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## **3B Land Land Representation**

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June 2016  
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# Outline

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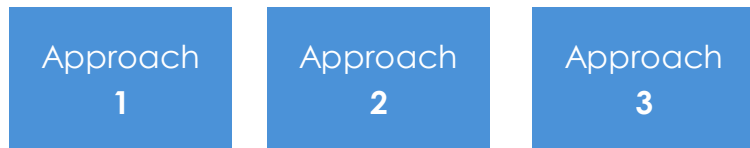
- Approaches
- Use of the IPCC Inventory Software

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# Land representation and approaches

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- When applying the 2006GL, identifying land conversion is a fundamental issue in the Land sector.
- There are three approaches for land representation:



- A country is allowed to use all three approaches for identifying the land conversion, representation of land.
- The 2006GL suggests that there is no hierarchy among these three approaches.
- In reality, more explicit data is available in approach 2 than approach 1, and approach 3 is sometimes necessary for using a model and higher tier estimation.

# Approach 1

- Approach 1 is probably the most common approach used for preparing estimates of emissions and removals.
- The basic methodology of this approach is to compare the area of each land use category at two points in time and to derive the land use change area in each land use category.
- It often uses area datasets likely to have been prepared for other purposes, such as forestry or agricultural statistics.

TABLE 2.3.1 EXAMPLE OF APPROACH 1: AVAILABLE LAND -USE DATA WITH COMPLETE TERRITORIAL COVERAGE				
Time 1		Time 2		Land-Use Change between Time 1 and Time 2
F	= 18	F	= 19	Forest = +1
G	= 84	G	= 82	Grassland = -2
C	= 31	C	= 29	Cropland = -2
W	= 0	W	= 0	Wetlands = 0
S	= 5	S	= 8	Settlements = +3
O	= 2	O	= 2	Other land = 0
Sum	= 140	Sum	= 140	Sum = 0
Note: F = Forest land, G = Grassland, C = Cropland, W = Wetlands, S = Settlements, O = Other land. Numbers represent area units (Mha in this example).				

