



REPORTING emissions and removals from FORESTS: experience from LULUCF in Europe and challenges for REDD

Giacomo Grassi

European Commission - Joint Research Centre, Ispra (Italy)



Outline of presentation

- **The importance of a good reporting**
- **How reporting of Annex I Parties looks like?**
- **LULUCF reporting in Europe**
- **Which challenges for reporting REDD?**



1. The importance of a good reporting

Under UNFCCC, information reported in greenhouse gas (GHG) inventories represents an essential link between science and policy, providing the means to monitor progress made by Parties

In any system which foresees an accounting procedure - as in the Kyoto Protocol and in REDD mechanism - the information reported in a Party's GHG inventory represents the basis for assessing compliance with commitments (KP) or assigning incentives (REDD).



2. How reporting of Annex I Parties looks like?

An inventory of GHG anthropogenic emissions and removals has two parts:

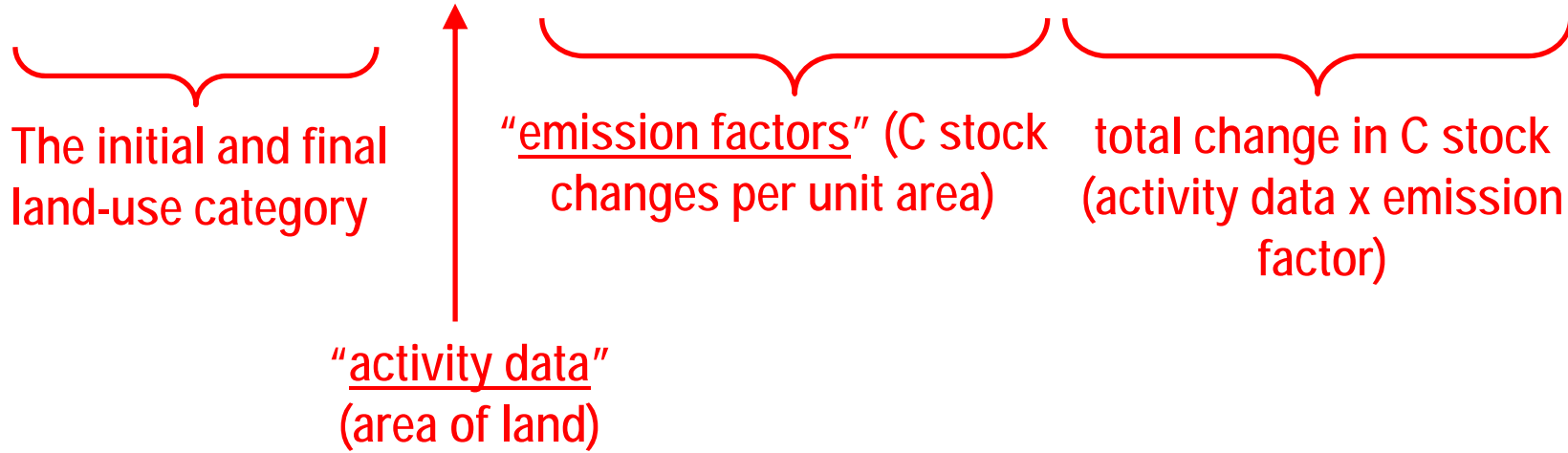
- **Reporting Tables** (Common Reporting Forms, CRF),
i.e. the numbers
- **National Inventory Report** (NIR), i.e. how the numbers
were estimated

The **reporting tables** of the sector **LULUCF** (Land Use, Land Use Change and Forestry) includes a general sectoral table

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	Net CO ₂ emissions/removals ^{(1), (2)}	CH ₄	N ₂ O
	(Gg)		
Total Land-Use Categories			
A. Forest Land			
1. Forest Land remaining Forest Land			
2. Land converted to Forest Land			
B. Cropland			
1. Cropland remaining Cropland			
2. Land converted to Cropland			
C. Grassland			
1. Grassland remaining Grassland			
2. Land converted to Grassland			
D. Wetlands			
1. Wetlands remaining Wetlands ⁽³⁾			
2. Land converted to Wetlands			
E. Settlements			
1. Settlements remaining Settlements ⁽³⁾			
2. Land converted to Settlements			
F. Other Land			
1. Other Land remaining Other Land ⁽⁴⁾			
2. Land converted to Other Land			
G. Other (please specify)⁽⁵⁾			
<i>Harvested Wood Products⁽⁶⁾</i>			
Information items⁽⁷⁾			
Forest Land converted to other Land-Use			
Grassland converted to other Land-Use			

...and many tables for each categories...

