2019 Refinement to the 2006 IPCC Guidelines: Refinements in Volume 4 (Agriculture, Forestry and Other Land Use)

Bonn Climate Change Conference (SB50)

SBSTA - IPCC Special Event on 2019 Refinement to the 2006 IPCC Guidelines
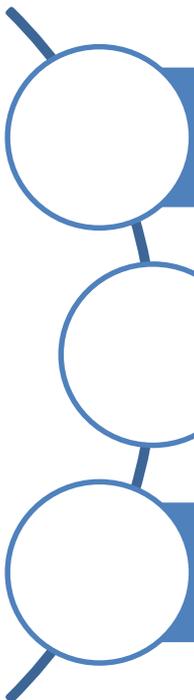
21 June 2019, Bonn, Germany

Sekai Ngarize,

IPCC TFI TSU

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INTERGOVERNMENTAL PANEL ON climate change

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Outline

Overview

Major refinements (by chapters)

Summary

AFOLU Sector in the 2006 IPCC Guidelines

The 2006 Guidelines integrates Land Use, Land Use Change and Forestry (LULUCF) and the Agriculture sectors into a single Sector: Agriculture, Forestry and Other land-use (AFOLU) sector:

AFOLU

3A. Livestock

3B. Land

3C. Aggregate Sources and Non-CO_2 Emissions on Land
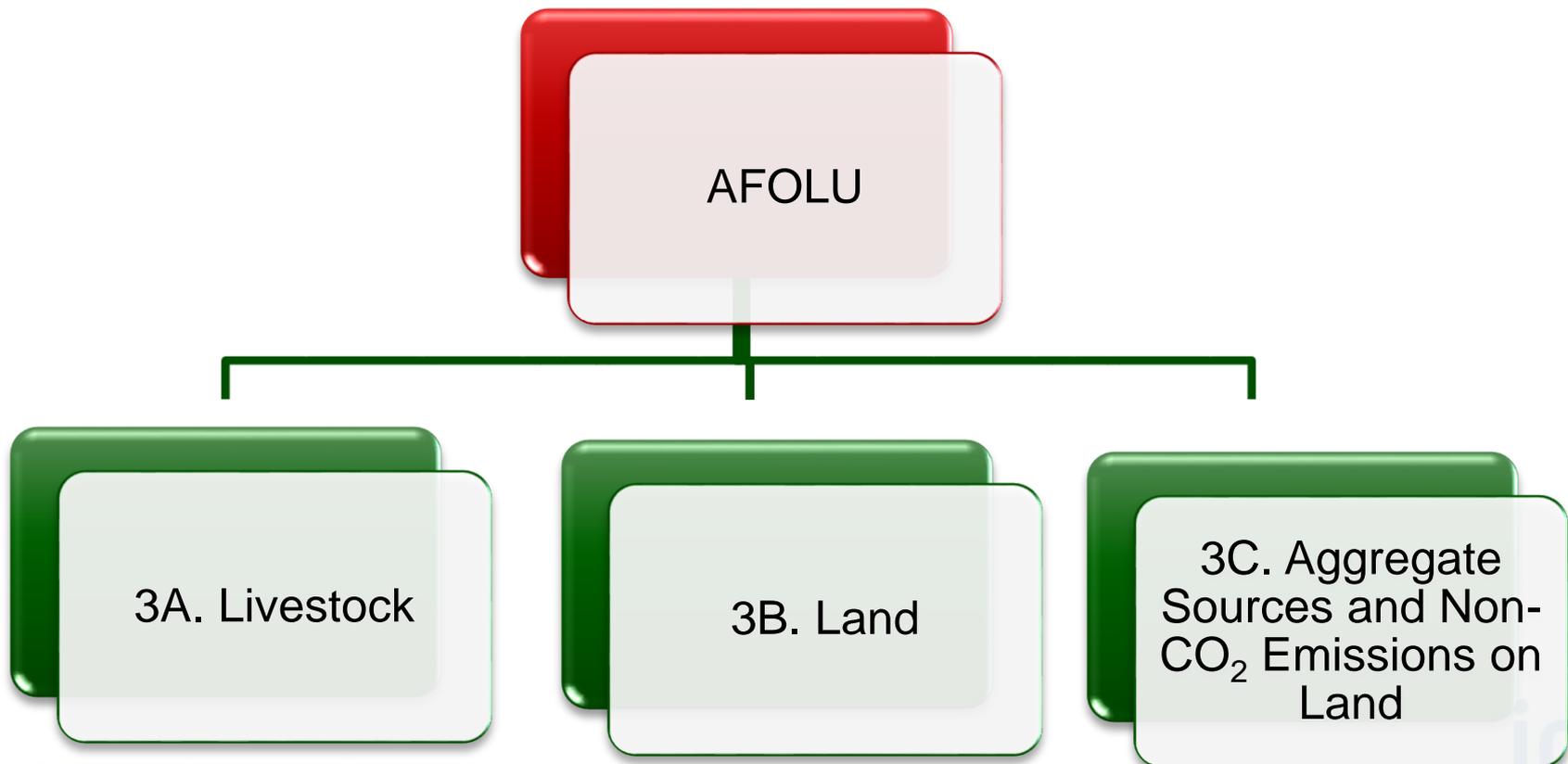
Overview: 2019 Refinement for the AFOLU sector

