CHAPTER 7

GOOD PRACTICE AND IMPLICATIONS FOR REPORTING

Contents

Figures

Tables

Equations

7 GOOD PRACTICE GUIDANCE AND IMPLICATIONS FOR REPORTING

7.1 INTRODUCTION

2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands (*Wetlands Supplement*) contains updated and new methodological guidance for greenhouse gas emissions and removals from drained and rewetted peatlands and organic soils as well as from specific human-induced changes in coastal, inland mineral soil, and constructed wetlands. The methodological guidance is given in chapters 2 to 6:

- Cross-cutting guidance on organic soils (supplemental guidance to *2006 IPCC Guidelines*, Chapter 2, on generic methods relating to organic soils on all land-use categories, especially Forest Land, Cropland and Grassland)
- Rewetting and restoration of peatlands and other organic soils
- Managed coastal wetlands
- Managed inland mineral soil wetlands
- Constructed wetlands—wastewater treatment systems.

The supplementary methodological guidance can introduce changes to the estimation and reporting of emission and removals according to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (hereafter *2006 IPCC Guidelines*) in all land-use categories (forest land, cropland, grassland, wetlands, settlements and other land) and of some sources of N_2O emissions from managed land in the Agriculture, Forestry and Other Land Use (AFOLU) Sector as well as to CH_4 and N_2O emissions related to wastewater treatment (constructed wetlands) in the Waste Sector. The changes come from more detailed methodologies to update the relevant emissions/removals as well as from methodologies for categories not covered by the *2006 IPCC Guidelines*. The 2013 Wetlands supplement maintains the 2006 IPCC approaches in estimation of the emissions and removals in the AFOLU chapter. The general guidance in Volume 1 of the *2006 IPCC Guidelines* is also applicable.

This chapter gives good practice guidance relevant to the methodologies provided in Chapters 2 to 6 of this *Wetlands Supplement* by addressing the following crosscutting issues:

- reporting including mapping the supplementary guidance into the categories of the *2006 IPCC Guidelines*
- uncertainty estimation
- key category analysis
- completeness
- time series consistency including guidance on estimation of historic emissions
- quality control and quality assurance.

This chapter summarises the good practice guidance on the above-listed and crosscutting issues given in Volume 1 of the *2006 IPCC Guidelines* but inventory experts need to refer to Volume 1 of the *2006 IPCC Guidelines* for the detailed guidance on the specific crosscutting issues. The crosscutting issues specific to the categories and methodologies included in Chapters 2 to 6 are also addressed in those chapters. Here the category-specific information is summarized and complemented.

7.2 REPORTING AND DOCUMENTATION

7.2.1 Changes to reporting categories in the 2006 IPCC Guidelines

Chapter 1 gives an overview of the purpose of the *Wetlands Supplement* as well as a description of its contents (Section 1.6.3) including the specific guidance provided and the linkage to the guidance in the *2006 IPCC Guidelines*. In Section 1.7 the estimation and reporting of emissions and removals from managed wetlands is addressed through a case study and Table 1.5 provides the extension of reporting categories in the *2006 IPCC Guidelines.*

In the sections below, the information presented in Chapter 1 is complemented with more details on the reporting aspects of the *Wetlands Supplement*. The changes in the methodologies are addressed in the sections below based on the Tier 1 methodologies in Chapters 2 to 6 to assess the need for changes to the reporting and background information tables of the *2006 IPCC Guidelines* (Volume 1, Chapter 8).

7.2.1.1 CO_2, CH_4 AND N_2O EMISSIONS FROM ORGANIC SOILS

The guidance in Chapter 2 for estimation of CO_2 emissions from organic soils implies changes for all land-use categories compared to the guidance given in the *2006 IPCC Guidelines* where the Tier 1 methodology was simply a multiplication of areas of organic soils with appropriate emission factors by land-use category and climate zone (boreal/temperate/tropical). For peat extraction also data on the nutrient status of the lands drained impacted the emission factors. The supplementary methodology in Chapter 2 is using the same approach as in the *2006 IPCC Guidelines* and no changes in the reporting tables or background tables in the *2006 IPCC Guidelines* are need due to these changes. The detailed information on the activity data and emission factors as well as other parameters used in the estimation should be provided in the national inventory report.

The *2006 IPCC Guidelines* did not provide a methodology for the estimation of CH_4 emissions associated with drainage whereas Chapter 2 provides a methodology to address CH_4 emissions from ditches. Otherwise CH_4 emissions from drained organic soils are assumed negligible. The estimation of the CH_4 emissions from ditches requires data on ditch width and ditch spacing. This information is in some cases needed by peatland type (raised bog/fen or blanket bog). These emissions could be reported under the specific land-use categories where drainage occurs or alternatively under Category 3C8 Other Non-CO_2 GHG emissions not included elsewhere.

The methodology for N_2O emissions from drainage is the same as in the *2006 IPCC Guidelines* but the default emissions factors are updated. In accordance with the *2006 IPCC Guidelines* the N_2O emissions from drainage of organic soils should be reported as aggregated to N_2O emissions from managed soils and, if data available, the emissions can be provided by land-use category. The N_2O emissions from drainage/management of histosols are reported under Category 3C4 Direct N_2O Emissions from Managed Soils.

The AFOLU reporting tables in the *2006 IPCC Guidelines* do not require changes due to the changes in supplementary methodology provided for drainage of organic soils. The worksheets addressing the calculations of all greenhouse gas emissions from drainage of organic soils will however be extended to take into account changes in methodologies as well as changes in the subdivision at which the updated emission factors are provided.

For easy assessment of all greenhouse gas emissions associated with drainage, it is *good practice* to provide a summary of all greenhouse gas from drainage by land-use category in the national inventory report.

Extended background tables and worksheets will be only included in the Second Order Draft.

7.2.1.2 REWETTING

Guidance on CO_2, CH_4 and N_2O emissions from rewetting is not included in the *2006 IPCC Guidelines*. Chapter 3 of this *Wetlands Supplement* provides this guidance. Tier 1 methodologies for rewetted peatlands and organic soils are given for CO_2 emissions/removals from soils including moss and grass vegetation and dead organic matter and also for dissolved organic carbon pools. The guidance addressing CH_4 emissions cover emissions from the rewetting as well as burning of biomass and peat on rewetted lands. N_2O emissions from rewetted soils are considered insignificant and assumed to be zero under Tier 1. When rewetted lands contain perennial woody vegetation, the guidance in the 2006 *IPCC Guidelines*, Sections 4.2, 4.4, 4.5 and 4.6, should be used.

The reporting of rewetting would be dependent on the resultant land-use after the rewetting. The rewetted land could remain in the same land-use category, e.g. when agricultural land with organic soil is rewetted to form a grazing marsh. The rewetting could also involve a land-use change, e.g. when a forest with organic soil is rewetted and the tree coverage declines below the threshold of the national forest definition. It is *good practice* to report emissions/removals from rewetting in the relevant land-use categories.

