EUROPEAN FOREST INSTITUTE

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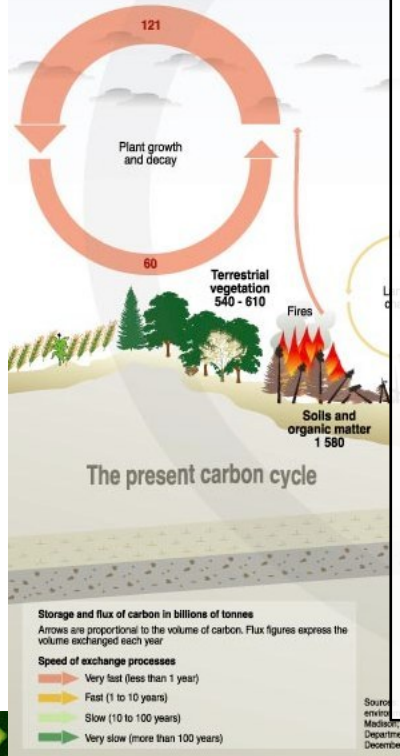
Monitoring carbon emissions from forests and wood products

Session on *Standards for GHG Emission Inventories*, BIPM workshop, Paris 30.6. – 1.7. 2015

The Global Carbon Balance



Forests and GHG emissions:

1. Carbon emissions from deforestation are responsible for 12% of global annual emission (Achard et al. 2014. GCB 20, 2540-2554)
2. Forests are a major sink of GHG and currently accumulate globally a large fraction of the 2.5 GtC yr-1 land carbon sink (LeQuere et al. 2015)
3. Additional forest carbon mitigation measures include carbon in HWP and substitution effects

System boundaries are crucial

- Protecting carbon stores in existing forests sounds convincing, but what counts in the end are the GHG emissions to the atmosphere. If forest protection constrains the use of other forest carbon mitigation strategies, the whole system response can be in the worst case an increase of GHG emissions!
- There is a lot of research on management effects on forest carbon sequestration, but carbon sinks in Harvested Wood Products are less investigated.
- To provide solid decision-support to policy makers, substitution effects are equally important to incorporate in the analysis!

