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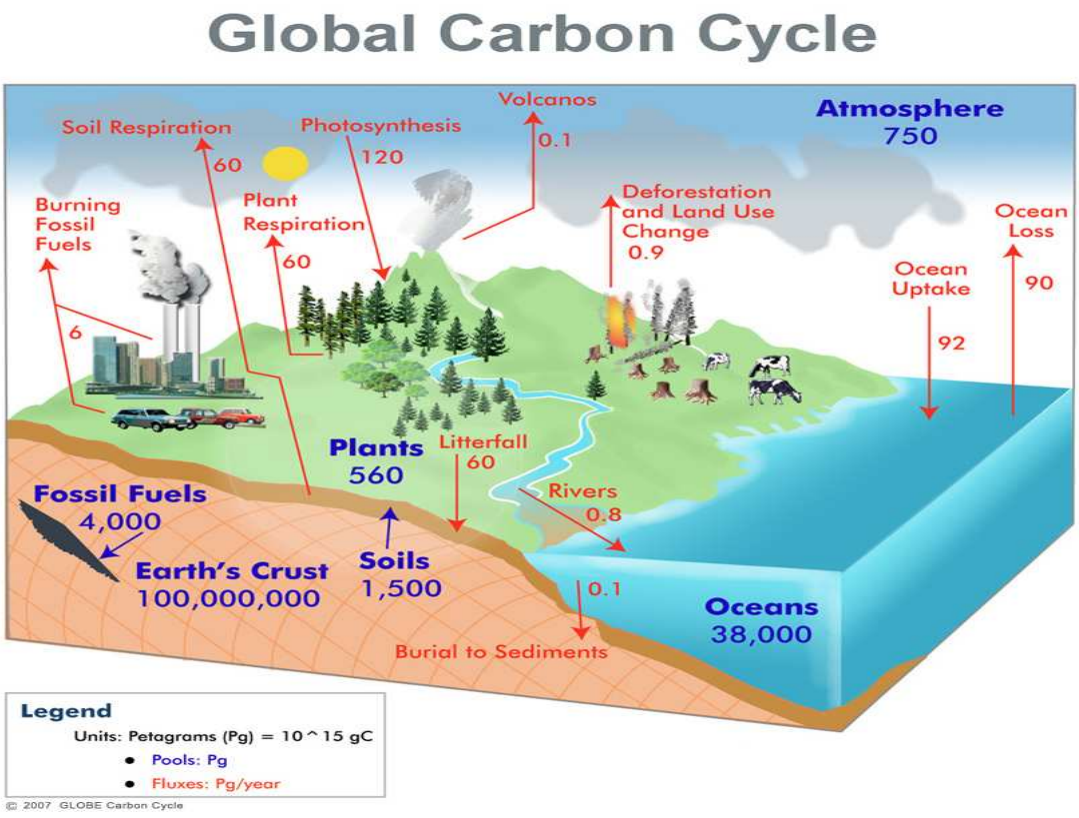
Greenhouse gas reporting in carbon accounting of SEEA ecosystem accounts

1. Introduction

The objective of the paper is to give a general picture on possibilities to achieve accounts for carbon sequestration in the SEEA ecosystem accounts. It is focused on applicability of Intergovernmental Panel on Climate Change (IPCC) Guidelines for national greenhouse gas inventories to offer both guidance on definitions and actual data to support the SEEA ecosystem accounts. These guidelines of the IPCC are a basis for estimating and reporting greenhouse gases according to the UN Climate Convention and the Kyoto Protocol. Current guidelines are from year 2003 (IPCC 2003), but reporting from 2013 is expected to take place according to updated 2006 guidelines.

Especially the Good Practice Guidance by the IPCC for reporting changes in carbon stock for greenhouse gas source and sink category 'Land Use, Land-Use Change and Forestry' is an important basis for recording carbon binding as an ecosystem service in the SEEA ecosystem accounts. With respect to the global carbon cycle as a whole (illustrated in the picture below), the approach of this paper based on Land Use, Land Use Change and Forestry -category is rather limited. However, at very aggregated level it covers all land ecosystems and inland water ecosystems that are subjects of the SEEA accounts as well.



2. Land use, land use change and forestry category in greenhouse gas reporting

In reporting greenhouse gases according to the UN climate convention and the Kyoto protocol, the main greenhouse gas (GHG) source and sink categories are 1) energy, 2) industrial processes, 3) solvent and other product use, 4) agriculture, 5) land use, land-use change and forestry, 6) waste, and 7) other. The category 5) Land use, land use change and forestry is further sub-divided into:

Forest land,
Cropland,
Grassland,
Wetlands,
Settlements and
Other land.