Biomass and peat burning on rewetted lands would be reported in the *2006 IPCC Guidelines* Table 3.4 AFOLU Background Table Biomass Burning under relevant sub-categories under Category 3C1 Emissions from biomass burning. The table could be modified so that it would be possible to specify the subcategory for which the burning is reported. Also, emissions from burning soils (peat) should be reported under relevant sub-categories under Category 3C1. The definition of Category 3C1 in Table 8.2 in Chapter 8, Volume 1 of the *2006 IPCC Guidelines* needs to be extended accordingly.

Extended background tables and worksheets will be only included in the Second Order Draft.

7.2.1.3 COASTAL WETLANDS AND INLAND MINERAL SOIL WETLANDS

Guidance on CO_2, CH_4 and N_2O emissions from managed coastal wetlands and inland mineral soil wetlands is not included in the *2006 IPCC Guidelines*. Chapters 4 and 5 of this *Wetlands Supplement* provide this guidance.

Guidance in Chapter 4 (Coastal wetlands) is provided in three discrete sections that cover Management Changes in Coastal Wetlands (Section 4.3), Drainage of Coastal Wetlands (Section 4.4), Rewetting and Restoration of Coastal Wetlands (Section 4.5), and as defined in Table 4.1. This chapter covers coastal wetlands that have been cleared or degraded, restored, or created, and where resource extraction occurs with little or no apparent degradation (e.g., selective logging of mangrove trees). New methods are presented for soil carbon Tier 1 level estimation whereas methods for biomass, dead organic matter and non-CO_2 emissions follow those of previous 2006 IPCC guidance.

In Chapter 5 (Inland mineral soil wetlands), guidance and methodologies mainly follow the *2006 IPCC Guidelines*, in particular the generic guidance given in Volume 4 Chapter 2. Chapter 5 provides additional information to be used in applying the methods in the 2006 IPCC Guidelines and should be read in conjunction with Volume 4 of the *2006 IPCC Guidelines*. Management changes that affect CO_2 and non-CO_2 (CH_4 and N_2O) emissions in inland mineral soil wetlands include water level management as well as activities that impact vegetation (such as grazing, vegetation removal, and cultivation, nutrient amendments). Emissions from these activities can be estimated with guidance provided in Chapter 5. Specifically, new default soil C stock data are provided and an emission change factor approach is presented for estimating changes in CO_2, CH_4 and N_2O emissions from activities including restoration and drainage.

These wetlands can occur in any of the six IPCC land-use categories. For example, a mangrove or riverine wetland with trees may be classified as a forest, while a marsh may be used for grazing and classified as grassland. The precise details of this classification are specific to each country so it is not possible to say exactly how a coastal wetlands or inland wetland on mineral soil may be classified. This guidance applies to all coastal wetlands and inland wetlands on mineral soils, however they are classified. The classification is important when reporting these emissions, and there is no intention to change in any way how land is classified, however there may be a need to sub-divide some land types to reflect differing management actions.

Extended background tables and worksheets will be only included in the Second Order Draft.

7.2.1.4 CONSTRUCTED WETLANDS

Supplementary guidance on CH_4 and N_2O emissions from wastewater treatment and discharge is provided in Chapter 6 on Constructed Wetlands. Constructed wetland systems are fully human-made wetlands for wastewater treatment, which apply various technological designs, using natural wetland processes, associated with wetland hydrology, soils, microbes and plants. Thus, constructed wetlands are engineered systems that have been designed and constructed to utilize the natural processes involving wetland vegetation, soils, and their associated microbial assemblages to assist in treating wastewater. Methodologies are based on the load of nitrogen and organic carbon into the systems. The CH_4 emissions are calculated based on the conversion of biological or chemical oxygen demand data and correction factors related to the flows in these constructed wetlands (free water surface, vertical subsurface flow and horizontal subsurface flow). The N_2O emissions are calculated based on the amount of nitrogen in the wastewater.

Reporting of CH_4 and N_2O emission from constructed wetlands will be done under category 4D Wastewater treatment and discharge. The emissions will be divided into Categories 4D1 Domestic wastewater treatment and discharge and 4D2 Industrial Wastewater treatment and discharge according to source of wastewater treated in the constructed wetlands.

The areas of constructed wetlands should be reported as part of settlements. If the establishment of the constructed wetland involves a land use conversion, the area changes should be reported under the specific land-use categories and the notation key “IE” should be used for the CH_4 and N_2O emissions. Any changes in carbon stocks due to the land-use conversion, e.g. due to cutting of trees or removing of other vegetation, should be reported under land converted to settlements.

Extended background tables and worksheets will be only included in the Second Order Draft.

7.2.2 Mapping the changes to categories in the 2006 IPCC Guidelines

Table 7.1 shows how the supplementary guidance and new categories introduced in the *Wetlands Supplement* are linked to the guidance and categories in the *2006 IPCC Guidelines*. This summarises the descriptions given in the above sections on the changes introduced.

TABLE 7.1
MAPPING BETWEEN THE CATEGORIES AND GUIDANCE IN THE *2006 IPCC GUIDELINES* AND THE CHANGES TO THOSE INTRODUCED BY THE *WETLANDS SUPPLEMENT*.

Source of emissions/ sink for removals	2006 IPCC Guidelines		Wetlands Supplement	
	Category	**Guidance by**	**Category**	**Guidance by**
Drainage of organic soils				
CO_2	3B1 to 3B6 Forest land, Cropland, Grassland, Wetlands, Settlements and Other land Category 3B4ai Peatlands remaining peatlands	• land-use category, for wetlands specific to peat extraction • climate zone • nutrient status for peatlands	3B1 to 3B6 Forest land, Cropland, Grassland, Wetlands, Settlements and Other land Category 3B4ai renamed as Peat extraction lands remaining peat extraction lands, respective change to 3B4bi	• land-use category • climate zone • drainage class
CH_4	-	-	3B1 to 3B6 Forest land, Cropland, Grassland, Wetlands, Settlements and Other land or 3C8	• land-use category • climate zone • peatland type ((bog or fen, tropical peat) • ditch area (width, spacing between ditched)
N_2O	3C4	• drained organic soils	3C4	• land-use category • climate zone
Rewetting of peatlands and organic soils				
CO_2, CH_4 and N_2O	-	-	3B1 to 3B6 Forest land, Cropland, Grassland, Wetlands, Settlements and Other land Subcategories for rewetted land remaining rewetted lands and lands converted to rewetted lands should be introduced for the land-use categories under which the activity takes place.	• climate zone • peatland type (bog or fen, tropical peat)
Coastal Wetlands				
CO_2, CH_4 and N_2O	-	-	3B4aiii (Other wetlands remaining wetlands) or 3B4biii (Land converted to other wetlands)	• climate zone/region • vegetation type • salinity (where applicable/available)

