Review of Application of GPG-LULUCF Guidelines for GHG Inventory by Annex I countries

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Countries selected

1. UK
2. Japan
3. Denmark
4. Italy

1. Croatia
2. Bulgaria

Key Questions

- **Application of Remote sensing for inventory**
  - **Limited application of RS by majority of the countries**
  - **Land use data for Inventory comes from National Forestry Statics or database, traditional sources,**
- **Treatment of disturbances**
  - **Disturbance is not seriously recognized / reported**
  - **Only Biomass burning considered and reported**
    - **BM burning partially reported by countries**
    - **Not all gases are reported**
- How are emissions forest degradation treated
  - **Forest degradation is not recognized & no method considered for GHG emission estimation**

Key questions contd.

- **Reporting of all C pools**
  - **Very few countries report for all C pools**
  - **Most report for AGB from national sources**
  - **No distinction made between litter and DW**
  - **Very often defaults used for BGB, DOM and SOC**
- **Organic soils:**
  - **Very limited reporting of organic soils**
  - **Limited separation of mineral & organic soils**

Key Questions

- **Critical EF for which region specific defaults needed**
  - Rates of gain and loss of biomass and SOC pools in lands subjected to conversion;
    - FL-GL, GK-FL, FL-CL, CL-FL, etc
  - SOC rate of change n FL-FL, GL-GL, Cl-CL, etc
  - DOM rate of change in FL-FL, L-FL

Major Conclusions

- **Definition; managed land not addressed?**
- **Representing Land areas – approaches used**
  - Approach-1 – adopted by most countries
  - National land use statistics / survey is the source of data on land use – traditional sources of land area
  - Limited use of Remote sensing
- **Limited implementation of uncertainty assessment associated with Approach used**
- **Land use change matrix for the year of inventory**
  - Most countries have not created LUC matrix,
  - Even when created – based on assumption or expert judgment on original and destination land use
  - Linear trend assumed

Key Category Analysis

- **Most countries have adopted KCA**
  - Some have used KCA but excluded LULUCF
- **Countries have adopted Tier-1**
  - Restricted largely to Land categories, not to gases
- KCA adopted to report which land categories are Key sources
- **But KCA doesn't seem to have led to any**
  - **increased effort for the Key Land categories;**
  - **Or adoption of higher tier methods**
  - **Methods are simply determined by availability of data**

Reporting Land categories

- **Many countries have reported the existence of different land categories; such as GL, WL, SL**
- **But not reported GHG for all land categories**
- **Most countries have not reported for SL, OL**
- **Most have reported for FL**
- **Many countries are unable to distinguish between**
  - **land remaining in the same category**
  - **land converted to that category**
- **Conversion from original land category**
  - **Based on assumptions –proportion al to area**

Uncertainty estimation

- Most countries have reported uncertainty estimates
  - some have estimated for all sectors excluding LULUCF
- Tier-1 approach adopted – most countries
- **Source of values for uncertainty estimation;**
  - IPCC default, expert judgment, assumption, field studies, model outputs
- **Estimates vary from 6 to 150%**

Tier used for inventory

- A combination of Tiers used
- Most countries use some components Tier-1
  - Majority adopt country specific for FL-AGB
  - IPCC default values for other C - pools
- Most countries do not seem to have data to completely shift to T2 or T3
- Higher tiers for FL and lower Tiers for other land categories
  - Tier-3 for FL category for CO2 emi/removal
  - Models used for SOC by many countries
- EF: country specific & IPCC default not determined by KCA, but by data avaialbility

QA/QC procedures

- Most countries claim QA/QC procedures routinely
- Very few provide adequate evidence for QA/QC procedures implemented
- Some countries are yet to extend QA/QC for LULUCF sector
- The agencies that generate data for other purposes are not aware of QA/QC procedures
  - QA/QC is Largely restricted to agencies making the inventory estimation after the data arrives

Transparency – explanation in NIR

- Only a few countries explain in NIR all the procedures, methods used, sources of AD & EF, Uncertainty estimation methods, QA/QC procedures, land use conversions, models used
- Transparency is poor for majority of countries
- Difficult for review teams to assess the quality of inventory
- Models are inadequately explained and low transparency

Inter-annual; variations

- Inter-annual; variations for LULUCF sector is very high, adding to uncertainty
  - Forest fire
  - Harvest levels
  - Improved data; area estimates, Growth data
  - News sources of data, changes in land use classifications

