CREEA - Compiling and Refining Environmental and Economic Accounts

Report practical application

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About CREEA

The main goal of CREEA is to refine and elaborate economic and environmental accounting principles as discussed in the London Group and consolidated in the future SEEA 2012, to test them in practical data gathering, to troubleshoot and refine approaches, and show added value of having such harmonized data available via case studies. This will be done in priority areas mentioned in the call, i.e. waste and resources, water, forest and climate change / Kyoto accounting. In this, the project will include work and experiences from major previous projects focused on developing harmonized data sets for integrated economic and environmental accounting (most notably EXIOPOL, FORWAST and a series of EUROSTAT projects in Environmental Accounting). Most data gathered in CREEA will be consolidated in the form of Environmentally Extended Supply and Use tables (EE SUT) and update and expand the EXIOPOL database. In this way, CREEA will produce a global Multi-Regional EE SUT with a unique detail of 130 sectors and products, 30 emissions, 80 resources, and 43 countries plus a rest of world. A unique contribution of CREEA is that also SUT in physical terms will be created. Partners are:

1. Nederlandse Organisatie Voor Toegepast Natuurwetenschappelijk Onderzoek (TNO), Netherlands (co-ordinator)
2. JRC -Joint Research Centre- European Commission (DG JRC IPTS), Belgium /Spain
3. Universiteit Leiden (Unileiden), Netherlands
4. Centraal Bureau voor de Statistiek (CBS), Netherlands
5. Norges Teknisk-Naturvitenskapelige Universitet (NTNU), Norway
6. Statistiska Centralbyran (SCB), Sweden
7. Universiteit Twente (TU Twente), Netherlands
8. Eidgenössische Technische Hochschule Zürich (ETH) Switzerland
9. 2.-0 LCA Consultants Aps (2.-0 LCA), Denmark
10. Wuppertal Institut Fur Klima, Umwelt, Energie Gmbh. (WI), Germany
11. SERI - Nachhaltigkeitsforschungs Und –Kommunikations Gmbh (SERI) Austria
12. European Forest Institute (EFI), Finland / Spain

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1 Introduction

1.1 CREEA project

In 2003, a system of satellite accounts for environmental accounting was proposed, known under the name of System of Environmental and Economic Accounting – in short: SEEA 2003 (UN et al., 2003). This accounting system gives guidelines for setting up environmental accounts which are compatible with the system of national accounts. A revised and extended SEEA is planned to be published in 2012 (in short: SEEA 2012). The UNCEEA (UN Commission of Experts on Environmental and Economic Accounting) is responsible for this work, with most of the operational work being executed in the so-called 'London Group' (LG), a group of experts from statistical offices globally.

The CREEA project on Compiling and Refining Environmental and Economic Accounts has as a main idea to elaborate economic and environmental accounting principles, building upon decisions and discussions in the London Group, to test them in practical data gathering, and show added value of having such harmonized data available via case studies.

In conclusion, it is expected that the project will set up along the following lines and will make major contributions to SEEA 2012, and above all, its practical implementation:

1. Take the existing guidance developed by the London Group for SEEA 2012 as a starting point.
2. Focus on the key areas of relevance for sustainability policy making, and where there is a need for further methodological refinement, demonstration of how to implement practical data gathering, and showcasing the added value in policy making. As confirmed by London Group members contacted and/or part of our consortium, this concerns the following areas also mentioned in the Work item:
    a. Water accounts
    b. Waste accounts in relation to material flow accounts (including stocks)
    c. Forest accounts
    d. Climate change related issues
3. Elaborate where still needed the methodologies currently proposed by the London Group, and test practical data gathering according to these approaches. Do trouble shooting and suggest adaptations of methodologies to make them most effective and efficient with regard to data gathering.
4. Showcase the added value of this more complete accounting system by application in practical policy cases.

In short, such a program fills in remaining gaps in SEEA 2012, gives guidance into the most effective ways of practical implementation (particularly data gathering), and can build a case showing the added value of practically implementing SEEA 2012.

1.2 Forest accounts work package

The Work Package 5 is devoted to forest accounts and its objectives are:

- Revising, refining and testing the methodology for forest accounts as suggested in the existing draft of the SEEA 2012

- Develop a procedure for incorporating UNECE/FAO data and national forest statistics into the SEEA 2012 integrated economic and environmental accounts system
- Investigate the usefulness of the SEEA 2012 forest related indicators for the development of forest policies at the EU and national level
- Providing a dataset of SEEA 2012 indicators for two test regions.
- In short, such a program fills in remaining gaps in SEEA 2012, gives guidance into the most effective ways of practical implementation (particularly data gathering), and can build a case showing the added value of practically implementing SEEA 2012.

Harmonized data collection on forests allow quantifying some of the factors which are relevant for developing forest management strategies and steering forest related policies. They can help to identify risks of forest overexploitation, to develop forest regeneration policies, and to monitor the consumption of wood and other market forest products.

Standard forest accounts aim to bring forest sector information in contact with other type of statistics, allowing for a more generalized analysis that can be used on different levels. However, the forest accounts have not been a major priority in the EU environmental accounts so far. Furthermore, the information about forests deducible from standard national accounting is essentially limited to those forest resources that are exchanged on the market or that are the object of market transactions and, therefore, produce economic benefit and are associated with ownership right. However, we should recognize that forests provide a number of goods and services that are not traded on markets and have no established market prices. These goods and services contribute significantly to the human wellbeing.

The main aim of the second task corresponding to the present deliverable is to:

- Explore whether and how existing national data would have to be adapted in order to make them consistent with the proposed standards in SEEA forestry accounts.
- Propose procedures that could be applied at the level of Member States or international level to make the existing data consistent with SEEA 2012 requirements.

For this purposes, a questionnaire was developed and delivered to statistical offices for its completion... The questionnaire intends to gather the practitioner view...

1.3 Forest accounts in the SEEA

The chapter 5 of the central framework of SEEA 2012 deals with asset accounting and a section of it is entirely devoted to forest accounts. The definitions and classifications of forests in SEEA2012 are based on the UN-ECE/FAO Forest Resource Assessment 2010 classification.Forest are considered a form of land cover but also a category of land use. SEEA recalls that timber resources are not found solely in forests; in fact in many countries other types of land cover, such as other wooded land, contain timber resources. As a result of this distinction between forests and timber resources, SEEA includes forests within the sub-categories of land and distinguishes the timber resources located on this land as a separate environmental asset.

A more detailed description on the role of forests in SEEA 2012 can be found in the first deliverable of CREEA project. Hence, a brief description of such role can be found here.

1.4 The aim of this deliverable

The aim of the deliverable was testing the SEEA 2012 framework and the proposed improvements on two case study regions/countries. The testing of the SEEA framework will also help:

- exploring the availability and accessibility of data;
- collecting information about potential data sources;
- evaluating the usefulness of the proposed SEEA 2012 accounting framework;
- establishing a comparison across countries/regions in terms of data availability and accessibility , and sources.

The selected case studies are Catalonia (Spain) and Sweden. The selection of the case studies was partly related to the location of the project partners (EFI, SCB) active in WP5. On the other hand, while the forest sector plays a significant role in the Swedish economy, in Catalonia it is rater of marginal importance, in economic terms.
Furthermore, in both cases we considered the administrative levels at which the forest related data are collected. While in Sweden this is the country level, in Spain the forestry competencies belong to the communities and these are responsible for developing their own forest policy (under the umbrella of the National forest policy) and for collecting all the data on the forestry activities that take place in the region. The inclusion of Catalonia, and not the whole country, is therefore justified as the regions are the primary source of data for forest related activities.

2 Method

2.1 SEEA tables

The chapter 5 of SEEA 2012 deals with asset accounting. An asset account shows how the closing stock of the asset differs from the opening stock by considering the type and quantity of stock changes, which have taken place during the accounting period.

Asset accounts in SEEA encompass physical and monetary accounts. In physical terms, the conceptual scope of SEEA is broad extending and surpasses that of the System of National Accounts (SNA). The requirement in physical terms for the SNA to record an environmental asset is that it must deliver benefits to an economic owner. On the contrary, physical accounting tables in SEEA record all the assets. For example, remote land and timber resources should be included within the scope of the SEEA environmental assets of a country even if they are not currently expected to deliver benefits to an economic owner. However, in monetary terms the conceptual scope of the SEEA is limited to these parts of the assets that have an economic value based on the market valuation principles of SNA.

Asset accounts for forests comprise timber and forest land accounts separately.

2.1.1 Timber Resources- physical account

More details on the contents of this account can be found in SEEA2012 and a discussion on it in deliverable 5.1 of CREEA project. This account records the volume of timber resources at the beginning and end of an accounting period and the change in this stock over the accounting period.

The timber resources are recorded even if they are not available for wood supply. In this case, since these timber resources do not have an economic value, they are not recorded in the asset accounts for timber resources in monetary terms. Consequently, the volume of these timber resources in physical terms should be clearly identified such that appropriate alignment can occur between asset accounts in physical and monetary terms.

