



The forest Carbon Budget Model as potential verification tool of MS GHG inventories

Roberto Pilli, Giacomo Grassi, Giulia Fiorese

**JRC technical workshop 2015
26-27 May 2015 Arona (Italy)**

- Since 2010, JRC is working to develop an in-house model capacity to estimate the EU carbon budget at country level for each MS
- After a preliminary analysis, the Carbon Budget Model (CBM) developed by the Canadian Forest Service was selected as potential tool
- Between 2010 and 2014 the CBM was:
 - successfully adapted to specific forest management conditions in Europe e.g. uneven-aged forests;
 - validated at regional level;
 - applied in one EU country case-study to estimate the C balance for Forest Management and Afforestation, including natural disturbances;
 - linked to FAO harvest statistics to provide consistent estimates on HWP mitigation potential
 - applied to 26 EU MSs



What is the Carbon Budget Model ?

The Carbon Budget Model (CBM) ...

*...simulates the carbon dynamics
of above- and belowground biomass
and DOM forest pools ...*

(Kurz et al. 2009)

CBM INPUT requirements

ESSENTIAL:

NFI or Management plan data:

Forest area

Age classes

Increment

Volume

REQUESTED:

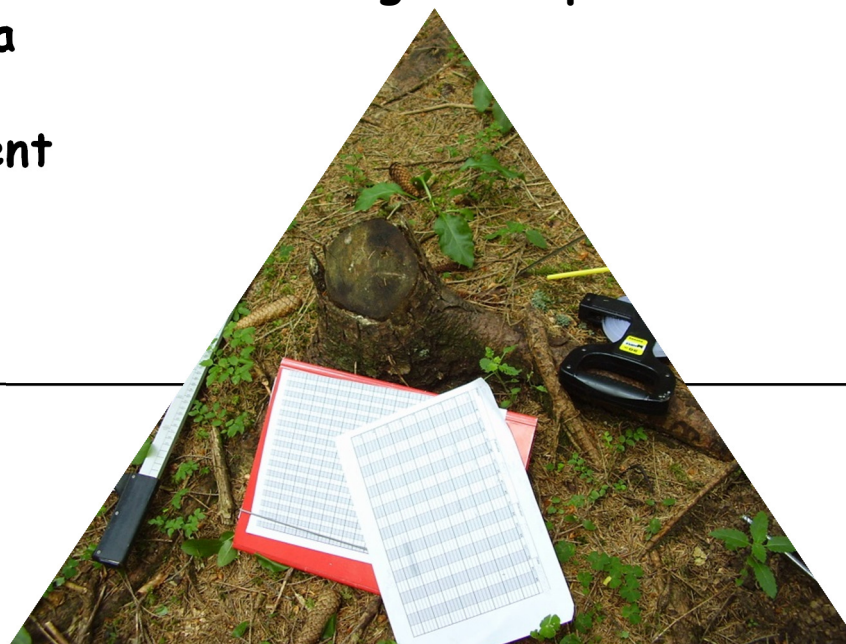
Harvest demand by:

- Conifers/Broadleaves
- Ind. RW/Fuelwood

USEFUL:

Other information:

- Silvicultural treatments
- Natural disturbances
- Etc.



State of the art ...

Spatial scale

26 EU countries at NUTS1 - 2 Level

Temporal resolution: 1 yr

Historical period: at least from 2000 → 2012

Basic Model assumptions

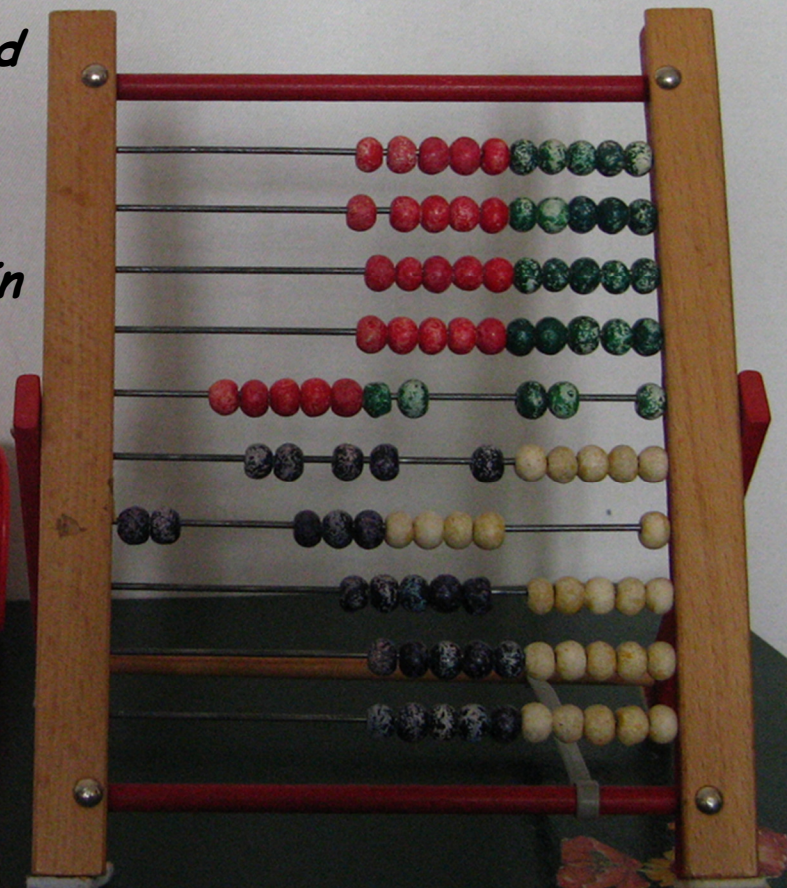
- Forest Management area*
- Land use change: Afforestation & deforestation*
- Natural disturbances: Fire & storms et al.*
- HWP → based on FAOSTAT data*