1. Monitoring carbon emissions from deforestation and forest degradation

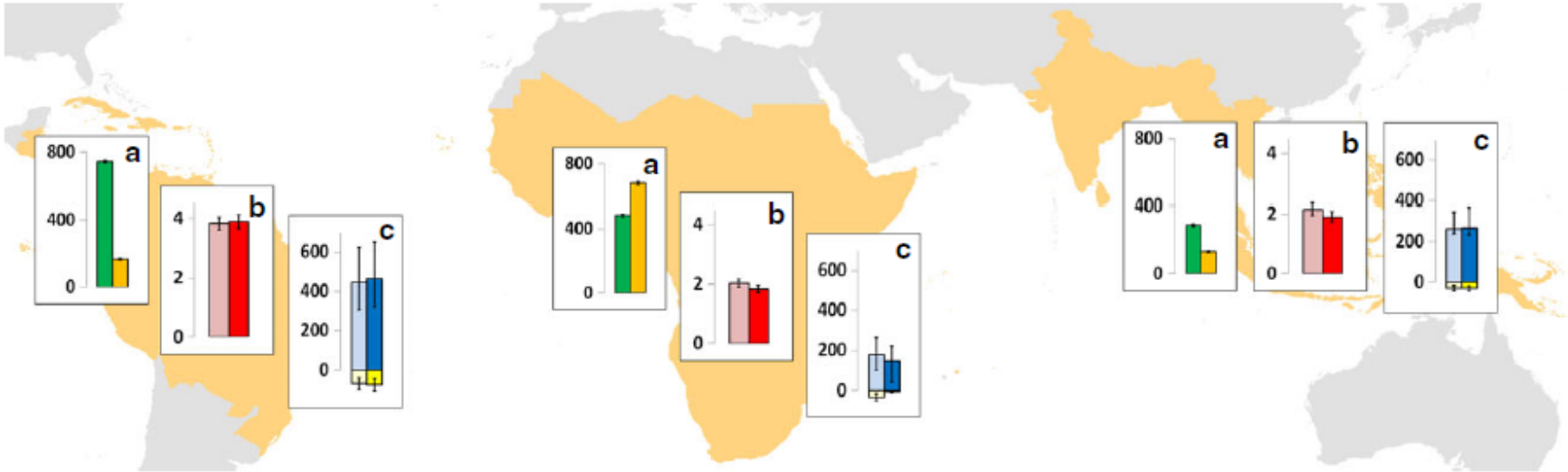


Fig. 4 Continental charts showing (from left to right): (a) area of forest cover (green) and other wooded land (orange) for year 2010 in million ha, (b) annual gross loss of forest cover for 1990s (pink) and 2000s (red) in million ha yr^{-1} and (c) annual gross loss of carbon losses from changes in forest cover and other wooded land for 1990s (light blue) and 2000s (dark blue) with removals from forest regrowth (yellow) in million tC yr^{-1}. Ranges represent statistical standard error for (a) and (b) and maximum–minimum estimates for (c).

Achard et al. 2014. *GCB 20, 2540-2554*

1a. Monitoring carbon emissions from deforestation and forest degradation

State of the art:

- Forest cover change is derived from remote sensing data series (e.g. from the MODIS sensor (Hansen et al. 2013) or LANDSAT images (Achard et al. 2014))
- Forest cover change information is linked with biomass maps to estimate carbon fluxes

➡ Biomass data for tree cover and other wooded land for tropical forests are of variable quality and improved forest inventory data are needed in many countries

2. Measurement of the forest carbon stock

2006 IPCC Guidelines for
National Greenhouse Gas Inventories
Volume 4
Agriculture, Forestry
and Other Land Use

- Methods are well established how to report GHG emissions from forests
- Because of the UNFCCC reporting, many countries have improved their national forest inventories and data coverage has improved

ipcc
INTERGOVERNMENTAL PANEL ON climate change

2013 Revised Supplementary Methods and Good Practice Guidance Arising from the Kyoto Protocol

Task Force on National Greenhouse Gas Inventories

2a. Measurement of the forest carbon stock – reporting practices

State of the art:

- Basis are national forest inventories: many countries have moved to statistical sample plot based inventories that are much more reliable than stand inventories for forest planning purposes. (Tomppo et al. (eds.) 2010. National Forest Inventories - Pathways for common reporting. Springer, 612 p.)
- Many countries have well established reporting procedures: e.g. revised inventory cycles (with each year subsets of plots measured) allow annual carbon budget reporting
- However, comparison of reported data within Forest Europe between subsequent reports (SoEF 2011 => SoEF 2015) for the same year (e.g. 2010) reveals surprising differences of sometimes more than 20% (G-J. Nabuurs, pers. communication)

3. Forest carbon mitigation through increased carbon sinks in Harvested Wood Products (HWP)

Importance of HWPs

- The average HWP sink in Europe from 2000 to 2012 was 44.7 Mt CO_2 yr^{-1}. => **10%** of the sink in EU forests and ≈**1%** of the total EU GHG emissions.

- By 2030, with a constant harvest scenario, the HWP sink is expected to saturate (Pilli et al. 2015. *Carbon Balance and Management* ***10***:*6*)
- => no substitution considered; no increased bioeconomy development…

Bioeconomy development – an opportunity for forest-based carbon mitigation

The biggest consumer of wood in Europe is the construction sector.

Expanding the use of wood in construction could create larger HWP carbon sinks!

Foto: M.Lindner

Metla House, Joensuu

One of the largest wooden office buildings in Finland

Fotos: Metla/ Luke website

No standard method established yet for HWP carbon reporting! Voluntary reporting for KP, first commitment period

