

Implementation of Tier 1 for Mineral Soil under Cropland and Grassland in EU MS

IPCC Tier 1 Approach

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Land Use and Management Categories

Cropland Management (CM)

System of practices on land on which agricultural crops are grown and on land temporarily set-aside from crop production. Includes arable and tillable land, rice fields, and agro-forestry systems*:

- *Long-term cultivated (annual crops)*
cereals, oils seeds, vegetables, root crops, forages
- *Paddy rice (wetland rice)*
- *Perennial / tree crops*
trees & shrubs with herbaceous crops, orchards, vineyards and plantations
- *Set-aside (temporary fallow land)*
land set at rest for one or several (<20) years before being cultivated again

* from: 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Chapter 5.1

Land Use and Management Categories

Grassland Management (GM)

System of practices on land used for livestock production aimed at manipulating the amount and type of vegetation and livestock produced. Generally has vegetation dominated by perennial grasses*:

- *Extensively managed rangelands and savannahs*
animal stocking rates and fire regimes are main management variables
- *Intensively managed continuous pasture*
with fertilization, irrigation, species changes
- *Hay land (meadows)*

* from: 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Chapter 6

IPCC Tier Levels

Tier 1

- Changes in C-stocks are based on C-stock after a change in land management relative to the reference condition.
- Changes are computed over inventory time period.

Tier 2

- Extension of Tier 1 allowing country-specific data.
- Using default equations for mineral and organic soils.

Tier 3

- Advanced estimation system (model) capturing annual variability in fluxes.
- May include estimates of changes in inorganic C pools.

from: 2006 IPCC Guidelines for National Greenhouse Gas Inventories

IPCC Tier 1

Tier 1 method employs

- *basic method*
- and
- *default emission factors*

provided in the IPCC Guidelines*.

Tier 1 method usually uses activity data that are spatially coarse, such as nationally or globally available estimates of deforestation rates, agricultural production statistics, and global land cover maps.

* from: IPCC Good Practice Guidance for LULUCF, Box 3.1.1

Tier 1 Method: Annual Changes in Soil C-Stock - ΔC_{Soil}

$$\Delta C_{Soil} = \Delta C_{Mineral} - L_{Organic} + \Delta C_{Inorganic} \quad \rightarrow \text{Tier 3}$$

Annual change in organic carbon stocks
in mineral soils:

$$\Delta C_{Mineral} = \frac{SOC_0 - SOC_{0-T}}{D}$$

Annual loss of carbon from drained
organic soils:

$$L_{Organic} = \sum_c (A \cdot EF)_c$$

where

$$SOC_t = \sum_{c,s,i} (SOC_{REF,c,s} \times F_{LU,c,s,i} \times F_{MG,c,s,i} \times F_{I,c,s,i} \times A_{c,s,i})$$

SOC_0
 SOC_{0-T}

T

D

A

EF

c,s,i

soil organic carbon stock in the last year of an inventory time period
soil organic carbon stock at the beginning of an inventory time period
number of year over inventory period; T is used instead of D if $T \geq 20$ years
default time period for transition to equilibrium (20 years)
land area of stratum defined by climate, soil and management history
emission factor climate type c
climate region (c), soil type (s), management system (i)

Tier 1 Method $C_{Mineral}$

Default Reference Soil Organic C-Stock - SOC_{REF}

Climate Region	Soil Type	HAC	LAC	Sandy	Spodic	Vulcanic	Wetland
Boreal		68		10	117	20	146
Cold temperate	dry	50	33	34		20	87
	moist	95	85	71	115	130	
Warm temperate	dry	38	24	19		70	88
	moist	88	63	34		80	
Tropical	dry	38	35	31		50	86
	moist	65	47	39		70	
	wet	44	60	66		130	
	montaine	88	63	34		80	

after: Table 2.3 2006 IPCC Guidelines for NGHG Inventories

Tier 1 Method $C_{Mineral}$

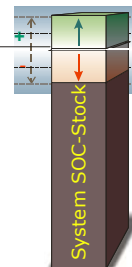
Land Use System Factors $F_{LUS} - F_{LU}, F_{MG}, F_I$

$$F_{LUS} : F_{LU} * F_{MG} * F_I$$



t C ha⁻¹
in 0-30cm

F_{LU} Land Use	F_{MG} Management	F_I Inputs
Grassland	- Improved - Nominal/non-deg. - Mod. degraded - Sev. degraded	- Medium - High
Cropland	- Full tillage - Reduced tillage - No tillage	- Low - Medium - High, no manure - High, with manure



