



# **Methodological Guidance for Coastal Wetlands in the 2013 SUPPLEMENT TO THE 2006 IPCC GUIDELINES FOR NATIONAL GREENHOUSE GAS INVENTORIES: WETLANDS**

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- Summary

# Introduction

# Introduction

- The *2013 Supplement to the 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Wetlands* provides methodological guidance on lands with wet and drained soils, and constructed wetlands for wastewater treatment
  - One such new element of the *2013 Wetlands Supplement* is guidance on specific management activities in coastal areas of mangroves, tidal marshes and seagrass meadows that provides:
    - Updated default data for estimation of C stock changes in mangrove living biomass and dead wood pools
    - New generic methodological guidance and data on:
      - CO<sub>2</sub> emissions and removals on coastal wetlands on organic and mineral soils for specific management activities
      - N<sub>2</sub>O emissions during aquaculture use
      - CH<sub>4</sub> emissions from rewetted soils and creation of mangroves and tidal marshes

# Generic methodological approaches of the *2006 IPCC Guidelines* relevant to the *2013 Wetlands Supplement*

# Three methodological Tiers

## **Tier 3: Higher order methods**

Detailed modeling and/or inventory measurement systems  
Data at a greater resolution

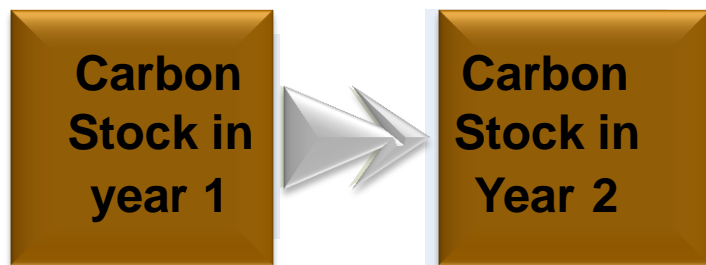
## **Tier 2: A more accurate approach**

Based on Tier 1 with country or region-specific values for the general defaults, greater stratification  
More disaggregated activity data

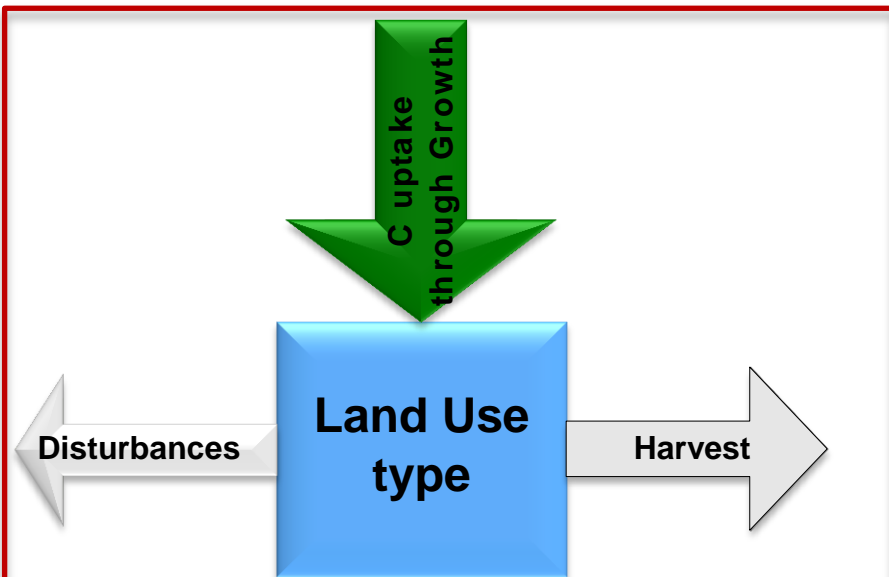
## **Tier 1: Simple first order approach**

Default values of the parameters from the IPCC guidelines  
Spatially coarse default data based on globally available data