What we learned ...

comparing CBM estimates with GHGI data → Countries with ...

- A. good match both in the trend and the level*
- B. good match in the trend but not in the level.*
- C. good match in the level but not in the trend*
- D. no match ...*





CBM outputs ...

Example A good match both in the trend and the level

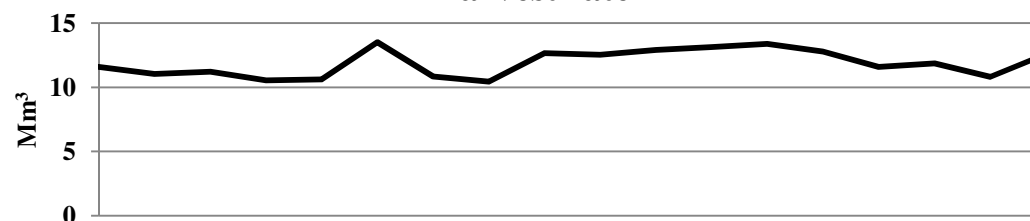
MODEL ASSUMPTIONS

Harvest + Fire disturbances

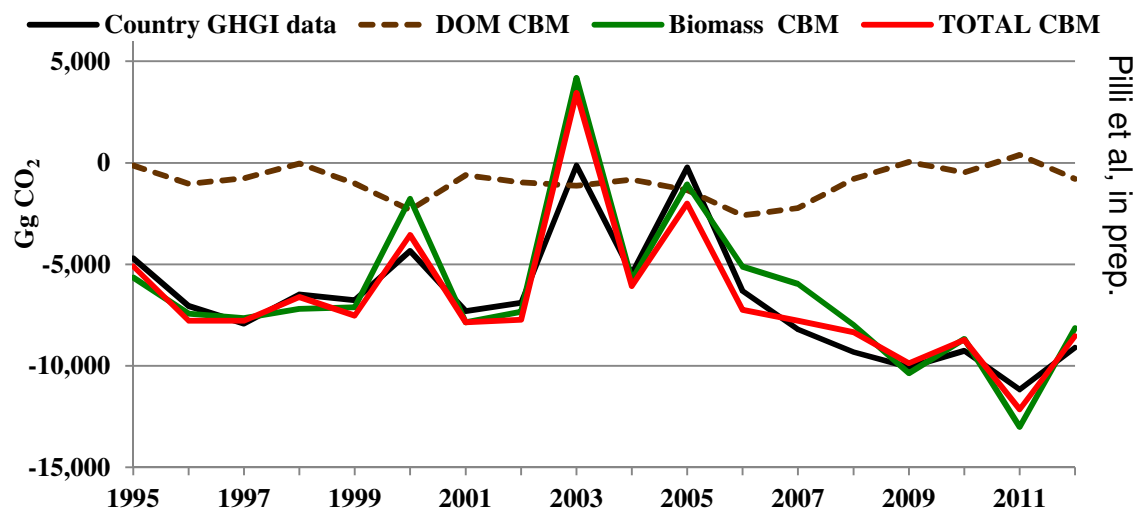
MODEL OUTPUT

- *Good match between CBM data - Country GHGI data*
- *Good match between CBM fire emissions - Country data*