Timber resources are divided into cultivated and natural. The reason for this distinction is that they are recorded very differently in the standard economic accounts although the physical processes of biological resources growing and yielding products are similar for cultivated and non-cultivated resources.

For cultivated biological resources growth is regarded as an output and may enter into stocks as either fixed capital or work in progress. Harvesting and natural death are recorded as negative capital formation.

For natural biological assets growth, harvest and natural death will be recorded as additions to and deductions from stock levels. The treatment of timber resources as either cultivated or natural depends on the management practices applied to the areas in which timber resources are found.

The key consideration is that the processes involved in cultivation must constitute a process of economic production. Hence, the level of activities undertaken in these areas should be significant relative to the value of timber resources and should be directly connected with the growth of the timber resources in question. Therefore, it needs to be clear that control over the harvesting is not sufficient to establish that a biological asset is cultivated.

2.1.1.1 Classification

A basic structure for a physical asset account for timber resources is presented in Table 5.8.2 of SEEA2012 that is reproduced below. The asset account should distinguish types of timber resources, most importantly between cultivated timber resources and natural timber resources. For natural timber resources a distinction should be made between those timber resources available for wood supply and those not available for wood supply to ensure that the different scope of the asset accounts in physical and monetary terms can be reconciled. Depending on the purpose of analysis and available data, accounts by species of tree may be compiled

2.1.1.2 Additions to and reductions in the stock

The stock of timber resources will increase due to natural growth. This is measured in terms of the gross annual increment i.e. the volume of increment over the reference period of all trees with no minimum diameter. The calculation of natural growth should be based on the timber resources available at the beginning of the accounting period.

Removals are estimated as the volume of timber resources removed from forest land, other wooded land and other land areas during the accounting period.

Natural losses are the losses to the growing stock (i.e. living, standing trees) during an accounting period due to mortality from causes other than felling. Examples include losses due to natural mortality, insect attack, fire, wind throw or other physical damages.

Exceptional and significant losses due to natural causes should be accounted for as **catastrophic losses**.

The volume of natural losses and catastrophic losses should only be recorded against these categories when there is no possibility that the timber resource can be removed.

Annual fellings are equal to the volume of standing timber that is felled during an accounting period. Fellings include silvicultural and pre-commercial thinnings and cleanings.

Figure 1. Physical asset account for timber resources according to SEEA 2012.

Table 5.8.2 Physical asset account for timber resources (cubic metres over bark)

	Type of timber resource		
	Cultivated timber resources	Natural timber resources	
		Available for wood supply	Not available for wood supply
Opening stock of timber resources			
Additions to stock			
Natural growth			
Reclassifications			
Total additions to stock			
Reductions in stock			
Removals			
Natural losses			
Catastrophic losses			
Reclassification			
Total reductions in stock			
Closing stock of timber resources			
Supplementary information			
Fellings			
Felling residues			

Source: SEEA 2012

2.1.2 Timber resources- monetary account

Monetary asset accounts for timber resources consist of measuring the value of the opening and closing stock of timber resources and the changes in the value of the stock over an accounting period.

Most of the changes in the stock relate directly to changes recorded in the physical asset account but there are also entries relating to the revaluation of timber resources which are recorded when the prices for timber change during an accounting period.

It is recommended that the volume of timber resources that cannot be harvested be separately identified and should not form a part of the overall calculations of the value of timber resources. Estimates are made for the value of natural growth and the value of removals.

For cultivated timber resources the natural growth is considered an increase in inventories and the removal of trees is treated as a decrease in inventories. For natural timber resources the natural growth is not considered an increase in inventories since the growth in the trees is not considered as part of a production process. The removal of the timber resources represents the point at which the timber resources enter the economy and output is recorded at that point.

Figure 2. Monetary asset account for timber resources according to SEEA 2012

Table 5.8.3 Monetary asset account for timber resources (monetary unit)

		Type of timber resource		
		Cultivated timber resources	Natural timber resources *	Total
Opening stock of timber resources				
Additions to stock				
	Natural growth			
	Reclassification			
	Total additions to stock			
Reductions in stock				
	Removals			
	Natural losses			
	Catastrophic losses			
	Reclassification			
	Total reductions in stock			
Revaluations				
Closing stock of timber resources				

Source: SEEA 2012

2.1.3 Forest and other wooded land – physical account

The objective of land accounts in physical terms is to describe the area of land and changes in the area of land over an accounting period. The scope of this account is defined consistently with the definitions of FAO Forest Resource Assessment 2010.

2.1.3.1 Classification

Forest land is classified according to different types of forest. The primary distinction is between naturally regenerated forest and planted forest.

Naturally regenerated forest is forest predominantly composed of trees established through natural regeneration. In this context, predominantly means that the trees established through natural regeneration are expected to constitute more than 50% of the growing stock at maturity. Two broad types of naturally regenerated forest are distinguished: Primary forest and Other naturally regenerated forests.

Planted forests are predominantly composed of trees established through planting and/or deliberate seeding. Planted/seeded trees are expected to constitute more than 50% of the growing stock at maturity, including coppice from trees that were originally planted or seeded.

Other wooded land is land not classified as forest land, spanning more than 0.5 hectares; with trees higher than 5 metres and a canopy cover of 5-10 percent, or trees able to reach these thresholds in situ; or with a combined cover of shrubs, bushes and trees above 10 percent.

In addition, countries may be interested to compile accounts based on the total area of different species of tree.

2.1.3.2 Additions to and reductions in the stock

Following are the definitions of the particular types of reclassification that apply in the case of forest and other wooded land.

Afforestation represents an increase in the stock of forest and other wooded land due to either the establishment of new forest on land that was previously not classified as forests or as a result of silvicultural measures such as planting and seeding. In particular, land previously classified as other wooded land may be converted to forest land as a result of silvicultural measures or natural restoration.

Natural expansion is an increase in area resulting from natural seeding, sprouting, suckering or layering.

Deforestation represents a decrease in the stock of forest and other wooded land due to the complete loss of tree cover and transfer of forest land to other uses (as agricultural land, land under buildings, roads etc.) or to no identifiable use. Removals of standing timber do not lead to decreases in forest and other wooded land if the use of the land does not change after felling.

Natural regression should be recorded when the stock of forest and other wooded land reduces for natural reasons.

Figure 2. Physical asset account for forest land according to SEEA 2012.

Table 5.6.6 Physical asset account for forest and other wooded land (hectares)

	Type of forest and other wooded land				
	Primary forest	Other naturally regenerated forest	Planted forest	Other wooded land	Total
Opening stock of forest and other wooded land					
Additions to stock					
Afforestation					
Natural expansion					
Total additions to stock					
Reductions in stock					
Deforestation					
Natural regression					
Total reductions in stock					
Closing stock of forest and other wooded land					

Source: SEEA 2012

2.1.4 Forest and other wooded land – monetary account

The monetary account for land reflects the value of land by type of land use. The figure 3 shows the SEEA table 5.6.7 where the monetary asset account for land is shown.

Determining the value of the land itself is a complex task as the market value of land encompasses different attributes of the land and separating them may be difficult. In the case of forest land, such separation should be based on the value of the stock of timber resources.

Figure 3. Monetary asset account for land according to SEEA 2012.

Table 5.6.7 Monetary asset account for land (monetary unit)

	Type of land use								Total
	Agriculture	Forestry	Land used for aquaculture	Use of built up and related areas	Land used for maintenance & restoration of environmental functions	Other uses of land n.e.c.	Land not in use	Inland water	
Additions to stock									
Acquisitions of land									
Reclassifications									
Total additions to stock									
Reductions in stock									
Disposals of land									
Reclassifications									
Total reductions in stock									
Revaluations									
Closing value of stock of land									

Source: SEEA 2012

2.2 Proposal for additional indicators

The State of Europe's Forests 2011 report consists of a series of qualitative and quantitative indicators to monitor the status of European forests. Our aim in revising SoEF indicators was to evaluate the suitability of some of the indicators for their possible inclusion in an environmental accounting framework for forests in broad sense and in particular in SEEA. Because these indicators were assessed on a pan-European scale and for a national level, could be suitable for their inclusion on an accounting framework such as SEEA that has a nation-wide scope.

Deliverable 5.2 show the results of a questionnaire submitted to statistical offices on the suitability of including this indicators into the forest accounting framework.