➤ Overall, the 2019 Refinement of the 2006 IPCC Guidelines builds on the objective of providing updates and new guidance to the 2006 IPCC Guidelines for chapters 1-12.

➤ The main changes for the AFOLU sector are related to the following:

✓ *Provision of New Guidance*

✓ *Provision of updated default emission factors*

✓ *Provision of new default emission factors*

✓ *Better and more complete coverage of sections*

➤ Volume 4 contains annexes:

✓ Annex 1 (Mapping tables)

✓ Annex 2 (Worksheets)

2019 Refinement of Vol4 - AFOLU Sector: Chapter 1

Chapter 1 : Introduction

➢ Refinements in Chapter 1 reflect the changes made to provide new guidance and updates in other chapters of this volume to ensure methodological consistency across the AFOLU volume

2019 Refinement of Vol4 - AFOLU Sector: Chapter 2

Chapter 2: Generic Methodologies Applicable to Multiple Land-use Categories

The main changes for the 3B (Land) categories are related to the refinements for the Biomass, Dead Organic Matter (DOM) and Soils carbon pools

➢ **Provision of New Guidance**

Biomass (Section 2.3.1)

✓ **Use of allometric models for biomass estimation**

- *Allometric models, including laser scanning techniques, to be used only if higher accuracy than IPCC defaults is demonstrated (through validation), and outcomes verified across time (good practice for models).*

✓ **Use of biomass density maps generated from remote sensing data for estimation of biomass carbon (amount of biomass per unit area)**

-Biomass maps, not set as a good practice, which implies that their use is subject to validation (to show higher accuracy than defaults), and verification across time (since regarded as a modelled approach)

2019 Refinement of Vol4 - AFOLU Sector: Chapter 2

Chapter 2:Generic Methodologies Applicable to Multiple Land-use Categories

➢ **Provision of updated default emission factors**

Dead Organic Matter (DOM) (Section 2.3.2)

✓ Updated default values for litter stocks and new default values for deadwood stocks were developed

Soils (Section 2.3.3)

✓ Updated Default Soil Reference carbon stocks.

✓ Tier 2 method for Biochar amendment

Non-CO_2 emissions (Section 2.4)

✓ Revised combustion factors for biomass burning

✓ Revised combustion rates for biomass burning

Chapter 2:Generic Methodologies Applicable to Multiple Land-use Categories

➢ **Enhanced Guidance and more complete coverage of sections**

✓ New guidance on Tier 2 method for soil C, including methods for estimating the change in soil C stocks due to biochar amendments (Section 2.3.3)

Updated section 2.5 on Additional Guidance on use of Tier 3 models

✓ Updated guidance for the development of Tier 3 Inventories in the AFOLU sector, with cross reference to Chapter 6 of Volume 1.

