

ANNEX 2

WORKSHEETS

All the Worksheets in Annex I to Volume 4 of 2006 IPCC Guidelines remain valid. In the 2019 Refinement, 10 new worksheets are added here as new guidance consistent with main chapters of Volume 4 of 2019 Refinement related to Flooded Land and Biochar Amendments to Soils for Cropland and Grassland.

Flooded Land Worksheets:

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Biochar and Soils - CL, GL Worksheets

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Annex 2 Worksheets

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3B3 Grassland.....A2.5

3B4 Wetlands.....A2.8

Sector		Agriculture, Forestry and Other Land Use				
Category		Cropland Remaining Cropland: Annual change in biochar carbon stock in mineral soils receiving biochar additions				
Category code		3B2a (New)*				
Sheet		3 of 3				
Equation		Equation 2.2	Equation 2.26A			
Land-use category		Subcategories for reporting year	Total quantity of biochar incorporated into mineral soil during the inventory year by production type	Organic carbon content of biochar	Fraction of biochar carbon remaining (unmineralised) after 1000 years	Annual change in biochar carbon stock in mineral soils receiving biochar additions
Initial land use	Land use during reporting year		(tonnes biochar dry matter yr ⁻¹)	(tonnes C tonne ⁻¹ biochar dry matter)	(tonnes sequestered C tonne ⁻¹ biochar C)	(tonnes sequestered C yr ⁻¹)
				Table 2.3A	Table 2.3B	$\Delta BC = BC_{TOTp} * F_{Cp} * F_{perm_p}$
			BC _{TOTp}	F _{Cp}	F _{perm_p}	ΔBC
CL	CL	(a)				
		(b)				
		(c)				
Total						

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Sector		Agriculture, Forestry and Other Land Use				
Category		Land Converted to Cropland: Annual change in biochar carbon stock in mineral soils receiving biochar additions				
Category code		3B2b (New)*				
Sheet		3 of 3				
Equation		Equation 2.2	Equation 2.26A			
Land-use category		Subcategories for reporting year	Total quantity of biochar incorporated into mineral soil during the inventory year by production type (tonnes biochar dry matter yr ⁻¹)	Organic carbon content of biochar (tonnes C tonne ⁻¹ biochar dry matter)	Fraction of biochar carbon remaining (unmineralised) after 1000 years (tones sequestered C tonne ⁻¹ biochar C)	Annual change in biochar carbon stock in mineral soils receiving biochar additions (tonnes sequestered C yr ⁻¹)
Initial land use	Land use during reporting year			Table 2.3A	Table 2.3B	$\Delta BC = BC_{TOTp} * F_{Cp} * F_{perm_p}$
			BC_{TOTp}	F_{Cp}	F_{perm_p}	ΔBC
FL	CL	(a)				
		(b)				
Sub-total						
GL	CL	(a)				
		(b)				
Sub-total						
WL	CL	(a)				
		(b)				
Sub-total						
SL	CL	(a)				
		(b)				
Sub-total						
OL	CL	(a)				
		(b)				
Sub-total						
Total						

Sector		Agriculture, Forestry and Other Land Use										
Category		Grassland Remaining Grassland: Annual change in carbon stocks in mineral soils										
Category code		3B3a										
Sheet		1 of 3										
Equation		Equation 2.2	Equation 2.25									
Land-use category		Subcategories of unique climate, soil, and management combinations	Area in the last year of an inventory period	Area at the beginning of an inventory period	Reference carbon stock for Climate/Soil Combination	Stock change factor for land-use system or sub-system	Stock change factor for management regime	Stock change factor for C input	Carbon stock in last year of an inventory period	Carbon stock at the beginning of an inventory period	Time dependence of stock change factors (D) or number of years over a single inventory time period (T)	Annual change in carbon stocks in mineral soils
			(ha)	(ha)	(tonnes C ha ⁻¹)	(-)	(-)	(-)	tonnes C	tonnes C	(yr)	(tonnes C yr ⁻¹)
					Table 2.3, Chap. 2, Sec. 2.3.3.1	Table 6.2	Table 6.2	Table 6.2			(default is 20 yr; if T>D then use the value of T)	$\Delta C_{\text{Mineral}}$ as in Equation 2.25
Initial land use	Land use during reporting year		A₍₀₎	A_(0-T)	SOC_{ref}	F_{LU}	F_{MG}	F_I	SOC₀	SOC_{0-T}	D	$\Delta C_{\text{Mineral}}$
GL	GL	(a)										
		(b)										
		(c)										
		(d)										
		(e)										
		(f)										
		(g)										
		(h)										
Total											20	