For most of these categories, changes in carbon stock of living biomass and soil are estimated for the GHG inventory and reporting purposes. Change in dead organic matter in forest land is also estimated. Reporting of changes in carbon stock of soil is not required for settlements. Carbon dioxide emissions of agriculture are reported in land use, land use change and forestry -category.

All land categories are subdivided to 'remaining' and 'converted' with respect to the main land use. For example, forest land remaining forest land are areas which have been forests for at least 20 years, and land converted to forest land are lands converted more recently to forests by natural or artificial activities. Some land categories are sub-divided also into 'managed' and 'unmanaged', and for these the GHG reporting covers only the 'managed' sub-category. As an example, managed forests are those subject to periodic or ongoing human interventions, including full range of management practices from commercial timber production to stewardship in non-commercial purposes.

Definitions of land categories and their sub-divisions in the greenhouse gas reporting

Forest land: All land with woody vegetation consistent with thresholds used to define forest land in the national GHG inventory, sub-divided into managed and unmanaged, and also by ecosystem. It also includes systems with vegetation that currently fall below, but are expected to exceed, the threshold of the forest land category.

Cropland: Arable and tillage land, and agro-forestry systems where vegetation falls below the thresholds used for the forest land category, consistent with the selection of national definitions.

Grassland: Rangelands and pasture land that is not considered as cropland. It also includes systems with vegetation that fall below the threshold used in the forest land category and are not expected to exceed, without human intervention, the threshold used in the forest land category. It also includes all grassland from wild lands to recreational areas as well as agricultural and silvi-pastural systems, subdivided into managed and unmanaged consistent with national definitions.

Wetlands: Land that is covered or saturated by water for all or part of the year (e.g., peatland) and that does not fall into other five categories of land. Wetlands can be subdivided into managed (e.g. reservoirs) and unmanaged (e.g. natural rivers and lakes) sub-divisions according to national definitions.

Settlements: Developed land, including transportation infrastructure and human settlements of any size, unless they are already included under other five categories. This should be consistent with the selection of national definitions.

Other land: Bare soil, rock, ice, and all unmanaged land areas that do not fall into any of the other five categories. (IPCC 2003)

These land categories provide the framework for the further sub-division by activity, management regime, climatic zone and ecosystem type as necessary to meet the needs of the methods for assessing carbon stock changes and greenhouse gas emissions and removals. They are broad enough to classify all land areas in most countries, to accommodate differences in national classification systems, and reasonably mappable by remote sensing methods. (IPCC 2003)

However, it is clearly recognized in the IPCC Good practise guidance, that the names of these land categories are a mixture of land cover and land use classes. Care will be needed in inferring national land use from these categories, because e.g. some forest land may be grazed, and firewood may be collected from scattered trees in the grassland. These kind areas with different use may be significant enough for countries to consider them separately. Managed land may be distinguished from unmanaged land by fulfilling production, ecological and social functions, but the national approach to distinguishing should be described. It is also recommended, that countries should specify national definitions for all categories used in the inventory, and to ensure compatibility of changes and development of national land classification with land-use classes presented in the IPCC. (IPCC 2003)

In the greenhouse gas reporting, estimation of greenhouse gas emissions and removals for each source is based on three tiers. These tiers correspond to a progression from the use of simple equations with default data to country-specific data in more complex national systems. Tier 1 methodologies usually use activity data that are spatially coarse, such as nationally or globally available estimates of deforestation rates, agricultural production statistics, and global land cover maps. At Tier 2 higher resolution activity data are typically used to correspond with country-defined coefficients for specific regions and specialized land-use categories. At Tier 3, higher order methods are used including models and inventory measurement systems tailored to address national circumstances, repeated over time, and driven by high-resolution activity data and disaggregated at sub-national to fine grid scales. (IPCC 2003)

3. The main correspondences between land categories in the SEEA and greenhouse gas reporting

Land use categories presented in the SEEA land use framework are rather well compatible with land use, land use change and forestry categories of the IPCC Guidelines for national greenhouse gas inventories. In both systems land use is partially related to land cover, and comparison of the IPCC categories to SEEA land cover types provides to some extent similar results. From the SEEA point of view the approach via land use is more informative, because land use offer better connections to economic activities than land cover.