# Estimating Carbon Stock Changes



**Stock-Difference** -- Difference between carbon stocks gives emissions/removals

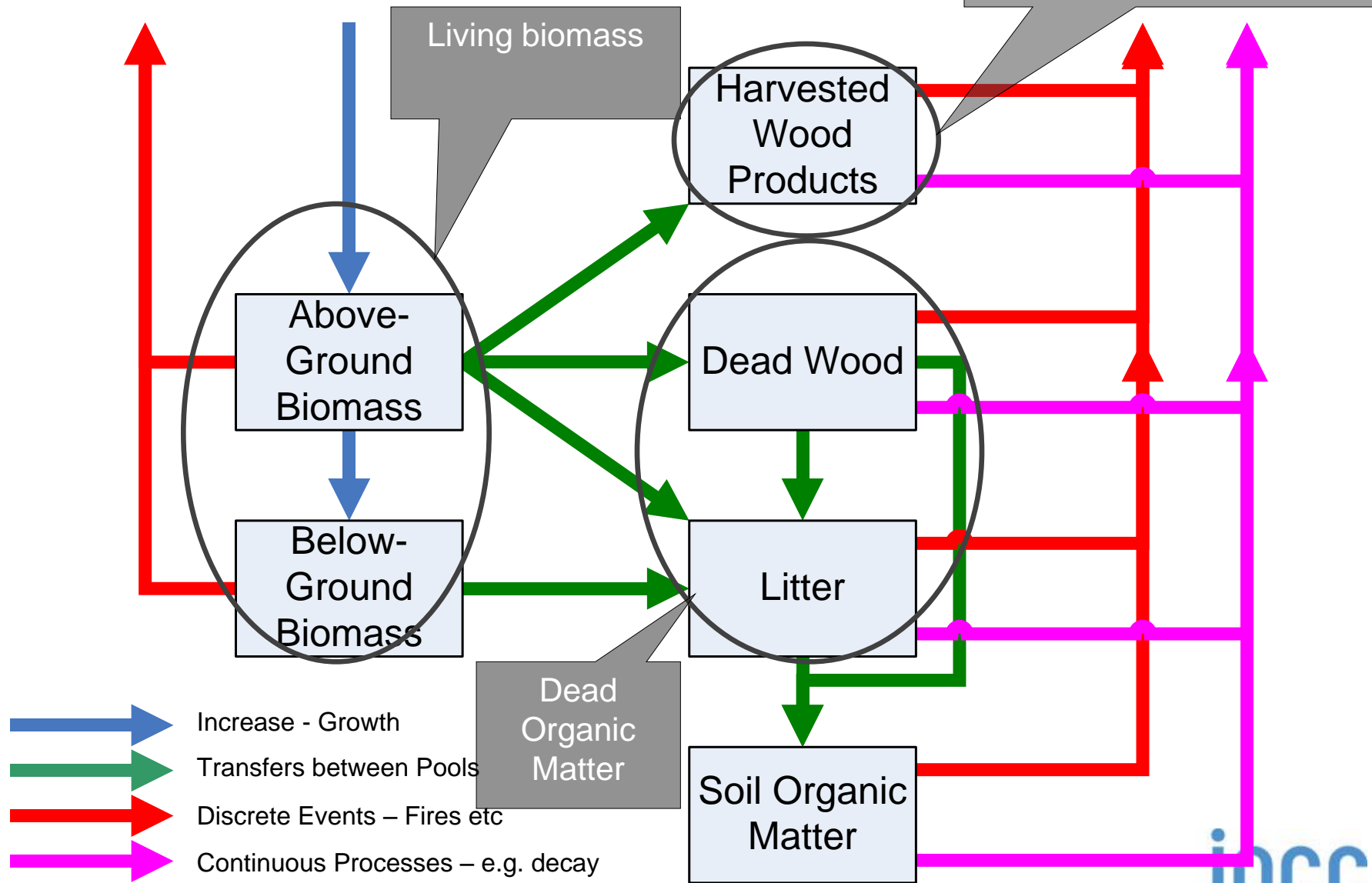


**Gain-Loss** -- Emissions/removals from sum of losses and gains through pool transfers, growth/decay rates or disturbance, harvest and fuelwood removals

**Approach assumes sum of gains and losses  
= net stock changes = total emissions/removals**

# C Pools in land-use categories

Countries can choose to account for HWP pool





# Non-CO<sub>2</sub> Emissions

- Non-CO<sub>2</sub> emissions rate is generally determined by an emission factor (EF) for a specific gas (e.g., CH<sub>4</sub>, N<sub>2</sub>O) and source category and activity data (e.g., N applied to soil or area burnt) that defines the emission

$$\text{Emission} = A \cdot EF$$

Where:

Emission = non-CO<sub>2</sub> emissions, tonnes of the non-CO<sub>2</sub> gas

A = activity data relating to the emission source (can be area or mass unit, depending on the source type)

EF = emission factor for a specific gas and source category, tonnes per unit of A (activity data)

