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## **3B Land Land Representation**

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# Outline

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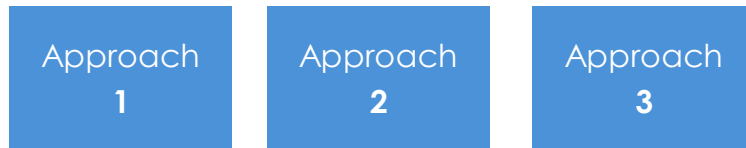
- Approaches
- Use of the IPCC Inventory Software

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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
<i>Sum</i>	= <i>140</i>	<i>Sum</i>	= <i>140</i>	<i>Sum</i>	= <i>0</i>

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.

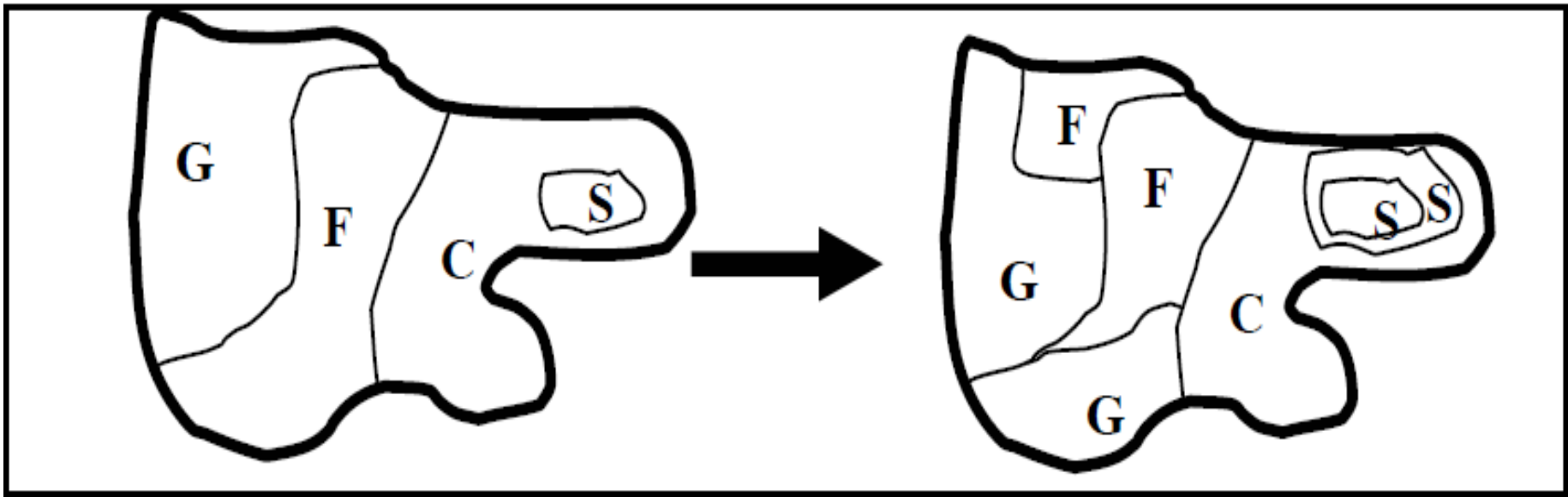
**TABLE 2.3.5**  
**SIMPLIFIED LAND-USE CHANGE MATRIX FOR EXAMPLE APPROACH 2**

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.