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		ACTIVITY DATA	IMPLIED CARBON-STOCK-CHANGE FACTORS (per unit of area)					CHANGES IN CARBON STOCK					Net CO ₂ emissions/removals
Land-Use Category	Sub-division	Area (kha)	biomass			dead org. matter	soils	biomass			dead org. matter	soils	
			Gains	Losses	Net change			Gains	Losses	Net change			
			(Mg C/ha)					(Gg C)					(Gg)
A. Total Forest Land													
1. Forest Land remaining Forest													
2. Land converted to Forest Land													





To ensure completeness, it is *good practice* to fill in all entries of the table. If data have not been estimated or cannot be reported, the following qualitative “notation keys” should be used:

Notation key	Explanation
NE (Not estimated)	Emissions and/or removals occur but have not been estimated or reported.
IE (Included elsewhere)	Emissions and/or removals for this activity or category are estimated but included elsewhere. In this case, where they are located should be indicated,
C (Confidential information)	Emissions and/or removals are aggregated and included elsewhere in the inventory because reporting at a disaggregated level could lead to the disclosure of confidential information.
NA (Not Applicable)	The activity or category exists but relevant emissions and removals are considered never to occur.
NO (Not Occurring)	An activity or process does not exist within a country.



The **inventory report** contains comprehensive and transparent information about the inventory, including:

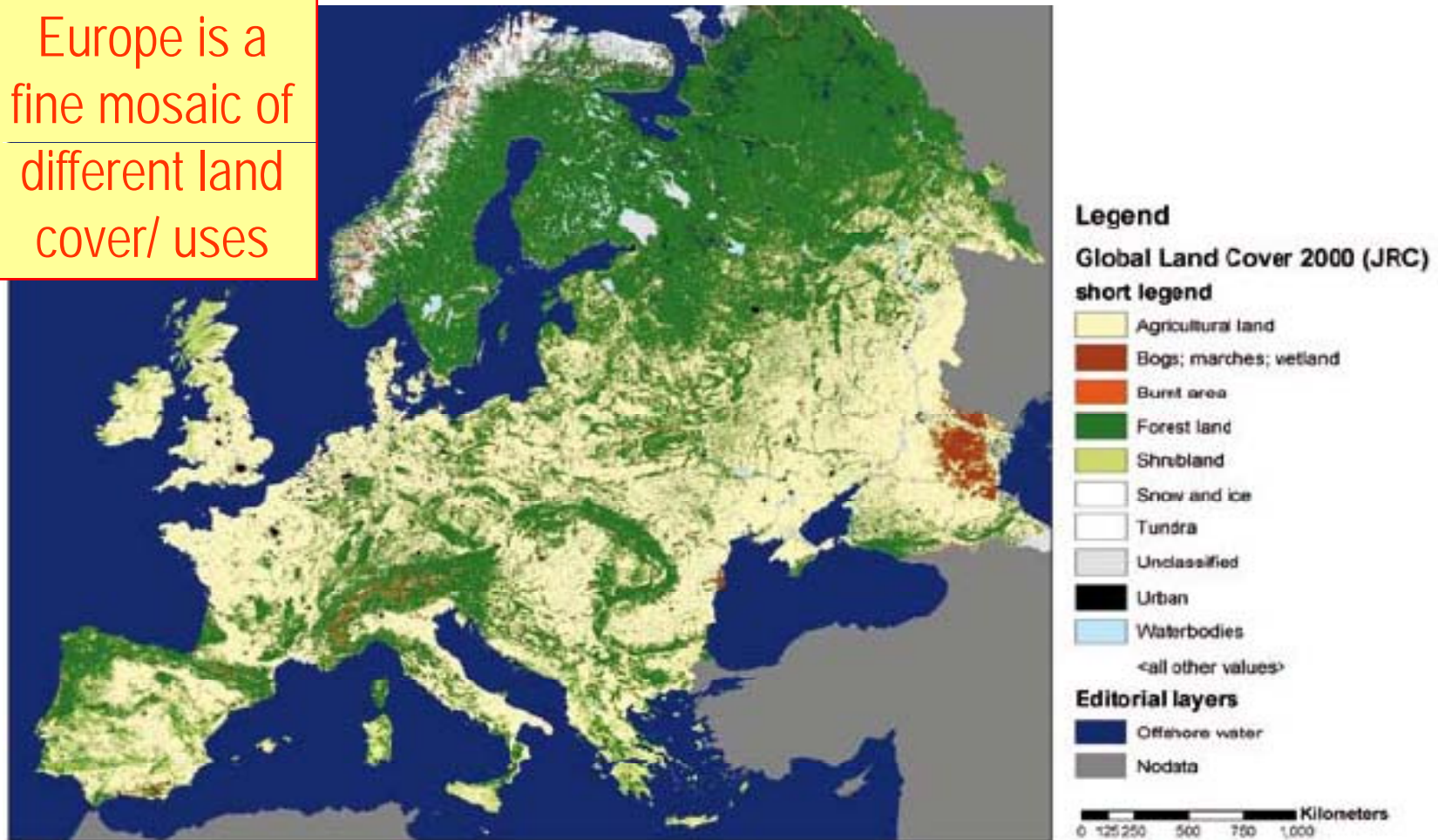
- Trends
- Description of methodologies used, land-use definitions and representation, assumptions, data sources and rationale for their selection, level of complexity (IPCC tiers) applied.
- Description of the key categories, including information on the level of category disaggregation used
- Information on uncertainties, time-series consistency, quality assurance and quality control procedures.
- A description of inventory preparation.