				• management activity including restored and drained
Inland Mineral Soil Wetlands				
CO_2, CH_4 and N_2O	-	-	3B4aiii (Other wetlands remaining wetlands) or 3B4biii (Land converted to other wetlands)	• climate zone/region • level of inundation (permanent and seasonal) • management activity (restored, created or drained)
Constructed wetlands				
CH_4, N_2O	-	-	4 D Wastewater treatment and discharge	• BOD/COD load and technology of the constructed wetland (type of flow)
CO_2	3B5	No specific guidance but C stock changes from land-use change covered by the general methodologies	3B5	No specific guidance but C stock changes from land-use change covered by the general methodologies in the *2006 IPCC Guidelines*

7.2.3 Documentation

Chapter 8 in Volume 1 of the *2006 IPCC Guidelines* provides guidance on reporting complete, consistent and transparent national greenhouse gas inventories. Detailed guidance on documentation relevant to the supplementary guidance provided in this report is provided in Chapters 2 to 6.

Reporting in accordance with the *Wetlands Supplement* involves combining guidance from two sets guidance, this Supplement and the *2006 IPCC Guidelines*. The estimation of emissions and removals requires in some cases a combination of methodologies which, if care is not taken, can lead to double-counting or omission of emissions or removals. The reporting of emissions and removals from specific activities, e.g. rewetting and drainage, is disaggregated among land-use categories and/or generic categories for reporting of non-CO_2 emissions. National circumstances will also affect the reporting much. In some countries the categories will have a significant impact on the national total emissions, in others they will be almost non-existent.

Transparent reporting will require that the following generic issues are documented in the national inventory report:

- a summary of the areas and emissions by land-use category and gas for organic soils, rewetting, coastal wetlands, inland mineral soil wetlands and constructed wetlands;
- information on how completeness has been assessed and double-counting avoided for reporting of CO_2 emissions when methodologies based on flux measurements and stock change methods are combined for a specific activity or land-use category as well as related to reporting of dissolved organic carbon.

7.2.4 Reporting tables

The *Wetlands Supplement* does not impact the Reporting Tables in Annex 8A.2 of Volume 1 of the *2006 IPCC Guidelines*.

The background tables included in Annex 8A.2 will be extended to take into account the changes introduced by the Wetlands Supplement (see sections above) and will be provided in Annex 7 in the Second Order Draft of the Wetlands Supplement.

7.2.5 Worksheets

Annex 7 provides also worksheets for each sub-category that can be used to estimate emissions based on Tier 1 methods and appropriate emission/stock change factors and activity data.

The worksheets will be provided in the Second Order Draft.

7.3 UNCERTAINTIES

7.3.1 Overview of Uncertainty Analysis

Uncertainty is an expression of the degree to which the value of a variable is unknown (IPCC 2007). In greenhouse gas inventories, uncertainty derives from quantifiable errors and variation in methods and data. Because of uncertainty, the true value of a variable is sometimes not known, but it is possible to estimate the possible range of values of the variable.

For greenhouse gas inventories, quantification of uncertainty is important because it allows inventory agencies to ascertain if estimated changes in greenhouse gas emissions and removals over time are larger than the uncertainty or range of possible estimates for an individual year. In wetlands, the magnitude of carbon stocks are often much larger than annual changes, so large uncertainties in carbon stock estimates may make it difficult to determine if estimated annual changes are real or a result of uncertainty. In this way, uncertainty analysis can indicate areas for future improvement of inventory methods.

In greenhouse gas inventories, major quantifiable sources of uncertainty include:

- field measurement errors
- remote sensing inaccuracies
- missing or incomplete data series
- misreporting or misclassification
- data bias or unrepresentative sampling
- random sampling error
- spatial variation
- spatial or temporal autocorrelation
- model inaccuracies

Uncertainty analysis generally proceeds through these steps:

- Identification of primary sources of uncertainty.
- Estimation of uncertainties of individual variables.
- Combination of individual variable uncertainties into total estimates of emissions or removals for a key category or a land-use category for a geographic area.

This section summarizes scientific methods (approaches) for each of these steps for the three tiers of greenhouse gas inventory methods. It summarizes material from the *2006 IPCC Guidelines*, including Volume 1, Chapter 3 (Frey et al. 2006) and Volume 4, Chapter 7, and summarizes any new methods for the wetlands sub-categories described in Chapters 2 to 6 of this *Wetlands Supplement*. This section aims to summarize new methods specific to the *Wetlands Supplement* and assess them across the wetlands subtypes. To the extent possible, it provides published examples that illustrate new methods. Inventory compilers should consult the detailed information in the 2006 IPCC Guidelines and this *Wetlands Supplement*.

7.3.2 Methods for quantifying uncertainty

The measure of uncertainty for national greenhouse gas inventories is the 95% confidence interval (CI). It is good practice to report the 95% CI for individual variables, including activity data, emissions factors, biomass densities, other parameters, and for total greenhouse gas emissions or removals from a key category or a land-use category for a geographic area.

Approach 1 - Use the measures of uncertainty given in the default tables in this *Wetlands Supplement* and the *2006 IPCC Guidelines* for individual variables. To combine individual variable uncertainties into total estimates of emissions or removals for a key category or a land-use category for a geographic area, use basic uncertainty combination methods (Mandel 1984), identified in Chapter 3 (Frey et al. 2006) of Volume 1 of the *2006 IPCC Guidelines*.

EQUATION 7.1
FRACTIONAL UNCERTAINTY

$$U_i = \frac{0.5 \times CI_i}{\mu_i}$$

Where:

U_i = uncertainty of a variable expressed as a fraction, from 0 to 1.0, of the mean of the variable

CI_i = 95% confidence interval of the variable

μ_i = mean value of the variable

EQUATION 7.2
COMBINING UNCERTAINTIES – ADDITION AND SUBTRACTION

$$U_{total} = \frac{\sqrt{(U_1 \times x_1)^2 + (U_2 \times x_2)^2 + \ldots + (U_n \times x_n)^2}}{\left| x_1 + x_2 + \ldots + x_n \right|}$$

Where:

U_{total} = fractional uncertainty of the sum of the variables

U_i = uncertainty of a variable expressed as a fraction, from 0 to 1.0, of the mean of the variable

x_i = value of a variable; $x_i < 0$ for subtraction

EQUATION 7.3
COMBINING UNCERTAINTIES – MULTIPLICATION

$$U_{total} = \sqrt{U_1^2 + U_2^2 + \ldots + U_n^2}$$

Where:

U_{total} = fractional uncertainty of the product of a set of variables

U_i = uncertainty of a variable expressed as a fraction, from 0 to 1.0, of the mean of the variable

Refer to the *2006 IPCC Guidelines* (Frey et al. 2006) for detailed steps of basic uncertainty combination, including calculation of uncertainties of temporal trends.

