

# Climate MRV for Africa – Phase 2

## Development of National GHG Inventory

### Wetlands

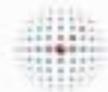


**NIRAS**  
Lead partner

GreenStream



TÜVRheinlan  
Precisely Right.



camco  
clean energy

**Project of the European Commission**  
**DG Climate Action**

EuropeAid/136245/DH/SER/MULTI

Tomasz Kowalczewski, Paolo Prospero  
Forestry Experts  
2017

# Methodological and Data Related Issues on Wetlands

- Category is including inland marshes, peat bogs, and natural and artificial water courses and water bodies.
- The methodology of Wetlands identification might not allow for the separation of managed and unmanaged Wetlands, but the area of Wetlands at least should be split into remaining and 'converted to' sub-categories.
- As wetlands are mainly precipitation dominated, their extent to a certain degree depends on the seasonal and annual variability in precipitation,



# Methodological and Data Related Issues on Wetlands

Absence of linkage between biomass carbon and soil carbon for different land categories or vegetation types

Ambiguity in classification of land-use/management systems, and soil types

Absence of activity data on land area under different conditions:

- land-use/management systems
- soil type
- for periods  $t$  (inventory year), and  $t-20$
- intensively managed organic soils

Absence of emission factors such as soil carbon in mineral soils and annual loss rate of carbon in managed organic soils.



# Sources of Activity Data

Activity data	Tier 1	Tier 2	Tier 3
Area under different land use/management systems and soil type during year t (inventory year)	FAO data base (faostat.fao.org)	National land use survey data	National land use maps overlaid on soil survey maps Ministries responsible for agriculture, forests and natural resources
Area under different land use/management systems and soil type 20 years prior to year t (inventory year)	FAO data base (faostat.fao.org)	Historical, national land use survey data	National land use maps overlaid on soil survey maps Ministries responsible for agriculture, forests and natural resources
Area under manager organic soils	Global datasets	National database on organic soils	National database

# Carbon stock changes as well as CO2 emissions

**According to Equations 7.3. and 7.4 of the IPCC 2006 GL, CO2 emissions (for all production phases) from peatlands include emissions from peatland extraction (both on-site and off-site) and from biomass clearing:**

$$\text{CO2-CWW peat on-site} = [(\text{ApeatRich} * \text{EFCO2 peatRich}) + (\text{ApeatPoor} * \text{EFCO2 peatPoor})] / 1000 + \Delta\text{CWW peat B}$$

where

- CO<sub>2</sub>-CWW peat on-site = on-site CO<sub>2</sub>-C emissions from peat deposits, Gg C yr<sup>-1</sup>
- ApeatRich = area of nutrient-rich peat soils managed for peat extraction, ha
- ApeatPoor = area of nutrient-poor peat soils managed for peat extraction, ha
- EFCO2 peatRich = CO<sub>2</sub> emission factors for nutrient-rich peat soils managed for peat extraction or abandoned after peat extraction, tonnes C ha<sup>-1</sup> yr<sup>-1</sup>
- EFCO2 peatPoor = CO<sub>2</sub> emission factors for nutrient-poor peat soils managed for peat extraction or abandoned after peat extraction, tonnes C ha<sup>-1</sup> yr<sup>-1</sup>
- ΔCWW peat B = CO<sub>2</sub> emissions from change in carbon stocks in biomass due to vegetation clearing, Gg C yr<sup>-1</sup>.

**Proxy data, i.e., statistics on peat extraction might be used for the estimates. For the emission factors, IPCC default values, i.e., 1.1 and 0.2 tonnes C ha<sup>-1</sup> yr<sup>-1</sup>, respectively, from Table 7.4 of Volume 4 of the IPCC 2006 GL also might be applied**

# Carbon stock changes as well as CO<sub>2</sub> emissions

Carbon stock change in biomass might be estimated for wetland prepared for peat extraction using Equation 2.16.

The typical biomass of peat bogs, i.e.,  $B_{\text{before}}$  in this equation, is usually grass amount. Therefore,  $B_{\text{before}}$  might be estimated i.e from the proportion and average specific biomass for cold dry and warm dry climate types:

$$\mathbf{B_{\text{before}} = PCD * BCD + PwD * BwD}$$

(PCD = 0.41, PwD = 0.59, BCD = 6.5 t biomass ha<sup>-1</sup> and BwD = 6.1 t biomass ha<sup>-1</sup>)

Bafter in the equation is 0, and the carbon fraction is the default value of 0.47 tC t biomass<sup>-1</sup>.

# Carbon stock changes as well as CO<sub>2</sub> emissions

Off-site emissions from managed peatlands were estimated using Equation 7.5:

$$\text{CO}_2\text{-C WW peat off-site} = \text{Wtdry\_peat} * \text{Cfractionwt\_peat}$$

where

CO<sub>2</sub>-C WW peat off-site = off-site CO<sub>2</sub>-C emissions from peat removed for horticultural use, tC yr<sup>-1</sup>

Wtdry\_peat = air-dry weight of extracted peat, tonnes yr<sup>-1</sup>

Cfractionwt\_peat = carbon fraction of air-dry peat by weight, tonnes C (tonnes of air-dry peat)<sup>-1</sup>.