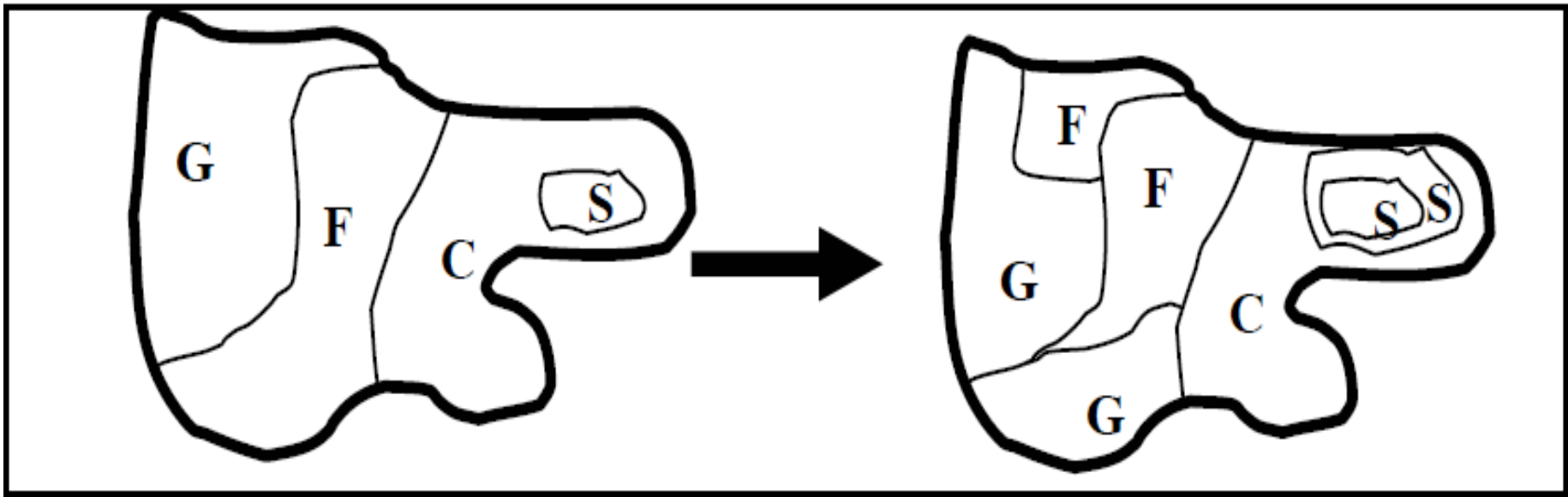
# Approach 2

- The essential feature of approach 2 is that it provides a national or regional-scale assessment of losses and gains in the area of specific land categories, and of what these changes represent (i.e., changes from and to a category).
- Thus, approach 2 includes more information on changes between categories.
- Tracking land-use changes in this explicit manner will normally require the estimation of initial and final land-use categories, as well as of total area of unchanged land by category.
- The final result of this approach can be presented as a non-spatially explicit land-use change matrix.

TABLE 2.3.5 SIMPLIFIED LAND-USE CHANGE MATRIX FOR EXAMPLE APPROACH 2							
Land-Use Change Matrix							
Final \ Initial	F	G	C	W	S	O	Final sum
F	15	3	1				19
G	2	80					82
C			29				29
W							
S	1	1	1		5		8
O						2	2
Initial sum	18	84	31		5	2	140
Note: F = Forest land, G = Grassland, C = Cropland, W = Wetlands, S = Settlements, O = Other land Numbers represent area units (Mha in this example). There is no Wetlands in this example. Blank entry indicates no land use change.							

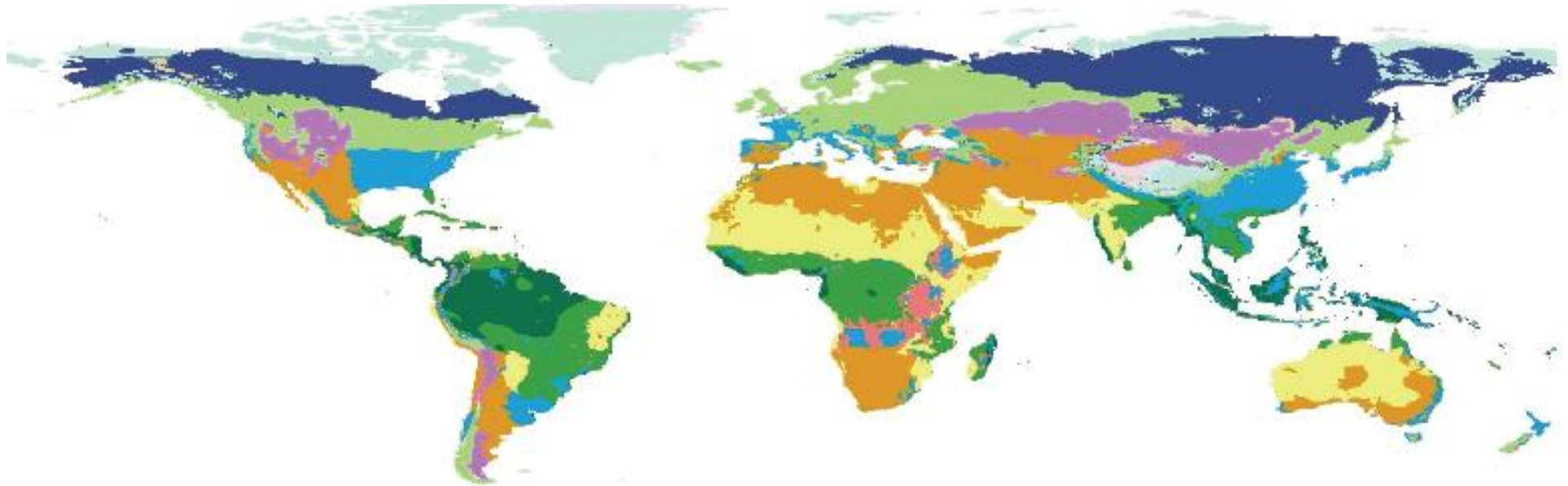
# Approach 3

- Approach 3 requires spatially explicit observations of land use and land-use change.
- The data may be obtained either by
  - sampling of geographically located points,
  - a complete tally (wall-to-wall mapping), or
  - a combination of the two.