All of the relevant information should be archived to allow reconstruction of the inventory by the expert review teams.

3. Reporting the LULUCF sector in Europe

Almost all land in Europe is under more or less intensive management:
about half is agriculture, more than one-third is forests.

Europe is a
fine mosaic of
different land
cover/ uses





Overview

LULUCF is an overall sink (-) in most countries, i.e. accumulates carbon

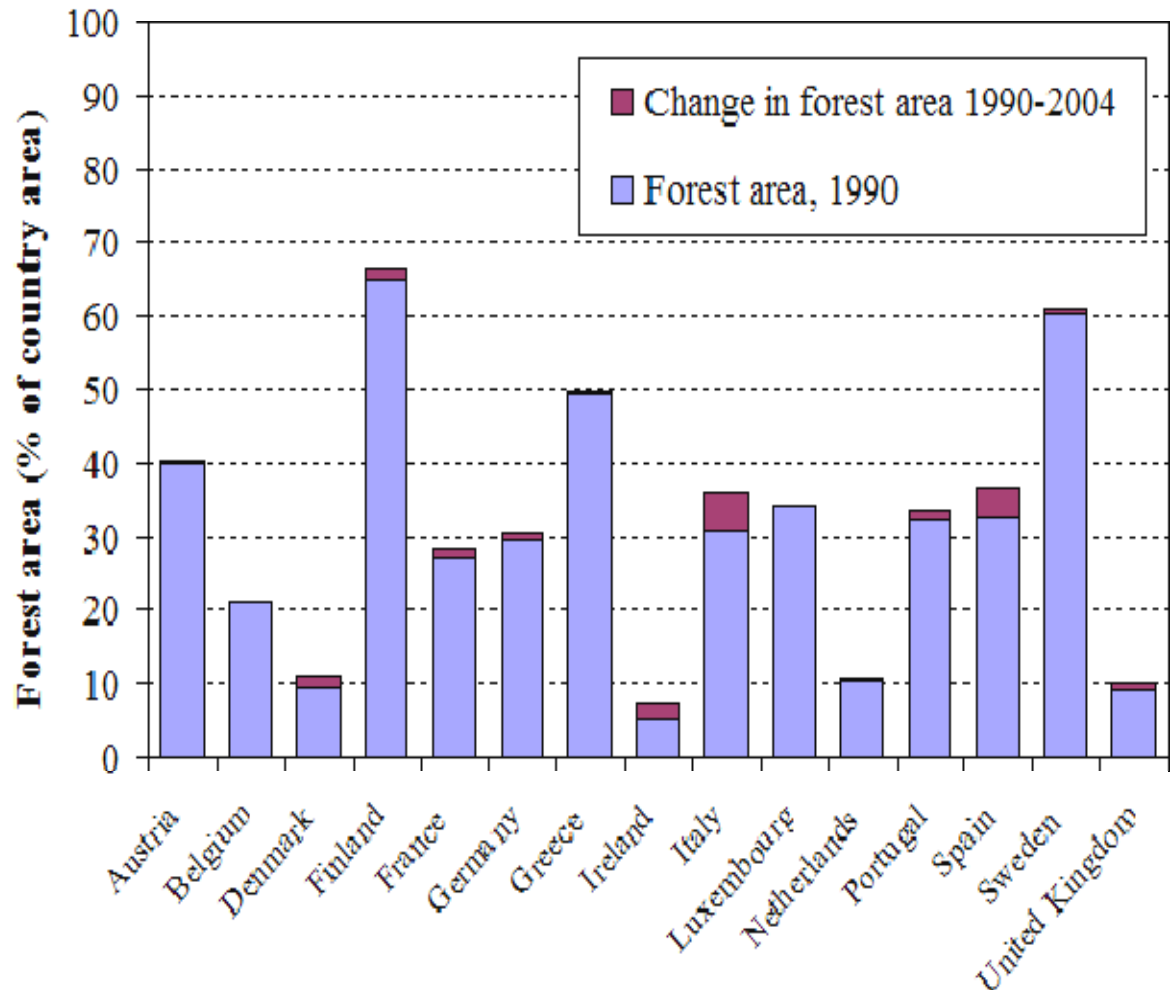
Overall, Forest land LULUCF offset 8.2% of the total EU-15 emissions, but only part of this may be accounted for under Kyoto!

Member State	Sector 5 over total emission excluding LULUCF	Category 5.A over total (Forest land)
	(a) (%)	(b) (%)
Austria	-18.2%	-18.7%
Belgium ⁽¹⁾	-0.8%	-2.0%
Denmark	-3.3%	-5.1%
Finland	-22.7%	-32.1%
France	-9.3%	-12.2%
Germany	-3.5%	-7.7%
Greece	-3.9%	-3.1%
Ireland	-0.1%	-1.0%
Italy	-18.1%	-15.9%
Luxembourg	-2.1%	-2.3%
Netherlands	1.1%	-1.1%
Portugal	-2.9%	-4.6%
Spain	-7.1%	-7.1%
Sweden	-23.6%	-26.7%
United Kingdom	-0.3%	-2.5%
EU15	-6.6%	-8.2%



The sink is due to:

- Forest expansion (deforestation is generally negligible)



- management: most EU forests are relatively young (i.e. still in an exponential growth phase) and are recovering from past overexploitation

- global change (likely): high nitrogen deposition, longer growing seasons, increased atmospheric CO₂



General methodological information

Where Activity Data and Emissions Factors for FORESTS come from?