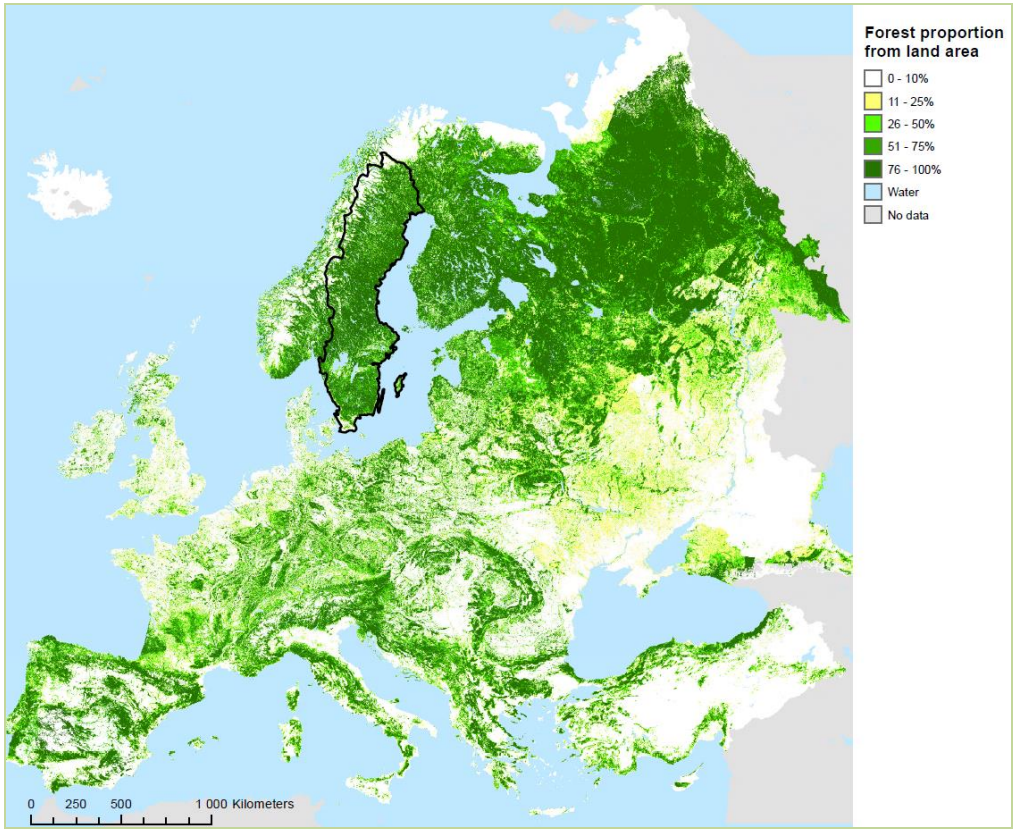
3 Institutional data set up

3.1 Description of the forests in the case studies

3.1.1 Sweden

Sweden is situated on the Scandinavian Peninsula in northern Europe. It stretches from the southern Baltic sea and up north of the Arctic Circle. The 31.000.000 ha of forests and other wooded land (FOWL) is the largest for any country in Europe, not counting Russia. In total this covers about 76 percent of the land in Sweden (FRA, 2010).

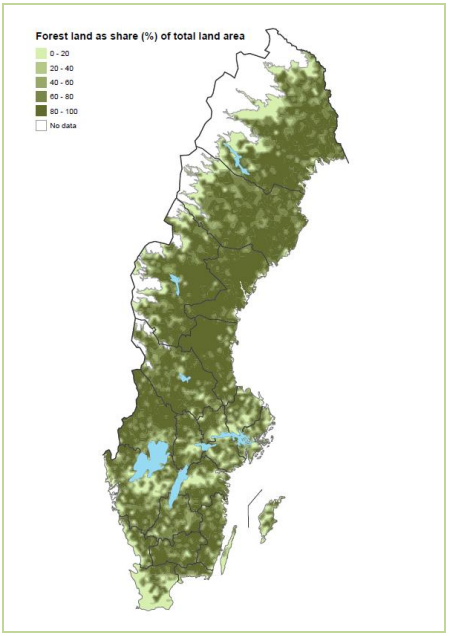
Figure 3.1.1 Location of Sweden and its forest land



(Source: European Forest map 2011, see references Kempeneers et al 2011, Päivinen et al 2001, Schuck et al 2002)

Being somewhat geographically elongated there are differences between forests in northern and southern Sweden. The north is dominated by the boreal forest type (considered part of the Taiga) where the most common tree species are pine and spruce, and also birch is frequent. When moving southwards these tree types are still dominating but other types like aspen, alder and oak become more common. Besides the tree composition, the forest growth rate increases in the south of the country. Table 3.1.1 shows the standing volume composition (according to the tree species) in three regions, where Northern Norrland is the northernmost region of Sweden and Götaland is the furthest south.

Figure 3.1.2 Share of forest land in Sweden



Source: Swedish NFI, 2007-2011

Table 3.1.1 Standing volume of forest by region and tree species, mill. m^3 standing forest

SPECIES	REGIONS				Whole Country	*Species Comp. (%)*
	N Norrland	S Norrland	Svealand	Götaland		
Pine	340	297	364	282	1282	*39.1*
Spruce	238	360	337	409	1345	*41.0*
Lodgepole pine	8	22	3	0	32	*1.0*
Birch	119	104	91	100	414	*12.6*
Aspen	5	9	20	19	53	*1.6*
Aldern	2	10	15	21	47	*1.4*
Oak	0	0	6	36	42	*1.3*
Beech	0	0	0	18	18	*0.5*
Goat willow	4	5	4	4	17	*0.5*
Mountain ash	0	2	2	3	7	*0.2*
Ash	0	0	1	6	7	*0.2*
Other	0	1	3	10	14	*0.4*
All	**715**	**809**	**845**	**908**	**3278**	*100.0*

Source: Swedish NFI 2007-2011

The Forest industry has traditionally been important in Sweden, as a provider of raw material in terms of timber, pulp, hygienic products etc. During 2012, 10 percent of Swedish exports were forest products. This has changed since 1970 when 23 percent of exports were forest products (Statistics Sweden, 2013). Table 3.1.2 gives a closer look at only the forestry and logging part of the forest industry. In the period 2006-2011 there has been an increase in the number of enterprises, employees and also the net turnover.

Table 3.1.2 Basic economic data for companies working with forestry and logging, NACE 02

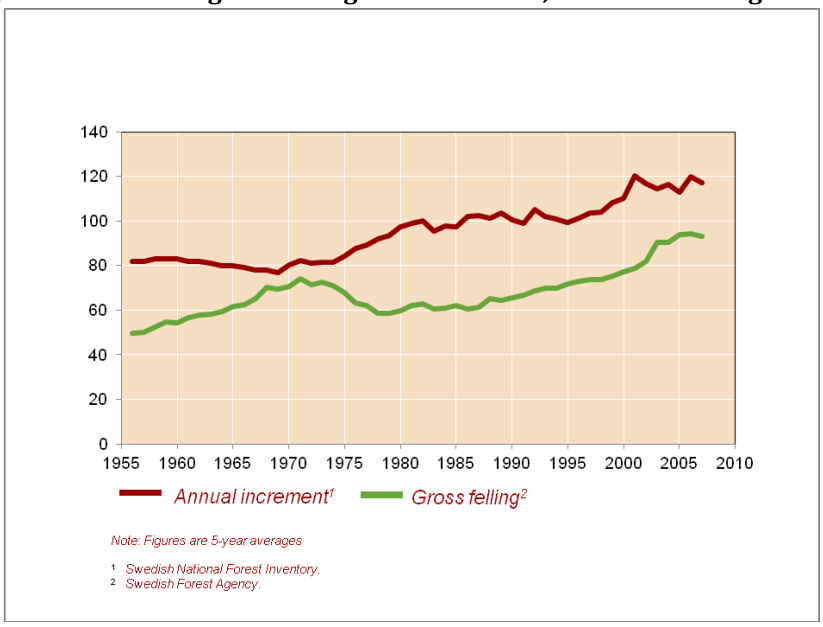
Year	Number of enterprises	Number of employees	Net turnover, SEK million[1]
2006	105,669	13,387	60,914
2011	126,663	16,406	87,688

[1]The average exchange rate for September 2013 was 8.7 SEK per EUR.

Source: Statistics Sweden, 2013

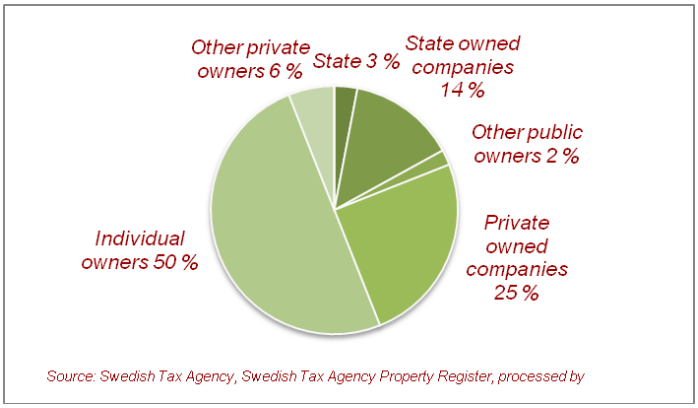
Furthermore, Figure 3.1.3 summarizes the development of the increment (growth) and fellings in Swedish forests. This relationship is important for the estimation of the long-term production capacity of forests. Starting in 1956 the annual increment has been greater than the felling throughout the time series. The annual figures are five-year moving averages, otherwise the impacts of the large storms Gudrun in 2005 and Per in 2007 might be more visible.