Harvest rate

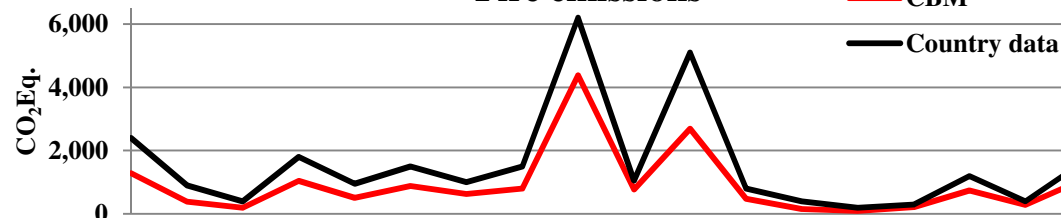


FM C stock change including HWP, deforestation and natural disturbances

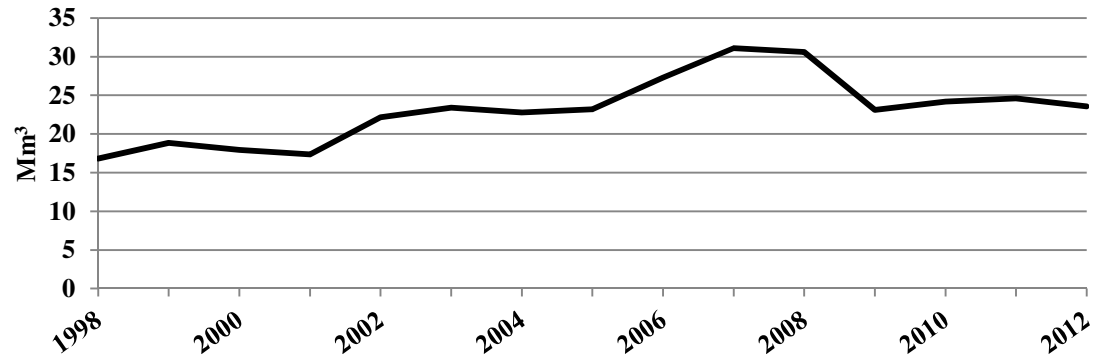


Pilli et al, in prep.

Fire emissions



Harvest rate



CBM outputs ...

Example B good match in the trend but not in the level

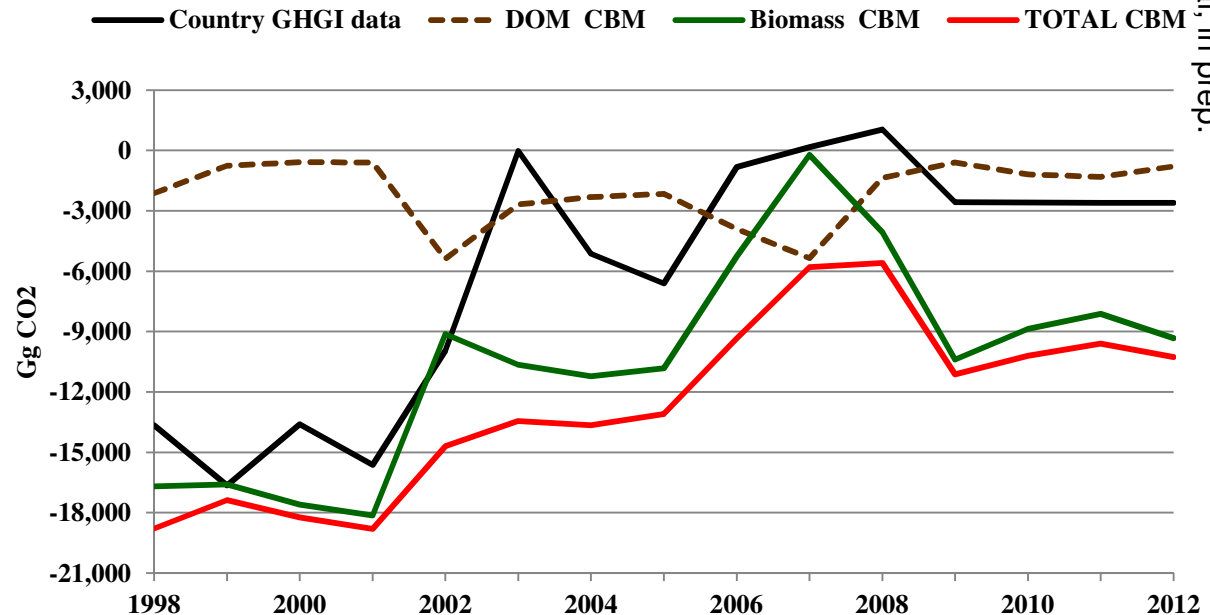
MODEL ASSUMPTIONS

**Harvest + Storms +
Insects attacks**

MODEL OUTPUT

- Differences on inter-annual variations due to natural disturbances
- Different level after 2008

FM C stock change including HWP, deforestation and natural disturbances



Pilli et al., in prep.



CBM outputs ...

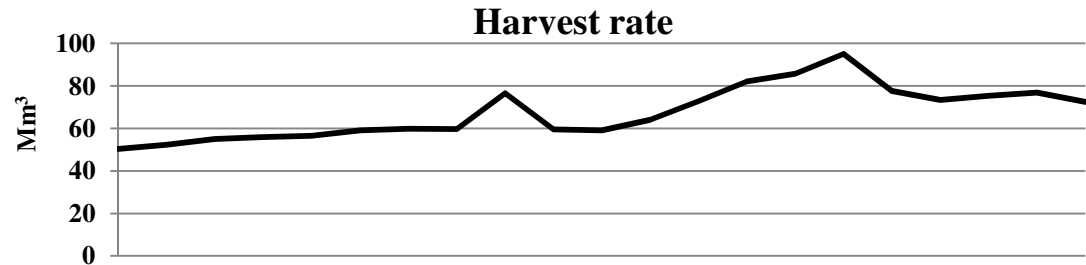
Example C good match in the level but not in the trend