Tier 1 Method $C_{Mineral}$

Land Use System Factor $F_{LUS} = F_{LU}, F_{MG}, F_I$

Factor type	Level	Climate Region	IPCC default	
Land Use F_{LU}	Long-term cultivated	Boreal	0.80	F_{LU}
	Paddy rice	Cold temperate		
	Perennial tree crop	dry		
	Set-aside (< 20 yrs)	moist		
Tillage F_{MG}	Full	Warm temperate	1.00	F_{MG}
	Reduced	dry	1.08	F_{MG}
	No-till	moist		
		dry		
Input F_I	Low	Tropical		
	Medium	moist		
	High without manure	wet	1.00	F_I
	High with manure	montane		

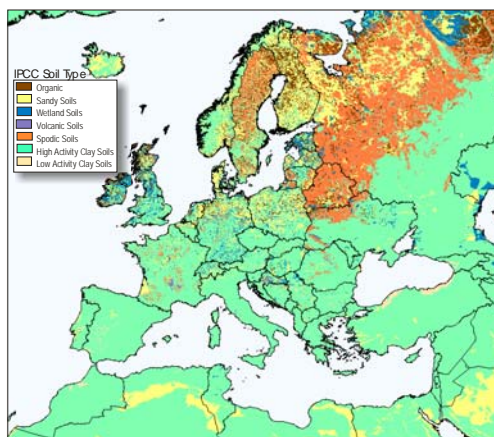
after: Table 5.5 2006 IPCC Guidelines for NGHG Inventories

$$F_{LUS(0)} = F_{LU} * F_{MG} * F_I = 0.80 * 1.00 * 1.00 = 0.800$$

$$F_{LUS(20)} = F_{LU} * F_{MG} * F_I = 0.80 * 1.08 * 1.00 = 0.864$$

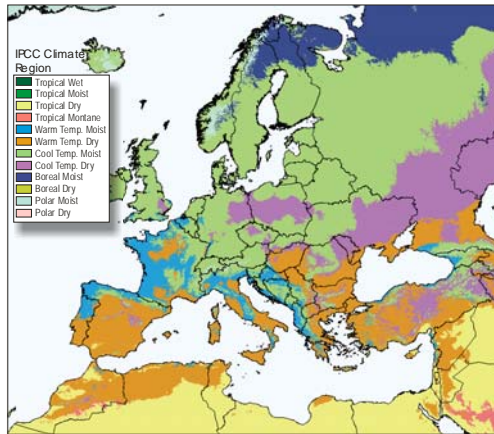
Tier 1 Implementation SOC_{REF}

Soil Type



Tier 1 Implementation SOC_{REF}

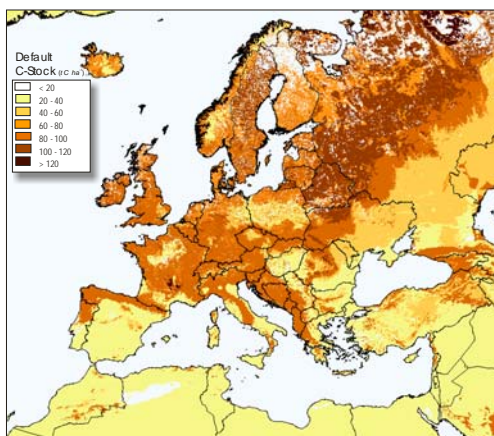
Climate Region



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Tier 1 Implementation SOC_{REF}