FOREST DEFINITIONS: until few years ago...

Austria	All areas covered by woody plants if these criteria are met: a) minimum area 0.05 ha and b) minimum width ≥ 10 m and c) minimum crown coverage of 30%. Below only marginal lands (mountain, not relevant), row of trees (except wind belts), nurseries. Afforestation/Reforestation become 'forest' when 30 % is reached (tree/ha reported).
Belgium	All areas covered by woody plants if these criteria are met: a) minimum area 0.5 and 0.3 ha, b) minimum width ≥ 25 and 9 m, c) minimum crown coverage of 20% and 10%, and d) minimum height 3 m for Flanders and the Wallonia Region, respectively
Denmark	The forest is to be or should be planted with tree-species which can develop on the location into high yielding stands, that would say at least, to the height of 6 m; the area should be more than 0.5 ha and wider than 20 m (at least on average)
Finland	Forestry land is grouped into three classes according to site productivity: <i>forest land</i> , where the potential annual increment is at least 1.0 m ³ /ha; <i>scrub land (unproductive forest land)</i> , is mainly exposed bedrock and scree or mires, where the potential annual increment is at least 0.1 m ³ /ha but over 0.1 m ³ /ha; <i>waste land</i> , unless naturally treeless, produces less than 0.1 m ³ /ha
France	Either: measured trees (diameter > 7.5 cm) have a crown cover percentage at least 10% and there are more than 500 stems per ha that are viable trees (seedlings, plants or shoots, vigorous, well shaped and regularly distributed. Minimum area: 5 acres) or minimum average width 15 m. definition by IFN 2004.
Germany	Forest within the meaning of the FFI is any area of ground covered by forest trees, irrespective of the information in the cadastral survey or similar records. The term forest also refers to cutover or thinned areas, forest tracks, firebreaks, openings, forest glades, feeding grounds for game, landings, rides located in the forest, further areas linked to and serving the forest including areas with recreation purposes, open heaths and moorland, overgrown former pastures, alpine pastures and rough pastures, as well as areas of dwarf pines and green alders. Heath areas, meadows, alpine pastures and rough pastures are considered to be overgrown if the natural forest cover has reached an average age of five years and if a minimum area is covered by forest. Areas with forest cover in open pasture land or in built-up areas of under 1000 m ² , coppices under 10 m wide and the cultivated areas and ornamental brushwood as well as parkland attached to country houses are not forest within the meaning of the FFI. Watercourses up to 5 m wide are not forest. The continuity of a forest area.
Greece	includes: (a) areas larger than 0.5 ha or strips more than 10 m wide with tree crown cover (stand density) of more than 10% of the area, or areas with 250 trees of reproductive age per hectare, able to produce wood or other products and are not used for any other land-use (b) areas where trees are removed to below 10% of stand density and are not given for other land-use (c) reforestation areas (d) scrublands (areas covered by broadleaved evergreens).
Ireland	All areas covered by woody plants if these criteria are met: a) minimum area 0.5 ha and b) minimum width ≥ 40 m and c) minimum crown coverage of 30% (20) and d) minimum height 2 m e) minimum potential production $\geq 2-4$ m ³ /ha/yr
Italy	Forest area: a territory with one or more of the following characteristics: -) purpose to wood or non-wood goods production currently regarded as forestal; -) contain tree or bush stands with direct or indirect function; -) contain spontaneous tree or bush stands with naturalist, scenic or recreation function. Included are also areas temporarily without a stand because of natural occurrence. Not included: city parks, gardens, botanical gardens and other areas with only aesthetic function. Likewise not considered: forest nurseries, stands of walnut and filbert, manna ash stands, carob tree stands and every fruit tree stands. Excluded are also the tree rows and scattered trees in agricultural territories and along the roads. the minimum size is 2000 m ² , the minimum width is 20 m and the minimum crown coverage is 20%.
Luxemb.	All areas covered by woody plants if these criteria are met: a) minimum area 0.5 ha and b) minimum crown coverage of 10% and c) minimum height 5 m
Netherl.	Land with tree crown cover (or equivalent stocking level) of more than 20% and area of more than 0.5 ha. Trees should be able to reach a minimum height of 5 m at maturity in situ. Furthermore, a forest must have a minimum average width of 30 m.
Portugal	Area greater than 0.2 ha and more than 15 m wide. Includes exploitable forest grounds temporarily deprived of vegetation, and grounds related to forestry
Spain	Minimum area 0,25 ha, minimum crown cover 5% and minimum width 20 m
Sweden	Forest land is defined as land suitable for forest production, not used for other purposes, and with an average production higher than (or equal to) 1 m ³ per hectare and year during a period of 100 years. The minimum area is 0.25 ha.
United Kingdom	the minimum woodland area to be considered as forest area is 2 (0.1) ha. In general the minimum width for a woodland is 50 (16) m. Areas of scattered trees with distinct crowns constitute of woodland if the canopy covers more than 20% of the ground.