MODEL ASSUMPTIONS

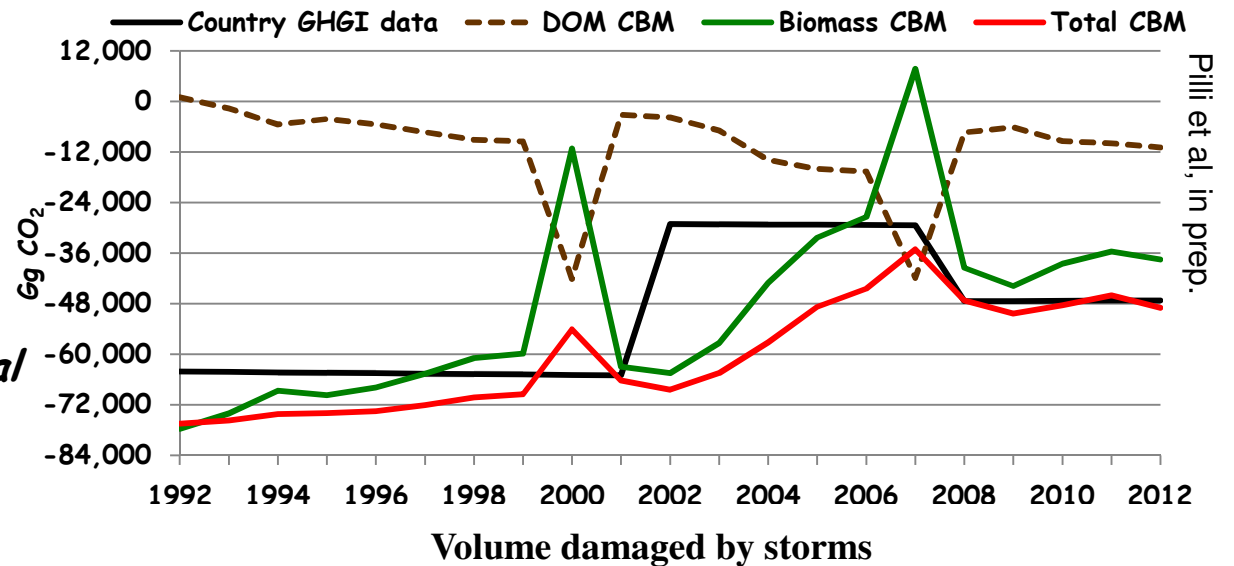
Harvest + Storms

MODEL OUTPUT

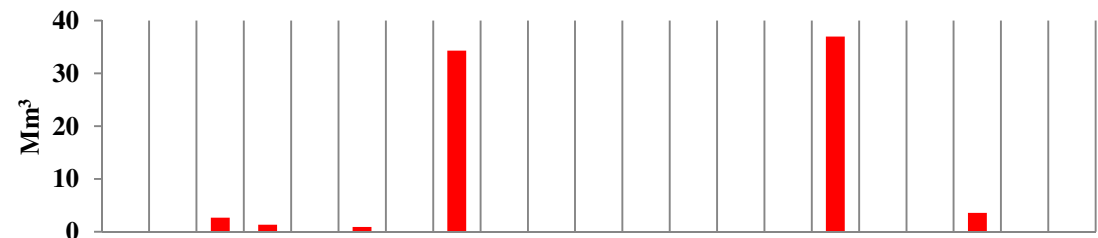
- Differences on inter-annual variations due to natural disturbances
- Different accounting approach



FM C stock change including HWP, deforestation and natural disturbances



Pilli et al, in prep.