Forest Sector

- Dominant land use category for most countries
- Maximum effort and explanation given for FL
- **Most countries have attempted to distinguish FL-FL & L-FL**
  - L-FL is largely based on assumption, proportional allocation for original land categories, linear extrapolation
- **Land area data from National surveys, forest database, and in few cases census survey of FL**
  - Limited use of Remote sensing data
- Data for an inventory year extrapolated for 5 or 10 yr interval data
- Very few full scale NFI are in place

Stratification of Forests

- Majority of countries are unable to distinguish between
  - naturally regenerated
  - artificial plantations
- Most countries have stratified the forest area into different types and regions based on national procedures

Methods

- **Tier;** multiple or a combination of tiers used
  - Largely Tier 2
  - Tier 3 for some C pools
- **Method:** Countries have used both Stock change and gain-loss method
- **Model:** Some have models for estimating the CO2 emi / removal
- Methods used vary with the pool

Methods for pools

- AGB: NFI, field studies, C-Flow model, Questionnaire survey, default values from IPCC
- BGB: Default, field measurement
- SOC: models, default value,
- R:S Ratio; default, model derived, filed measurement
- **BEF**: Biomass survey, model, default,

Overall Assessment of LULUCF Inventory

		Japan	UK	Italy	Denmark
1.	Reporting for all land categories	-FL, CL, GL, WL, SL, OL (reported) - FL-FL, SL-SL (reported)	- FL, CL, GL, SL (reported) - WL, OL (IE, NE, NO) - FL-FL (IE, NO) - SL-SL (NO) - HWP (reported)	- FL, CL, SL, Gl - Yes - WL, OL – NO - HWP – NA	-FL, CL-CL, GL-GL, WL (reported) - SE, OL (Not estimated) - HWP : NE
2.	Reporting for land conversion	-Reported for all land categories -Approach 1 adopted	- Land converted to FL, CL, GL, SL - reported	-Yes	- L-FL, L-WL (reported) - L-CL, L-GL, L-SL, L-OL (NA, NO, NE)
3.	Reporting land-use change matrix	-LUC Matrix given	- Matrix reported - Data from country side survey and data from forest planting and deforestation	-LUC Matrix Reported - National land-use statistics	- LUC Matrix : Not given (2008) - LUC categories reported as NE, NA, NO
4.	Approaches used for land conversion	- Based on existing statistics and assumed proportions	- Country side survey – 1990 - LUC up to 2007 based on rolling forward from 1990 – using afforestation and deforestation data	- Annual transition; linear trend, based on assumption and expert judgment	- Not considered yet
5.	LULUCF - Source or a sink	- A sink (81 Tg)	- A sink (1.8 Tg)	- A sink (71 Tg)	- A sink (1.1 Tg)
6.	Dominant land category	- FL : 91.1% of removal	-Land converted to CL : Source - L-Fl : Sink	- FL Dominates; 88 % of removal	- FL-FL & CL-CL

Overall Assessment of LULUCF Inventory

		Japan	UK	Italy	Denmark
7.	KCA	- Conducted using Tier 1 & 2	- Conducted using Tier 3	- Conducted -Tier 1	- Not performed
8.	QA/QC	- QA/QC procedures implemented; Tier 1	- Implemented using Tier 1	-Implemented - described for FL only	- Partially implemented
9.	Uncertainty estimation	-Estimated for all land categories - Sector 6%	- Estimated	-Estimated - FL: 86% - Sector : 56 %	- LULUCF Sector not covered
10.	Method/Tier for Uncertainty	-Field study, expert judgement and default values - DOM/ SOC; Century model output variants	- Tier 1 & 2 methods	- Tier 1	-Tier 1 approach adopted – assumptions made (10-20%) - High uncertainty for EFs - Overall 15.6%
12.	Tier used for Inventory	-Methods : Tier 1,2 & 3 - EF : CS, D	- CS, D, T 3	-Tier 1,2 for methods - EF : CS, D	-AD : T 1, 2 & CS - EF: CS & DF - FL-Not described - CL – T 1, 2
13.	Use of T-3 model	- Century Model for SOC & DOM	- C-Flow Model	- Growth model used for growing stock & increment	- No T 3 models used