# Climate zone

- IPCC Climate Zone has not changed since the Revised 1996 GL



## IPCC Climate Zones

No Data	Tropical Dry	Cool Temperate Dry	Polar Dry
Tropical Montane	Warm Temperate Moist	Boreal Moist	
Tropical Wet	Warm Temperate Dry	Boreal Dry	
Tropical Moist	Cool Temperate Moist	Polar Moist	

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# Identification of Climate zone

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- Mean Annual Temperature (MAT)
    - $18 > \text{MAT} > 10$  : Warm Temperate
    - $10 > \text{MAT} > 0$  : Cold Temperate
  - Mean Annual Precipitation (MAP) to Potential Evapotranspiration (PET) ratio
    - $\text{MAP} > \text{PET}$  : Moist
    - $\text{MAP} < \text{PET}$  : Dry
- \* PET is estimated from average daily temperature



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## Quiz (managed land)

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- What is the correct description of the treatment of unmanaged land when the 2006 IPCC guidelines is applied?
  - Area of unmanaged land should be reported. Emissions and removals occurred on unmanaged also should be estimated and reported.
  - Area of unmanaged land should be reported. Emissions and removals occurred on unmanaged are not necessary to be estimated and reported.
  - Area of unmanaged land as well as emissions and removals occurred on unmanaged are not necessary to be reported.

# IPCC Inventory Software: Land Type Manager

- In the IPCC Inventory Software, all subcategories must be created by using the “Land Type Manager”
- If you click any of category which shown blue color, you can open “Land Type Manager”.

Area Entry Table | Land-Use Conversion Matrix | Annual increase in carbon stocks in biomass | Loss of carbon from wood removals | Loss of carbon from fuelw

Worksheet

**Sector:** Agriculture, Forestry, and Other Land Use  
**Category:** Land  
**Subcategory:** 3.B.1.a - Forest land Remaining Forest land  
**Sheet:** Area Entry Table

2013

Data

Initial land use		Final land use		Area (ha)	
▶ Forest Land	Unmanaged	Forest Land	Unmanaged	!	

Land Type Manager

# AFOLU Land Type Manager

- From the Manual, This menu item opens a dialog window which allows managing Land Use Subcategories for AFOLU category 3.B – Land. This window is also accessible from relevant worksheets under category 3.B – Land. Parameters defined here are used in all relevant worksheets.

The screenshot shows the 'AFOLU Land Types' dialog window. On the left, a tree view under 'Land Use Subcategory' shows 'Forest Land' expanded, with 'FL Custom 1' selected. The main area is titled 'Common Land Type Data' and contains the following fields:

- Country/Territory:** Slovakia
- Land Use Subcategory:** FL Custom 1
- Continent:** Europe
- Climate Region:** Cool Temperate Moist
- Soil Type:** High Activity Clay Mineral

Below these are the 'Forest Land Data' fields:

- Ecosystem type:** User-defined
- Species:** Pinus
- Continent type:** Unspecified
- Age class (yr):** Unspecified
- Growing stock level (m3/ha):** Unspecified
- Natural Forest:** ☐
- Plantation:** ☒
- Carbon fraction of aboveground forest biomass (tonne C/tonne d.m.):** 0.470
- Ratio of below-ground biomass to above-ground biomass (R) (t root d.m./t shoot d.m.):** 0.400
- Biomass conversion and expansion factor for wood and fuelwood removal (BCEFr) (t / m3 wood volume):** 0.700
- Above-ground biomass in forests (t d.m. / ha):** 120.000
- Above-ground biomass growth in plantation/natural forests (t d.m. /ha/yr):** 10.000
- Reference soil organic carbon (SOC) stock (t C / ha):** 95.000
- Litter carbon stocks of mature forests (t C / ha):** 26.000
- Relative stock change factor Land use (FLU):** 1.000
- Management (FMG):** 1.000
- Input (FI):** 1.000

At the bottom left are 'Add', 'Copy', and 'Delete' buttons. At the bottom right are 'Save', 'Undo', and 'Close' buttons.