Figure 3.1.3 Annual gross felling and increment, mill. m³ standing volume



In Sweden roughly 22.5 million hectares of forests (72.6%) are categorized as productive forests, which means that they can produce at least one cubic meter of timber per hectare and year. More than 80 percent of the productive forests are privately owned. The majority of private owners are individuals, who together own 50 percent of productive forest land in Sweden. Slightly below 20 percent is owned by the government and largest within this group is the government owned companies that own 14 percent of productive forest land.

Figure 3.1.4 Productive forest land area by ownership, 2011



3.1.2 Catalonia

The Spanish Autonomous Community (AC) of Catalonia (see Fig. 3.1.5) is situated in the Northeast of Spain. It displays a notable geographical diversity on an area of about 32.000 km^2. The main geographical areas are the Pyrenees and Pre-Pyrenees mountainous system, the Central or Ebro Depression, the Mediterranean area, with coastal plains, and the Serralada transversal mountain range (see Fig. 3.1.6).

Figure 3.1.5 Location of Catalonia

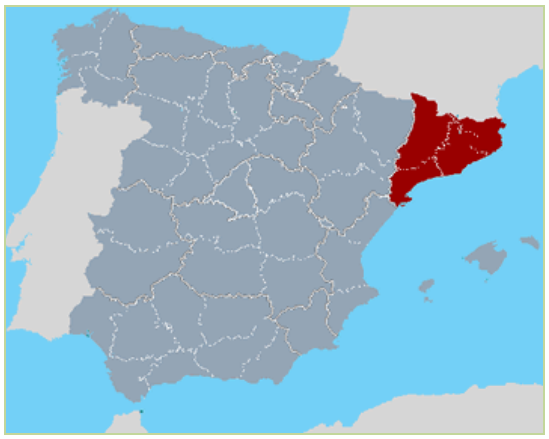
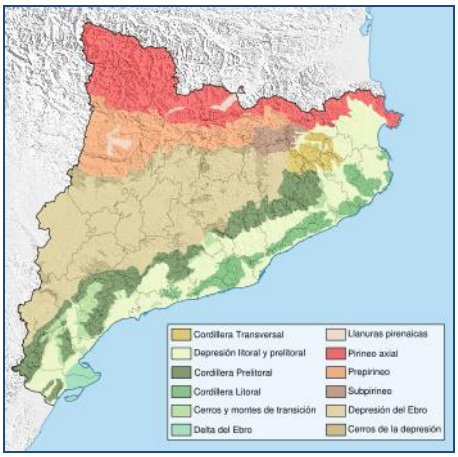


Figure 3.1.6 Geographic areas in Catalonia



Forests and Other Wooded Land (FOWL) cover almost 2 million hectares, what represents almost 61% of Catalonia (GENCAT, 2010) (Figure 3.3). Despite forest fires and urban sprawl, the total area of forest and other wooded land (FOWL) has increased by 74,537 ha between 1990 and 2001 (see Table 3.1.3). Land abandonment and a significant decrease of agriculture activities are the main reasons for this change.

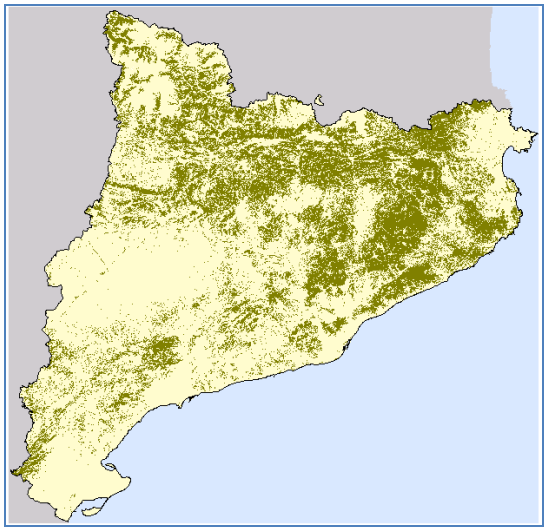
Table 3.1.3 Evolution of FOWL in Catalonia

	NFI1(1966-1975)	NFI2 (1989-1990)	NFI 3 (2000-2001)
Forest land	1,164.200	1,394,074	1,626,212
Other Wooded Land	683,533	461,870	304,269
F + OWL	1,847,833	1,855,944	1,930,481

Source: NFI3

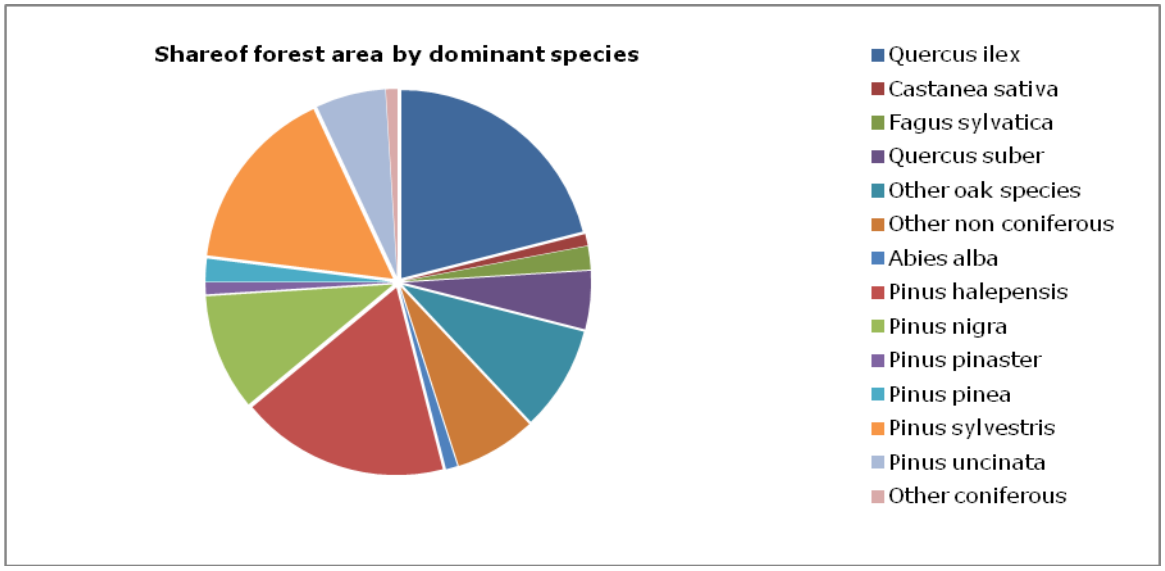
The main tree species in the Mediterranean forests are holm oak (*Quercus ilex*), Aleppo pine (*P. halepensis*), Scotch pine (*P. sylvestris*) and black pine (*P. nigra*). These tree species represent approximately 2/3 of the total number of trees. Nevertheless, there is great variety of different tree species (e.g. the Catalonian forest inventory lists more than 75 tree species) and mixed forests are predominant. However, in the national forest inventory, a forest is classified as "pure forest" when the share of one tree species in the basal area is more than 70% and it covers more than 40% of stand area. Considering this classification Aleppo pine forests (239,000 ha) have the highest share (Gracia et al. 2000-2004)

Figure 3.1.7 Forest distribution in Catalonia



Source: Gracia et al. 2000-2004

Figure 3.1.8 Share of forest area by dominant species



Source: NFI3

The total growing stock in Catalonia accounts for 118,157,000 m^3 and represents 13% of the total growing stock of Spanish forests. The average growing stock per hectare is 72.7 m^3/ha, which what is above the mean density for the country (50 m^3/ha) (SECF, 2010).

Since 1975, Spain in general has experienced an increase in the standing timber volume, with Catalonia being one of the regions where this increase was significant (SECF, 2010). This process is common to northern Mediterranean countries. The main reasons are land abandonment and decreased agricultural activities, due to rural exodus, the lack of profitability of forestry and decreased use of fuelwood, which resulted in reduced timber extraction.