15 different definitions!

With the initial report for KP, some standardization occurred...

Table 11 EU-15 Member States' selection of threshold values for the forest definition for reporting under Article 3 paragraph 3

Member State	Minimum value for tree-crown cover	Minimum tree height	Minimum area for forest land area
Austria	30 %	2 m	0.05 ha
Belgium	20 %	5 m	0.5 ha
Denmark	10 %	5 m	0.5 ha
Finland	10 %	5 m	0.5 ha
France	10 %	5 m	0.5 ha
Germany	10 %	5 m	0.1 ha
Greece	25 %	2 m	0.3 ha
Ireland	20 %	5 m	0.1 ha
Italy	10 %	5 m	0.5 ha
Luxembourg	10 %	5 m	0.5 ha
Netherlands	20 %	5 m	0.5 ha
Portugal	10 %	5 m	1 ha
Spain	20 %	3 m	1 ha
Sweden	10 %	5 m	0.5 ha
United Kingdom	20 %	2 m	0.1 ha



How has forestry data been collected?

Country	Survey	Frequency of survey	Latest(s) survey
Austria	National Forrest Inventory, sample plot – based, 4 x 4 km grid across all of country	5-10 years	2000-2002
Belgium			
Denmark			ses were and 2000.
Finland			nal forest
France			
Germany			
Greece			
Ireland			
Italy			in the
Netherlands			
Portugal			
Sweden	Sample-based since 1983, with an area measured each year	5-10 years	Ongoing
United Kingdom	National Inventory of Woodland and Trees carried out between 1995 and 1999, combined with Forestry censuses data (combined with model feeded by yield table data)	Various	1999

Forest inventory is the primary tool to assess **forest areas** and **biomass stocks**. Other statistics (e.g. on harvests) and cadastral information also used.

The use of satellite data for estimating land use changes in EU is not as important as it will likely be for REDD.

The majority of MS used the default IPCC method for assessing changes in biomass (Gains-losses), but some used the stock change method or “mixed” methods.



Which Expansion Factors have been used to convert forest inventory biomass into carbon?

Member State	BECF / biomass function
Austria	until 2005: BEFs; 2006: biomass functions
Belgium	until 2005: a few factors; 2006: new revised factors
Denmark	conifers/stemwood-total: 1,8; broadleaves/aboveground-total: 1,2; wood densities by species
Finland	tabular data by species; will be replaced by biomass functions next year
Germany	data in various tables
Ireland	BEF of 2 for young forests, 1.4 for mature forests, dry density in the range 0.35-0.55
Netherlands	the COST E21 database was used
Portugal	tabular data by species
(Spain)	only some data for Estremadura in 2005
Sweden	tree-level functions are used
United Kingdom	mean values for three species



Why so many different definitions, methods, sampling strategies?

- socio-economic reasons
 - historical reasons
 - ecological reasons



This heterogeneity is a richness in term of biodiversity and culture,
but represents a challenge when developing an EU inventory!





COMPLETENESS: which subcategories and pools have been reported ?

Coverage of emissions (E) and removals (R) by subcategories (2005)

Joint Research Centre

Member State	Reporting category											
	Forest land		Cropland		Grassland		Wetland		Settlements		Other land	
	5.A.1. FL-FL	5.A.2. L-FL	5.B.1. CL-CL	5.B.2. L-CL	5.C.1. GL-GL	5.C.2. L-GL	5.D.1. WL-WL	5.D.2. L-WL	5.E.1. SL-SL	5.E.2. L-SL	5.F.1. OL-OL	5.F.2. L-OL
Austria	R	R	R	R	E	E		E		E		E
Belgium	R		E		E							
Denmark	R	R	E		E		E	R				
Finland	R		E		E			E				
France	R	R		E	E	R		E		E		E
Germany	R	R	E	E	E	R						E
Greece	R		R									
Ireland	R	E	R	E	E	R	E			E		R
Italy	R	R	R	E						E		
(Luxembourg)	R											
Netherlands	R	R		R	E	R				R		E
Portugal	R	R	R	E		R		E	E	E		E
Spain	R	R										
Sweden	R	R	E	R	R	R			R	E		
United Kingdom		R	E	E	E	R				E		

Coverage of C stock changes (I-increase, D-decrease, 0=no change) in the C pools (2005)