Note: This worksheet is designed for computations using Formulation A in Box 2.1 of Section 2.3.3.1

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Sector		Agriculture, Forestry and Other Land Use				
Category		Grassland Remaining Grassland: Annual change in biochar carbon stock in mineral soils receiving biochar additions				
Category code		3B3a (New)*				
Sheet		3 of 3				
Equation		Equation 2.2	Equation 2.26A			
Land-use category		Subcategories for reporting year	Total quantity of biochar incorporated into mineral soil during the inventory year by production type	Organic carbon content of biochar	Fraction of biochar carbon remaining (unmineralised) after 1000 years	Annual change in biochar carbon stock in mineral soils receiving biochar additions
Initial land use	Land use during reporting year		(tonnes biochar dry matter yr ⁻¹)	(tonnes C tonne ⁻¹ biochar dry matter)	(tonnes sequestered C tonne ⁻¹ biochar C)	(tonnes sequestered C yr ⁻¹)
				Table 2.3A	Table 2.3B	$\Delta BC = BC_{TOTP} * F_{CP} * F_{permP}$
			BC _{TOTP}	F _{CP}	F _{permP}	ΔBC
GL	GL	(a)				
		(b)				
		(c)				
Total						

Sector		Agriculture, Forestry and Other Land Use				
Category		Land Converted to Grassland: Annual change in biochar carbon stock in mineral soils receiving biochar additions				
Category code		3B3b (New)*				
Sheet		3 of 3				
Equation		Equation 2.2	Equation 2.26A			
Land-use category		Subcategories for reporting year	Total quantity of biochar incorporated into mineral soil during the inventory year by production type (tonnes biochar dry matter yr ⁻¹)	Organic carbon content of biochar (tonnes C tonne ⁻¹ biochar dry matter)	Fraction of biochar carbon remaining (unmineralised) after 1000 years (tones sequestered C tonne ⁻¹ biochar C)	Annual change in biochar carbon stock in mineral soils receiving biochar additions (tonnes sequestered C yr ⁻¹)
Initial land use	Land use during reporting year			Table 2.3A	Table 2.3B	$\Delta BC = BC_{TOTp} * F_{Cp} * F_{perm_p}$
			BC_{TOTp}	F_{Cp}	F_{perm_p}	ΔBC
FL	GL	(a)				
		(b)				
Sub-total						
GL	GL	(a)				
		(b)				
Sub-total						
WL	GL	(a)				
		(b)				
Sub-total						
SL	GL	(a)				
		(b)				
Sub-total						
OL	GL	(a)				
		(b)				
Sub-total						
Total						

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Sector		Agriculture, Forestry and Other Land Use			
Category		Flooded Land Remaining Flooded Land: Non-CO₂ Emissions from Reservoirs			
Category code		3B4aii and 3B4bii² (New)*			
Sheet		1 of 2			
Equation		Equation 2.2 (2006 IPCC Guidelines)	Equation 7.10		
Land-use category		Subcategories for reporting year	Area of Flooded Land remaining Flooded Land (Reservoir > 20 yrs) located in a climate zone "j"	Emission factor from Flooded Land for reservoir > 20 yrs located in a climate zone "j"	Annual CH ₄ emissions for Reservoirs >20 years old (Flooded lands remaining Flooded Lands) in a climate zone "j"
Initial land use ³	Land use during reporting year		(ha)	(kg CH ₄ ha ⁻¹ yr ⁻¹)	(kg CH ₄ yr ⁻¹)
				Table 7.9	$F_{CH_4, tot} = \sum_{j=1}^6 \sum_{i=1}^{nms_j} \alpha_{ch_4, i} \left(EF_{CH_4, age > 20, j} \cdot A_{flooded, j, i} + R_d \cdot EF_{CH_4, age > 20, j} \cdot A_{total, j, i} \right)$
			A	EF	CH₄
Total					