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# ***AFOLU Land Type Manager***

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- Land Type Manager window consists of the following sections:
  - Navigation section – contains the list of Land Use Subcategories divided into corresponding main Land Type categories (Forest, Cropland, ...). Activation of the particular Land Use Subcategory shows relevant details.
  - Common Land Type Data – contains data that is common for all Land Types (Country, Climate Region, ...)
  - Particular Land Use Subcategory data – contains details of the particular Land Use Subcategory that is selected in the navigation section.

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# ***AFOLU Land Type Manager***

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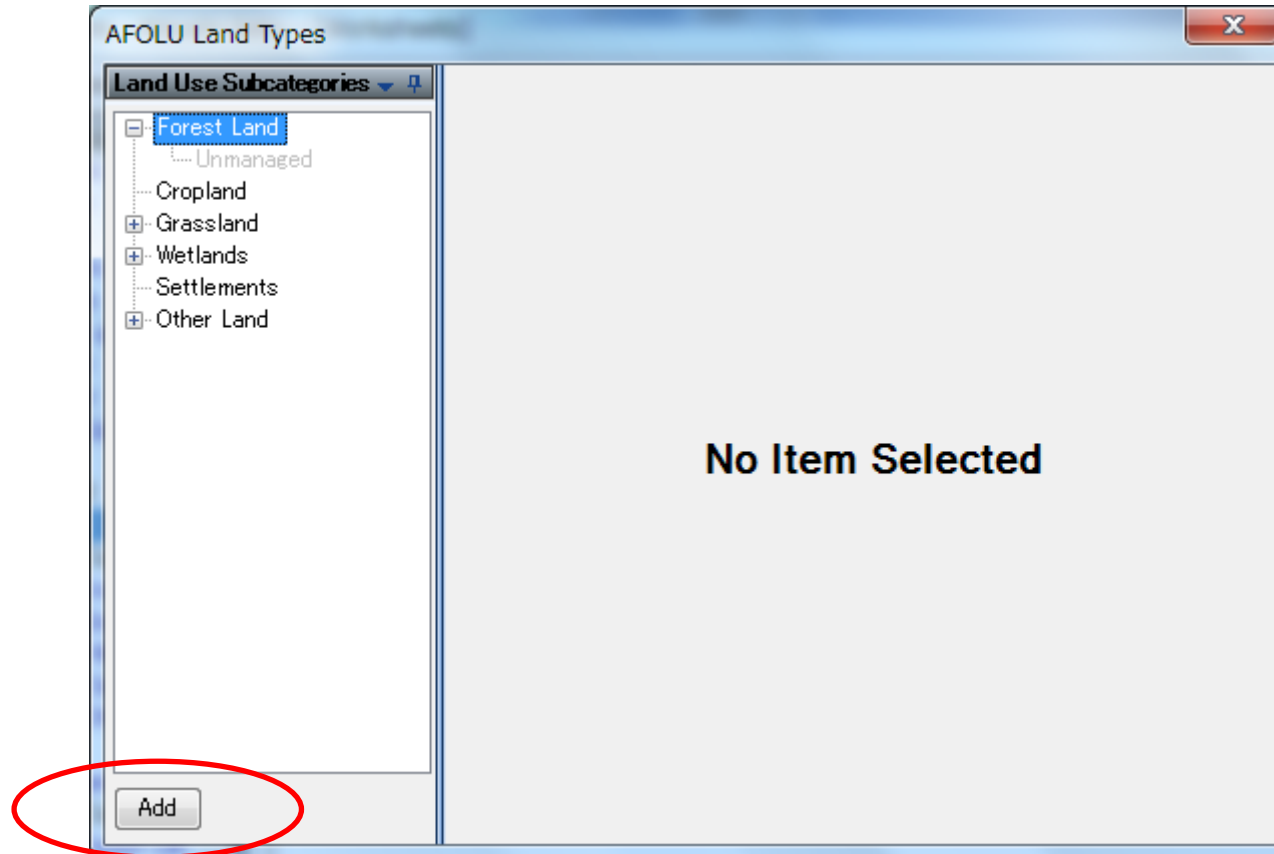
## ■ Adding new Land Use Subcategory