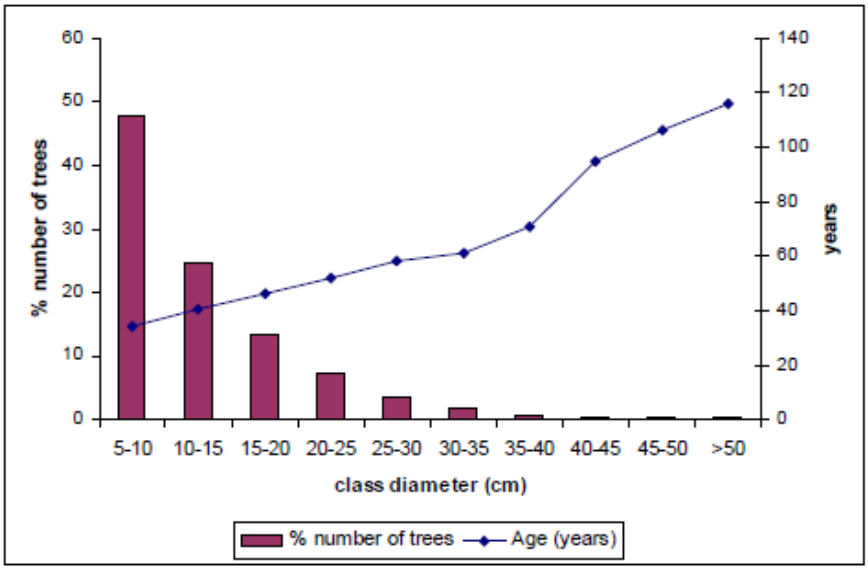
Table 3.1.4 Evolution of the standing timber volume, 1975-2009 ()

	Standing timber (Thousands of m3)		Ratio of change (%)
	1975	2009	1975-2009
Spain	456,721	921,913	101.9
Catalonia	52,726	118,157	124.1

Source: SECF, 2010

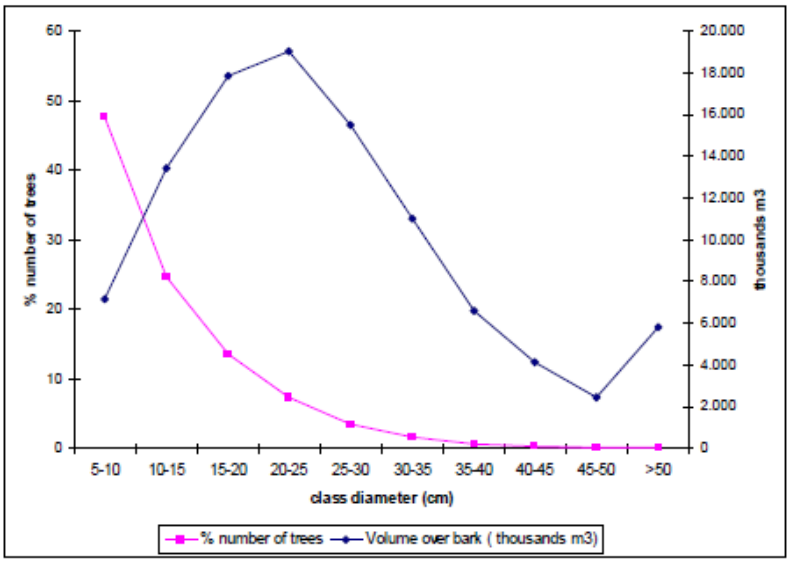
Catalan forests are characterized by a high number of small diameter trees (mainly below 25 cm DBH), and so big amounts of standing volumes of small trees. This is the result of the traditional harvesting methods employed till nowadays, where only high quality round wood, with big diameters, was extracted to ensure an economical profitability (Navarro et al. 2010). Figures 3.1.9 and 3.1.10 show how more than 50% of the standing volume is allocated in ages between 20 and 50 years, and with diameters smaller than 20 cm (NFI3).

Figure 3.1.9 Distribution of tree age and number of trees with respect to diameter classes



Source: Gracia et al. 2000-2004

Figure 3.1.10 Distribution of number of trees and standing volume per diameter class



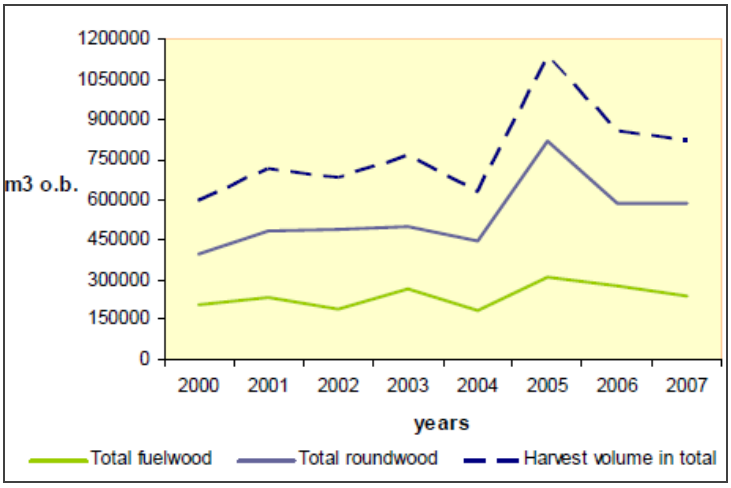
Source: Gracia et al. 2000-2004

Figure 3.1.11 shows the evolution of the annual fuelwood and roundwood harvests in Catalonia (Navarro et al. 2010). Before 2004, the production was more or less constant. In 2004 there was an increase in the demand for building wood (not structural wood, but for making building works). Besides there is an increasing trend in elaboration of planning documents for wood properties, thus easing felling and silvicultural treatments (Navarro et al. 2010). Since 2008, wood markets have experienced two important changes. First, with the beginning of the economic crisis on 2008, wood products demand was significantly reduced. Second, storms in 2009 left big amounts of low quality wood on closed markets, decreasing wood prices.

Coniferous species represent 77% of round wood harvests. Roundwood represents 69% of the total harvest while firewood represents 31%, in Catalonia (Navarro et al. 2010).

With respect to firewood, more than 86% come from broadleaved species and 13% from coniferous.

Figure 3.1.11 Evolution of annual fuelwood and roundwood harvesting



Source: Navarro et al. 2010

Despite timber is the only forest product reflected in the SEEA framework for forest accounts, it is not the only relevant product. In Mediterranean forests in particular, non-wood forest products (e.g., cork, hunting, mushrooms, grazing) are more relevant than timber. For example, Spain is the second country in terms of cork forest area after Portugal, producing almost 30% of the world's cork, i.e. 78,000 tonnes per year (IPROCOR 2000). The productivity in Spain is around 200-225 kg of cork/ha. Catalonia has approximately 73,500 ha of cork forests that in 2007 produced 2,600 tonnes of cork (although this quantity varies across the years, with 5000 tonnes produced in 1999, for example).

Almost 80% of the Catalonian forest and other-wooded land (FOWL) are privately owned. Only 18% of private properties are bigger than 25 ha; however, these represent 80% of the total private FOWL (Plana and Domínguez, 2000). The rest of the FOWL are public, owned, by municipalities (16.1%) or the Autonomous government (3.9%). The majority of public forests are located in the Pyrenees and Pre-Pyrenees, while the forests in the Mediterranean region are predominantly private.

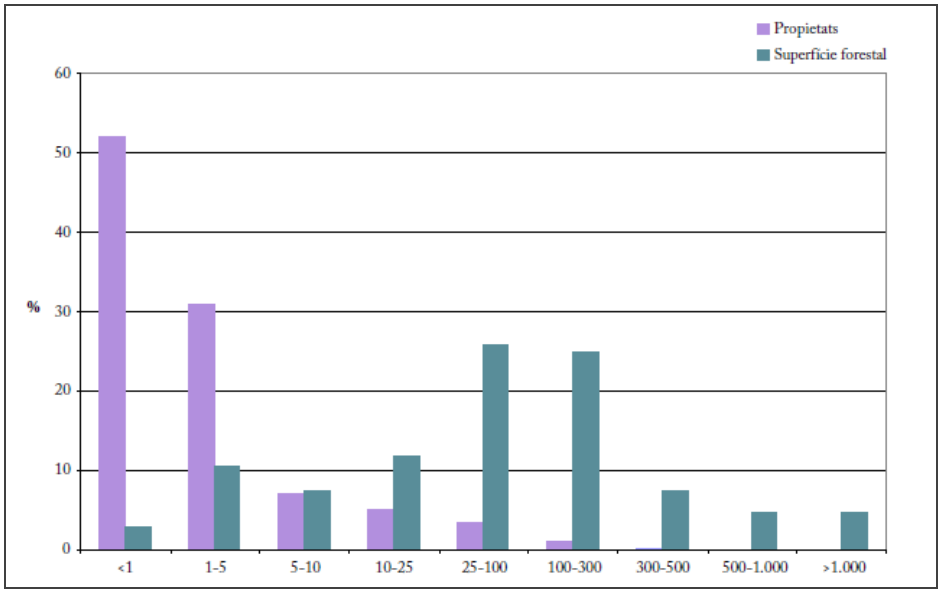
Table 3.1.6 Forest area by Ownership in Catalonia (ha and %)

Regional government (Public)	Local councils (Public)	Private property	Total
94,517 ha 4.9%	350,725 ha 18.2%	1,485,240 ha 76.9%	1,930,482 ha 100%

Source: GENCAT 2013

52% of the private forest properties are smaller than 1ha and they represent 2.8% of the total private forest property. On the other hand, only 1.2% of these properties are bigger than 100ha and these represent 41.5% of the forest land (Fletas et al., 2013).