¹ Sub-totals of emissions for each land pre-conversion land-use category will have to be calculated for conversion categories.

² This worksheet can be used for any category under 3B. Inventory compilers should specify an appropriate category code here. When this worksheet is used to calculate emissions to be reported in the category Flooded Land Remaining Flooded Land, "3B4aii" and "3B4bii" should be entered as category code.

³ For conversion categories, if data by initial land use are not available, use only "non-LU" in this column.

Sector		Agriculture, Forestry and Other Land Use			
Category		Flooded Land Remaining Flooded Land: Non-CO₂ Emissions from Other Constructed Waterbodies (Freshwater Ponds, Saline Ponds, Canals, Drainage Channels and Ditches)			
Category code		3B4biii² (New)*			
Sheet		2 of 2			
Equation		Equation 2.2 (2006 IPCC Guidelines)	Equation 7.12		
Land-use category		Subcategories for reporting year	Area of other water body "i" of type "w" located in a climate zone "j"	Emission factor from " for constructed canals, drainage channels, ditches and ponds located in a climate zone "j" and adjusted for trophic state	Annual CH ₄ emissions for constructed canals, drainage channels, ditches and ponds located in a climate zone "j"
Initial land use ³	Land use during reporting year		(ha)	(kg CH ₄ ha ⁻¹ yr ⁻¹)	(kg CH ₄ yr ⁻¹)
				Table 7.11 and 7.12	$F_{CH_4, other} = \sum_{j=1}^6 \sum_{w=1}^3 \sum_{i=1}^{nother_{w,j}} (A_{j,w,i} \cdot EF_{CH_4,j,w} \cdot \alpha_{j,w,i})$
			A	EF	CH₄
Total					

¹ Sub-totals of emissions for each land pre-conversion land-use category will have to be calculated for conversion categories.

² This worksheet can be used for any category under 3B. Inventory compilers should specify an appropriate category code here. When this worksheet is used to calculate emissions to be reported in the category Constructed canals, drainage channels, ditches and ponds "3B4biii" should be entered as category code.

³ For conversion categories, if data by initial land use are not available, use only "non-LU" in this column.

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Sector		Agriculture, Forestry and Other Land Use					
Category		Land Converted to Flooded Land - CO₂ Emissions from Reservoirs					
Category code		3B4biii² (New)*					
Sheet		1 of 1					
Equation		Equation 2.2 (2006 IPCC Guidelines)	Equation 7.13				
Land-use category		Subcategories for reporting year	Area of land newly flooded as a result of construction of reservoir "j" located in a climate zone "j"	Soil carbon stock per climate zone "j" and soil type "k"	Annual on-site CO ₂ -C emissions/removal s from newly flooded land < 20 yrs	Net annual CO ₂ emissions from Land converted to Flooded Land < 20 yrs ago	Scaling factor to convert Soil Organic Carbon Stocks based on empirical relationships between emissions estimated from G- res ⁴ and soil C stock and climate zone "j"
Initial land use ³	Land use during reporting year		(ha)	(tonnes C ha ⁻¹)	(tonnes C ha ⁻¹ yr ⁻¹)	(tonnes C yr ⁻¹)	yr ⁻¹
				Table 2.3 2006 Guidelines or FAO Global soil Organic Map	Table 7.13	$F_{CO2} = \sum_{j=1}^{12} \sum_{i=1}^{nres_j} \sum_{k=1}^{nsoil} A_{flooded,j,i} \cdot \phi_{i,k} \cdot SOC_{j,k} \cdot M_j$	
			A		EF	CO₂-C = A * EF	C stock
Total							

¹ Sub-totals of emissions for each land pre-conversion land-use category will have to be calculated for conversion categories.