Table on the next page show, how the IPCC land use, land use change and forestry subcategories may fall into SEEA land use categories. Some connections are very clear, but ‘one to many’ relations are numerous. The IPCC guidelines give countries some room to apply national thresholds and definitions, which in practise effects to compatibility of categories. Tier levels used in estimation of changes in carbon stock effect to comparability as well, as it is obvious that use of tier 3 methodologies provides better information for analysing the sub-categories than tier 1 and 2.

Jukka Muukkonen

SEEA Land use classification	IPCC LULUCF Category 5. Land use, land use change and forestry
Land	**Forest land f) ef)**
Agriculture a)	Forest land remaining forest land f)
Land under temporary crops a)	Managed intensively/extensively f)
Land under temporary meadows and pastures a)	Natural, undisturbed f) ef)
Land with temporary fallow a)	Land converted to forest land f)
Land under permanent crops a)	Managed intensively/extensively f)
Land under permanent meadows and pastures a)	Natural, undisturbed f) ef)
Cultivated a)	**Cropland a)**
Naturally grown a)	Cropland remaining cropland a)
Land under protective cover a)	Land converted to cropland a)
Forestry f)	**Grassland a), ef)**
Forest land f)	Grassland remaining grassland a) ef) ou) nu)
Primary regenerated forest f)	Managed a)
Other naturally regenerated forest f)	Unmanaged ou) no) ef)
Planted forest f)	Land converted to grassland a) ou) nu) ef)
Other wooded land f)	Managed a)
Land used for aquaculture aq)	Unmanaged ou) no) ef)
Land used for hatcheries aq)	**Wetlands**
Managed grow-out sites on land aq)	Wetlands remaining wetlands
Use of built-up and related areas b)	Managed
Mining and quarrying b)	Peat land ou) nu) b) if in peat extraction
Construction b)	Flooded land ou) nu) ef) w)
Manufacturing b)	Unmanaged
Technical infrastructure b)	Peat land ou) nu)
Transport and storage b)	Flooded land ou) nu) ef) w)
Commercial, financial and public services b)	Land converted to wetland
Recreational facilities b)	Managed
Residential b)	Peat land b), if to peat extraction
Land used for maintenance and	Flooded land, incl. reservoirs ou) nu) ef) w)
restoration of environmental functions ef)	Unmanaged
Other uses of land n.e.c. ou)	Peat land ou) nu) ef)
Land not in use nu)	Flooded land, incl reservoirs ou) nu) ef) w)
Inland water w)	**Settlements b)**
Inland waters used for aquaculture or holding facilities w)	Settlements remaining settlements b)
Inland water used for maint. and restor. of envir. funct. w)	Land converted to settlements b)
Other uses of inland water n.e.c. w)	**Other land ou) nu) ef)**
Inland water not in use w)	Other land remaining other land
	Land converted to other land

4. Some conclusions on carbon accounting in the SEEA ecosystem accounts

Annual reporting on greenhouse gases according to the UN climate convention and the Kyoto protocol will be the main data source for carbon accounts of the SEEA. Coverage and quality of information on carbon flows and changes in carbon stocks will probably improve in the next decade, when national estimation methodologies shift from tier 1 to more accurate and tailored tiers 2 and 3.

At aggregated level the land use, land use change and forestry -category and its' subcategories by the IPCC Good practise guidance cover most of the land use and cover types presented in the SEEA framework. Classification/grouping of ecosystems for the SEEA ecosystem accounts should be linkable to land categories used in greenhouse gas reporting, as well as to land use and land cover categories in the SEEA standard.

The IPCC guidance on land use, land use change and forestry is concentrated on changes in carbon stocks of biomass and soil. Opening and closing stocks are not reported for Climate Convention or Kyoto Protocol. This does not support efforts to construct full physical balances of stocks of carbon in ecosystems. Changes in carbon stocks also represent rather small share of total stocks of carbon in most ecosystems, and accurate estimates are easier to obtain to changes in stocks than to total stocks. This is especially the case concerning carbon in soils.

According to the IPCC guidance changes of carbon stocks in unmanaged areas need not to be reported. In SEEA ecosystem accounts both managed and unmanaged areas have to be covered. One objective of the SEEA ecosystem accounts is to provide a framework for assessing the capacity of ecosystems to deliver ecosystem services such as carbon binding, and distinction between managed and unmanaged areas/ecosystems is very important. This distinction is related to distinction between cultivated and natural resources and assets in the SEEA framework.

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United Nations Committee of Experts on Environmental Economic Accounting (UNCEEA)

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Chapter 5: Asset accounts