Take the following steps to define new Land Use Subcategory:

- 1) Select one of the main Land Use Categories in the Navigation section.
- 2) Click the Add button located at the bottom of the navigation section. New Land Use Subcategory will be created with the default name.
- 3) Enter desired details of the new Land Use Subcategory
- 4) Click the Save button to save new Land Use Subcategory into database

# ***AFOLU Land Type Manager: Adding new sub category***

- Select the land category and click “Add” to create a new sub-category



- Moldova Identified 11 group of forest species in the 2015 NIR (p278). Let's try to recreate it in the software!

# Adding new sub category: Forest land

- You should input a lot of conditions of sub-category.
  - Name, Climate region, Soil-type, Ecosystem type, Species, Age class, Growing stock level, plantation/natural forest

The screenshot displays the 'AFOLU Land Types' application window. On the left, a tree view under 'Land Use Subcategories' shows 'Forest Land' expanded, with 'QU' selected. The main panel is divided into two sections: 'Common Land Type Data' and 'Forest Land Data'. In the 'Common Land Type Data' section, the following fields are highlighted with red circles: 'Country/Territory' (Republic of Moldova), 'Land Use Subcategory' (QU), 'Climate Region' (Cool Temperate Dry), 'Continent' (Europe), and 'Soil Type' (User-defined). The 'Forest Land Data' section contains: 'Ecosystem type' (User-defined), 'Species' (Pinus), 'Natural Forest' (selected with a radio button), 'Continent type' (Unspecified), 'Age class (yr)' (Unspecified), and 'Growing stock level (m3/ha)' (101-200). The 'Plantation' radio button is also visible but not selected.

Field	Value
Country/Territory	Republic of Moldova
Land Use Subcategory	QU
Climate Region	Cool Temperate Dry
Continent	Europe
Soil Type	User-defined
Ecosystem type	User-defined
Species	Pinus
Natural Forest	<input checked="" type="radio"/>
Plantation	<input type="radio"/>
Continent type	Unspecified
Age class (yr)	Unspecified
Growing stock level (m3/ha)	101-200

# Adding new sub category: Forest land

- And, the parameters for estimation of carbon stock changes.

Carbon fraction of aboveground forest biomass (tonne C/tonne d.m.) 0.500

Ratio of below-ground biomass to above-ground biomass (R) (t root d.m./t shoot d.m.) 0.400

Biomass conversion and expansion factor for wood and fuelwood removal (BCEFr) (t / m<sup>3</sup> wood volume) 0.000

Above-ground biomass in forests (t d.m. / ha) 0.000

Above-ground biomass growth in plantation/natural forests (t d.m. /ha/yr) 3.000

Reference soil organic carbon (SOC) stock (t C / ha) 0.000

Litter carbon stocks of mature forests (t C / ha) 0.000

Abandoned managed land ☐

Relative stock change factor

Land use (FLU) 1.000

Management (FMG) 1.000

Input (FI) 1.000

Estimation for Biomass

Estimation for Biomass gain

Estimation for litter stock change

Estimation for soil



# Adding new sub category: Cropland

- For cropland, different type of information required

The screenshot displays the 'AFOLU Land Types' software window. On the left, a tree view under 'Land Use Subcategories' shows 'Forest Land' (with sub-item 'QU'), 'Unmanaged', 'Cropland' (with 'Vineyards' selected), 'Grassland', 'Wetlands', 'Settlements', and 'Other Land'. The main panel is titled 'Common Land Type Data' and contains the following fields:

- Country/Territory:** Republic of Moldova
- Land Use Subcategory:** Vineyards
- Continent:** Europe
- Climate Region:** Cool Temperate Dry (dropdown)
- Soil Type:** User-defined (dropdown)

Below this is the 'Cropland Data' section:

- Perennial crops:** Selected with a radio button.
- Annual crops:** Unselected with a radio button.
- Above-ground biomass (t d.m. / ha):** 15.000 (dropdown)
- Cropland type:** All perennials (dropdown)
- Relative stock change factor:** 1.000 (dropdown)
- Reference soil organic carbon (SOC) stock (t C / ha):** 0.000 (dropdown)
- Land use (FLU):** 1.000 (dropdown)
- Harvest/Maturity cycle (yr):** 0.000 (dropdown)
- Tillage (FMG):** 1.000 (dropdown)
- Biomass carbon loss (L) (t C /ha/yr):** 0.080 (dropdown)
- Input (FI):** 1.000 (dropdown)
- Biomass accumulation rate (G) (t C /ha/yr):** 0.200 (dropdown)
- Carbon fraction of dry matter (t C/t d.m.):** 0.500 (dropdown)

# Adding new sub category: Grassland

- Only stock data for biomass and soil is required.

AFOLU Land Types

Land Use Subcategories

- Forest Land
  - QU
  - Unmanaged
- Cropland
  - Vineyards
- Grassland
  - Meadows- High productivity
  - Unmanaged
- Wetlands
- Settlements
- Other Land

Common Land Type Data

Country/Territory: Republic of Moldova

Continent: Europe

Land Use Subcategory: Meadows- High productivity

Climate Region: Cool Temperate Dry

Soil Type: User-defined

Grassland Data

Vegetation type: Semi-Amid

Improved grassland: ☒

Reference soil organic carbon (SOC) stock (t C / ha): 0.000

Relative stock change factor

Land use (FLU): 1.000

Management (FMG): 1.000

Input (FI): 0.000

Herbaceous biomass stocks present on land (t d.m. / ha): 0.000

Woody biomass stocks present on land (t d.m. / ha): 0.000

Herbaceous biomass stocks after conversion from other land use (t d.m. / ha): 0.000

Woody biomass stocks after conversion from other land use (t d.m. / ha): 0.000

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

Carbon fraction of dry matter for woody biomass (t C/t d.m.): 0.500

# Adding new sub category: Wetlands

- Flooded land type sub-category is requested to enter only biomass stock exist at the land

The screenshot shows the 'AFOLU Land Types' software window. On the left, a tree view under 'Land Use Subcategories' shows 'Reservoir' selected under 'Wetlands'. The main panel is divided into two sections: 'Common Land Type Data' and 'Wetland Data'.

**Common Land Type Data**

<b>Country/Territory</b>	Republic of Moldova	<b>Continent</b>	Europe
<b>Land Use Subcategory</b>	Reservoir		
<b>Climate Region</b>	Cool Temperate Dry	<b>Soil Type</b>	Organic

**Wetland Data**

<b>Type</b>	
<input type="radio"/> Peatland	
<input checked="" type="radio"/> Flooded land	
<input type="radio"/> Other wetland	
<b>Biomass stocks after the conversion (t d.m. / ha)</b>	0.000
<b>Biomass stocks present on land (t d.m. / ha)</b>	0.000
<b>Carbon fraction of dry matter (t C / t d.m.)</b>	0.500

# Adding new sub category: Wetlands

- Peatland type sub-category is requested to enter EF relevant information as well

The screenshot displays the 'AFOLU Land Types' application window. On the left, a tree view under 'Land Use Subcategories' shows 'Wetlands' expanded, with 'new wetland custom type' selected. The main panel is divided into two sections: 'Common Land Type Data' and 'Wetland Data'.

**Common Land Type Data**

<b>Country/Territory</b>	Republic of Moldova	<b>Continent</b>	Europe
<b>Land Use Subcategory</b>	Peatland		
<b>Climate Region</b>	Cool Temperate Dry	<b>Soil Type</b>	Organic

**Wetland Data**

Type: ☒ Peatland ☐ Flooded land ☐ Other wetland

Biomass stocks after the conversion (t d.m. / ha)	0.000
Biomass stocks present on land (t d.m. / ha)	0.000
Carbon fraction of dry matter (t C / t d.m.)	0.500
CO2 Emission factor for nutrient rich soil peat soils (t C /ha/yr)	1.100
CO2 Emission factor for nutrient poor soil peat soils (t C /ha/yr)	0.200
N2O Emission factor for drained nutrient-rich organic soils (kg N2O-N /ha/yr)	1.800
Carbon fraction of air-dry peat by weight (t C / t peat)	0.450
Carbon fraction of air-dry peat by volume (t C / m3 peat)	0.070