Overall Assessment of LULUCF Inventory

		Croatia	Bulgaria	Romania
1.	Reporting for all land categories	Reported only for FL Other land categories; NE / NO	-FL, CL, WL – reported - GL, SL, Ol; NE, NO	
2.	Reporting for land conversion	No land conversion reported	No land conversion reported	
3.	Reporting land-use change matrix	No LUC matrix	No LUC matrix	
4.	Approaches used for land conversion	Not relevant	Not relevant	
5.	Source or a sink	Sink 6.3 Tg	Sink 6.8 Tg	
6.	Dominant land category		FL-FL: 94% of	

Overall Assessment of LULUCF Inventory

		Croatia	Bulgaria	Romania
7.	KCA	Not conducted	Not implemented for LULUCF	
8.	QA/QC	Very limited	QA/QC; very limited	
9.	Uncertainty estimation	Value provided; 40-50%,	Not estimated	
10.	Method/Tier for Uncertainty	No details provided	Not relevant	
11.	Tier used for Inventory	T-1	Tier-1 EF: default	
13.	Use of T-3 model	None	None	

Forest Land- Forest land

		Japan	UK	Italy	Denmark
1.	FL-Area estimation-AD	- Based on existing forest data survey and National Forest Resources database – 5 years frequency	- Country side survey – 1990 rolling forward for 2007 based on forest planting and deforestation	- Linear trend projection based on data for; 1985-2002	- Forest Census based on data for; 1990 &2000
2.	Method for CO_2 emission/removal	- Stock change method (Tier 2)	- Carbon accounting model, C-Flow - Model calculates C gain and loss	- Model using growing stock estimates derived for 1985 & growth function	- Gain – loss method based on 1990 & 2000 Forest census and harvest data
3.	Tier used	- Tier 2	-Tier 3	- Tier 1, 2 & 3	- T 2 (CS)
4.	Method: Growing stock	- Tier 2	- C-Flow Model	- Estimates from sample measurements for 1985	- Growing stocks and increments obtained based on questionnaire and standard yield table functions
5.	Method: AGB	- Tier 2; yield tables (age Vs volume)	- C-Flow Model	- AGB extrapolated based on values using model with 1985 data	- Same as above
6.	Method: BGB	- Using root-shoot ratio	- C-Flow Model	- Using root-shoot ratio for different forest types	- Not given

Forest land – Forest Land

		Japan	UK	Italy	Denmark
7.	Method: BEF	-Biomass survey of dominant tree species - <20 years and >20 years	- C-Flow Model	- Derived nationally for different forest types	- 1.2 (broadleaves) &1.8 (conifers) from literature
8.	Method: R:S	- Biomass survey of dominant tree species	- C-Flow Model	- Derived nationally for different forest types	- From NFI (2002 to 2006)
9.	Method: DOM	- Tier 3 method; Century model	- C-Flow Model	- Calculated using dead mass conversion factor - IPCC DF	- From NFI (2002 to 2006)
10.	Method: SOC	- Tier 3; Century Model	- C-Flow Model	- Estimated using linear equation based on AGB	- From NFI (2002 to 2006)
11.	Uncertainty	-Field study, expert judgement & default values for AGB - DOM, SOC from century model output	- Approach 1 (error propagation) - IPCC default of 70% used for EF	-Tier 1: For 1985 C-stocks - AGB 42%, SOC 152% , overall 81%	- Partially estimated based on NFI
12.	QA/QC	- Tier 1 procedures adopted	- General QA/QC procedures adopted	-QC activities implemented - Land-use matrix, C values cross-checked	-QA for area implemented - QA/QC planned for future

Forest land – Forest Land

		Croatia	Bulgaria
1.	FL-Area estimation-AD	Croatian Forestry Plan	National data sources from State Forestry Agency
2.	Method for CO_2 emission/removal	Gain-Loss method	No methods mentioned
3.	Tier used	T1 & T-2	T-1
4.	Method: Growing stock	Country specific	National methods
5.	Method: AGB	No explanation	Default
6.	Method: BGB	Default	Default

Forest land – Forest Land

		Croatia	Bulgaria
7.	Method: BEF	National source; 1.15 for Coniferous 1.2 for Deciduous	Default
8.	Method: R:S	National source; 0.23 and 0.24 factor used	Default
9.	Method: DOM	Not reported	Not estimated
10.	Method: SOC	Not reported	
11.	Uncertainty	Reported; 30-50%	No uncertainty estimation
12.	QA/QC	QA/QC procedures implemented i- limited	Very limited or absent