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ADOPTION AND ACCEPTANCE OF THE "2013 SUPPLEMENT TO THE 2006 GUIDELINES: WETLANDS"

Adopted Overview Chapter

(Submitted by the Co-Chairs of the Task Force Bureau)

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WMO UNEP

2013 SUPPLEMENT TO THE 2006 IPCC GUIDELINES FOR NATIONAL GREENHOUSE GAS INVENTORIES: WETLANDS

Methodological Guidance on Lands with Wet and Drained Soils, and Constructed Wetlands for Wastewater Treatment

Adopted text

OVERVIEW

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[1]Until February, 2013.

1 INTRODUCTION

The *2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands* (*Wetlands Supplement*) provides methods for estimating anthropogenic emissions and removals of greenhouse gases from wetlandsand drained soils. The scope of the *Wetlands Supplement*is broader than the coverage of Wetlands in the *2006 IPCC Guidelines for National Greenhouse Gas Inventories*[2] (*2006 IPCC Guidelines*), where managed wetlands are defined as lands where the water table is artificially changed (e.g. drained or raised) or those created through human activity (e.g. damming a river) and that do not fall into ForestLand, Cropland, or Grassland categories. The emissions and removals from wetlandsand drained soils addressed in the *Wetlands Supplement* can occur under any land-use category or other relevant category of the *2006 IPCC Guidelines*.The guidance in the *Wetlands Supplement* is not intended to change the allocation of wetlands for reporting purposes.

The guidance provided is supplementary to that contained in the *2006 IPCC Guidelines*, which provide methodologies for estimating national anthropogenic emissions by sources and removals by sinks of greenhouse gases not controlled by the Montreal Protocol.[3]The content of the *2006 IPCC Guidelines*on wetlands is restricted to peatlands drained and managed for peat extraction, conversion to flooded lands, and some guidance for drained organic soils. It is therefore incomplete; it does not cover all wetlands types and does not characterize all of the significant activities occurring on the wetlands that it does cover (e.g., rewetting of peatlands is not included).

This *Wetlands Supplement* supplements the *2006 IPCC Guidelines* by filling in gaps in the coverage and providing updated information reflecting scientific advances. This includes updating of emission factors. It covers inland organic soils and wetlands on mineral soils, coastal wetlands including mangrove forests, tidal marshes and seagrass meadows, and constructed wetlands for wastewater treatment.For the reasons described subsequently, the *Wetlands Supplement* does not provide guidance on permanently flooded lands such as reservoirs.

[2]Intergovernmental Panel on Climate Change (IPCC 2006) 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Prepared by the National Greenhouse Gas Inventories Programme, Eggleston H.S., Buendia L., Miwa K., Ngara T. and Tanabe K. (eds).Published: IGES, Japan.

3Greenhouse gases addressed in this Supplement are: CO_2, CH_4, and N_2O.

2 BACKGROUND

The *IPCC ExpertMeeting onHWP, Wetlands and Soil N_2O* held on 19th-21st October, 2010 in Geneva[4], concluded that:

> *Since the 2006 IPCC Guidelines were completed much new scientific information is now available about various wetlands that enable emissions and removals to be estimated from wetland restoration and rewetting especially for peat lands. The meeting recommended that the IPCC provide additional methodological guidelines for the rewetting and restoration of peat land; emissions from fires, ditches and waterborne carbon; and constructed wetlands for waste water disposal, to fill gaps in the existing guidelines.*

The*Wetlands Supplement* has been produced in response to the conclusions of this expert meeting, and in response to an invitation from the Subsidiary Body for Scientific and Technological Advice (SBSTA) of the United Nations Framework Convention on Climate Change (UNFCCC) at its 33rd session, held in December 2010 in Cancun, which invited the IPCC to prepare additional guidance on wetlands, focusing on the rewetting and restoration of peatlands. Document FCCC/SBSTA/2010/13, paragraph 72 states:

> *...the SBSTA invited the IPCC to undertake further methodological work on wetlands, focusing on the rewetting and restoration of peatland, with a view to filling in the gaps in the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (hereinafter referred to as the 2006 IPCC Guidelines) in these areas and to complete this work for the thirty-ninth session of the SBSTA.*

In response to this invitation, the IPCC held a scoping meeting in Geneva, Switzerland, from 30 March to 1 April, 2011. This meeting produced a draft Terms of Reference (ToR), including annotated chapter outline,which was approved by the IPCC at its 33rd Session in Abu Dhabi (10-13 May 2011).