This *Wetlands Supplement* presents guidance to take into consideration the sources of uncertainty, either in activity data or emissions factors that are important specifically for wetlands and organic soils. The definitions of wetland sub-categories and delineation of their surface areas can, by themselves, be sources of uncertainty. While the *2006 IPCC Guidelines* generally stratified land-use categories by ecological zone (Aalde et al. 2006) or climate zone, this *Wetlands Supplement* can stratify wetland sub-categories by other properties. Sources of uncertainty and new tables that provide inventory compilers with default uncertainty values include:

- **Organic soils** – Surface areas and emissions factors are a function of drainage class, which requires estimates of the depth of the water table. Emissions from drainage ditches area is a function of the width and spacing of ditches.
    - Table 2.1 - Tier 1 CO_2 emission/removal factors for organic soils in all land-use categories
    - Table 2.3 - Tier 1 CH_4 emission/removal factors for organic soils in all land-use categories
    - Table 2.5 - Tier 1 N_2O emission/removal factors for organic soils in all land-use categories
- **Rewetted peatlands –** Surface areas are a function of time from rewetting.
    - Table 3.3 - Default DOC emission factors for rewetted peatlands and organic soils
    - Table 3.4 - Default emission factors for CH_4 from rewetted peatlands and organic soils
- **Coastal wetlands**
    - Table 4.3 - Default values for carbon stored in coastal wetlands (SOCREF) based upon average carbon density measured in top 1 m
    - Table 4.4 - Ratio of below-ground baiomass to above-ground biomass (R)
    - Table 4.5 - Default biomass conversion and expansion factors (BCEF), tonnes biomass (m^3 of wood volume)$^{-1}$ (IPCC 2006)
    - Table 4.6 - Default values for above-ground biomass of mangrove and tidal salt marsh wetlands
    - Table 4.7 - Default values for above-ground growth in mangrove and tidal salt marsh wetlands
    - Table 4.8 - Default values for above-ground biomass and net growth of seagrasses
    - Table 4.9 - Tier 1 Default values for dead wood and litter carbon stocks
    - Table 4.11 - Emission factors for coastal wetland soils changed through aquaculture, salt production or extraction
    - Table 4.12 - Emission factors for CH_4 from coastal wetlands with altered Hydrology
    - Table 4.13 - Emission factors for N_2O emission from coastal wetlands
    - Table 4.14 - Annual Emission Factors (EF) for Drained Soils for Tier 1 estimation
    - Table 4.15 - Relative Stock Change Factors for Drained Coastal Wetlands for Tier 1 level estimation
    - Table 4.16 - Annual removal factors for rewetted and restored soils for tier 1 estimation
    - Table 4.17 - Emission factors for CH_4 from "intact" coastal wetlands for Tier 1 estimation
- **Inland mineral soil wetlands** – Emissions are a function of time under management.
    - Table 5.1 - Default reference soil organic carbon stocks for IMS wetlands
    - Table 5.2 - Default CH_4 emission factors for permanently inundated IMS wetlands
    - Table 5.3 - Default CH_4 emission factors for seasonally inundated IMS wetlands
    - Table 5.4 - Emission factors for estimating N_2O emissions from IMS wetlands
    - Table 5.5 - Emission factors due to drainage or restoration of IMS wetlands (to be completed)
    - Table 5.6 - Soil CO_2 emission factors for IMS wetlands to be used in Equation 5.4
- **Constructed wetlands** – Emissions estimates require maximum CH_4 producing potential, vegetation, and temperature correction factors, human population (for estimating wastewater flow), and protein consumption (for estimating N_2O emissions). Other sources of uncertainty include the degrees to which wastewater is treated in constructed wetlands or in semi-natural treatment wetlands, the fraction of organics that is converted anaerobically to CH_4 during wastewater collection, and the amount of industrial organic waste from small or medium scale industries that is discharged into constructed wetlands.

- Table 6.5 - Default uncertainty ranges for domestic and industrial wastewater
- Table 6.7 - Nitrous oxide methodology default uncertainties

It is *good practice* to use measures of uncertainty specific to a country or an ecosystem type, when available. Use published uncertainty estimates for similar ecosystems when country-specific estimates are not available. To combine individual variable uncertainties into total estimates of emissions or removals for a key category of a land-use category for a geographic area, use Equations 7.1, 7.2, and 7.3. Table 7.2 lists a selection of wetlands with published data for individual variables and examples of combination of variables.

TABLE 7.2
SELECTION OF WETLANDS WITH PUBLISHED UNCERTAINTIES

Continent	Country	Wetland	Reference
Africa	Botswana	Okavango Delta	Mladenov et al. 2005
	Madagascar	estuary	Ralison et al. 2008
	Senegal	estuary area	Sakho et al. 2011
Asia	China	constructed wetland	Chen et al. 2011
	Indo-Pacific	mangroves	Donato et al. 2011
	Indonesia	peat swamps and oil palms	Murdiyarso et al. 2010
North America	Canada	restored wetlands	Badiou et al. 2011
	Costa Rica	tropical inland wetlands	Bernal and Mitsch 2008
	USA	streams and rivers	Butman and Raymond 2011
South America	Argentina	river marsh	Vicari et al. 2011
	Brazil	Pantanal	Schöngart et al. 2011
	Peru	Amazonian peatland	Lähteenoja et al. 2012
Global	Global	coastal ecosystems	Mcleod et al. 2011
	Global	freshwater wetlands	Kayranli et al. 2010
	Global	freshwater wetlands methane	Bastviken et al. 2011
	Global	restored wetlands	Moreno-Mateos et al. 2012
	Global	wetlands carbon and methane	Mitsch et al. 2010

Approaches to reducing uncertainty for the wetlands sub-categories in the *Wetlands Supplement* include:

- **Organic soils** – Use spatially disaggregated CO_2 flux measurements to develop local emission factors, correcting for carbon losses through leaching of dissolved organic carbon or runoff. For emissions estimates in boreal zones, include winter emissions, which can account for 10-30% of net annual emissions (Alm et al. 1999).
- **Rewetted peatlands** – CO_2 and CH_4 emissions are often a function of present vegetation composition and previous land use history, so stratification of an area by these properties can improve emissions estimates.
- **Coastal wetlands** – More detailed stratification of land by drainage and other management systems can improve emissions estimates.
- **Inland mineral soil wetlands** – No new uncertainty issues identified.
- **Constructed wetlands –** No new uncertainty issues identified.