# Methodological guidance provided in the Coastal Wetlands chapter

# CO<sub>2</sub> emissions and removals for specific management activities

- *Forest management practices\* in mangroves*
  - Coastal wetlands covered: mangroves
- *Extraction (e.g. excavation for port development, construction of aquaculture and salt production ponds)*
  - Coastal wetlands covered: mangroves, tidal marshes, seagrass meadows
- *Rewetting, revegetation and creation*
  - Coastal wetlands covered: mangroves, tidal marshes, seagrass meadows
- *Drainage*
  - Coastal wetlands covered: mangroves, tidal marshes

\*for UNFCCC reporting

# CO<sub>2</sub> emissions and removals for specific management activities

- Key Features of default methods for *forest management practices\* in mangroves*
  - Follows the default methodologies of the 2006 IPCC Guidelines (Volume 4, Chapters 2 and 4) – Gain-Loss method for biomass
  - New Tier 1 biomass and dead wood/litter carbon (C) stock data on:
    - C fraction of aboveground mangrove biomass
    - Aboveground biomass in mangroves by IPCC (climate) domain and region
    - Aboveground biomass growth in mangroves by IPCC domain and region
    - Ratio of belowground to aboveground biomass (R) for mangroves by IPCC domain and region
    - Wood density to be used in computation of BCEF
  - Soil CO<sub>2</sub> emissions and removals are assumed zero where there is no land-use change or management activities that occur.
  - New sources of activity data (e.g. web sources & databases)

# CO<sub>2</sub> emissions and removals for specific management activities

- Key Features of default methods for *extraction*
  - Provides new default methodologies consistent with the 2006 *IPCC Guidelines* (Volume 4, Chapter 7) – extraction activities result in an initial conversion of biomass, dead wood/litter and soil C stocks to CO<sub>2</sub> emissions during the year of extraction
  - Extraction activities include excavation for port/marina development and construction of aquaculture and salt production ponds
  - New default biomass and soil carbon (C) stock data on:
    - Ratio of belowground to aboveground biomass (R) for tidal marsh and seagrass meadow by IPCC domain and region
    - Soil C stocks for mangrove, tidal marsh and seagrass meadow for organic and mineral soils
  - New sources of activity data (e.g. web sources & databases)

# CO<sub>2</sub> emissions and removals for specific management activities

- Key Features of default methods for *extraction*
  - The sum of C stock changes associated with all extraction activities (excavation and construction of aquaculture and salt production ponds)

**TIER 1 ESTIMATION OF INITIAL CHANGE IN C STOCKS  
WITH EXTRACTION (ALL C POOLS)**

$$\Delta C_{\text{EXT}} = \Delta C_{\text{excav}} + \Delta C_{\text{aq-constr}} + \Delta C_{\text{sp-constr}}$$

$\Delta C_{\text{EXT}}$  = Changes in C stocks from all extraction activities; tonnes C

$\Delta C_{\text{excav}}$  = Initial change in biomass, dead organic matter and soil carbon stocks from extraction due to excavation; tonnes C

$\Delta C_{\text{aq-constr}}$  = Initial change in biomass, dead organic matter and soil carbon stocks from extraction during construction of aquaculture ponds; tonnes C

$\Delta C_{\text{sp-constr}}$  = Initial change in biomass, dead organic matter and soil carbon stocks from extraction during construction of salt production ponds; tonnes C

# CO<sub>2</sub> emissions and removals for specific management activities

- Key Features of default methods for *extraction* activities
  - The conversion of the biomass, dead wood/litter and soil C pools are estimated similarly (e.g. biomass method is presented below)

## TIER 1 ESTIMATION OF INITIAL CHANGE IN BIOMASS C STOCKS DUE TO EXTRACTION ACTIVITIES

$$\Delta C_{B^{-}\text{CONVERSION}} = \sum_{v,c} \{B_{\text{AFTER}} * (1+R) - B_{\text{BEFORE}} * (1+R)\}_{v,c} * CF * A_{\text{CONVERTED},v,c}$$

$\Delta C_{B^{-}\text{CONVERSION}}$  = Changes in biomass stock from conversion due to extraction activities; tonnes C

$B_{\text{AFTER}}$  = Stock in aboveground biomass per unit of area immediately after the conversion by vegetation type (v) and climate (c); tonnes d.m. ha<sup>-1</sup>; default value = 0

$B_{\text{BEFORE}}$  = Stock in aboveground biomass per unit of area immediately before the conversion; tonnes d.m. ha<sup>-1</sup>

R = ratio of belowground biomass to aboveground biomass by vegetation type (v) and climate (c); tonnes d.m. belowground biomass (tonnes d.m. above ground biomass)<sup>-1</sup>.