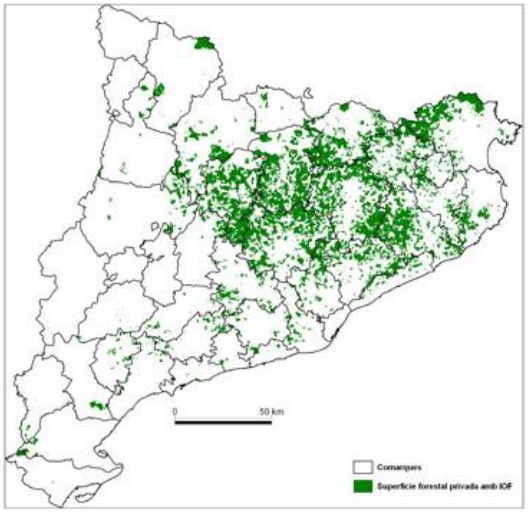
Figure 3.1.12 Number of private forest holdings classified according their area



Source: Fletas et al. 2012

In 2012, 432,349 ha (29%) of the private forests in Catalonia had a management plan (CPFC, 2012), which somehow indicates that the rest of the private forests is not managed. Managed forests (Figure 3.9) are mainly used for wood or cork production.

Figure 3.1.13 Distribution of private forests with a management plan



3.2 Forest data collection and how it is organized: Sweden and Catalonia

3.2.1 Sweden

There are two separate actors when it comes to official statistics on forests in Sweden. The national forest inventory (NFI) and the forest agency.

The NFI has a long tradition of data collection in Swedish forests, dating back to 1923 (databases since 1983). The Swedish University of Agricultural Sciences is responsible for the NFI. The inventory is carried out by field crews (two or three people) from May to October every year. Roughly 95,000 trees are measured every year scattered over

12,000 sample plots. It takes five years to finish the measurement of all inventory plots in Sweden. Thus, the annual figures presented by the NFI are in fact an average of the last five years period. Data is published on stand conditions, forest area, growth, standing volume of forest, forest damage and fellings. Data can be divided into regions, tree type, age class, diameter class etc. More detailed views of the data will be given later in this report.

The Swedish forest agency is the administrative body responsible for the implementation of the forest policy, in terms of its production and environmental objectives. Thus, the agency is responsible for providing some of the official statistics regarding forestry, for example statistics on the price of round wood, employment in large scale forestry and environmental consideration after final felling.

3.2.2 Catalonia

The main source of forest information in Catalonia and in Spain is the National Forest Inventory (NFI). NFI is conducted on a continuous basis and on permanent plots that cover the whole national area. The Ministry of Environment is responsible for the NFI. The last NFI (NFI3) dates from 2000. The economic crisis and the reduction of resources allocated to this task are delaying the 4th NFI data collection process.

In the case of Catalonia, the Centre for Ecological Research and Forestry Applications (CREAF), performed some complementary data collection in selected Catalonian plots. CREAF has developed an interactive application (Mirabosc) for Catalonia where the data from the 2nd and 3rd NFIs can be retrieved. This application is a valuable source of information for timber accounts development.

In general, the forestry data in Catalonia is compiled by the regional environmental administration and then submitted to statistics Catalonia for the regional statistics.

Forest data is collected by two public bodies:

- The Forest Ownership Center (CPF) that was created to provide support and guidance to private forest owners. Forest owners that have elaborated a forest management plan passed by the CPF, obtain their timber permits from the CPF. The CPF then submits the data on timber extractions and managed area to the regional statics office.
- The regional department for environment, also a public body, manages the public forests and also provides timber harvesting permits to forest owners without a management plan.

To sum up, there are two regional bodies that compile forestry data on extractions and managed area in the region, the CPF and the environment department. This aspect is relevant, as it will be seen later, for the establishment of a criteria that allows differencing between cultivated and natural resources.

Finally, it is worth noticing that timber permits to private forest owners are not always supervised in the field, so the quantities of timber recorded do not always correspond to the real quantities extracted.

4 Results

4.1 Presentation of the SEEA tables

The aim of this section is presenting the SEEA accounting tables on timber and on forest land as well as describing the process followed to obtain the data to fill them in. Therefore, this section has a double fold objective: fill-in the tables and contrasting them with the existing data and knowledge of the forests in the case studies, to see whether the SEEA tables are anyhow informative. Moreover, this section intends, by describing the data collection process followed in each case, showing the difficulties any practitioner may encounter when attempting to apply this framework.

4.1.1 SEEA physical account for timber

4.1.1.1 Sweden

One of the first aspects where problems were experienced when working with the SEEA tables had to do with he cultivated and natural categories. The two categories needed to be clearly defined in order to be practically applicable. In discussions with the data providers, this proved to be a challenge. What is considered natural and cultivated might be difficult to define. Consider the following example, after an area is cut clean of pines, new pines will be planted. As the decades pass other trees will begin to grow around the planted pines, in Sweden this might be birch or some other leafy tree. The number of these "natural" growing trees might even become greater than planted pines which might give the impression of this being a natural forest, especially if the pines become damaged or have low quality and therefore are cut down earlier than initially planned. These situations makes it difficult for the field crews to get a clear impression if and what kind of management is undertaken, therefore there is no inventory data that can be used to fit into the cultivated/natural categories.

When forest is subject to final felling it has to be notified beforehand to the Swedish forest agency. Since felling in most cases in Sweden lead to other management activities (e.g. land preparation, planting and further on pre-commercial thinning) this could be used as an approximation for what land is actively managed and therefore be an estimation on the cultivated forest category proposed by the SEEA. But there are several issues that need to be dealt with before this data can be used. First, reporting felling does not obligate the forest owner to actually carry out the felling, therefore other data needs to be used to know to what extent the reporting is actual felling. Secondly, after the report is sent to the forest agency it needs to get approval, this approval is then valid for 5 years. Therefore it is not known exactly when the felling is carried out. These first two issues are some of the reasons that statistics on fellings in Sweden is not based on these reports but instead on the use of timber in the production industry, foreign trade etc. Thirdly, it needs to be known (or at least assumed) at what point in time after felling the subsequent management activities are carried out and if they are carried out. Here the choice of accounting period in the SEEA tables will be crucial, felling, planting, fertilizing might be in one or the following accounting period but the next management activity might be several accounting periods in the future, the timber is still belonging to the cultivated category but it will be difficult to keep track of this timber over time.

Regarding the other categorization of forests according to their availability for wood supply, a possibility is provided where some forest is legally protected and cannot be managed, for example national parks. There are also some voluntary measures that can be taken by Swedish forest owners to protect forests but there is no legal base for this protection, therefore it is not advisable also to consider voluntary measures when defining forests not available for wood supply. Hence, in the tables below the sole difference between the two categories is the legal protection status. On the other hand, timber in forest that is difficult to access (e.g., extreme slopes) is not separated within the NFI and is therefore considered as available for wood supply, although in practice it is very unlikely that it would be ever exploited. This is roughly 23,000 ha forest land and includes e.g. forest on steep slopes or small strips of forest in between roads and railways.

Looking instead to the rows of the proposed SEEA table, a few experiences have been gathered. The term natural growth implies that there is also some unnatural growth, which is misleading. General terms such as natural should be avoided as they tend to be subjective. The interpretation from the SEEA CF is that natural growth is the gross annual increment of all trees with no minimum diameter. This would imply that the statistics on increment is a fairly[1] good estimation for "natural growth", a better term to use would then be increment or simply growth.

Felling residues are not measured other than the occurrence deadwood. The category natural and catastrophic losses are not separated within NFI and are therefore only provided as a single figure in the table below.

In conclusion it is possible to get data on timber assets available for wood supply, if using legal definitions[2]. But the differentiation between cultivated and natural is not possible with existing NFI data and definitions. Compromises can be made if using categories used in forest inventory. For example, the Swedish NFI includes categorization on age, diameter class and tree species. As an example the SEEA table with a differentiation between young and old forest (see Table 4.1.1) instead of the one between natural and cultivated. Here the line between young and old forest is drawn at 140 years in the boreal zone (northern and central Sweden) and 120 years in the nemoral and hemiboreal zone (central and southern Sweden)[3].

However, separation old/young is not in line with SEEA standards, therefore the table 4.1 should be viewed as an example of what can be done with existing NFI categorizations not as a recommendation for what the SEEA standards should be.

[1] There is a minimum diameter of 10 cm for a tree to be taken into account in the Swedish NFI.

[2] A possibility is also to use existing Swedish definitions on productive an unproductive forest land. This is mentioned in the section on SEEA land physical account.

[3] The SEEA CF instead proposes that tree type or product type (e.g. roundwood, fuelwood) can be used to give further detail among the rows additions and reductions in stock.

Table 4.1.1 SEEA timber account table with old/young forest, yearly average 2007-2011, 1000 ha.