Chapter 2:Generic Methodologies Applicable to Multiple Land-use Categories

➢ **Enhanced Guidance and more complete coverage of sections**

New section 2.6 on Approaches for estimating the influence of inter-annual variability (IAV) on GHG emissions/removals

✓ The new section 2.6 provides an optional approach for reporting significant GHG emissions from natural disturbances (ND) that affect interannual variability of anthropogenic GHG fluxes

✓ Optional guidance to report the influence of natural disturbances (ND), e.g. wildfires, on the inter-annual variability by *disaggregating* within the anthropogenic GHG emissions and removals those associated with ND.

✓ It is good practice to estimate and report total E/R that occur on managed land, as captured by IPCC methods (MLP)

2019 Refinement of Vol4 - AFOLU Sector: Chapter 3

Chapter 3: Consistent Representation of Lands

➢ **Provision of New and Updated Guidance**

✓ New and updated guidance on use of Remote Sensing (RS) data (satellite data) and products in assessing changes in land areas and land use changes over time;

✓ The updates and new guidance were introduced based on recent sound scientific literature for representing land area, land-use change and related emissions and removals in the AFOLU sector.

✓ Guidance specifically covers:

(i) How to combine different data sources and types of information,

(ii) The coherence between national land-use classification systems and IPCC land-use categories, uncertainty and accuracy of activity data of RS data.

2019 Refinement of Vol4 - AFOLU Sector: Chapter 4

Chapter 4: Forest Land

➢ **Provision of updated default emission factors**

✓ Updated default factors for the biomass carbon pool, (Section 4.5 Tables 4.4, 4.7, 4.8,4.9, 4.10,4.11, 4.12)

➢ **New Guidance**

✓ Additional guidance on application of methods to estimate the soil C stock changes

2019 Refinement of Vol4 - AFOLU Sector: Chapter 4

Chapter 4: Forest Land

New Guidance

➢ Additional guidance on how to ensure methodological and time series consistency in the case of the Forest Land category during gap filling - (guidance reflects main drivers of emissions/removals, e.g., forest increment and harvest).

In extrapolating/interpolating by using functional relationships, it is good practice:

✓ To assume that the historical management practices continue during the period to be gap-filled;

✓ That the model used utilizes information on the methodological elements consistent with the rest of the time series

✓ To demonstrate that the model used for the extrapolation reproduces the existing time series, for a selected historical "calibration period".

Chapter 5:Cropland

Refinements in this chapter are associated with the estimation of changes in carbon stocks for biomass and soil C pools and Methane emission from Rice Cultivation

➢ **Provision of updated default emission factors**

Biomass

✓ Updated default coefficients for <u>maximum and mean</u> *above-ground biomass*, biomass <u>accumulation rate</u> and *harvest/maturity cycles* in agroforestry systems containing perennial species, and for monoculture.

✓ Updated default coefficients for *above- and below- ground biomass* <u>accumulation rate</u> in agroforestry systems containing perennial species.

✓ At Tier 1, given the large variation in cropping systems, incorporating trees or tree crops, it is good practice to <u>seek national data</u> on above-ground woody biomass growth rate.

New Guidance

✓ Guidance on how to calculate ΔCG for Land converted to Cropland, and updated biomass default factors for carbon stocks after a year of conversion

2019 Refinement of Vol4 - AFOLU Sector: Chapter 5

Soils

Provision of updated default emission factors

- ✓ Updates to default stock change factors,

- ➤ **New Guidance**

- ✓ Additional guidance on developing Tier 2 stock change factors,

- ✓ New Tier 2 steady state method that can be used to estimate country-specific stock change factors

- ✓ New Tier 2 method for SOC changes in mineral soils is based on three sub-pool steady-state with fast (Active sub-pool), intermediate (Slow sub-pool), and long turnover times (Passive sub-pool).