Approach 2 – For individual variables, calculate the 95% CI from the PDF of measurements of each variable. Derive the PDF from a random sample. Capture the principal forms of spatial and temporal variation in the sample or calculate different PDFs for the principal spatial and temporal strata.) The *2006 IPCC Guidelines*, Volume 1, Chapter 3, Section 2.2.4 (Frey et al. 2006), provide methods to develop PDFs.

To combine individual variable uncertainties into total estimates of emissions or removals for a land-use category or a geographic area, use the Monte Carlo method (Metropolis and Ulam 1949), identified by the *2006 IPCC Guidelines* (Frey et al. 2006) as Approach 2. The Monte Carlo method is a statistical technique that quantifies the uncertainty of a variable based on a large number of randomized realizations of the value of the variable based on its mean value, the standard error of the mean, and a PDF of the standard errors.

For example, the diameter at a height of 1.3 m of a tree (d_{bh}) is an essential variable in estimating its carbon mass. In a typical forest inventory, a person measures the tree once and records the measurement. If the measurement were immediately repeated, the result may be slightly different due to the shape of the trunk, how the diameter tape drapes around the trunk, where the person estimates the 1.3 m height for measurement, possible errors in transcribing the value, and other factors. Repeating the measurement 100 or 1000 times would generate a PDF that might typically take the form of a normal distribution. The 95% CI of the distribution is a measure of the uncertainty of the d_{bh} measurement.

Monte Carlo analysis consists of running a calculation for a statistically significant number of replications, typically 100 to 10 000, producing a probability density function of the result, and calculating the 95% CI of the PDF. For any equation, the Monte Carlo form of a variable (Equation 7.4) can replace all the variables in the equation. The large number of realizations of the result effectively combines the uncertainties of individual variables.

EQUATION 7.4

MONTE CARLO ANALYSIS – GENERAL FORM OF A VARIABLE

$$x_i = mean_x + \left(random_i \times SE_x\right)$$

Where:

x_i = value of realization i of a variable,

i = statistically significant number of realizations, typically 100 – 10 000

$mean_x$ = mean value of a variable

$random_i$ = random number for realization i, from -1 to 1, taken from a set of random numbers that form a probability distribution function specific to the variable

SE_x = standard error of the mean value of the variable

Refer to the *2006 IPCC Guidelines* (Frey et al. 2006) for detailed steps of Monte Carlo analysis, including selection of an appropriate PDF for a variable and its random numbers. Inventory agencies and scientists have quantified uncertainty in greenhouse gas inventories in a range of cases, including the national inventories of Austria (Winiwarter and Muik 2010), Finland (Monni et al. 2007), and the Netherlands (Ramírez et al. 2008) and high-biomass ecosystems in California, USA (Gonzalez et al. 2010) and Canada (Kurz et al. 2008).

Approaches to reducing uncertainty for the wetlands sub-categories in the *Wetlands Supplement* include:

- **Organic soils** – Quantification of impacts of land-use and management on emissions can improve emissions estimates. Examples include organic matter additions to agricultural land that can increase substrate supply for methane production in ditches, short-term pulses of ditch CH_4 emission associated with land-use change, and nutrient-enriched soils that are a legacy of past land-use.
- **Rewetted peatlands** – Determination of spatial variation of peat type and depth, vegetation composition, soil temperature, mean water table depth, the provision by vegetation of substrates for CH_4 production, and transport by vegetation of CH_4 from saturated soil to the atmosphere can improve emissions estimates.
- **Coastal wetlands** – Quantification of the effects of coastal grassland management, including grazing, fire, liming, and fertilization, can improve emissions estimates.
- **Inland mineral soil wetlands** – No new uncertainty issues identified.
- **Constructed wetlands** – Provide separate estimates for anaerobic and aerobic constructed wetlands.

7.4 IMPACT ON KEY CATEGORIES

7.4.1 Overview of key category analysis

Methodological choice for individual source and sink categories is important in managing overall inventory uncertainty. Generally, inventory uncertainty is lower when emissions and removals are estimated using the most rigorous methods provided for each category or subcategory in the sectoral volumes of these Guidelines. However, these methods generally require more extensive resources for data collection, so it may not be feasible to use more rigorous method for every category of emissions and removals. It is therefore good practice to identify those categories that have the greatest contribution to overall inventory uncertainty in order to make the most efficient use of available resources. By identifying these key categories in the national inventory, inventory compilers can prioritize their efforts and improve their overall estimates. The purpose, general rules and approaches for the key category analysis of the whole greenhouse gas inventory are presented in Chapter 4 of Volume 1 of the *2006 IPCC Guidelines*.

According to Section 4.2 in Volume 1 of the *2006 IPCC Guidelines* the general rules for performing the key category analysis are

- The key category analysis should be performed at the level of IPCC categories or subcategories at which the IPCC methods and decision trees are provided.
- Each greenhouse gas emitted from each category should be considered separately, unless there are specific methodological reasons for treating gases collectively.
- Emissions and removals from a category should also be considered separately, where possible and relevant to the methodology used.

The Table 4.1 in Section 4.2 in Volume 1 of the *2006 IPCC Guidelines* also gives a recommended level at which the key category analysis should be performed. Countries may however choose to perform the quantitative analysis at a more disaggregated level than suggested.

The key category analyses are performed using two approaches. Approach 1 is based on level and trend assessments. In the level assessment, categories of the inventory are listed in the order of absolute values of the emissions or removals, and the largest categories contributing to 95 per cent of the total emissions are considered as key categories. The trend assessment analyses the contribution of a category to the trend as well as if the trend of the category is significantly different from the trend of the inventory. The categories contributing most to the trend and which add up to contributing 95 per cent to the trend are considered key categories. Approach 2 is based on similar assessments but the results of the uncertainty analysis are taken into account. The most significant categories contributing together 90 per cent to the uncertainties of the total emissions or the trend are considered key categories.

7.4.2 Key category analysis including the categories impacted by the Wetlands Supplement

The suggested level for CO_2 emissions (carbon stock changes) reported under the land-use categories in the AFOLU Sector according to Table 4.1 in Volume 1 of the *2006 IPCC Guidelines* is to divide the emissions or removals for each land-use category to lands remaining in the category and lands converted to it. In addition, the inventory compilers should determine which pools and subcategories are significant. This approach is sensible, as the CO_2 emissions/removals from the land-use categories are generally estimated using the same or similar generic methodologies and also the same activity data (area data).

The *Wetlands Supplement* introduces more detailed guidance for organic soils by the introduction of the impact of the drainage class into the methodological approach in the *2006 IPCC Guidelines*. It introduces also new subcategories to some land-use categories, mostly under the land-use category Wetlands. Also the wastewater treatment category in the Waste Sector is complemented with one additional subcategory (constructed wetlands). The supplementary methodological guidance for these categories is mainly different by land-use category. Therefore it suggested to that the inventory compilers consider the land-use categories for which the emissions/removals are estimated using the supplementary methodologies separately in the key category analysis. The suggested level for the key category analysis for the AFOLU and Waste Sectors is included in Table 7.3. The changes to the Table 4.1 in Volume 1 of the *2006 IPCC Guidelines* are highlighted with shading.

