

## *Carbon binding of forests*

### *1. Introduction*

In this paper the main connections between forest asset accounts and greenhouse gas inventory on carbon binding of forests are briefly summarised, as well as the main concepts and classifications according to Global Forest Resource assessment of the Food and Agricultural Organisation (FAO). The paper is mainly based on presentation held in the 12. LG meeting in Rome by Lars Gunnar and Adrian Whiteman from the FAO (LG/12/10.1) and on issue papers LG/11/19 and LG/12/10 by J. Muukkonen.

### *2. The main forest asset -related issues in greenhouse gas inventory*

Forests are one of the main greenhouse gas source and sink categories in reporting greenhouse gases according to the UN climate convention and the Kyoto protocol. The main greenhouse gas (GHG) source and sink category related to forests in the GHG inventory is category 5. Land use, land use change and forestry. This is further subdivided into Forest land, Cropland, Grassland, Wetlands, Settlements and Other land.

The Forest land consists of:

1. Forest land remaining forest land
  - 1.1. Managed (intensively/extensively)
  - 1.2. Natural, undisturbed
2. Land converted to forest land
  - 2.1. Managed (intensively/extensively)
  - 2.2. Natural, undisturbed

The GHG reporting covers only managed forests. Managed forests are subject to periodic or ongoing human interventions and they include the full range of management practices from commercial timber production to stewardship in non-commercial purposes. Division between intensively and extensively managed forest is a tool in defining conversion factors of carbon binding. Forest Land Remaining Forest Land are forest areas which have been forests for at least 20 years. Land Converted to Forest Land are lands converted more recently to forests by natural or artificial regeneration, afforestation or reforestation.

Carbon pools in the GHG inventory are Living Biomass, Dead Organic Matter and Soils. For the forests the **annual change in carbon stock** consist of:

#### **Change in carbon stocks in living biomass**

- + Increase due to above and below ground biomass growth
- Decrease due to fellings, fuelwood gathering, disturbances

#### **Change in carbon stocks in dead wood and litter**

#### **Change in carbon stocks in mineral and organic soil**

Of the environmental asset categories of the SEEA 2003, cultivated and non-cultivated timber resources EA.141 and wooded land EA.23 are rather directly linked to forest categories of the GHG inventory system. Timber forms an essential part of living tree biomass, and both mineral and organic soil of wooded land are sinks and sources of carbon.

In the SEEA2003 forest asset accounts availability for timber supply and authenticity or naturalness (natural, semi-natural, plantations) were used as basic classification prin-

principles. Division between managed and natural forests in the GHG inventory do not correspond to SEEA2003 availability/non availability for wood supply. However, intensively managed forests equal to plantations, extensively managed to semi-natural forests, and natural to undisturbed forests in GHG inventory. Classifications according to predominant tree types and eco-floristic zones used in the SEEA2003 forest asset accounts are also used in the GHG inventory in defining conversion factors for carbon release and uptake.

In the SEEA2003, a generic asset account for a physical asset is formulated as:

Opening stock levels

Increases in stock due to economic activity and regular natural process

Decrease in stock due to economic activity, regular natural process  
and natural disaster (net decrease)

Changes due to economic classifications

Closing stock levels

This general model has been adapted to both forest land accounts and timber accounts. In the greenhouse gas inventory the structure of changes in carbon stocks -calculation formula is to great extent similar than in the SEEA2003. The main differences are, that the SEEA only takes into account timber, when the whole tree biomass and carbon in soils are included into the greenhouse gas calculations.

### ***3. Some basic concepts and classifications in Global Forest Resources Assessment (FRA) of the FAO***

Current definition of forest is a combination of tree cover and land use. Definition has been stable since 2000 and is globally accepted. According to the definition, land spanning more than 0.5 hectares with trees higher than 5 meters and a canopy cover of more than 10 percent, or trees able to reach these thresholds *in situ*. It does not include land that is predominantly under agricultural or urban land use.

In the FRA forests are further divided into **Naturally regenerated forests and Planted forests**. Naturally regenerated forests are either Primary forests or Other forests. Other forests are forests, where signs of human impact are evident. Primary forests equal to Natural, undisturbed forests according to GHG inventory.

The concept of semi-natural forests have been dropped from the FRA. Statistics on "Forest available for wood supply" are not collected any more, and availability for wood supply is not used as classification criteria in the FRA.

According to forest designation the FRA includes production, protection of soil and water, conservation of biodiversity, social services and multiple use of forests. Forest management consists of areas of permanent forest estate, area within protected areas, area under sustainable forest management and area with management plan.

Of the forests stocks, FRA includes **Growing stock** (volume of living trees), **Biomass stock** (above- and below-ground) and **Carbon stock** (in biomass, dead organic matter and soil). Carbon and biomass stock estimates are based on 2006 IPCC (International Panel of Climate Change) Guidelines used in GHG reporting.

#### **4. Classification and valuation issues for timber and carbon binding of forests in the SEEA2012**

Forest statistics compiled at national level for the Global Forests Resources Assessment are the most important data source for physical forest asset accounts. These statistics are also used as a basis for national greenhouse gas inventories for the GHG source and sink category “5. Land use, land use change and forestry”. For the forest stocks, carbon and biomass stock estimates of the FRA are based on IPCC Guidelines on GHG reporting according to the UN climate convention and the Kyoto protocol.

Concerning the forest stocks, the FRA and GHG definitions of forest are similar, and classifications and forest categories are compatible with each other. These definitions, classifications and categories should as far as possible be used in the SEEA2012 forest accounts.

Cultivated timber resources EA.1411 of the SEEA includes 1) Planted forests and 2) Other forests (2. sub-category of Naturally regenerated forest) of the FRA framework. From the GHG inventory, timber in Managed forest is included into SEEA Cultivated timber resources.

Non-cultivated timber resources EA.1412 includes Primary forests (1. sub-category of Naturally regenerated forest) of the FRA, and Natural, undisturbed forests of the GHG inventory.

The SEEA asset “EA.231 Forested land” equals to current definition of forest in the FRA. “EA232 Other wooded land” category also equals to the FRA. The division of forestry land into sub-categories “EA.2311 Available for wood supply” and “EA2312 Not-available for wood supply” is not supported by the FRA framework or the GHG inventory, and data availability according to this division will be quite low.

**In the SEEA2012, it might be practical to use only cultivated / not cultivated categories for both timber and forested land.** These categories are compatible with FRA and GHG inventory classifications. **It also seems, that categories natural / semi-natural / plantations used in the SEEA2003 as an alternative hierarchy for classifying forest land and timber is not any more useful.** The category “semi-natural forests” do not fit well with the present SNA asset categories.

According to forest designation the FRA includes production, protection of soil and water, conservation of biodiversity, social services and multiple use of forests. These designation issues might be a better basis for sub-categories of forest land than availability for wood supply. However, it should be noted that forestry activities and extraction of timber can at least to some extent take place also in forests that are not designated for production.

Direct economic importance of forests as a sink (or source) of greenhouse gases is increasing due to e.g. emission trade arrangements. Emission trade gives basis for estimation of monetary value of forests as carbon binding natural resource and environmental asset. Due to international agreements on climate protection and the GHG inventory, data availability and quality on physical carbon balances of both trees and forest soils is improving. Valuation of carbon binding expands information on monetary value of forest assets, because valuation reaches also forest assets for which calculation of timber values are not relevant. It also offers information for the decision making on optional uses of forests, such as e.g. intensive timber production or protection of forests to prevent climate change.