- ✓ Guidance for estimating the impact of biochar C amendments to C stocks in mineral soils of croplands

2019 Refinement of Vol4 - AFOLU Sector: Chapter 5

Methane Emissions from Rice Cultivation

Refinements on estimation of CH_4 emissions from rice cultivation include updates on the following:

✓ (i) Baseline emission factor (EFc) at a global scale (with new default values at regional scales - i.e, stratified by region);

✓ (ii) Scaling factors for water regimes before and during the cultivation periods; and

✓ (iii) Default conversion factors for different types of organic amendments.

✓ (iv) A new table on default cultivation periods, at global and regional scales, and

✓ (v) A new section showing an example of how to implement the Tier 1 method, are provided. Also included is a new box on good practice guidance for developing EFc

2019 Refinement of Vol4 - AFOLU Sector: Chapter 6

Chapter 6: Grassland

Soils

Provision of updated default emission factors

✓ Default method for mineral soils, C stock change factors updated

New Guidance

✓ Additional guidance on developing Tier 2 stock change factors, for a higher resolution classification of management, climate and soil types if empirical analysis show significant differences in the C stock change factors

✓ Guidance for estimating the impact of biochar C amendments to C stocks in mineral soils of grasslands

✓ New classification scheme for grazing management systems, the grazing management system is includes introducing a management system with high intensity grazing to replace moderately degraded systems.

2019 Refinement of Vol4 - AFOLU Sector: Chapter 7

Chapter 7: Wetlands

New Guidance- Flooded Land

Definition for Flooded land:

➢ Waterbodies where human activities have changed the hydrology of existing natural waterbodies thereby altering water residence times and/or sedimentation rates, in turn causing changes to the natural GHG flux;

➢ Waterbodies that have been created by excavation, such as canals, ditches and ponds

➢ Seasonally flooded wetlands such as riparian floodplain wetlands are not considered; where these have been modified by human activity, E/R may be estimated using methods described in the 2013 Wetlands Supplement

2019 Refinement of Vol4 - AFOLU Sector: Chapter 7

Chapter 7: Wetlands

New Guidance- Flooded Land

➢ Refinements to this chapter include the development of Flooded Lands sections on CO_2 and CH_4 emissions and removals from Flooded Land Remaining Flooding Land and Land Converted to Flooded Land.

✓ The methods developed are consistent with the managed land proxy

✓ A method is also provided to develop indicative estimates of the anthropogenic component of total CO_2 and non-CO_2 emissions for reservoirs

✓ Methods and emission factors are presented for Reservoirs and Other constructed waterbodies.

✓ There are no refinements to the sections on peatlands

2019 Refinement of Vol4 - AFOLU Sector: Chapter 7

Chapter 7: Wetlands

New Guidance- Flooded Land

➢ For those that choose to develop indicative estimates of the anthropogenic component of total GHG E/R, it is good practice to report the MLP E/R, as well as the indicative estimates of the anthropogenic component.

➢ Emissions from Wastewater are estimated with methods provided in Waste sector

2019 Refinement of Vol4 - AFOLU Sector: Chapter 8

Chapter 8: Settlements

Provision of updated default emission factors

Biomass

✓ *Tier 2:Settlements remaining Settlements*:

a) Crown-cover-area annual growth rates

b) Biomass accumulation average annual growth

✓ Enhanced guidance for Tier 2 and Tier 3 on the selection of default emission factors is provided including clarification of steps on data collection for Tier 2 and 3 methodologies.

✓ There are no refinements to the guidance for dead organic matter or soil C.

Chapter 10: Emissions from Livestock and Manure Management

New and updated Guidance

- ✓ The updated and new guidance provides different options to adapt emission estimates to consider the productivity of the livestock systems and improves consistency among emission estimates for different sources of emissions resulting from livestock production.