Default
Reference
Soil Organic
C-Stock

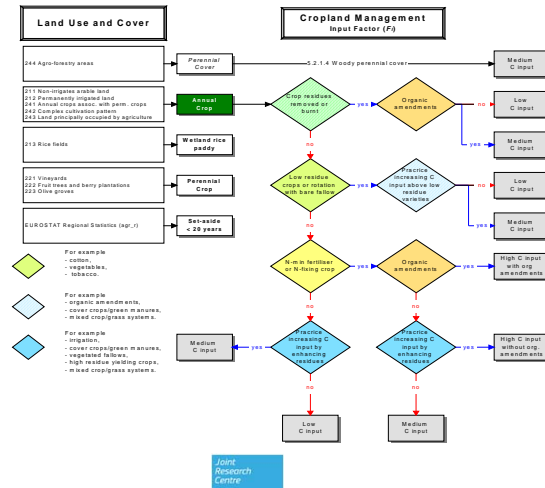


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Tier 1 Implementation F_{LUS}

Cropland:

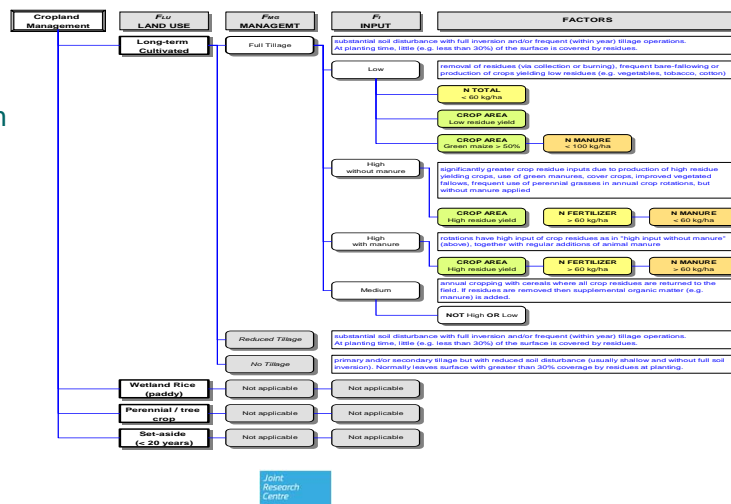
adapted
classification
scheme from
Figure 5.1



Tier 1 Implementation F_{LUS}

Cropland:

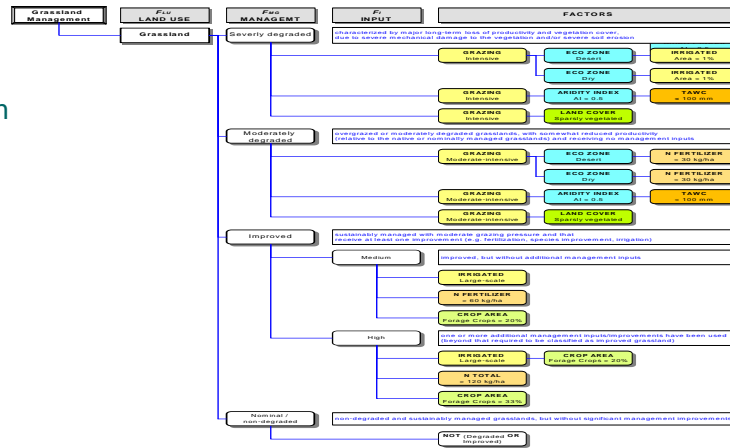
quantified
classification
scheme



Tier 1 Implementation F_{LUS}

Grassland:

quantified
classification
scheme



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Data Concerns

Base Year

- Land Use Category in reference year 1990 uncertain.
- Stability of status in reference year.

Tier Land Use System

- IPCC Land Use Categories mixed with types of land cover.
- F_{MG} and F_I are main source of C-stock changes on CC.

Associated Areas

- Area from statistics based on administrative units.
- Aggregation unit (field or stratum of management system).

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