*CBM outputs ...
Example D no match ...*

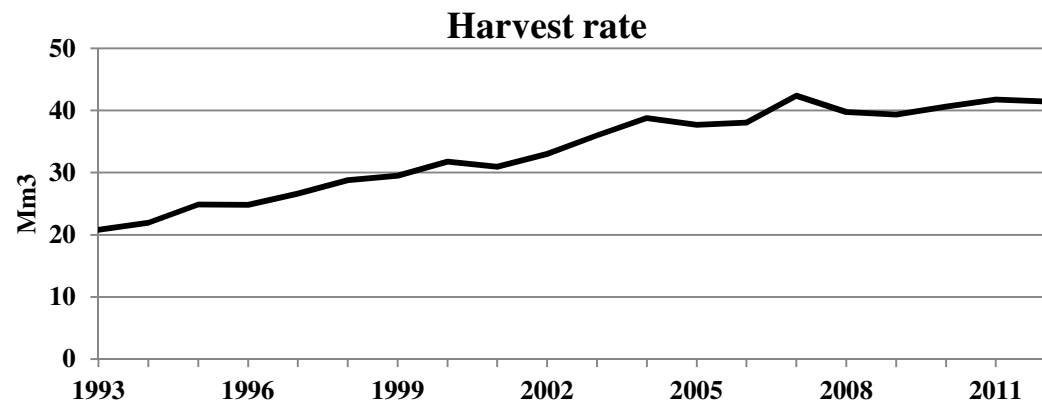
MODEL ASSUMPTIONS

Harvest

*No relevant disturbance
reported by country*

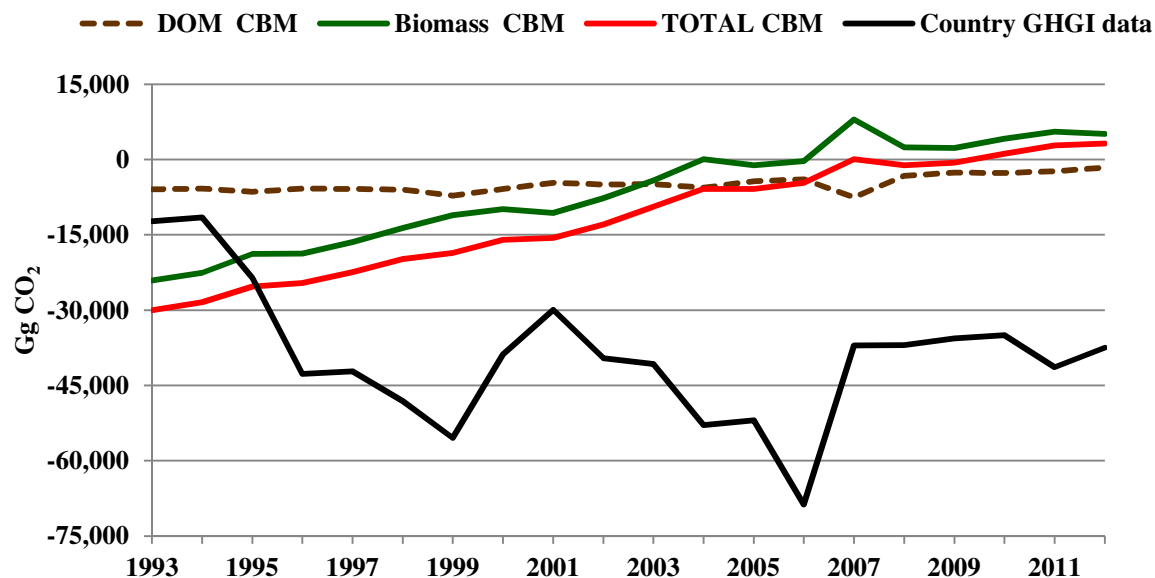
MODEL OUTPUT

- *Opposite trend between
CBM - Country GHGI data:*