4*IPCC Expert Meeting on HWP, Wetlands and Soil N_2O*eds: Eggleston H.S., Srivastava N., Tanabe K., Baasansuren J., and Fukuda M. Meeting Report of the IPCC Expert Meeting on HWP, Wetlands and Soil N_2O, Geneva, Switzerland, 19-21 October, 2010, Pub. IGES, Japan 2011

3 COVERAGEOF THE WETLANDS SUPPLEMENT

The *2006 IPCC Guidelines*classify all land area into six broad land-use categories: Forest Land, Cropland, Grassland, Wetlands, Settlements, and Other Land (see Chapter 3, Volume 4 of the *2006 IPCC Guidelines*). The lands covered in the *Wetlands Supplement* may occur in any of the IPCC land-use categories. The land-use category that land is reported under depends on national land-use category definitions, data collection systems and tracking of land transitions. For example, forested peatland can be classified asForest Land, plantations on peatland may be classified as Forest Land or Cropland depending on national forest definitions, and mangrove forests may be classified as Forest Land or Wetlands. Due to its function, Constructed Wetlands are not considered as a land-use category. The coverage of the *Wetlands Supplement* is briefly summarized in Table 1.

TABLE 1
COVERAGE OF THE *WETLANDS SUPPLEMENT*

Chapter	Coverage
1. Introduction	Guidance on the use of this report and generic information on the linkages between the *2006 IPCC Guidelines* and the supplementary guidance presented in this document.
2. Drained Inland Organic Soils	Guidance for managed inland organic soils including land drained for forestry, croplands, grazing, and settlementsacross climate zones.
3. Rewetted Organic Soils	Guidance on rewetted organic soils including boreal, temperate, and tropical wetlands occurring in any land-use category.
4. Coastal Wetlands	Guidance for specified management activities in coastal areas of mangroves, tidal marshes and seagrass meadows.
5. Inland Wetland Mineral Soils	Guidance for managed inland wetland mineral soils, including lands used for forestry, cropland, grazing, and settlements, and rewetted mineral soils.
6. Constructed Wetlands for Wastewater Treatment	Guidance on wetlands constructed for wastewater treatment.
7. Cross-cutting Issues and Reporting	Overall guidance on how to report anthropogenic emissions and removals from wetlands in the framework of the *2006 IPCC Guidelines*. Also gives general good practice guidance on cross-cutting issues (key category and uncertainty analysis, times series consistency and QA/QC) to supplement that given in Volume 1 of the *2006 IPCC Guidelines.*

A summary of the main methodological updates to the *2006 IPCC Guidelines*is provided below.Chapter 1 provides a decision tree to helpinventory compilers determine which chapters of this supplementto apply and describes the coverage and definitions of the wetland types.

Peatlands and organic soils.The *2006 IPCC Guidelines*included some guidance on drainage (Chapter 4, Volume 4) and peat extraction (Chapter 7, Volume 4), but not on rewetting.In this supplement, peatlands are included along with organic soils and bothdrainageand rewetting are covered.Updated emission factors and methods are provided for both drained and rewetted organic soils including for off-site carbon dioxide (CO_2) emissions via waterborne carbon losses. Guidance on methane (CH_4) emissions from rewetting of organic soils (Chapter 3 of the*Wetlands Supplement*), ditches on drained inland organic soils and CO_2, CH_4 and carbon monoxide (CO) emissions from peat fires are also provided (Chapter 2 of the*Wetlands Supplement*).

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Peatland managed for peat production. Peat production is covered in the *2006 IPCC Guidelines*(Chapter 7, Volume 4) andno additional guidanceis given here except some updated emission factors in Chapter 2.

Rice cultivation.Rice cultivation is covered in the *2006 IPCC Guidelines* (Chapter 5, Volume 4) and additional emission factors for lowland rice production are given in Chapter 2.

Coastal wetlands.The *2006 IPCC Guidelines*provided no specific guidance for coastal wetlands and new guidance is given in Chapter 4on how to treat anthropogenic emissions and removals associated with specified human activities that affect them.Coastal wetlands in this supplement include mangrove forests, tidal marshes and seagrass meadows.Emissions factors and methodologies are provided for management of mangrove forests (i.e. harvesting), rewetting and revegetation, aquaculture and drainage.