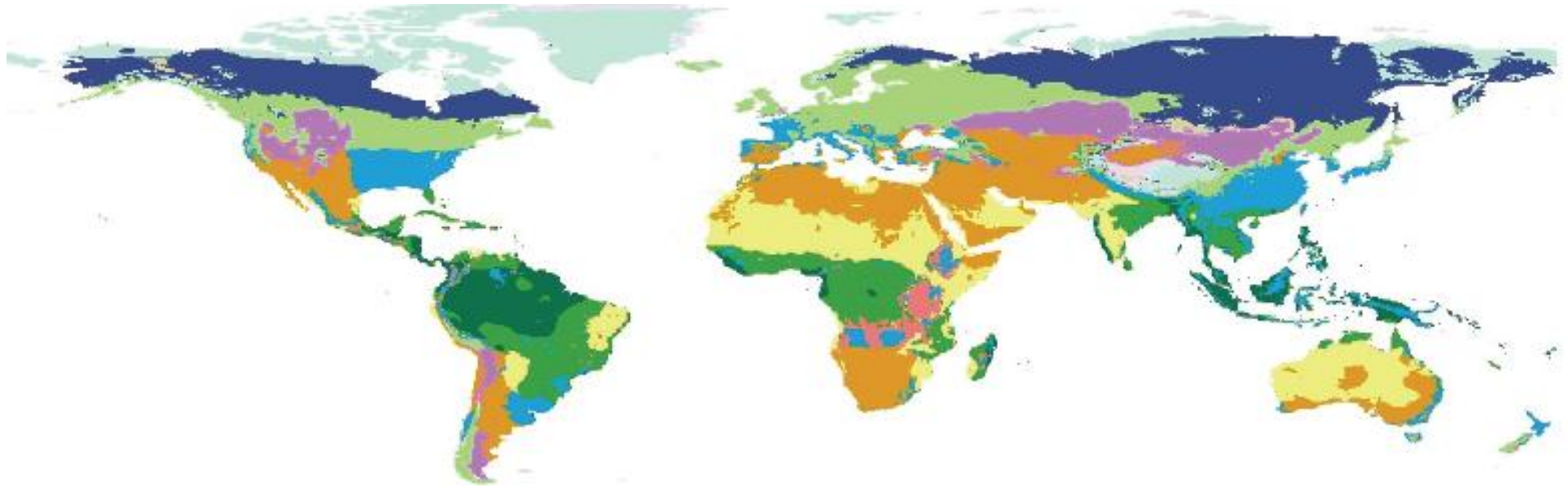
# Approach 3

- 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”.

The screenshot displays the IPCC Inventory Software interface. At the top, there are several tabs: "Area Entry Table", "Land-Use Conversion Matrix", "Annual increase in carbon stocks in biomass", "Loss of carbon from wood removals", and "Loss of carbon from fuel". The "Area Entry Table" tab is active. Below the tabs, the "Worksheet" section shows the following details:

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

The year "2013" is displayed in blue text on the right side of the worksheet. Below the worksheet details, there is a "Data" section with a table. The table has four columns: "Initial land use", "Final land use", "Area (ha)", and an empty column. The first row of data shows "Forest Land" under "Initial land use", "Unmanaged" under "Final land use", and "Area (ha)" with a red exclamation mark icon. To the right of the "Area (ha)" cell are two small icons: a square and a question mark.

At the bottom right of the interface, there is a button labeled "Land Type Manager", which is circled in red.

# 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.

AFOLU Land Types

Land Use Subcategory: Forest Land

- FL Custom 1
- FL Custom 2
- Organic
- Unmanaged
- Cropland
- Grassland
- Wetlands
- Settlements
- Other Land

Common Land Type Data

Country/Territory: Slovakia

Continent: Europe

Land Use Subcategory: FL Custom 1

Climate Region: Cool Temperate Moist

Soil Type: High Activity Clay Mineral

Forest Land Data

Ecosystem type: User-defined

Continent type: Unspecified

Species: Pinus

Age class (yr): Unspecified

Natural Forest:

Plantation:

Growing stock level (m3/ha): Unspecified

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

Add Copy Delete Save Undo Close

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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:

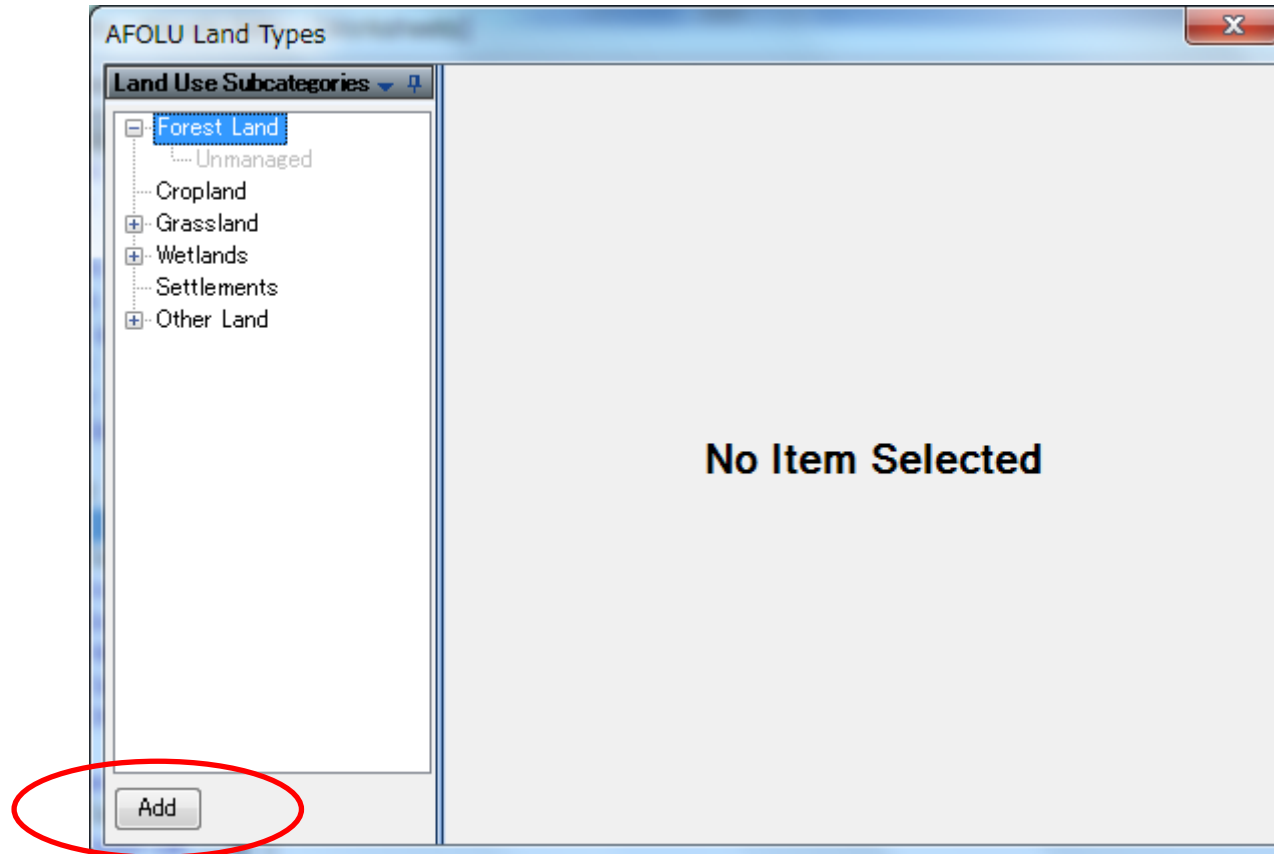
- 1) Select one of the main Land Use Categories in the Navigation section.
- 2) Click the Add button located at the bottom of the navigation section. New Land Use Subcategory will be created with the default name.
- 3) Enter desired details of the new Land Use Subcategory
- 4) Click the Save button to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

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

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- 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 shows the 'AFOLU Land Types' software interface. On the left, a tree view under 'Land Use Subcategories' shows 'Forest Land' selected, with a sub-entry 'QU' highlighted. The main area is divided into two sections:

- Common Land Type Data:**
  - Country/Territory: Republic of Moldova
  - Land Use Subcategory: QU
  - Climate Region: Cool Temperate Dry
  - Continent: Europe
  - Soil Type: User-defined
- Forest Land Data:**
  - Ecosystem type: User-defined
  - Species: Pinus
  - Natural Forest:  (selected)
  - Plantation:
  - 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.

The screenshot shows a software interface for estimating carbon stock changes. The interface includes several input fields and dropdown menus, with red circles and arrows highlighting specific parameters and their corresponding estimation purposes:

- Carbon fraction of aboveground forest biomass (tonne C/tonne d.m.):** 0.500 (dropdown) - Estimation for Biomass
- Ratio of below-ground biomass to above-ground biomass (R) (t root d.m./t shoot d.m.):** 0.400 (dropdown) - Estimation for Biomass
- Biomass conversion and expansion factor for wood and fuelwood removal (BCEFr) (t / m3 wood volume):** 0.000 (dropdown) - Estimation for Biomass
- Above-ground biomass in forests (t d.m. / ha):** 0.000 (dropdown) - Estimation for Biomass gain
- Above-ground biomass growth in plantation/natural forests (t d.m. /ha/yr):** 3.000 (dropdown) - Estimation for Biomass gain
- Reference soil organic carbon (SOC) stock (t C / ha):** 0.000 (dropdown) - Estimation for litter stock change
- Litter carbon stocks of mature forests (t C / ha):** 0.000 (dropdown) - Estimation for litter stock change
- Abandoned managed land:**
- Relative stock change factor:**
  - Land use (FLU):** 1.000
  - Management (FMG):** 1.000
  - Input (FI):** 1.000 - Estimation for soil