7 of 43 Annex I countries reporting HWPs carbon in 2014


Australia

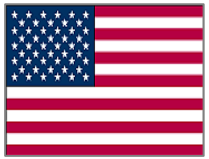

Canada


Finland


Latvia


Portugal


UK


USA

Approach	SC	P	SC	P	P	P	P
Tier	3	3	3	2	2	3	3

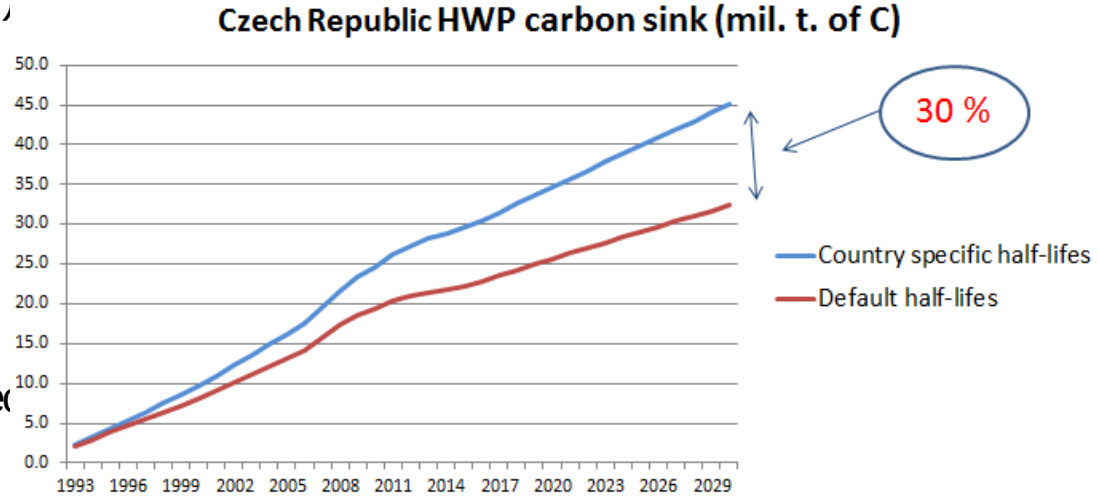
SC – stock change approach
P – production approach

Source: Skog K. 2014, IUFRO World Congress, Salt Lake City

Choice of methods and data has quite strong implications for the HWP carbon sink estimate

- Moving from default values to country – specific data on wood products can result in much larger HWP carbon sink potential (cf. possible increase of share of wooden buildings...)

Ongoing work in the CASTLE projec
(Jasinevicius et al. unpublished)



Example of Finland: some data available on HWP

HWPs were divided into two groups

- (sawn wood, wood-based panels and round wood for long-term use, e.g. poles (based on real inventory data) and
- paper products (estimated using the flux data method)

(Finland's NIR 2010).

4. Forest carbon mitigation through energy and material substitution and cascade use of wood

- Increased use of wood as building material substitutes considerable amount of fossil energy, because materials like concrete, aluminium and steel require a lot more energy in the production process (Gustavsson & Sathre 2011. Climatic Change **105**, 129-153)
- Cascade use of wood maintains the HWP carbon pool without fresh biomass use, thus expanding the life-time of the wood fibres. After the end of life of wood products, they can be used to produce energy, substituting once more fossil fuels

(Keegan et al. 2013. Biofuels, Bioproducts and Biorefining **7**, 193-206)

4a. Forest carbon mitigation through energy and material substitution and cascade use of wood

State of the art:

- Comparative LCA studies are available to compare products and materials
  (e.g. Sathre, R., O'Connor, J., 2010. Environmental Science and Policy **13**, 104-114)
- Very poor data situation on existing pools and the use of wood in secondary wood products (e.g. in the construction sector).
  => difficult to quantify substitution effects at regional or national level
- Recycling rates are only reported for recovered paper (but not how much is used)

Examplified substitution effect

Wälludden building

Case-study building:
Wood frame

Built in Växjo, Sweden 1995-1996

- Production of wood building material uses significantly less energy and emits less carbon than the production of reinforced concrete material.
- Comparing two functionally equivalent buildings made with a wooden frame and a reinforced concrete frame, the **manufacture of material for the wooden building used 28% less primary energy** and **emitted 45% less carbon than the manufacture of materials for the concrete building**.

Sathre & Gustavsson 2009, Applied Energy **86**, 251-257

Data needs to quantify substitution effects

Example of using wood in construction to substitute other materials

- Existing pools and current share of building materials in the construction sector
- Statistics about construction of buildings should not only record number of multi-storey and single-family houses, but also the type of building with information on building materials
- Materials used for construction/ maintenance of houses and infrastructure elements should be categorised and expressed in volume but not monetary values (like in most cases)

In which sector are wood products consumed?