- *CBM: decreasing sink with
increasing harvest*
- *Country data: increasing
sink with increasing harvest*



FM C stock change including HWP and deforestation

Pilli et al., in prep.



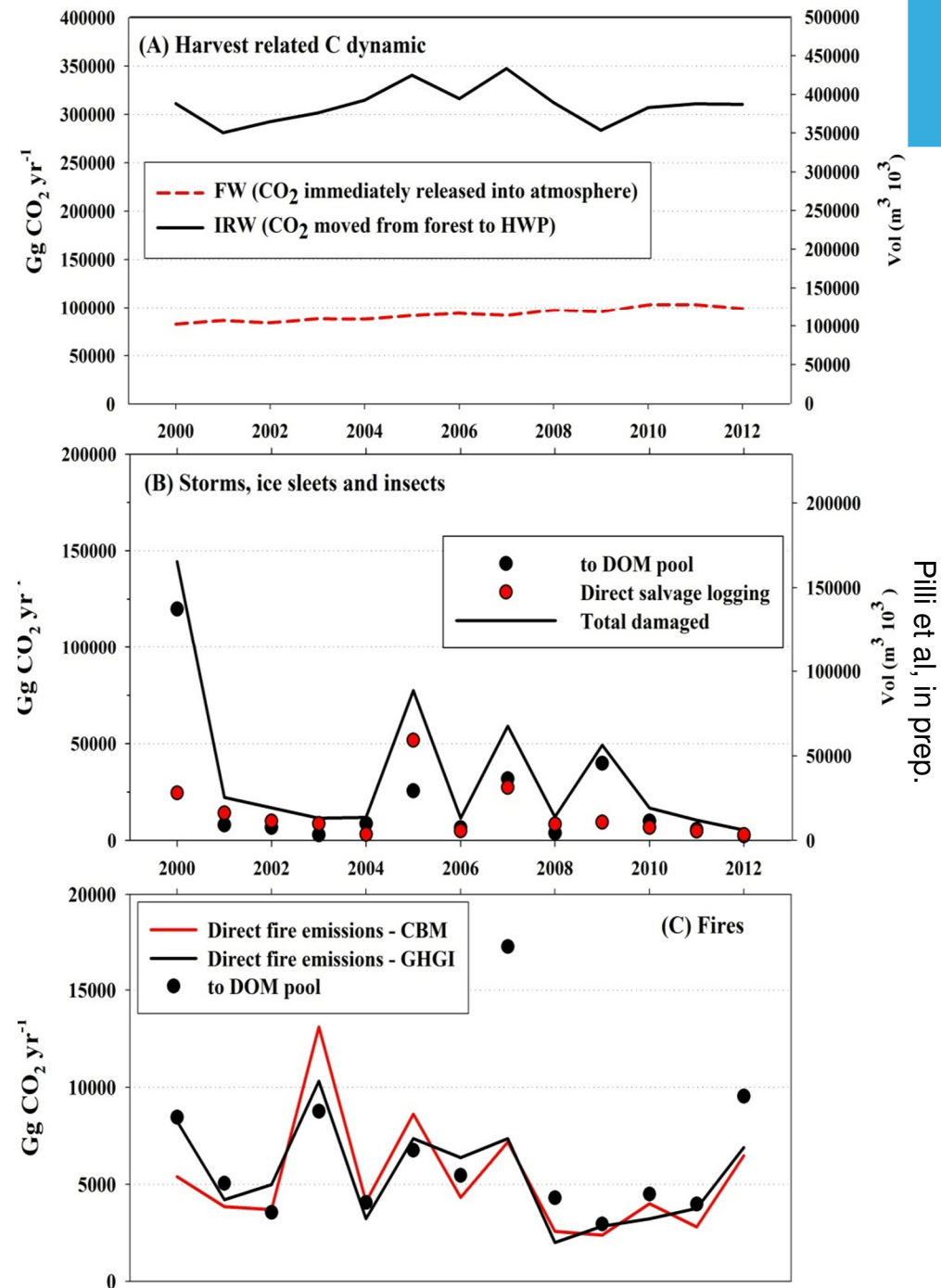
What we learned ...