- ✓ Enteric fermentation emission factors are updated based on current productivity statistics and improved methane conversion rates (Ym)

- ✓ Default emission factors for low and high productivity systems (Tier 1a EFs) for Enteric Fermentation (CH_4) and Manure Management (CH_4 and N_2O) for regions that have dual production systems for cattle, sheep and goats were developed for all emission sources
  - ❑ *high and low productivity apply in regions where there is a coexistence of local subsistence systems versus higher productivity systems aimed at fulfilling national or export markets*

- ✓ Tier 2 calculation parameters were provided for goats

2019 Refinement of Vol4 - AFOLU Sector: Chapter 10

Chapter 10: Emissions from Livestock and Manure Management

Provision of updated default emission factors and Tier 2 coefficients used to calculate emission factors

- ✓ Improved methane conversion factors (MCF) for liquid manure storage systems, considering manure retention time and a simple model to carry out country-specific estimates of the MCF

- ✓ Updated guidance on how to deal with non-CO_2 emissions due to agricultural biogas production

- ✓ Updated N excretion parameters for all livestock categories considering updated livestock characterization;

- ✓ Updated volatilization and leaching factors for manure management system;

- ✓ Improved parameters based on different feeding strategies for cattle and sheep; updated emission factors for CH_4 and N_2O from manure management system descriptions.

2019 Refinement of Vol4 - AFOLU Sector: Chapter 11

Chapter 11: N_2O Emissions from Managed Soils, and CO_2 Emissions from Lime and Urea Application

Provision of updated default emission factors

N_2O emissions from Managed Soils

- ✓ Refinements in Chapter 11 include updates of the emission factors direct N_2O emissions: EF_1, EF_{1FR} and EF_{3PRP} (Table 11.1) and for indirect N_2O emissions: EF_4, EF_5, $Frac_{GASF}$ $Frac_{GASM}$ and $Frac_{LEACH-(H)}$ (Table 11.3).

- ✓ Updated aggregated values were estimated for all of these factors on a much larger number of measurements than were available for the 2006 IPCC Guidelines.

- ✓ Furthermore, EF_1, $EF_{3PRP,CPP}$ (CPP -Cattle, Poultry and Pigs only) and EF_4 values for wet and dry climates are provided, with a distinction between synthetic and other fertilisers in wet climate for the EF_1.

- ✓ In addition, the EF_{1FR} is disaggregated by flooding / drainage regime for rice cultivation.

Chapter 11: N₂O Emissions from Managed Soils, and CO₂ Emissions from Lime and Urea Application

Provision of updated default emission factors

- ✓ Different $Frac_{GASF}$ values are provided according to chemical composition of fertiliser categories. Data and methods used for these updates are provided in Annexes 11A.2 – 9.

- ✓ Ratios of belowground residues to harvested yield recalculated as belowground biomass to aboveground biomass

- ✓ Alternative method to estimate aboveground residues Updated

- ✓ Defaults for N from crop residues and forage/pasture renewal updated: Includes an update of the equation for calculating the amount of N in crop residues returned to soils annually (F_{CR}) (Equation 11.6). Default values to be used in this Equation are available in the new Table 11.1A.

2019 Refinement of Vol4 - AFOLU Sector: Chapter 12

Chapter 12: Harvested Wood Products (HWP)

✓ The guidance in Chapter 12 maintains the existing approaches covered in the 2006 IPCC Guidelines.

✓ The refinement takes account of new relevant scientific information, including relevant methodological information and parameters contained in IPCC KP Supplement (e.g. carbon conversion factors).

✓ The new structure of this chapter aims to clarify the relationships between new information and the 2006 IPCC Guidelines and to allow for inclusion and updating of new parameters where appropriate.

✓ The description of the application of methodologies is clarified based on the updated parameters.

✓ No update on reporting and documentation has been included since the reporting conventions and format are specified in Decision 24/CP.19 Annex II and the associated CRF.