# Adding new sub category: Cropland

- For cropland, different type of information required

The screenshot shows the 'AFOLU Land Types' configuration window. On the left, a tree view under 'Land Use Subcategories' shows 'Forest Land' (with sub-items 'QU' and 'Unmanaged'), 'Cropland' (with 'Vineyards' selected), 'Grassland', 'Wetlands', 'Settlements', and 'Other Land'. The main area is divided into two sections:

**Common Land Type Data**

<b>Country/Territory</b>	Republic of Moldova	<b>Continent</b>	Europe
<b>Land Use Subcategory</b>	Vineyards		
<b>Climate Region</b>	Cool Temperate Dry	<b>Soil Type</b>	User-defined

**Cropland Data**

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

# 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 displays the 'AFOLU Land Types' software window. On the left, a tree view under 'Land Use Subcategories' shows 'Reservoir' selected under 'Wetlands'. The main area is divided into 'Common Land Type Data' and 'Wetland Data'. In the 'Common Land Type Data' section, 'Country/Territory' is 'Republic of Moldova', 'Continent' is 'Europe', 'Land Use Subcategory' is 'Reservoir', 'Climate Region' is 'Cool Temperate Dry', and 'Soil Type' is 'Organic'. The 'Wetland Data' section shows 'Type' set to 'Flooded land' (selected with a radio button). Below this, three input fields are present: 'Biomass stocks after the conversion (t d.m. / ha)' with a value of 0.000, 'Biomass stocks present on land (t d.m. / ha)' with a value of 0.000, and 'Carbon fraction of dry matter (t C / t d.m.)' with a value of 0.500.

Field	Value
Country/Territory	Republic of Moldova
Continent	Europe
Land Use Subcategory	Reservoir
Climate Region	Cool Temperate Dry
Soil Type	Organic
Wetland Type	Flooded land
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

# Adding new sub category: Wetlands

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

The screenshot shows the 'AFOLU Land Types' software interface. On the left, a tree view under 'Land Use Subcategories' shows 'Wetlands' expanded, with 'new wetland custom type' selected. The main area is divided into 'Common Land Type Data' and 'Wetland Data'.

**Common Land Type Data:**

- Country/Territory: Republic of Moldova
- Continent: Europe
- Land Use Subcategory: Peatland
- Climate Region: Cool Temperate Dry
- Soil Type: 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)

The screenshot shows the 'AFOLU Land Types' configuration window. The left sidebar lists 'Land Use Subcategories' with 'Settlements' and 'new settlements custom' selected. The main panel is divided into 'Common Land Type Data' and 'Settlement Data'. In the 'Common Land Type Data' section, 'Country/Territory' is 'Republic of Moldova', 'Continent' is 'Europe', and 'Land Use Subcategory' is 'Urban forest'. 'Climate Region' is set to 'Cool Temperate Dry'. The 'Soil Type' dropdown menu is open, showing a table with the following data:

FullName	Abbr	Soils classified 2003 for addit
Organic	ORG	

The 'Soil Type' dropdown has a red 'X' icon next to it, indicating an error. In the 'Settlement Data' section, 'Relative stock change factor' is set to 1.000. Below this, there are three input fields, all set to 1.000: 'Land use (FLU)', 'Management (FMG)', and 'Input (FI)'. On the right side, there are two more input fields: 'Reference soil organic carbon (SOC) stock (t C / ha)' set to 0.000 and 'Carbon fraction of dry matter (t C/t d.m.)' set to 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 w < >

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).

The screenshot shows the '2006 IPCC Categories' software interface. On the left is a tree view of categories, with '3.B.1.b.i - Cropland converted to Forest Land' selected. The main window displays the 'Area Entry Table' worksheet. The 'Sector' is 'Agriculture, Forestry, and Other Land Use', the 'Category' is 'Land', and the 'Subcategory' is '3.B.1.b.i - Cropland converted to Forest Land'. The 'Sheet' is 'Area Entry Table'. The 'Data' table is as follows:

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 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		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 1990

Category: Land

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

Sheet: Annual Area Table

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	!		
	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

Worksheet										
Sector: Agriculture, Forestry and Other Land Use										1990
Category: 3.B.2.b) - Forest Land converted to Cropland										
Sheet: Land Use Matrix										
Data										
View: Area Entry Table										
Initial	Final	Forest Land				Cropland				Final Area
		FL Custom 1	FL Custom 2	Organic	Unmanaged	Irrigated rice	Mineral 1	Non Rice ecosystem	Organic 1	
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
	Perennial 1									0
	Initial Area	22	34	30	581	0	0	0	0	1,358
	Net Change	68	63	69	-461	57	77	87	66	0