Member State	Reporting category																	
	Forest land						Cropland						Grassland					
	5.A.1. FL-FL			5.A.2. L-FL			5.B.1. CL-CL			5.B.2. L-CL			5.C.1. GL-GL			5.C.2. L-GL		
B	DOM	Soil	B	DOM	Soil	B	DOM	Soil	B	DOM	Soil	B	DOM	Soil	B	DOM	Soil	
Austria	I	I		I		I	D		I	I		D			D	D		I
Belgium	I	0	I	0	0	0	0	0	D	0	0	0	0	0	D	0	0	0
Denmark	I			I			I		D						D			
Finland	I	I	D						D						I			
France	I	D	0	I	I	I	0	0	0	D	D	D	0	D	0	D	D	I
Germany	I	0	0	I	0	0	D	0	D	I	0	D	0	0	D	D	0	I
Greece	I	D		I			I		D									
Ireland	I	I		I	I	D			D	D		D			D	I		I
Italy	I	I	I	I	I	I	I	0	0	I	0	D	0	0	0	0	0	0
(Luxembourg)	I	0	I															
Netherlands	I	I		I								I			D	D		I
Portugal	I	D	I	I	D	I	I	D	D	D	D	D	0	0	0	D	D	I
Spain	I			I														
Sweden	I	I	D	I	I	D	I	0	D	I	0	D	I	D	I	I	D	I
United Kingdom				I	I	I	I		D	D		D			D	I		I



UNCERTAINTIES

- **Forest area:** errors in the range 1 to 10 % for FL-FL, but more for L-FL (e.g. Austria reports an uncertainty of 50-100% for L-FL).
- **Volume and growth increment:** generally within 1–5 %. Volume and yield functions may sometimes be old. In Germany, the latest NFI revealed that measured increment was twice the one that had been expected using yield tables.
- **Harvested timber:** statistics are usually quite uncertain, but their quality is improving. Some countries have moved from the default method to the stock-change method, which makes this data unnecessary.
- **Expansion and conversion factors.**

Wood density data are mostly based on literature, sometimes are quite variable for the same species in different places. Germany estimated the standard error of wood density from 8.7 to 27.2%, depending on species.

Uncertainty of *biomass expansion factors* (BEF), used to expand wood stem volume/biomass to total volume/biomass, is mostly unknown, but potentially relevant. Most of the countries use only two expansion factors, one for deciduous and one for conifers.