² This worksheet can be used for any category under 3B. Inventory compilers should specify an appropriate category code here. When this worksheet is used to calculate emissions to be reported in the category Constructed canals, drainage channels, ditches and ponds "3B4biii" should be entered as category code.

³ For conversion categories, if data by initial land use are not available, use only "non-LU" in this column.

⁴ Prairie et al 2017b

Sector		Agriculture, Forestry and Other Land Use			
Category		Land Converted to Flooded Lands: Non CO₂ Emissions from Reservoirs			
Category code		3B4bii² (New)*			
Sheet		1 of 2			
Equation		Equation 2.2 (2006 IPCC Guidelines)	Equation 7.14		
Land-use category		Subcategories for reporting year	Area of Land converted to Flooded Lands (Reservoir < 20 yrs) located in a climate zone "j"	Emission factor from Land converted to Flooded Land for reservoir < 20 yrs located in a climate zone "j"	Annual CH ₄ emissions for Reservoirs < 20 years old (Land converted to Flooded Lands) in a climate zone "j"
Initial land use ³	Land use during reporting year		(ha)	(kg CH ₄ ha ⁻¹ yr ⁻¹)	(kg CH ₄ yr ⁻¹)
				Table 7.14	$F_{CH_4, tot} = \sum_{j=1}^6 \sum_{i=1}^{mns_j} \alpha_{chla_j} \left(EF_{CH_4 age < 20_j} \cdot A_{flooded, j, i} + R_d \cdot EF_{CH_4 age < 20_j} \cdot A_{total, j, i} \right)$
			A	EF	CH₄
Total					

¹ Sub-totals of emissions for each land pre-conversion land-use category will have to be calculated for conversion categories.

² This worksheet can be used for any category under 3B. Inventory compilers should specify an appropriate category code here. When this worksheet is used to calculate emissions to be reported in the category Land converted to Flooded Land, "3B4bii" should be entered as category code.

³ For conversion categories, if data by initial land use are not available, use only "non-LU" in this column.

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Sector		Agriculture, Forestry and Other Land Use			
Category		Land Converted to Flooded Lands: Non CO₂ Emissions from Other Constructed Waterbodies (Freshwater Ponds, Saline Ponds, Canals, Drainage Channels and Ditches)			
Category code		3B4biii ² (New)*			
Sheet		2 of 2			
Equation		Equation 2.2 (2006 IPCC Guidelines)	Equation 7.12		
Land-use category		Subcategories for reporting year	Area of other water body "i" of type "w" located in a climate zone "j"	Emission factor from" for constructed canals, drainage channels, ditches and ponds located in a climate zone "j" and adjusted for trophic state	Annual CH ₄ emissions for constructed canals, drainage channels, ditches and ponds located in a climate zone "j"
Initial land use ³	Land use during reporting year		(ha)	(kg CH ₄ ha ⁻¹ yr ⁻¹)	(kg CH ₄ yr ⁻¹)
				Table 7.11 and 7.12	$F_{CH_4 other} = \sum_{j=1}^6 \sum_{w=1}^3 \sum_{i=1}^{nother_{w,j}} \left(A_{j,w,i} \cdot EF_{CH_4,j,w} \cdot \alpha_{j,w,i} \right)$
			A	EF	CH₄
Total					

¹ Sub-totals of emissions for each land pre-conversion land-use category will have to be calculated for conversion categories.

² This worksheet can be used for any category under 3B. Inventory compilers should specify an appropriate category code here. When this worksheet is used to calculate emissions to be reported in the category Constructed canals, drainage channels, ditches and ponds "3B4biii" should be entered as category code.

³ For conversion categories, if data by initial land use are not available, use only "non-LU" in this column.