TABLE 7.3
SUGGESTED AGGREGATION LEVEL OF ANALYSIS FOR APPROACH 1 FOR AFOLU AND WASTE SECTORS [a]

Source and Sink Categories to be Assessed in Key Category Analysis		Gases to be Assessed [c]	Special Considerations
Category Code [b]	**Category Title [b]**		
Agriculture, Forestry and Other Land Use			
3A1	Enteric Fermentation	CH_4	If this category is *key*, the inventory compiler should determine which animal categories are significant. For *key categories*, decision trees for livestock population characterisation as well as for CH_4 emissions estimation should be followed.
3A2	Manure Management	CH_4, N_2O	If this category is *key*, the inventory compiler should determine which animal categories and waste management systems are significant. For *key categories*, decision trees for livestock population characterisation as well as for CH_4 or N_2O emissions estimation should be followed.
3B1a	Forest Land Remaining Forest Land	CO_2	If this category is key, the inventory compiler should determine which pools (biomass, DOM, mineral soils, organic soils) are significant and should then follow the guidance for key categories in decision trees for carbon stock changes for the significant pools. This category would include rewetted lands classified as forest land remaining forest land[e]
3B1b	Land Converted to Forest Land	CO_2	If this category is *key*, the inventory compiler should determine which pools and subcategories are significant. This category would include rewetted lands classified as land converted to forest land[e]
3B2a	Cropland Remaining Cropland	CO_2	If this category is *key*, the inventory compiler should determine which pools are significant. This category would include rewetted lands classified as cropland remaining cropland[e]
3B2b	Land Converted to Cropland	CO_2	Assess the impact of forest land converted to cropland in a separate category. [d] If this category is *key*, the inventory compiler should determine which pools and subcategories are significant. This category would include rewetted lands classified as land converted to cropland.[e]
3B3a	Grassland Remaining Grassland	CO_2	If this category is *key*, the inventory compiler should determine which pools are significant. This category would include rewetted lands classified as grassland remaining grassland.[e]
3B3b	Land Converted to Grassland	CO_2	Assess the impact of forest land converted to grassland in a separate category. [d] If this category is *key*, the inventory compiler should determine which pools and subcategories are significant. This category would include rewetted lands classified as land converted to grassland.[e]

TABLE 7.3
SUGGESTED AGGREGATION LEVEL OF ANALYSIS FOR APPROACH 1 FOR AFOLU AND WASTE SECTORS [a]

Source and Sink Categories to be Assessed in Key Category Analysis		Gases to be Assessed [c]	Special Considerations
Category Code [b]	**Category Title [b]**		
3B4ai + 3B4bi	Peat Extraction lands (Remaining as and converted to Peat Extraction lands	CO_2, N_2O, CH_4	Assess the impact of peat extraction including the use of horticultural peat together for lands remaining and converted to peat extraction. If this category is *key*, the inventory compiler should determine which subcategories and pools are significant.
3B4aii	Flooded land remaining Flooded land	CO_2	
3B4aiii	Wetlands remaining wetlands (excluding 3B4ai and 3B4aii)	CO_2, N_2O, CH_4	This category would include rewetted land, coastal wetlands and inland mineral soil wetlands remaining in the relevant categories and not reported under any other land-use categories. If this category is *key*, the inventory compiler should determine which subcategories and pools are significant. This category would include rewetted lands classified as wetlands remaining wetlands.[e]
3B4b	Land Converted to Wetlands (excluding 3B4bi)	CO_2, N_2O, CH_4	This category would include lands converted to rewetted land[e], coastal wetlands and inland mineral soil wetlands and not reported under any other land-use categories. Assess the impact of forest land converted to wetland in a separate category (see below). [d] If this category is *key*, the inventory compiler should determine which pools and subcategories are significant. This category would include rewetted lands classified as land converted to wetlands.[e]
3B5a	Settlements Remaining Settlements	CO_2	If this category is *key*, the inventory compiler should determine which pools are significant. The areas of constructed wetland should be included under this category. This category would also include rewetted lands classified as settlements remaining settlements.[e]
3B5b	Land Converted to Settlements	CO_2	Assess the impact of forest land converted to settlements in a separate category. [d] If this category is *key*, the inventory compiler should determine which pools and subcategories are significant. The areas of land converted to constructed wetland should be included here. This category would include rewetted lands classified as land converted to settlements.[e]
3C1	Biomass Burning	CO_2, CH_4, N_2O	CO_2 emissions should be included only for those sources which are not covered under reporting of CO_2 emissions /removals in categories 3B1 to 3B6. If this category is *key*, the inventory compiler should determine which subcategories are significant.
3C2	Liming	CO_2	
3C3	Urea Application	CO_2	

TABLE 7.3
SUGGESTED AGGREGATION LEVEL OF ANALYSIS FOR APPROACH 1 FOR AFOLU AND WASTE SECTORS [a]

Source and Sink Categories to be Assessed in Key Category Analysis		Gases to be Assessed [c]	Special Considerations
Category Code [b]	**Category Title [b]**		
3C4	Direct N_2O Emissions from Managed soils	N_2O	If this category is *key*, the inventory compiler should determine which subcategories are significant.
3C5	Indirect N_2O Emissions from Managed soils	indirect N_2O	If this category is *key*, the inventory compiler should determine which subcategories are significant.
3C6	Indirect N_2O Emissions from Manure Management	indirect N_2O	
3C7	Rice Cultivations	CH_4	
3D1	Harvested Wood Products	CO_2	Use of *key* category analysis is optional.
3	Miscellaneous	CO_2, CH_4, N_2O	Assess whether other sources or sinks in the AFOLU Sector not listed above should be included. Key category analysis has to cover all emission sources and sinks in the inventory. Therefore all categories not presented above should be either aggregated with some other category, where relevant, or assessed separately.
Waste			
4A	Solid Waste Disposal	CH_4	If this category is *key*, the inventory compiler should determine which subcategories are significant.
4B	Biological Treatment of Solid Waste	CH_4, N_2O	
4C	Incineration and Open Burning of Waste	CO_2, N_2O, CH_4	
4D	Wastewater Treatment and Discharge	CH_4, N_2O	Assess whether domestic or industrial wastewater treatment is a significant subcategory. Emissions from constructed wetlands are included in this category.
4	Miscellaneous	CO_2, CH_4, N_2O	Assess whether other sources in the Waste Sector not listed above should be included. Key category analysis has to cover all emission sources in the inventory. Therefore all categories not presented above should be either aggregated with some other category, where relevant, or assessed separately.
5A	Indirect N_2O Emissions from the atmospheric deposition of nitrogen in NO_x and NH_3	indirect N_2O	
5B	Other	CO_2, N_2O, CH_4, SF_6, PFCs, HCFs	Include sources and sinks reported under 5B. Key category assessment has to cover all emission sources in the inventory. Therefore all categories not presented above should be either aggregated with some other category, where relevant, or assessed separately.