# Adding new sub category: Settlements, other land

- There seems error in selecting soil type in the version 2.17. (only organic soil is able to select)

**AFOLU Land Types**

**Land Use Subcategories**

- Forest Land
  - QU
  - Unmanaged
- Cropland
  - Vineyards
- Grassland
  - Meadows- High productivity
  - Unmanaged
- Wetlands
  - Peatland
  - Reservoir
  - Unmanaged
- Settlements
  - new settlements custom
- Other Land

**Common Land Type Data**

**Country/Territory** Republic of Moldova **Continent** Europe

**Land Use Subcategory** Urban forest

**Climate Region** Cool Temperate Dry

**Soil Type** Organic

**Settlement Data**

Relative stock change factor

Land use (FLU) 1.000

Management (FMG) 1.000

Input (FI) 1.000

FullName	Abbr	
Organic	ORG	Soils classified 2003 for addition

Biomass stocks present on land (t C / ha)

Reference soil organic carbon (SOC) stock (t C / ha) 0.000

Carbon fraction of dry matter (t C / t d.m.) 0.500

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# ***AFOLU Land Type Manager***

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## ■ Editing existing Land Use Subcategory

Take the following steps to edit existing Land Use Subcategory:

- 1) Select the Land Use Subcategory of interest in the navigation section
- 2) Edit data as desired
- 3) Click the Save button to save changes into database or click the Undo button to discard all changes.

## ■ Making copy of existing Land Use Subcategory

It is possible to make a copy of existing Land Use Subcategory. Follow the next steps:

- 1) Select the Land Use Subcategory of interest in the navigation section
- 2) Click the Copy button located at the bottom of the navigation section.
- 3) New copy of selected Land Use Subcategory will be created with the new name
- 4) Edit data as desired
- 5) Click the Save button to save new Land Use Subcategory into database.

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# ***AFOLU Land Type Manager***

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## ■ Deleting existing Land Use Subcategory

- 1) Select the Land Use Subcategory of interest in the navigation section
- 2) Click the Delete button located at the bottom of the navigation section
- 3) Confirm or cancel deletion when prompted.

# AFOLU Area Entry Table (for 20 year)

- This worksheet is available in all 3.B – Land categories. It is designated for defining 20-year Land Area Transitions between Land Use Subcategories defined in Land Type Manager
- The user needs to enter land areas for Land remaining in a Land-use category and for Land converted to other Land Use Subcategories (in the 20 year sense).

Area Entry Table | Land-Use Conversion Matrix | Annual increase in carbon stocks in biomass | Loss of carbon from v < >

Worksheet

**Sector:** Agriculture, Forestry, and Other Land Use 2013

**Category:** Land

**Subcategory:** 3.B.1.a - Forest land Remaining Forest land

**Sheet:** Area Entry Table

Data

Initial land use		Final land use		Area (ha)		
Forest Land	PI	Forest Land	PI	6.8		
			QU	0		
	QU		PI	0		
			QU	154.7		
	Unmanaged		Unmanaged	0		

Land Type Manager



# AFOLU Area Entry Table (for 20 year)

- Land converted to other Land Use Subcategories (in the 20 year sense).