Wood products Germany (2007) -

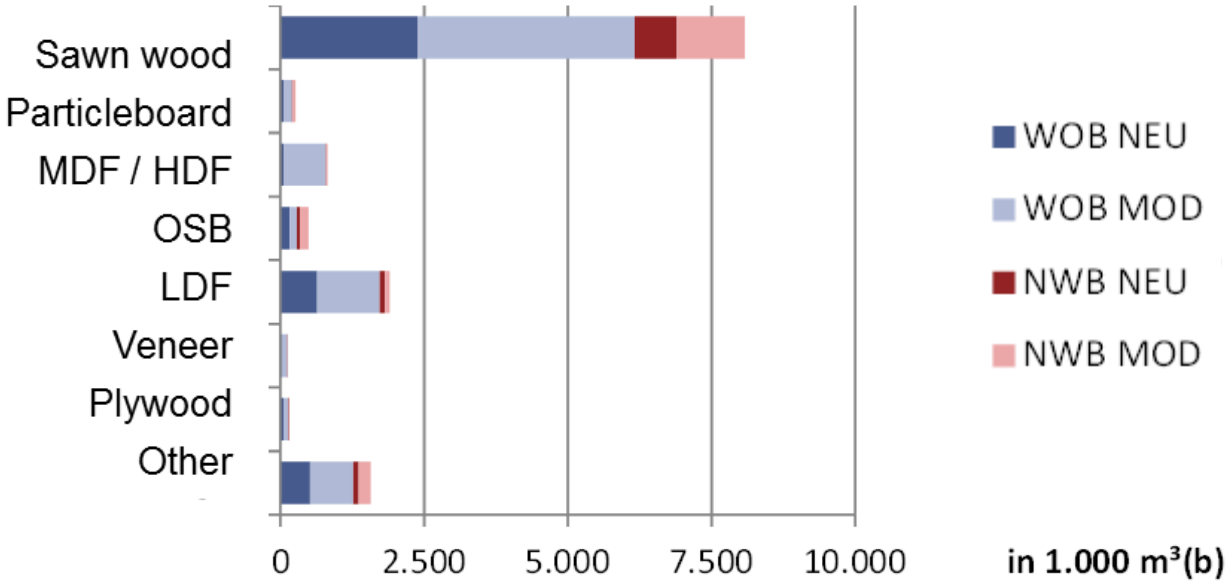
Analysis of end-use sector distribution

Products / end-use sectors		in % Wood
	Construction	53.5
	Furniture	27.5
	Packaging	14.8
	Other	4.2
Σ	total in M m³	39.1

Mantau & Bilitewski 2010: Stoffstrom-Modell-Holz 2007, Rohstoff-ströme und CO2-Speicherung in der Holzverwendung, Forschungsbericht für das Kuratorium für Forschung und Technik des VDP, Celle, 75 p.

Wood use in construction

Semi-finished wooden products in 1.000 m³(b)



WOB = residential **NEU = New buildings**
NWB = non-residential **MOD = Remodelling**

Data for Germany 2012

For other countries such data is not available

Mantau U, Döring P, Hiller D (2014): Holzeinsatz im Bauwesen - Verwendungsstrukturen nach Gebäuden und Gewerken. in: http://http://www.ti.bund.de/media/publikationen/thuenen-report/Thuenen_Report_09.pdf

Outlook – what would improve the data situation?

Volumes of primary (semi-finished) HWPs according to their use:

- Sawn-wood is mainly used for construction, furniture or packaging (EURO pallets). For example, especially in East European countries up to 10% of sawn-wood is used for EURO pallets, but is reported under the category of sawn-wood
  =>life-time varies from 6 to 90 years
- Pulp is used for paper products and viscose =>life-time varies
- Wood-based panels used for construction and furniture =>life-time varies
- Industrial residuals (chips, slashes, sawdust's…) and recovered paper used for production of energy or for primary wood products =>life-time varies

More desirable output figures

- **Volumes of secondary HWPs.** Since there are many products, ideally they can be grouped according to the Combined Nomenclature or larger groups, like:

1. Paper (carton, paper boards ...)
2. Furniture (indor, outdor...)
3. Carpentry (windows, doors, stairs …)
4. Houses (wooden frame, log houses…)
5. Infrastructure elements (electricity poles, fences, bridges…)
6. Flooring (parquet, laminate…)
7. Industrial residuals (chips, slashes, sawdust…)

Summary

- Forests can help mitigating climate change through reduced deforestation and forest degradation (REDD), increased forest carbon storage, increased carbon sink in harvested wood products, and through indirect substitution effects
- For each of these mitigation options there are different data needs
- Besides forest inventories, more efforts should be directed to collect information about wood product utilization; e.g. production figures of main wood product categories (Construction, Furniture) should always be reported not only on a monetary basis, but also as volumes

Thank you for your attention!

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Science-policy in action: the role of European forests

13 October 2015, Brussels

First part: **Towards Paris 2015: How can the forest sector contribute?**
International Press Centre, at 9:00-13:00

Second part: **ThinkForest in the forest: biodiversity and forest management**
Brussels City Forest, at 13:00-16:45