TABLE 7.3
SUGGESTED AGGREGATION LEVEL OF ANALYSIS FOR APPROACH 1 FOR AFOLU AND WASTE SECTORS [a]

Source and Sink Categories to be Assessed in Key Category Analysis		Gases to be Assessed [c]	Special Considerations
Category Code [b]	**Category Title [b]**		

[a] In some cases, inventory compilers may modify this list of IPCC categories to reflect particular national circumstances.

[b] The categories should include the respective codes and be consistent with the IPCC terminology.

[c] All the gases in this column are to be assessed separately, except 'Miscellaneous' category, where gases can be assessed jointly. There may also be some new gases other than those listed here, and those should also be assessed separately.

[d] In the quantitative key category analysis, conversion of forest land is spread out under the different land-use change categories. Countries should identify and sum up the emission estimates associated with forest conversion to any other land category and compare the magnitude to the smallest category identified as key. If its size is larger than the smallest category identified as key it should be considered key.

[e] In the quantitative key category analysis, emissions/removals from rewetting are spread out under the different land-use change categories. Countries should identify and sum up the emission/removal estimates associated rewetting to any other land category and compare the magnitude to the smallest category identified as key. If its size is larger than the smallest category identified as key it should be considered key.

7.5 COMPLETENESS

Completeness means that inventory estimates have been prepared for all categories and gases. Complete greenhouse gas inventories will include estimates of emissions and removals from the sources and sinks for which methodological guidance is provided in the *2006 IPCC Guidelines* and the *Wetlands supplement* unless the specific sources and sinks do not occur on the national territory. The decision tree in Figure 1.1 in Chapter 1 of this report and Table 7.1 above provides guidance on the links between guidance in the *2006 IPCC Guidelines* and the *Wetlands Supplement* to facilitate countries in ensuring complete coverage of all relevant categories in the inventory.

A country may consider that a disproportionate amount of effort would be required to collect data for a category or a gas from a specific category that would be insignificant in terms of the overall level and trend in national emissions. The *Wetlands Supplement* addresses sources and sinks for which the significance varies considerably by country. For instance, some wetland types occur only in some regions of the world, the amount of organic soils may be very small in some countries and tidal effects on the emissions are applicable only to coastal countries. In circumstances where the supplementary guidance is not applicable to a country or emissions/removals have not been reported due to their insignificance, they should use the notation keys "NO" (not occurring) and "NE" (not estimated) respectively. For details on the use of the notation keys, the inventory compilers should refer to together with a justification for exclusion in terms of the likely level of emissions or removals and identify the category as 'Not Estimated' using the notation key 'NE' in the reporting tables (refer to Section 8.2.5 in Volume 1 of the *2006 IPCC Guidelines*), The inventory compiler should note that it is good practise to provide justification for each emission estimate for which the notation key "NE" is used.

7.6 TIME SERIES CONSISTENCY

7.6.1 Overview of time series issues

Greenhouse gas inventory methods should be consistent for an entire time series so that each year in the time series can be validly compared with other years. This provides countries with information to robustly assess temporal trends in their greenhouse gas emissions and removals and the effectiveness of emissions reduction actions. Circumstances that will affect time series consistency include:

- changes and refinements to methods due to scientific advances
- addition of new categories
- technological change
- data gaps
- correction of errors

In a consistent time series, changes in emissions or removals over time will be due to real phenomena in the field rather than any influence of the above set of circumstances in the calculations.

This *Wetlands Supplement* includes substantial changes to the *2006 IPCC Guidelines* methods and refines the subcategories within the wetlands land-use category. For some countries, this will make necessary the recalculation of results from previous years to produce a consistent time series.

This section summarizes material from and adds recent scientific information to sections from the *2006 IPCC Guidelines*, including Volume 1, Chapter 5 (Irving et al. 2006) and Volume 4, Chapter 7. Inventory compilers should consult the detailed information in the *2006 IPCC Guidelines*.

7.6.2 Methods for producing consistent time series

The guidance for producing consistent times series for the categories in the *Wetlands Supplement* is addressed below taking the tier used to estimate the emissions/removals into account as the requirements for activity data and emission factors as well as other parameters are very different depending on the tier used, and thus impact the methods by which times series consistency is ensured.

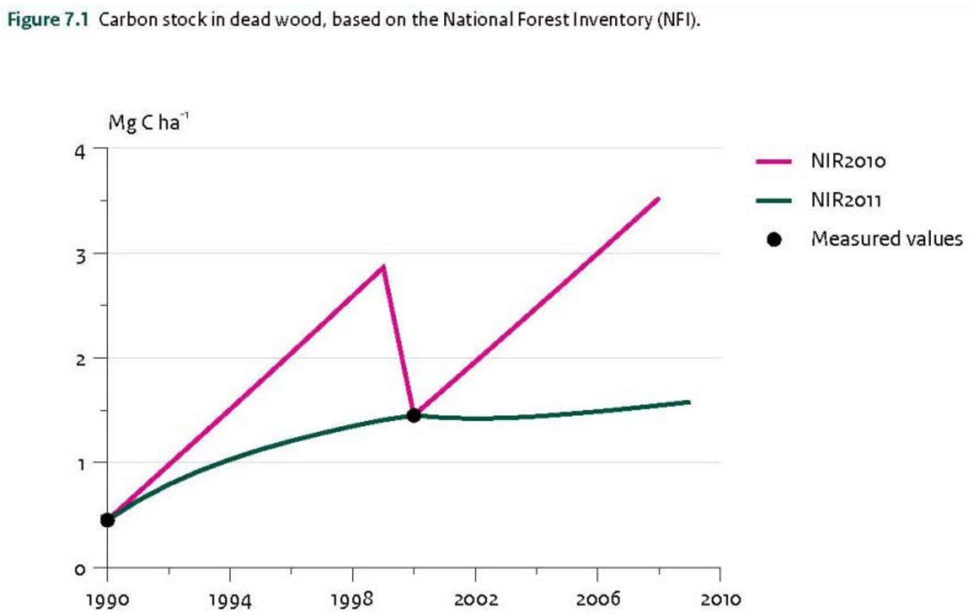
All tiers - Recalculate an entire data series when changing from the *1996 IPCC Guidelines*, *2003 Good Practice Guidance*, and *2006 IPCC Guidelines* to the *Wetlands Supplement*, when methods are refined due to scientific advances, when new data becomes available, when quality control finds errors in previous estimates, and when wetlands are reported as a new category separate from previously reported land-use categories (e.g. reporting mangroves as wetlands rather than forests). For data gaps, it is good practice to clearly report which results are calculated from measurements and which are modelled.