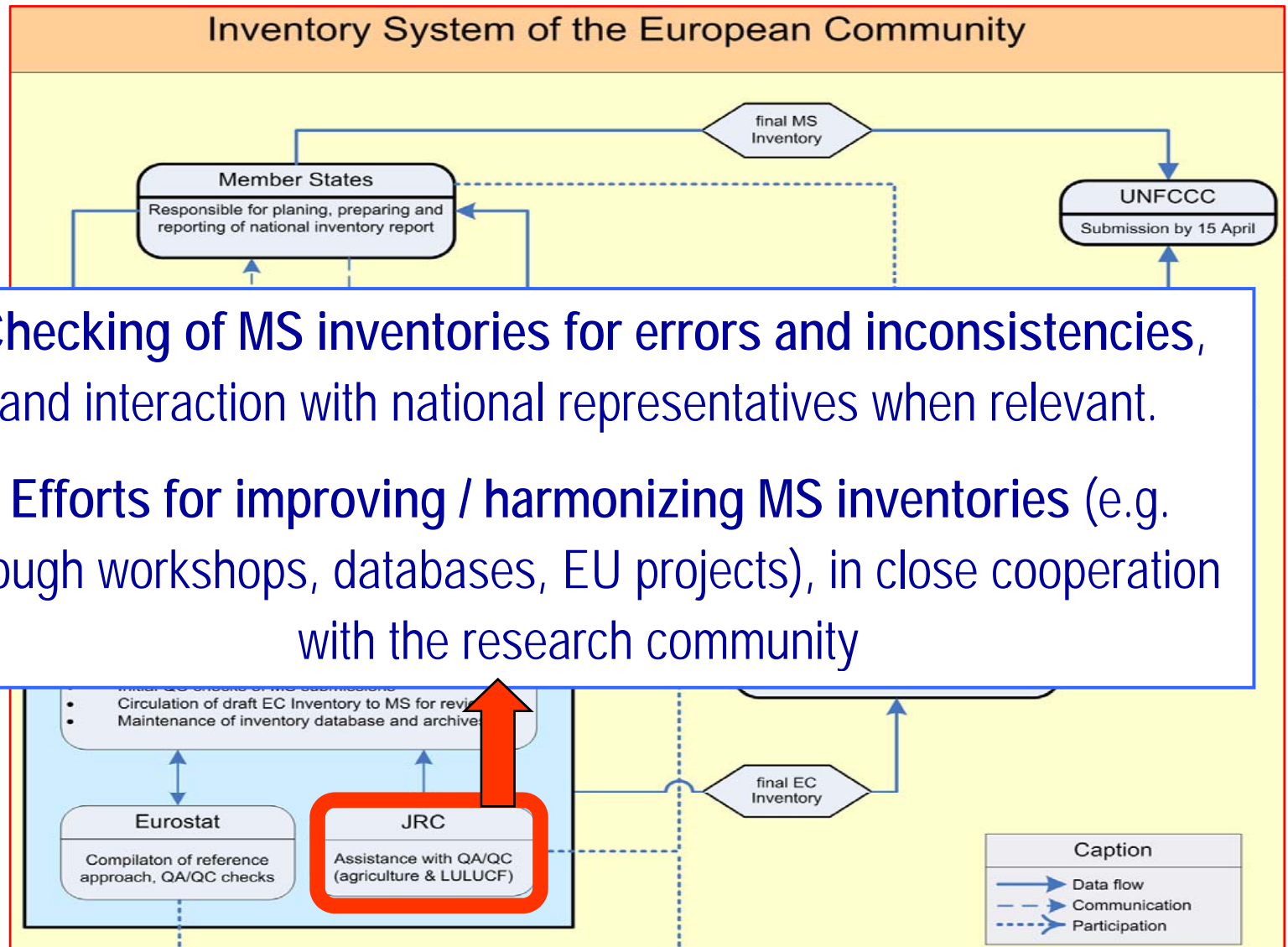


Improvements at Member State level

Considerable efforts have been made to:

- Include the requirements arising from UNFCCC/KP reporting in the design and implementation of the new/ongoing National Forest Inventories
- Improve and transform the NFI information (timber volume) into carbon stock change, e.g. developing new biomass functions instead of factors (e.g. Austria, Finland, Ireland), by measuring new data to improve representativity

Improvements at EU level



- Checking of MS inventories for errors and inconsistencies, and interaction with national representatives when relevant.
- Efforts for improving / harmonizing MS inventories (e.g. through workshops, databases, EU projects), in close cooperation with the research community



Some conclusion on LULUCF reporting in Europe

- Very heterogeneous forest situation
- Forest inventory is the primary tool to assess forest area and biomass stocks.
- Most current submissions to UNFCCC not fully complete, and uncertainty still rather high (and uncertain itself), but improvements will likely occur under KP

Which challenges for reporting REDD?

How a REDD reporting table could look like?

(example, not real table!)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES		ACTIVITY DATA	IMPLIED CARBON STOCK CHANGE FACTORS ⁽³⁾					IMPLIED EMISSION/ REMOVAL FACTOR PER AREA ⁽⁴⁾	CHANGE IN CARBON STOCK ⁽²⁾					Net CO ₂ emissions/ removals ⁽³⁾
			Net carbon stock change per unit area in:						Net carbon stock change in:					
Land-Use Category	Sub-division ⁽²⁾	Total area (kha)	biomass		dead organic matter		soils	biomass		dead organic matter		soils		
			above-ground	below-ground	dead wood	litter		above-ground	below-ground	dead wood	litter			
			(Mg C/ha)					(Mg CO ₂ /ha)	(Gg C)					(Gg CO ₂)
Total deforestation and degradation														
A. Total Deforestation														
1. Forest Land converted to Cropland	(specify)													
	(specify)													
2. Forest Land converted to Grassland	(specify)													
	(specify)													
.....														
B. Total Degradation ⁽¹⁾														



The REDD context

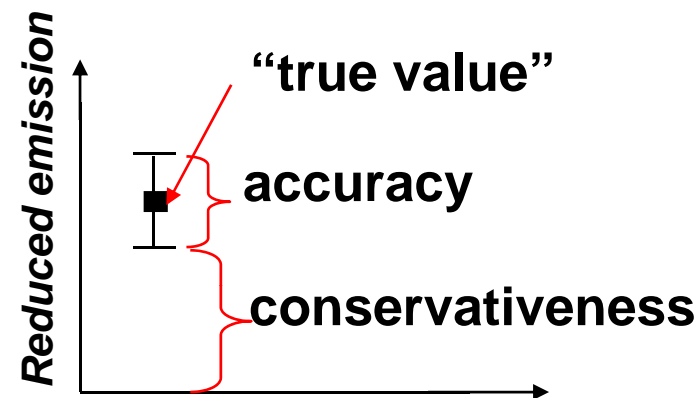
- The link to positive incentives requires scientifically robust estimate of REDD
- 5 UNFCCC reporting principles (transparency, accuracy, completeness, consistency, comparability)
- It is likely that many developing countries will encounter some difficulty in meeting the **completeness** and **accuracy** principles.
- Is it possible to set up a CREDIBLE and simple reporting REDD mechanism?

How to address the potentially incomplete and highly uncertain REDD estimates?

UNFCCC:

Accuracy: reduction of emissions neither over nor underestimated systematically.