CF = carbon fraction of dry matter, tonnes C (tonnes d.m.)<sup>-1</sup>

$A_{\text{CONVERTED}}$  = Area of conversion by veg type (v) and climate (c); ha

# CO<sub>2</sub> emissions and removals for specific management activities

- Key Features of default methods for *rewetting, revegetation and creation*
  - Follows the default methodologies of the 2006 IPCC Guidelines for biomass and dead wood/litter (Volume 4, Chapters 2, 4 and 6 and new data provided in the Coastal wetlands chapter)
  - Provides new methods whereby an EF equivalent to a CO<sub>2</sub> removal (soil C accumulation) is applied when vegetation is established through seeding or colonization (by developing conditions conducive to plant establishment)
  - The area is determined and EF applied, disaggregated by vegetation, soil and climate as appropriate or possible as

## CO<sub>2</sub> EMISSIONS ON REWETTED COASTAL WETLANDS

$$CO_{2SO-RE} = \sum_{v,s,c} (A_{RE} * EF_{RE})_{v,s,c}$$



# CO<sub>2</sub> emissions and removals for specific management activities

- Key Features of default methods for *drainage*
  - Follows the default methodologies of the 2006 IPCC Guidelines for biomass and dead wood/litter (Volume 4, Chapters 2, 4 and 6) and new data provided in the Coastal wetlands chapter.
  - The area is determine and EF applied regardless of vegetation or soil type
  - EF is applied until soil C stock is depleted

## CO<sub>2</sub> EMISSIONS ON DRAINED ORGANIC AND MINERAL SOILS

$$CO_2\text{-SO-DR} = (A_{\text{DR}} \cdot EF_{\text{DR}})$$

# CH<sub>4</sub> emissions from rewetted soils and creation of mangroves and tidal marshes

- Key Features
  - Provides new default methodologies consistent with the 2006 *IPCC Guidelines* and 2013 *Wetlands Supplement* (Chapter 3)
  - Provides a new soil method whereby an EF is applied when mangroves or tidal marshes are rewetted or created associated with salinity (i.e. salinity is most important factor driving CH<sub>4</sub> emissions)
  - The area is determined and EF applied based on vegetation/salinity

## CH<sub>4</sub> EMISSIONS IN REWETTED TIDAL MARSHES AND MANGROVES

$$\text{CH}_{4\text{SO-REWET}} = \sum_v (A_{\text{rewet}} * \text{EF}_{\text{rewet}})_v$$

# N<sub>2</sub>O emissions during aquaculture use

- Key Features

- Provides new default methodologies consistent with the 2006 *IPCC Guidelines* (Chapter 11)
- Provides a new method whereby an EF is applied based on the mass of fish produced per year to estimate direct N<sub>2</sub>O emissions from coastal wetland areas
- The EF is estimated based on the N content of fish, excretion of N into the water column and the conversion of N to N<sub>2</sub>O

**DIRECT N<sub>2</sub>O EMISSIONS FROM AQUACULTURE USE**

$$N_2O-N_{AQ} = F_F * EF_F \text{ (based on fish production)}$$

N<sub>2</sub>O-N<sub>AQ</sub> = annual direct N<sub>2</sub>O-N emissions from aquaculture use, kg N<sub>2</sub>O-N yr<sup>-1</sup>

F<sub>F</sub> = annual fish production, kg fish yr<sup>-1</sup>

EF<sub>F</sub> = emission factor for N<sub>2</sub>O emissions from fish produced, kg N<sub>2</sub>O-N (kg fish produced)<sup>-1</sup>

# Summary

- The *2013 Wetlands Supplement* provides methodological guidance on CO<sub>2</sub> emissions and removals and coverage of non-CO<sub>2</sub> emissions for wetlands including coastal wetlands.
- Generic methodological guidance on coastal wetlands is consistent with that of the *2006 IPCC Guidelines*, and both updates and provides new guidance to the *2006 IPCC Guidelines*.
- The coastal wetlands guidance provides methods on determining CO<sub>2</sub> emissions and removals associated with specific management activities, N<sub>2</sub>O emissions from aquaculture and CH<sub>4</sub> emissions from rewetted soils in line with *good practice*.