	Type of timber resource (10^6 m^3)			
	Timber available for wood supply			Timber not available for wood supply
	Young forest	Old forest	Total	
Opening stock of timber resources	2,610	350	2,960	277
Additions to stock				
Natural growth	99	6	104	5
Reclassifications (1)	0	0	0	0
Total additions to stock	99	6	104	5
Reductions in stock				
Removals	59	13	72	0
Felling residues	0	0	0	0
Natural losses	6	1	7	1
Catastrophic losses (2)				
Reclassifications	10	0	10	0
Total reductions in stock	75	14	89	1
Closing stock of timber resources	2,633	342	2,975	282

(1) Values are available but very small
(2) Catastrophic losses are included in Natural losses

4.1.1.2 Catalonia

One of the first issues when undertaking the stock accounting task was to set the accounting period, i.e. the time frame adopted to analyze the change in the stocks.

Because the situation in the forests in Catalonia is relatively stable, with minor changes in their area, we decided to take an accounting period long enough to perceive some of these changes. One of the criteria used was to set the same accounting period for the timber and for the land accounting tables, so these could be compared and relationships could be established between them. Thus, the accounting period established for these accounts was 10 years, from 2000 to 2010. The reason was that the land use maps for Catalonia are produced every 10 years, and that the existing land use and land use change data are from 2000 and 2010. In relation to timber, data comes from the 3rd National Forest Inventory (NFI3) carried out in 2000/2001. Hence, data used for the opening stock figures comes from the NFI3 and it is assumed that the forest growth follows the same pattern for the period 2000-2010. This is one of the most important assumptions made in the calculation of the timber stock accounts.

The main sources of information to complete the tables are the NFI together with regional data on timber extractions and on the share of managed land.

Data collection was focused on forest land due to the lack of data on timber extraction taking place in other wooded lands. However, it is worth noting that forest land in Catalonia, and in Spain, encompasses also other wooded land, where trees may not be present. These extensions of shrubby species are quite large and administratively are considered as forest land. According to the national forest inventory (NFI) land with a canopy cover equal or above 5% classifies as forest. However, the NFI distinguishes

three types of forest depending on the canopy cover: 1.Equal/above 5% and below 10% 2. Equal/above 10% and below 20% and 3. Equal/above 20%. Only the two last classes would fit into the FRA2010defnition of forests, that sets the boundary for forest land at 10% canopy cover.

The timber physical accounting records standing timber in m^3. However, many of the existing forest data is reported in hectares and related standing volumes are not always easy to calculate. We have relied, when possible, on data on standing volumes. However, when this was not available, we used volumes per area unit (i.e. m^3/ha) from the NFI to convert the hectares into standing timber. Finally, it is important to know that data on land area related to the standing timber is necessary to estimate the timber production and forecast future timber values in the monetary timber account.

Furthermore, the timber accounts have been established separately for conifers and broadleaved species since the features of these stands and the destination of their timber differ significantly.

4.1.1.2.1 Opening stock and the cultivated/natural boundary

One of the first difficulties experienced when dealing with timber accounts is the boundary setting between timber proceeding from cultivated and natural forests. This classification is meaningful from an accounting perspective, as it allows aligning the results with the SNA. It can also be meaningful and easy to apply in countries with vast natural forest areas (e.g. Indonesia or Brazil). However, we find two main drawbacks when attempting to apply such division in our European case studies as it caused some misunderstandings.

Apart from the misunderstandings that arose with the terminology, setting the classes themselves was a tough task. The way forests are classified by the forest sector differs significantly from the criteria established by SEEA. NFI or regional (national) data collection systems split forests into classes that are ecologically based such as forest types, diameter or age classes. These classes differ from the cultivated/natural boundary proposed in SNA and there is no straightforward possibility to link the two nomenclatures.

4.1.1.2.2 Natural class: the available/not available for wood supply boundary

According to SEEA, when "timber resources are not available for wood supply, this may be because of harvesting is restricted or prohibited, because the areas are inaccessible or remote areas where logging is technically not possible or economically viable, or, trees may not be commercially useful species.

In Catalonia, there are different classes of timber resources not available for wood supply. Standing timber in the National Park is classified as not available for wood supply (NAFWS) due to legal restriction. In addition, important areas of the region are classified as NAWFS due to their inaccessibility. These stands are located in remote areas with steep slopes that restrict timber removals. Calculations of these NAFWS volumes have been done considering the data of a public enterprise, Forestal Catalana, that is nowadays elaborating a map of available timber resources in Catalonia. Based on these estimations, we calculated the share of standing timber available and not available for wood supply for conifers and broadleaved species, respectively.

This share has been allocated to the private natural timber stands to split them into the available and not available for wood supply categories. The logic behind is that the managed properties do not have inaccessible/limited access areas, which probably is not the case, but the share of inaccessible areas in these forest is likely lower than in unmanaged forests which include natural increase in forest areas resulting from abandoned land due to low productivity and accessibility.

4.1.1.2.3 Additions to the stock

The additions to the stock reflect the natural growth and reclassifications.

To calculate the natural growth we assumed that the average yearly growth as calculated in NFI3 (1991-2000) remained the same also during the period 2001-2010.

To account for the natural growth of the standing timber that has been reallocated to a different class during the accounting period, we assumed that this reallocation took place in the middle of the accounting period. Hence, half of the natural growth of this timber will belong to the original class and the other half is allocated to the final destination class.
In the case of Catalonia, the reclassifications are due to the increase in managed private forest area, i.e. more forest owners with management plans for their properties. We have assumed that all the forests with newly established management plans shift from natural and available for wood supply, into cultivated. The data on forest management plans was obtained from the CPF.

The public land area remains the same along the accounting period and the remaining increase in stock comes from afforestation that took place both on private and public land. Data on afforestation is rather poor and it would be difficult to estimate the standing timber in these areas. Hence, the data from NFI3 on average volumes (m^3/ha) for conifer and broadleaved forest was used. The average yearly growth was calculated only for 5 years instead, which means that we considered that on average the afforestation took place in the middle of the 10 years accounting period.

4.1.1.2.4 Reductions to the stock

The reduction in the stock reflects the natural and catastrophic losses as well as the removals and residues of the accounting period.

The data on removals were provided by the CPF for private properties with a management plan, while the data on public removals and private areas without management plan were provided by the environment department.

According to SEEA, "*natural losses account for mortality from causes other than felling. Examples include losses due to natural mortality, insect attack, fire, wind throw or other physical damages"*. And "*catastrophic losses should be recorded when there are exceptional and significant losses of timber resources due to natural causes*".

The NFI3 also provides information about the average mortality rate for conifers and broadleaved (m^3/ha/year) that was employed to calculate the total losses (i.e. natural plus catastrophic losses) for the accounting period. The total forest area, in each of the

accounting classes was multiplied by the average timber mortality (m^3/ha/year), calculated as the mortality rate between NFI3 and NFI2. The total losses were calculated as the sum of catastrophic and natural losses for the accounting period. To calculate the losses of standing timber, which was reallocated to a different class during the accounting period, we assumed that this reallocation took place in the middle of the period. Hence, half of the losses of this timber will belong to the initial class and the other half is allocated to the final class.

In Catalonia the only losses recorded annually are those due to forest fires. Most of forest fires in Catalonia (95%) are caused by humans. Therefore, all the losses caused by forest fires were allocated to the catastrophic losses category. The total losses less the catastrophic losses represent the natural losses for all the classes.

The difficulty however lies in the fact that statistics on forest fires are focused on recording the burnt area (hectares), but not the burnt volumes. To obtain catastrophic losses for the accounting period the burnt area was multiplied by the average timber mortality (m^3/ha/year) in NFI3,. To avoid double counting, the removals of burnt timber were deducted from the total timber mortality.
Furthermore, the changes that forest fires produce in the landscape are quite varied. If not too severe, forest fires can initially decrease the standing volume. However, once tree species resprout or colonize the area the forest production capacities are slightly altered. On the other hand, if fires are intense, too frequent or affect fire prone species, then this may lead to a reduction in production capacities and forest area losses.

To summarize, due to the lack of data on burnt volumes and other than forest fire related losses results should be treated with caution. The main assumptions concern the mortality rates on the burnt areas and other area. Assuming that the average mortality calculated between NFI2 and NFI3 (i.e., 1990-2001) can be extrapolated to the next decade, i.e., 2000-2010, represents a significant assumption, especially when considering that the pattern of forest fires is highly variable.

4.1.1.2.5 Physical accounting table for timber

Table 4.1.2 shows the accounting table for Catalonia for the period 2000-2010.

The data should be handled with care due to the assumptions made in the elaboration process. Thus, the table should be considered as a demonstration of the elaboration process rather than as a source of reliable estimates of the accounting classes.

Despite the different assumptions made, still some patterns can be identified from the accounting table:

- The reclassifications of standing timber that have taken place in the accounting period are due to the increase in private forest area under management plans. This is a positive trend as having more owners engaged in forest management indicates increasing efforts for active land management. Furthermore, the increased share of managed forests is expected to reduce the occurrence and severity of forest fires.

- The reclassification of standing timber influences the figures on natural growth and stock reductions of natural and cultivated forest classes to the. However, the

sum of losses and removals is always below 60% of the natural growth for all the classes, which indicates a sustainable use of forests.