# N<sub>2</sub>O emissions

The IPCC 2006 GL provides a Tier 1 methodology to estimate N<sub>2</sub>O emissions due to peat extraction. These emissions were only estimated for nutrient rich sites using Equation 7.7:

$$\mathbf{N_2O\ WW_{peatExtraction} = (A\ peatRich * EF\ N2O\ peatRich) * 44/28 * 10^{-6}}$$

Where:

N<sub>2</sub>O WW<sub>peatExtraction</sub> = N<sub>2</sub>O emissions due to peat extraction, GgN<sub>2</sub>Oyr<sup>-1</sup>

A peatRich = area of nutrient rich peat extraction sites, ha

EF N<sub>2</sub>O peatRich = emission factor for drained nutrient-rich wetlands, kg N<sub>2</sub>O–N ha<sup>-1</sup>yr<sup>-1</sup> for which the IPCC default value of 1.8 kg N<sub>2</sub>O–N ha<sup>-1</sup>yr<sup>-1</sup> from Table 7.6 was used (the multiplier 10<sup>-6</sup> is necessary to obtain the result in units of GgN<sub>2</sub>Oyr<sup>-1</sup>).



# Conversions: Grassland converted to wetland biomass

Equation 7.10 of the IPCC 2006 GL was applied as follows:

$$\Delta\text{CLWfloodLB} = \text{AConversion} * (\text{Bafter} - \text{Bbefore}) * \text{CF}$$

where:

- $\Delta\text{CLWfloodLB}$  = biomass carbon stock change due to land-use conversion to Wetland, tC year-1
- AConversion = annual area of land converted to Wetland, ha
- Bafter = carbon stocks of biomass after the conversion to Wetland, tonnes C ha-1
- Bbefore = carbon stocks in biomass before the conversion to Wetland, tonnes C ha-1
- CF = carbon fraction, tC (t biomass)-1.

To estimate the amount of biomass cleared in the year of conversion, the annual area of land converted to Wetlands is needs to be used. Bafter is zero, and Bbefore was estimated the same way as described for wetland prepared for peat extraction



# Conversions: Settlements converted to wetland biomass

This land-use change category mainly contains the area of sandpits and gravel pits, extraction and construction area which are not covered by soil and biomass. Therefore, emissions from these land-use change conversions are most probably zero.



# Sources of Emission/Removal Factors

Activity data and emissions/removal factor	Tier 1	Tier 2	Tier 3
Peat extraction	<p>AD/ Country estimates of the total area</p> <p>EF/ International data sets on peat extraction sites and production</p>	<p>AD/national peat production data and the corresponding peatland areas.</p> <p>AD/areas of organic soils manager for peat extraction</p> <p>AD/peat production data and local moisture content</p> <p>EF/country-specific carbon content</p>	<p>AD/national peat production data and the corresponding peatland areas.</p> <p>AD/areas of organic soils manager for peat extraction</p> <p>AD/peat production data and local moisture content</p> <p>AD/ area of organic solis divided by peat extraction technology, peat types and extraction depths.</p> <p>EF/local carbon content</p>

# Sources of Emission/Removal Factors

Activity data and emissions/removal factor	Tier 1	Tier 2	Tier 3
N <sub>2</sub> O Emissions from manager peatlands	AD/ Country estimates of the total area EF/Table 7.6. of the IPCC 2006	AD/national peat production data and the corresponding peatland areas. AD/areas of organic soils manager for peat extraction AD/peat production data and local moisture content EF/country-specific emission factor	AD/national peat production data and the corresponding peatland areas. AD/areas of organic soils manager for peat extraction AD/peat production data and local moisture content AD/ area of organic solis divided by peat extraction technology, peat types and extraction depths. EF/ off-site use of horticultural peat

# Sources of Emission/Removal Factors

Activity data and emissions/removal factor	Tier 1	Tier 2	Tier 3
Flooded Land Remaining Flooded Land	No methodologies are provided for Flooded Land Remaining Flooded Land. It is assumed that CO <sub>2</sub> and N <sub>2</sub> O emissions occurring on flooded lands are already covered by methodologies described in other sectors		
Land Converted to Flooded Land	<p>No guidance is provided on carbon stock changes from soils due to land conversion to Flooded Land at this time</p> <p>The stock change method assumes that all the carbon in biomass that existed prior to flooding is emitted and this may lead to overestimates.</p> <p>Countries are only encouraged to develop higher tier country-specific methods based on models, measurements and associated parameter</p>		

# Summary

- Part of our efforts to establish a system estimating the emission and removal estimates was dedicated to further improve the time series consistency.
- Short-term strategy is to improve the emission and removal estimates
- However, whereas this inventory is more consistent than before, further improvements are possible, and in fact planned, to update the land use change area after 2006 by processing remote sensing information that has become, and may become, available for the GHG inventory.



# Thank you!

Tomasz Kowalczewski, Paolo Prospero