2006 IPCC Categories

- 1 - Energy
- 2 - Industrial Processes and Product Use
- 3 - Agriculture, Forestry, and Other Land Use
  - 3.A - Livestock
  - 3.B - Land
    - 3.B.1 - Forest land
      - 3.B.1.a - Forest land Remaining
      - 3.B.1.b - Land Converted to Forest Land
        - 3.B.1.b.i - Cropland converted to Forest Land
        - 3.B.1.b.ii - Grassland converted to Forest Land
        - 3.B.1.b.iii - Wetlands converted to Forest Land
        - 3.B.1.b.iv - Settlements converted to Forest Land
        - 3.B.1.b.v - Other Land converted to Forest Land

Area Entry Table | Land-Use Conversion Matrix | Annual increase in carbon stocks in biomass | Loss of carbon stocks in biomass

Worksheet

**Sector:** Agriculture, Forestry, and Other Land Use  
**Category:** Land  
**Subcategory:** 3.B.1.b.i - Cropland converted to Forest Land  
**Sheet:** Area Entry Table

Data

Initial land use		Final land use		Area (ha)	
Cropland	Vineyards	Forest Land	PI	10	
			QU	15	

Only created land use sub categories in “Land Type Manger” appear here.

# AFOLU Area Entry Table (for 20 year)

- The software applies some basic rules on the Land Use Subcategory combinations to restrict the number of “possible” transitions appearing in the table such as:
  - A Land Use Subcategory cannot change from one “climate-soil” combination to a different “climate-soil” combination. For example, a Land Use Subcategory defined in the Land Type Manager as “Boreal-Organic soil” cannot change to “Warm Temperate-Mineral Soil” no matter how the land use change occurs; its post-conversion land type will always be restricted to “Boreal-Organic soil”.

Area Entry Table

Land-Use Conversion Matrix

Annual increase in carbon stocks in biomass

Loss of carbon from v

Worksheet

Sector: Agriculture, Forestry, and Other Land Use



Category: Land

Subcategory: 3.B.1.a - Forest land Remaining Forest land

Sheet: Area Entry Table

2013

Data

Initial land use			Final land use		Area (ha)		
Forest Land	PI	Forest Land	PI	6.8			
	QU		QU	154.7			
	Unmanaged		Unmanaged	0			

Example of Identifying the different soil type for PI and QU

# AFOLU Annual Area Table

- This worksheet is available in all 3.B – Land categories which contain worksheets based on “annual area change”. It is used for defining annual land area changes between Land Use Subcategories defined in Land Type Manager

Area Entry Table Annual Area Table Land-Use Conversion Matrix Annual change in carbon stocks in biomass

Worksheet

Sector: Agriculture, Forestry, and Other Land Use

Category: Land

Subcategory: 3.B.2.b.i - Forest Land converted to Cropland

Sheet: Annual Area Table

1990

Data

Initial land use		Final land use		Annual Area Change (ha)		
Forest Land	FL Custom 1	Cropland	Deep water	220		
			DW2	180		
			Tes 1	50		
	FL Custom 2		Irrigated rice	0		
	Organic		Deep water	55		
			Organic 1	80		

Land Type Manager

# Land Matrix

- Area information entered in Area Entry Table or Annual Area Entry Table is summarized and shown as a land use matrix

Area Entry Table   Annual Area Table   Land Use Matrix   Annual change in carbon stocks in organic soils   Annual change in carbon stocks in biomass   Annual change in carbon stocks in dead organic m...											
Worksheet											1990
Sector: Agriculture, Forestry and Other Land Use											
Category: 3.B.2.b) - Forest Land converted to Cropland											
Sheet: Land Use Matrix											
Data											
View: Area Entry Table											
	Initial	Forest Land				Cropland					
	Final	FL Custom 1	FL Custom 2	Organic	Unmanaged	Irrigated rice	Mineral 1	Non Rice ecosystem	Organic 1	Pe	Final Area
Forest Land	FL Custom 1	22			18						90
	FL Custom 2		34		40						97
	Organic			30	15						99
	Unmanaged				100						100
Cropland	Irrigated rice				23						57
	Mineral 1				43						77
	Non Rice ecosystem				22						87
	Organic 1				44						66
	Perennial 1				23						46
	Rainfed				35						90
	Upland rice				24						78
	Unmanaged										0
Grassland	Improved				23						111
	Test Grassland				54						120
	Unimproved				44						89
	Unmanaged										23
Wetlands	Flooded Land 1										0
	Other Land 1										0
	Other Land 2										0
	Peatland 1										0
	Initial Area	22	34	30	581	0	0	0	0		1,358
	Net Change	68	63	69	-481	57	77	87	66		0