Conservativeness: reduction of emissions should not be overestimated

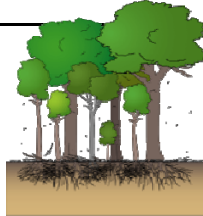



In the context of REDD the KEY point is to have **conservative estimates**, i.e. be sure that – despite incompleteness and uncertainties in inputs data - the “reduced emissions” are not overestimated (or at least the risk of overestimating is minimized)

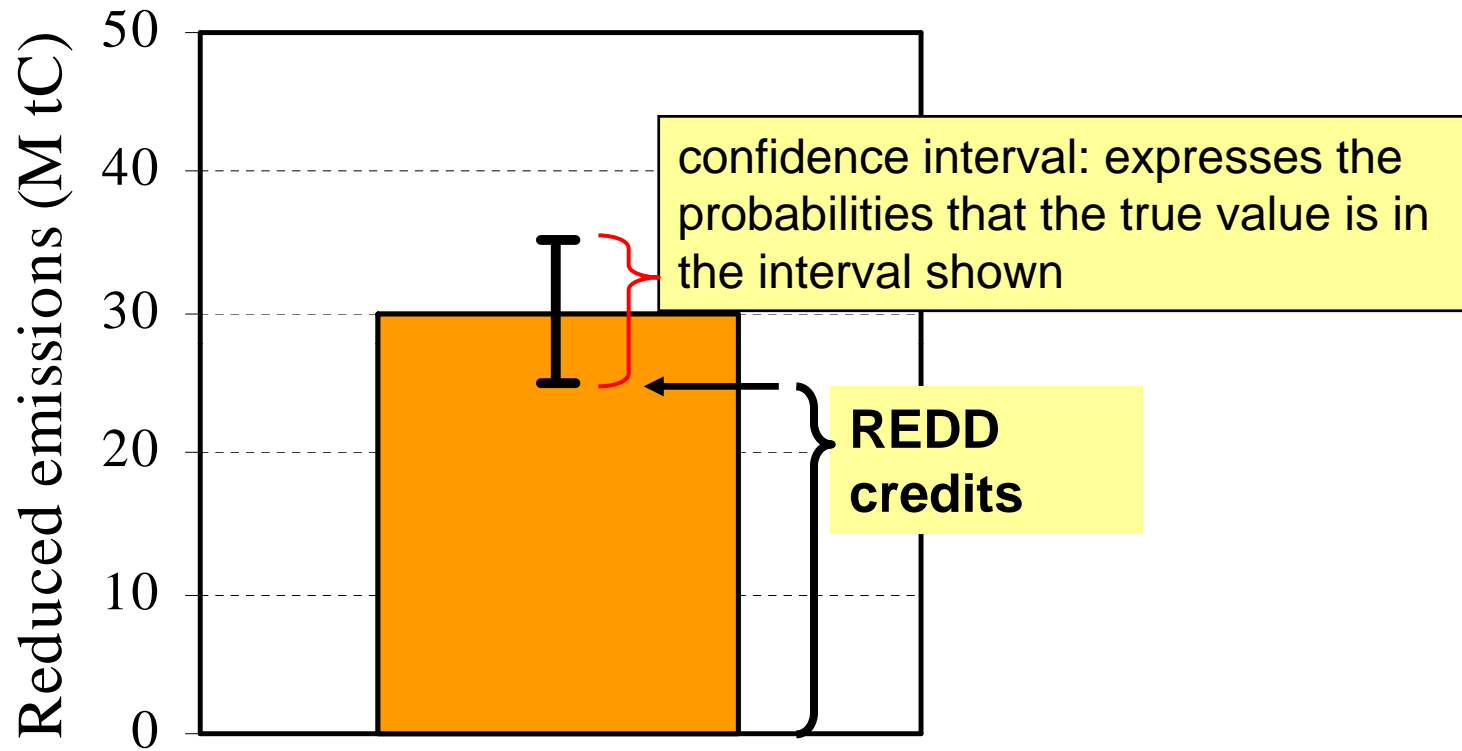
Two Examples:

1. Incomplete estimate (e.g. soil C emissions not estimated)

Joint Research Centre

	Area deforest. (ha x 10 ³)	Carbon stock change (t C/ha)		Emissions (area deforested x C stock change, t C x 10 ³)	
		Biomass	Soil	 Biomass + SOIL	 only Biomass NO SOIL
Reference level	10	100	50	1500	1000
Assessment period	5	100	50	750	500
Reduction of emissions (reference level – assess. period, t C x 10 ³)				750	500
				estimate accurate	estimate not accurate, but conservative

2. Uncertain estimate (risk of low credibility)



A possibility could be that the Party itself report conservative REDD estimates, based on the **quantified uncertainties** (realistic at least for activity data). This would mean reducing (slightly) the REDD “credits”, but making them more credible!

Conclusions

REDD estimates should be as complete/accurate/precise as far as practicable. However, once the Party has made all possible efforts to reduce uncertainties, **conservativeness principle** may help to:

- *Increase the credibility of any REDD mechanism*, i.e. decrease the risk of economic incentives to not-real reductions of emissions, even starting with uncertain data
- *Reward the quality of the estimates*: more accurate/precise/complete estimates could translate in higher REDD values (more incentives)
- *Allows flexible monitoring requirements*: if conservativeness is satisfied, Parties could be allowed to choose themselves the level of accuracy to reach, depending on their own cost-benefit analysis.
- *Stimulates a broader participation*, i.e. allows countries to join REDD even if they cannot provide very accurate/precise estimates.
- *Increases the comparability of estimates across countries*



“To start to roll, a snowball does not need to be perfectly round”

if REDD starts with conservativeness, accuracy will follow

Thank you!