2019 Refinement of Vol4 - AFOLU Sector: Chapter 12

Chapter 12: Harvested Wood Products (HWP)

✓ HWP categories (sawnwood, wood-based panels, paper and paperboard),

✓ Section 12.2 clarifies some existing terms, definitions and concepts.

✓ Section 12.3 provides guidance on available HWP approaches, describing and clarifying the options for defining a conceptual framework and system boundary for estimating emissions and removals arising from HWP.

✓ The subsequent guidance in this chapter is structured to consider three distinct subject areas relevant to harvested wood biomass: i) wood products in use (i.e. wood utilised as a material); ii) wood biomass used for energy purposes and iii) wood biomass in solid waste disposal sites (SWDS).

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2019 Refinement of Vol4 - AFOLU Sector: Chapter 12

Chapter 12: Harvested Wood Products (HWP)

✓ Section 12.4 gives detailed guidance on wood products in use, specifically providing good practice guidance on the choice of method for wood products in use. This includes improved methodological guidance for estimating CO_2 emissions and removals arising from HWP following different approaches.

✓ This section also includes refined guidance for calculating the initial carbon stock in the HWP pool in use as well as parameters such as HWP carbon conversion factors.

✓ Section 12.5 addresses wood biomass used for energy purposes.

✓ Section 12.6 provides clarification of the treatment of "wood biomass in SWDS".

✓ It should also be noted that the HWP Worksheet accompanying the 2006

2019 Refinement of Vol4 - AFOLU Sector: Chapter 12

	TABLE 12.5 — REPORTING OF CO_2 EMISSIONS FROM WOOD BIOMASS BURNT BY PRODUCING AND CONSUMING COUNTRIES UNDER DIFFERENT HWP APPROACHES			
Element of wood biomass	**Assumption of 'a steady-state HWP pool'**	**'Stock-change' approach**	**'Production' approach***	**'Atmospheric-flow' approach**
Unutilized wood harvest residues	Producing country	Producing country	Producing country	Producing country
Harvested wood biomass used directly as energy feedstocks				Consuming country
Industrial residues from manufacturing semi-finished wood products				
Industrial residues from manufacturing finished wood products in use**		Consuming country		
Wood biomass collected and burnt as post-consumer waste				

Summary

Provision of New Guidance

(i)   Use of allometric models and biomass density maps (amount of biomass per unit area) for estimation of biomass carbon;

(ii)   Use of Remote Sensing (RS) data (satellite data) and products in assessing changes in land areas and land use changes over time;

(iii)   New guidance on methods for estimating the influence of inter-annual variability on greenhouse gas emissions and removals

(iv)   Development of higher tier (new Tier 2) method for mineral soils in croplands

(v)   New guidance on the estimation of emissions/removals for flooded lands;

(vi)   New guidance for estimation of carbon stock change from biochar amendments to mineral soils;

(iii)   New guidance on the treatment of the relationship between productivity and emissions, focusing in particular on the ability to differentiate between commercial/industrial production systems and local/subsistence systems for livestock categories.

Summary

Provision of updated default emission factors and new default emission factors

(i) Updated carbon stock change factors for mineral soils associated includes the influence of land use change, tillage management, paddy rice systems and perennial crop systems.

(ii) CH_4 emissions from rice cultivation include updates on the following: (i) baseline emission factor (EFc) (ii) scaling factors for water regimes before and during the cultivation periods; and iii) conversion factors for organic amendments

(iii) New emission factors for livestock – Default emission factors for low and high productivity systems (Tier 1a EFs) for regions that have dual production systems for cattle, sheep and goats were developed

(iv) Updated default values for soil N_2O emissions including: updated factors for direct N_2O emissions with global defaults and disaggregated values by broad climate types, updated factors for indirect N_2O emissions, new fractions for volatilization and leaching of N.

(v) Harvested Wood Products (HWP), Better coverage and update of the relevant technical parameters, maintaining the existing approaches in the 2006 IPCC Guidelines;

Thank you

https://www.ipcc-nggip.iges.or.jp/index.html