extreme right end of the row) and to re-enter the correct one.

 $<sup>^{18}</sup>$  Note that for a unit of land that did not intervene any conversion across the entire time series of the inventory the notation key NA is used by the *Software*.

#### Guide to Land Representation

## Annual land representation matrix Tab

For land representation approaches 2 and 3, a land matrix Tab provides for the total area of the land representation to be classified either as a land that has not undergone a change between the initial (rows) and final (columns) year of the land-use conversion matrix or as a land that has undergone a change between 2 different subcategories.

Note: that such classification does not correspond to the IPCC categorization in *land remaining under one use/management* and *land under conversion from one use/management to another one*. Although a land reported in a matrix as converted from the initial year to the final year is part of the IPCC *land under conversion* categories, such categories include also land that have undergone a change in use/management in years before the initial year of the land-use conversion matrix.

For instance,



in the year 2015, 80 ha are reported as converted -from the initial year to 2015- from *managed grassland* to managed forest land. In the year 2015, those 80 hectares are reported, in the national GHG inventory, under *Grassland converted* to *Forest land*. However, in the same year additional land is reported under *Grassland converted to Forest land*, for instance the 40 ha reported in the land-use conversion matrix of the year 2010.