comparing CBM estimates with GHGI data → Countries with ...

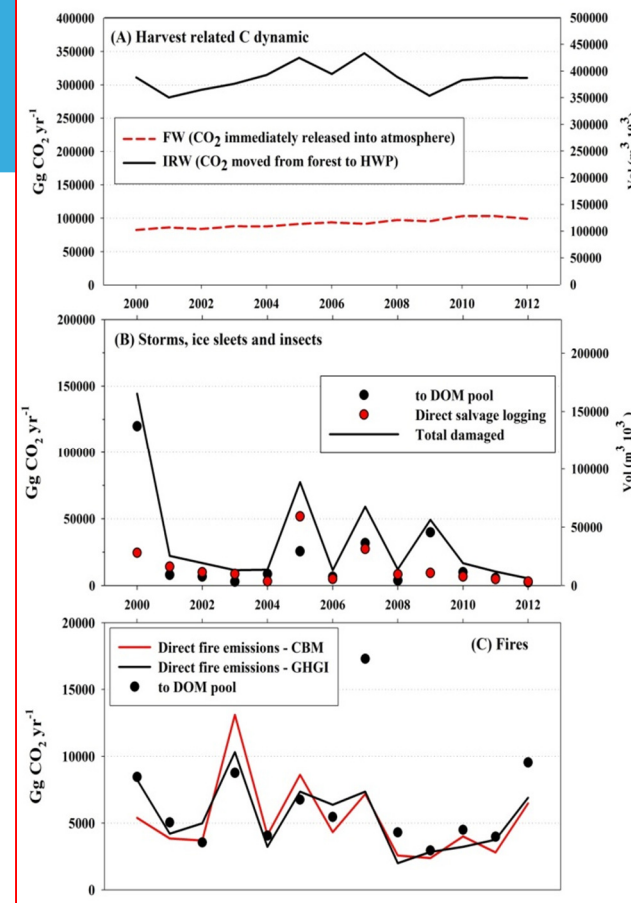
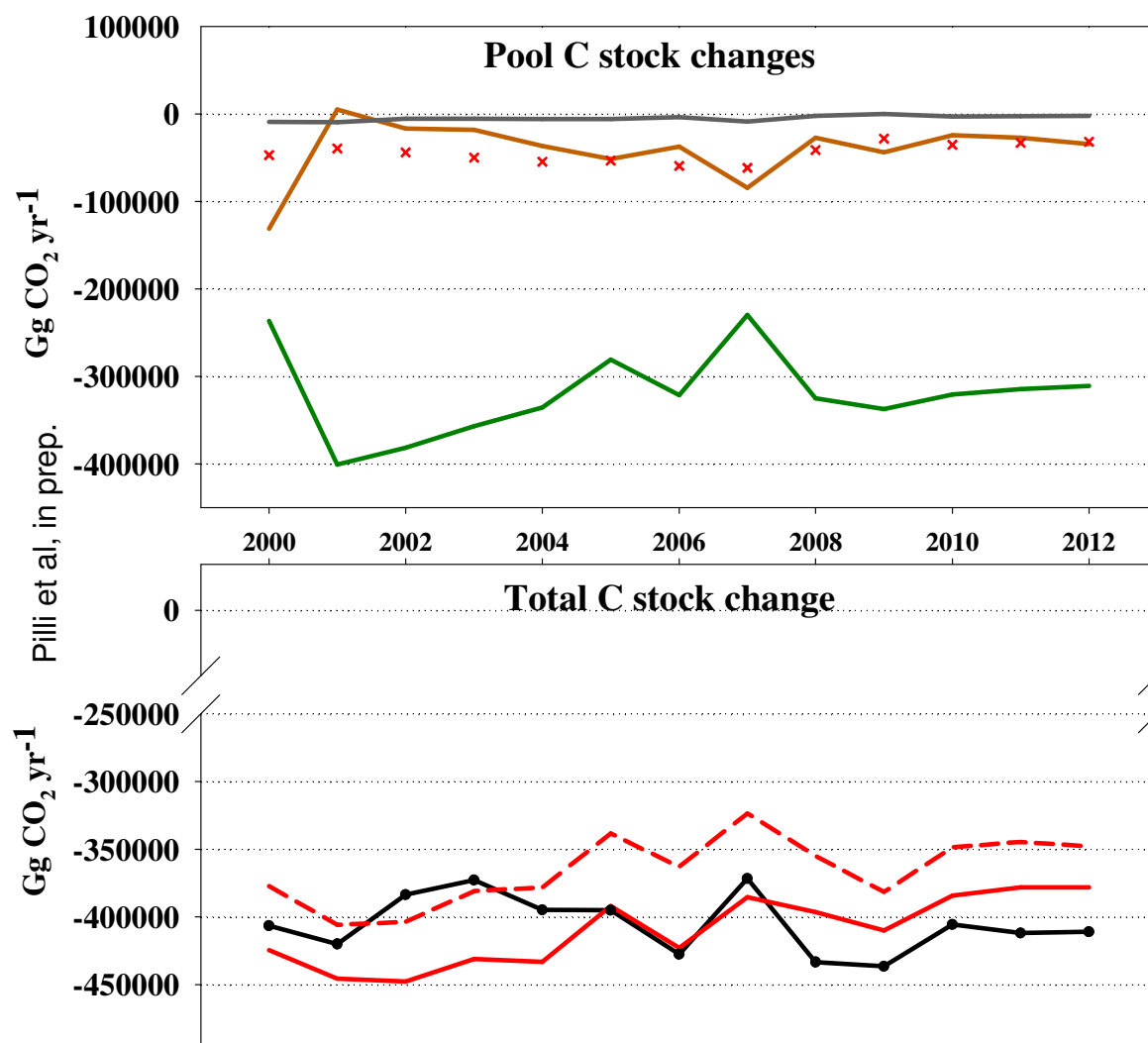
- A. good match both in the trend and the level → 9 countries*
- B. good match in the trend but not in the level: different conversion factors, different input data, etc. → 5 countries*
- C. good match in the level but not in the trend: country-specific circumstances (e.g. the country uses the stock-change method to report emissions/removals) or differences in input data used for our analysis. → 5 countries*
- D. no match: additional analysis and/or updated input data → 7 countries*