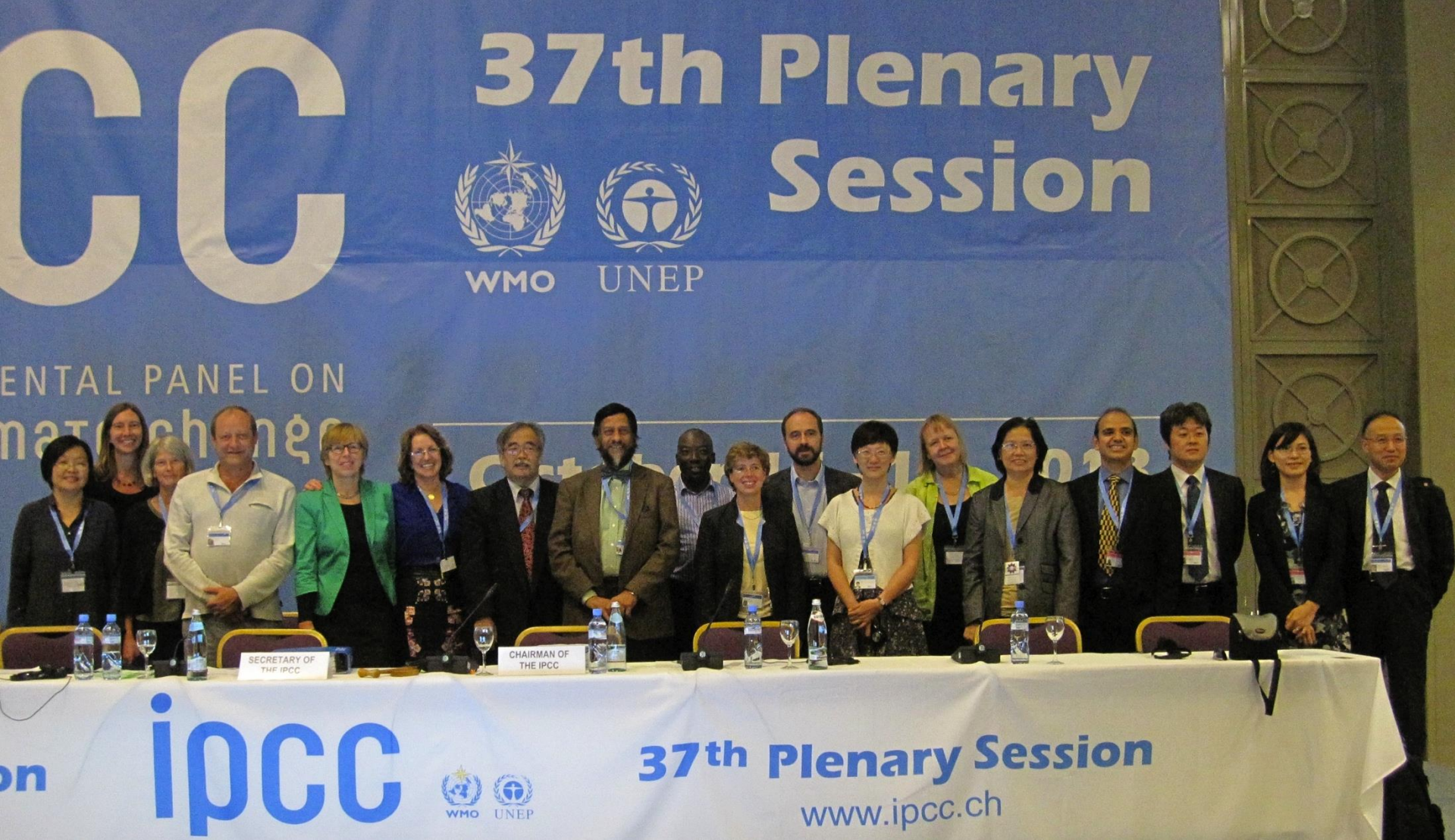
**The adopted Overview Chapter and accepted Full Report (pre-copy edit version) can be found on the IPCC website:**

**[http://www.ipcc.ch/scripts/\\_session\\_template.php?page=\\_37ipcc.htm](http://www.ipcc.ch/scripts/_session_template.php?page=_37ipcc.htm)**

**The *2013 Wetlands Supplement* will be published on the TFI website on 2 November. Please visit the TFI website for more information:**

**<http://www.ipcc-nggip.iges.or.jp/home/wetlands.html>**





**Thank you!**