Inland wetland mineral soils (IWMS). The *2006 IPCC Guidelines* provided limited data on soil carbon in wetland mineral soils. Chapter 5 provides updated default soil carbon factors andcovers methodologies for quantifying emissions and removals of CO_2 and emissions of $CH_4$from (i) artificial drainage of IWMS (ii) subsequently rewetting of artificially drained IWMS and (iii) the artificial flooding of mineral soils for the purposes of wetland creation.Mineral soil wetlands[5] include riparian wetlands, forested swamps and marshes and can occur in all climate zones.

Saline inland wetlands.Saline wetlands are important parts of otherwise arid landscapes across the globebut little information is available in the literature to assess potential greenhouse gas emissions or removals from these lands. Thusemission or removal factors cannot be given and no guidance is provided for these wetland types.These are also known as playas, pans, salt lakes, brackish wetlands, salinas, and sabkhas.

Constructed wetlands for wastewater treatment.The guidance supplements Volume 5 of the *2006 IPCC Guidelines* on Waste (Chapter 6).These are wetlands that have beendesigned and constructed to use natural processes involving vegetation, soils, and associated microbial assemblages to treat wastewater. New guidance is also provided on semi-natural treatment wetlands.

Permanently flooded lands.No new guidance on permanently flooded lands is provided. The *Expert Meeting on HWP, Wetlands and Soil N_2O*[6]did not agree that there was sufficient new information available to produce new and additional guidance based on the latest literature.[7]. The *IPCC Special Report on Renewable Energy Sources and Mitigation of Climate Change*[8] also noted that it was not possible to make global estimates of the size of emissions from reservoirs.

[5] Wetlands do not all have organic soils. Wetland Mineral Soils are classified as Aquic soil (USDA) or Gleysols (World Reference Base), and are described as having restricted drainage leading to periodic flooding and anaerobic conditions (Table 2.3, Chapter 2 of the*2006 IPCC Guidelines*).

IPCC 2011, *IPCC Expert Meeting on HWP, Wetlands and Soil N_2O*eds: Eggleston H.S., Srivastava N., Tanabe K., Baasansuren J., and Fukuda M. Meeting Report of the IPCC Expert Meeting on HWP, Wetlands and Soil N_2O, Geneva, Switzerland, 19-21 October, 2010, Pub. IGES, Japan 2011

[7] The attendees of the *Expert Meeting on HWP, Wetlands and Soil N_2O* agreed on the need to discuss a range of issues such as the impact of reservoirs on total emissions from watersheds, allocation of emissions to specific drivers, and how emissions may be related to specific reservoir typologies.

[8]IPCC, 2011: *IPCC Special Report on Renewable Energy Sources and Climate Change Mitigation. Prepared by Working Group III of the Intergovernmental Panel on Climate Change* [O. Edenhofer, R. Pichs-Madruga, Y. Sokona, K. Seyboth, P. Matschoss, S. Kadner, T. Zwickel, P. Eickemeier, G. Hansen, S. Schlömer, C. von Stechow (eds)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1075 pp.

4 MANAGED LAND AND ANTHROPOGENIC EMISSIONS

Parties to the UNFCCC have committed to report anthropogenic emissions and removals of greenhouse gases not covered by the Montreal Protocol.[9]In practice, it is difficult to separate anthropogenic and natural emissions in Agriculture, Forestry and Other LandUse (AFOLU). Thus, the *2006 IPCC Guidelines* provides that it is *good practice* to report emissions and removals from managed land as a proxy for anthropogenic emissions and removals (Pages 1.4-1.5, Chapter 1, Volume 4 of the*2006 IPCC Guidelines*). An expert meeting[10] held in May 2009 in Brazil, reconsidered the issue and concluded that, although suitable methods for a better quantification of anthropogenic emissions and removals had been demonstrated in specific circumstances, there was no suitable, globally applicable alternative to the use of managed land as a proxy for anthropogenic emissions and removals.

The*Wetlands Supplement*continues to usemanaged land as a proxy for estimation of anthropogenic emissions and removals. The *Wetlands Supplement*notesthat many wetlands on managed landhave significant non-anthropogenic fluxes of greenhouse gases. The *2006 IPCC Guidelines* restricted managed wetlands tothose landswhere the water table is artificially changed (e.g., drained or raised). This *Wetlands Supplement*extends this coverage also to include wetlands created (e.g., constructed), or where emissions and removals from coastal wetlands are attributed to specified human activities.The focus on human activities such as drainage or construction of aquaculture ponds maintains the justification for the managed land proxy. In the case of seagrass meadows the guidance estimates emissions and removals associated with changes linked to a specific human activity, rather than estimating emissions and removals from that coastal wetland type as a whole. Application of the supplement will maintain consistency with previous estimates so long as these activities can be recognised as subsets within the broader definition of managed land. The application of new emission factors will not introduce inconsistency so long as the historical time series is updated, consistent with long-standing IPCC guidance.