CBM outputs ... Overall EU MODEL RESULTS

- *Harvest C dynamic further distinguished between IRW (to HWP pool) and FW (to atm.)*
- *Storm, ice sleets and insects: including salvage logging and residues to DOM → no direct emission*
- *Fires: direct emissions to atmosphere + burned biomass residues to DOM*

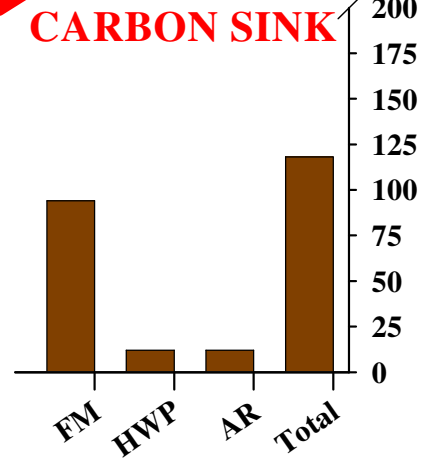
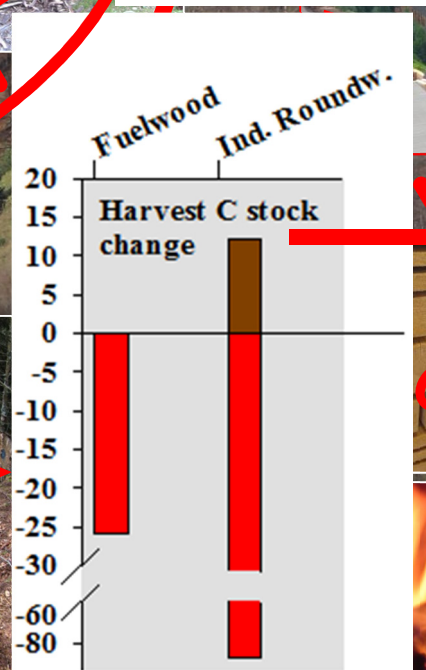
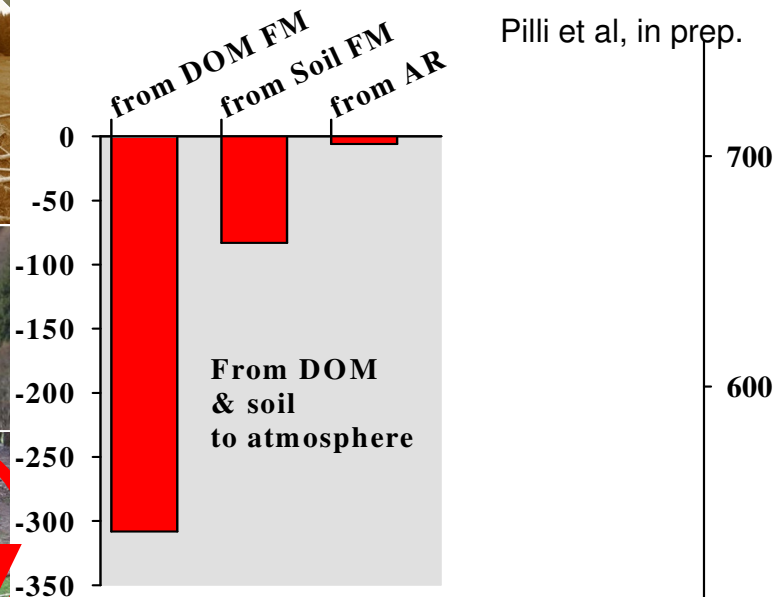
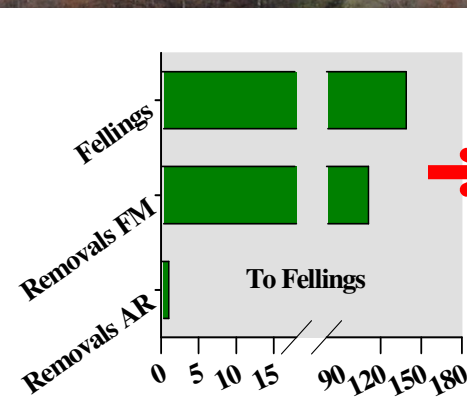
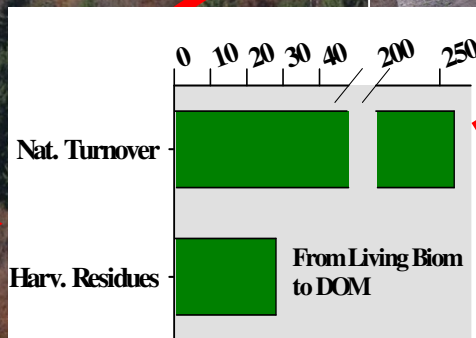
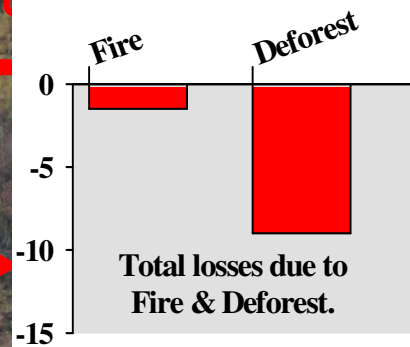
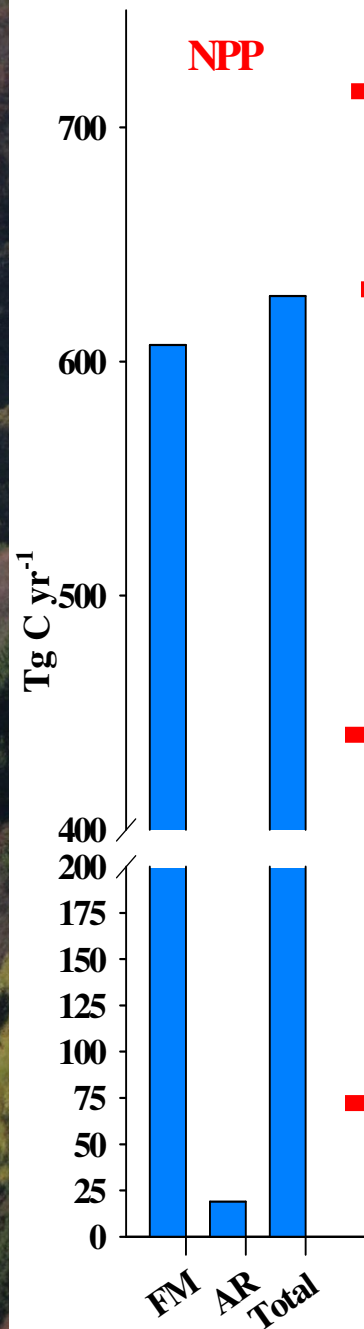


Overall EU MODEL RESULTS



— Biomass CBM
— DOM - CBM
— Soil - CBM
x HWP (Pilli et al. 2015a)

— Total GHGI
- - - Total CBM
— Total CBM + HWP



Carbon Sink 19% of NPP