Tier 1 – Use the activity data for years available in the default sources in the *Wetlands Supplement* and the *2006 IPCC Guidelines*. Report data from years of measurement only.

Tier 2 - To fill data gaps, examine all available historical sources, administrative records, aerial photographs, or remote sensing. Use linear interpolation to fill historical data gaps.

Tier 3 –To fill data gaps, interpolate using a function that models empirical trends or underlying processes. Some examples include field validation of model dead wood time series in the Netherlands national greenhouse gas inventory (van der Maas et al. 2011; Figure 7.1), data gap filling of CO_2 fluxes from Everglades National Park, USA (Barr et al. 2010), and filling of night-time gaps in ecosystem respiration in Lake Victoria wetlands, Uganda (Saunders et al. in press). The case of the Netherlands is just an example that illustrates recalculation of a time series to improve consistency. When field measurements of dead wood showed that modelled estimates were not accurate, the inventory agency revised the parameters in its dead wood model and recalculated the entire time series (van der Maas et al. 2011; Figure 7.1). Refer to the *2006 IPCC Guidelines* (Irving et al. 2006) for detailed steps of filling historical gaps by splicing and for the use of surrogate parameters.

Figure 7.1 Filling data gaps by multivariate statistical analysis and recalculation of the time series of carbon in dead wood in the Netherlands national greenhouse gas inventory.



Note that the graph clearly distinguishes between measured and modelled values (van der Maas et al. 2011).

7.7 QUALITY ASSURANCE AND QUALITY CONTROL

7.7.1 Overview of quality issues

Quality assurance and quality control are procedures to ensure the accuracy of calculated results. Effectively implemented quality procedures can reduce uncertainties of greenhouse gas inventories. Quality control (QC) is a system of routine technical activities that inventory compilers undertake to assess and maintain the condition of data and results as they compile the inventory. Quality assurance (QA) is a planned system of review of finished inventory results conducted by personnel not directly involved in the inventory.

This section summarizes material from and adds recent scientific information to sections from the *2006 IPCC Guidelines*, including Volume 1, Chapter 6 (Winiwarter et al. 2006) and Volume 4, Chapter 7. Inventory compilers should consult the detailed information in the *2006 IPCC Guidelines*. The guidance below is organised taking the tier used to estimate the emissions/removals from the categories included in this *Wetlands Supplement* into account to emphasize that specific QA/QC measures will depend on the tier level of the methodology.

7.7.2 Quality Assurance and Quality Control Methods

All tiers – Provide routine and consistent checks to ensure data integrity, correctness, and completeness. Identify and address errors and omissions. Document and archive inventory material and record all quality control activities. Check labelling, transcription, and other clerical related to data entry (See complete list in *2006 IPCC Guidelines*, Volume 1, Table 6.1*)*. Double-check outlying values against data sources. Check final results against previous years and published values. Compare inventories with results from similar ecosystems in other countries. Conduct an area-balance for land-use category areas and a mass-balance for greenhouse gas emissions and removals. Develop automated data control procedures. It is good practice to prioritize key categories for more extensive quality assurance and quality control.

Tier 1 - Double-check that correct default values were used.

Tier 2 - Double-check data sheets against local data sources used for activity data, emissions factors, and other variables.

Tier 3 - Validate computer models against field measurements and include the error in the calculation of uncertainty (Section 7.2.1). The validation measure can be correlation of predicted and measured values (Figure 7.2; Miehle et al. 2006), fractional agreement of modelled and measured values (Figure 7.3; Chadwick 2011), or other measures. Separate the data set used for calibration of a model from the data set used for validation of the model. It is good practice to establish a system of repeated monitoring of permanent plots or benchmark sites for continued validation of model output against field data over time. When more than one model is available for a particular parameter, inter-comparison of model output can provide indications of the robustness of individual model output. Furthermore, comparison of Tier 3 models with estimates using Tier 1 and Tier 2 methods can serve that same purpose. IPCC (2011) provides numerous specific examples of model development, calibration, and validation.

Figure 7.2 Validation of the Forest DNDC model by comparison of modelled against measured values of aboveground biomass in *Eucalyptus globulus* in Australia (Miehle et al. 2006).

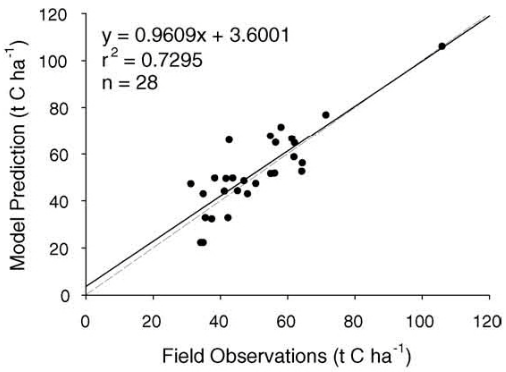
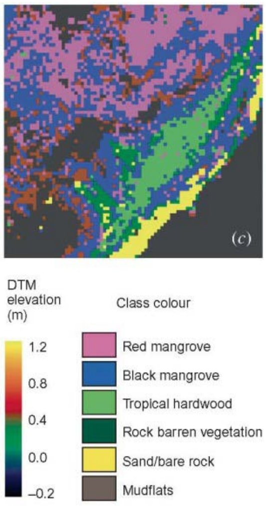


Figure 7.3 Validation of Ikonos satellite-derived land cover using an error matrix comparing remote sensing-derived wetlands classes in Florida, USA against field observations (Chadwick 2011).

Class	RM	BM	THH	CRB	Sand/ Rock	Mudflats	Asphalt	Omission (%)
(*a*) IKONOS classification: overall accuracy = 83.3%; kappa coefficient = 0.79								
RM	**82.0**	10.3	6.2	0.43	0	1.1	0	18.0
BM	3.6	**77.6**	2.3	9.9	0.33	6.3	0	22.4
THH	7.1	6.9	**73.8**	11.7	0.48	0	0	26.2
CRB	0	3.3	1.3	**93.4**	2.0	0	0	6.6
Sand/Rock	0	0	0	0	**100**	0	0	0
Mudflat	1.5	1.5	0	1.4	6.0	**89.6**	0	10.5
Asphalt	0	0	0	0	13.51	0	**86.5**	13.5
Commission	9.9	27.2	11.4	22.3	10.3	28.6	0	



Annex 7 Worksheets

Worksheets will be developed for the Second Order Draft.

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