[9] UNFCCC Article 4 1 (a).
http://unfccc.int/files/essential_background/background_publications_htmlpdf/application/pdf/conveng.pdf

[10] IPCC 2010, *Revisiting the Use of Managed Land as a Proxy for Estimating National Anthropogenic Emissions and Removals*, eds: Eggleston H.S., Srivastava N., Tanabe K., Baasansuren J. Meeting Report, 5 -7 May, 2009, INPE, São José dos Campos, Brazil, Pub. IGES, Japan 2010

5 THE WETLANDS SUPPLEMENT AND THE 2006 IPCC GUIDELINES

The *Wetlands Supplement* follows the same approach to estimating emissions and removals as the *2006 IPCC Guidelines.*The *2006 IPCC Guidelines* themselves are an evolutionary development starting from the *1996 IPCC Guidelines, 2000 IPCC Good Practice Guidance(GPG2000)* and *Good Practice Guidance – Land Use, Land-use Change and Forestry (GPG-LULUCF).* This evolutionary approach helps ensure continuity, and allows for the incorporation of experiences with the existing guidelines, new scientific information, and the results of the UNFCCC inventory review process. An important structural change occurred in Volume 4, which consolidated the guidance for*LULUCF* in *GPG-LULUCF* and the Agriculture sector in *GPG2000* into a single Agriculture, Forestry and Other Land Use (AFOLU) Volume. This *Wetlands Supplement* adds to the guidance given in Volume 4 of the *2006 IPCC Guidelines*, and providesupdates where science has advanced, but does not replace it. This *Wetlands Supplement* also adds to the guidance given in Volume 5 (Waste).Where the *Wetlands Supplement*provides guidance that updates emission factors for land areas, categories, gases, and pools covered directly by Volumes 4 and 5, the guidance in the *Wetlands Supplement* should take precedence.

The *2006 IPCC Guidelines* retained the definition of *good practice* that was introduced with *GPG2000*. This definition has gained general acceptance amongst countries as the basis for inventory development. According to this definition, national inventories of anthropogenic greenhouse gas emissions and removals consistent with *good practice* are those, which contain neither over- nor under-estimates so far as can be judged, and in which uncertainties are reduced as far as practicable.These requirements are intended to ensure that estimates of emissions by sources and removals by sinks, even if uncertain, are *bona fide* estimates, in the sense of not containing any biases that could have been identified and eliminated.

The *Wetlands Supplement*, like the *2006 IPCC Guidelines*, generally provides guidance, usually with decision trees, on estimation methods at three levels of detail, from Tier 1 (the default method) to Tier 3 (the most detailed method; Chapter 1, Volume 1). The Tier 1 guidance generally consists of mathematical specification of the methods and equations for estimating emissions/removals, information on emission factors or other parameters to use in generating the estimates, and sources of activity data to estimate the overall level of net emissions (emission by sources minus removals by sinks). Properly implemented, all tiers are intended to provide unbiased estimates, and accuracy and precision are expected to improve from Tier 1 to Tier 3. The provision of different tiers enables inventory compilers to use methods consistent with their resources and to focus their efforts on those categories of emissions and removals that contribute most significantly to national emission totals and trends.

National circumstances include the availability of data and knowledge, and contribution made by the category to total national emissions and removals and to their trend over time. The most important categories, in terms of total national emissions and the trend, are called *key categories*[11]. The decision trees generally require Tier 2 or Tier 3 methods for *key categories*. This approach to the use of different tiers allows limited resources to be focused on those areas of the inventory that contribute significantly to the overall total or trend in emissions.

Within Chapter 7 of the *Wetlands Supplement* advice is also provided on:

(i) ensuring time series are consistent,

(ii) estimation of uncertainties,

(iii) guidance on quality assurance and quality control procedures to provide cross-checks during inventory compilation,

(iv) information to be documented to achieve transparent reporting, avoiding double-counting and omissions, to facilitate review and assessment of inventory estimates, and

(v) reporting tables and worksheets for Tier 1 methods are provided as well as mapping between the categories and guidance in the *2006 IPCC Guidelines* and the changes to those introduced by the *Wetlands Supplement*.

[11] In the *GPG2000* and *GPG-LULUCF* these were called *key sources* or *key categories* where there could be removals.