- Removals in Catalonia are noticeably below the natural growth. This is already known and it is a general trend in northern Mediterranean countries and further confirmed by our calculations. Therefore, the removals nowadays don't represent a threat for the sustainability of the resource, although the proliferation in biomass in these ecosystems is considered as one of the main drivers for the increase in the severity of forest fires, that certainly represent a threat for these ecosystems.

- An interesting trend is observed for the removals of broadleaved in natural AFWS areas. These removals are higher than those in cultivated areas. About 35% of these removals are for fuel wood. although there are different interpretations of this finding, some doubt exist whether intense removals in forests lacking management plans will not affect their sustanability

Table 4.1.2. Physical timber accounting table for Catalonia in m³. Period 2000-2010

	FINAL ACCOUNTING TABLE FOR TIMBER IN THE PERIOD 2000-2010					
	Type of timber resource (Thousands of m3)					
	Cultivated		Natural			
			Available for wood supply		Not available for wood supply	
	Conifers	Broadleaved	Conifers	Broadleaved	Conifers	Broadleaved
Opening stock 2000	25,111	9,041	25,434	14,545	35,600	21,517
Additions to stock						
Natural growth	9,804	4,276	6,770	3,469	11,583	7,059
Reclassifications	9,653	7,986				
Total additions to stock	19,457	12,262	6,770	3,469	11,583	7,059
Reductions in stock						
Removals	2,583	918	1,939	1,676	0.00	0,00
Felling residues	-					
Natural losses	750	224	251	156	436	318
Catastrophic losses	206	58	408	73	693	148
Reclassifications			9,526	7,937		
Total reductions in stock	3,539	1,201	12,124	9,842	1,128	466
Closing stock 2010	41,029	20,102	20,079	8,170	46,054	28,109

4.1.2 SEEA physical account for forest land

4.1.2.1 Sweden

For Sweden it is possible with existing data and assumptions to fill in stock variables which are the same as required in the FRA reporting, but not the flows (additions and reductions) with the categorization proposed in the SEEA.

Especially the data for naturally regenerated and planted forest is not possible from the existing NFI data. Trying instead to show what the table can look like with existing variables in the NFI, for example using the categories of old/young previously used in the timber account table. This is provided in the table 4.1.3 below. The old forest does not change much year to year, all of the additions and reductions take place in the young category. These age classes can be further divided for better detail.
Regarding the rows of table 4.1.3 the reductions in stock cannot be differed between deforestation and natural regression. Again the term "natural" can cause misunderstandings and is difficult to define.

A different accounting length has been chosen in this forest land account than the timber account, only to show that there are possibilities for differences in chosen time periods as well when compiling these accounts. This table shows the full five year cycle of the forest inventory instead of the moving average year used for the timber accounts. This can be more useful in the way that there are not many changes in forest land from year to year so a longer time frame will be more intuitive for the user and easier to compile if it coincides with the NFI.

Table 4.1.3. SEEA forest land table with old vs young categorization, accounting period 2007-2011, 1000 ha, (na= not available)

	Type of forest and other wooded land				Total
	Primary forest	Old	Young	Other wooded land	
Opening stock of forest and other wooded land	2,417	2,439	23,164	2,432	30,452
Additions to stock					
Afforestation	0	0	0.2	0	0.2
Natural expansion	0	0	123	0	123
Total additions to stock	0	0	123	0	123
Reductions in stock					
Deforestation	na	0	70	na	70
Natural regression	*	*	*	*	*
Total reductions in stock	na	0	70	na	70
Closing stock of forest and other wooded land	2,417	2 439	23,217	2,432	30,505

Another possibility for classifying forest land is to use the estimation of productivity as an indicator. In Sweden, any forest land that can produce more than one cubic meter of timber per hectare and year is considered to be productive forest land and below is unproductive forest land. It is possible the productive forest land can be further divided

into subcategories that can be useful for analysis. There needs to be a comparison between countries on the use of the term (and estimator) productive an unproductive forest land before it can be used for accounting purposes.

4.1.2.2 Catalonia

For establishing a forest land account for Catalonia, we relied on the Catalonian land use maps, which are based on high resolution ortophotos and are elaborated by the Autonomous University of Barcelona.

The first edition of these maps was completed in 1993, while the second was expected by 2000, but is still incomplete and only covers a small part of the territory of Catalonia. The following complete editions of the map date from 2005 and 2009 respectively. Hence, the land accounts will consider the four-year period existing between these two editions. This means that timber and land accounts are not fully compatible in terms of accounting periods.

Land cover maps provide very good bases for compiling information on different classes of forest stocks (i.e., broadleaves, conifers). The only problem could represent the scales of land cover maps, which differ between versions.

More challenging is to provide land use changes (flows) according to the SEEA classification. The land cover maps available for Catalonia are not directly comparable at the more detailed level due to the different methodologies and scales (i.e., 1:5000 the 2005 version and 1:2500 the 2009 version), so the changes taking place in the accounting period cannot be properly tracked for the more detailed level of the legend, where the differences between broadleaved and conifer stands are shown. However, the researchers from CREAF provided us with a couple of correspondence matrices where the land use changes from 2005 to 2009 classes can be tracked in terms of percentages for the aggregated classes for forests, plantations, shrublands and others. These matrices are shown in tables 4.1.8 and 4.1.9.

In addition to the land cover map, annual information has been compiled from the Catalan statistics on different events that represent flows in the forest land cover: afforestation, burnt area and clearings for agricultural use (i.e. land cover change from forest to agriculture). These data are shown in tables 4.15, 4.1.6 and 4.1.7. These data however are difficult to fit in the accounting classes. The allocation of these flows therefore responds to our best guessing based on the knowledge about the ecological processes taking place in the Catalan forests nowadays. A color code shows how these figures have been allocated in the accounting table. Still, the land account shows many gaps in flows, in particular in cases where the initial of final land-use could not be defined accurately. Detailed explanations are provided in the next paragraph.

Data on afforested land per conifer and broadleaved species is shown in table 4.1.5. The afforested areas are allocated to the cultivated class as we hypothesized that these areas are under management and the owners undergo an afforestation process due to their interest in future revenues. Clearing of forest land is a minor process in Catalonia that usually takes place in areas that used to be cultivated but were abandoned and then covered by trees and shrubs by secondary succession. Data on cleared area is shown in table 4.1.6. The statistics on cleared area do not specify the previous land cover and

hence this area cannot be allocated into the accounting classes. Similarly, the burnt area shown in table 4.1.7 for the period 2005-2009 cannot be allocated into the accounting classes due to the lack of information on the situation of these areas after the forest fire took place. Furthermore, no information is available to be used as a proxy to establish the difference between cultivated natural classes for the burnt plots.

The following paragraphs compare jointly the results reflected in the SEEA land accounting table and the CREAF matrices to give an overview of the situation in Catalonia.

The main changes that can be observed in the global comparison of SEEA opening and closing stocks are the increase in coniferous forests, both naturally regenerated and planted, while the area of broadleaved species and other wooded land decreased.

Secondary succession processes (natural afforestation) are the main reason for the increase of forest lands in Catalonia. These processes are mainly triggered by land abandonment or after a forest fire. Table 4.1.9 shows that 3.5% of the total open forest areas (less than 20% of canopy cover) in 2009 were shrublands in 2005. Further, table 4.1.8 shows that 3% of the burnt areas in 2005 turned into dense forests (more than 20% of canopy cover) in 2009. With regards to forest fires, their impact can also be traced in the correspondence matrices. The burnt areas in 2005 developed mainly into shrublands (89%); while the area classified as burnt in 2009, were in 2005 dense forests (48.4%), shrubland (39.2%) and open forests (8.9%). The thresholds established for classifying open and closed forests are in accordance with the NFI that sets this boundary at 20% canopy cover. However, the usual international level is 40%. Although, as FRA (2000) stresses, this is not a well established level and some countries have defined a different threshold.

Afforestation is another cause of increase in forest land area. They can take place either on other wooded land or on agricultural land (low productive land that is set aside and converted into forests). However, table 4.1.5 shows that afforestation plays a minor role in Catalonia.

Table 4.1.4. SEEA forest land table, accounting period 2005-2009

	Type of forest and other wooded land (ha)					Total
	Other naturally regenerated forest		Planted forest		Other wooded land	
	Conifers	Broadleaved	Conifers	Broadleaved		
Opening stock of forest and other wooded land (2005)	**737,269**	**535,726**	**28,221**	**14,758**	**667,986**	**1,983,959**
Additions to the stock						
Afforestation	846	273				
Natural expansion	35,820					
Total additions to stock	36,666		1601			
Reductions to the stock						
Deforestation						
Natural regression						
Total reductions in stock		4,988		324	51,773	18,817
Balance between the two land cover data maps (2009-2005)	**36,666**	**-4988**	**1,601**	**-324**	**-51,773**	**-18,817**
Closing stock of forest and other wooded land (2009)	**773,935**	**530,738**	**29,822**	**14,434**	**616,213**	**1,965,142**

Figures corresponding to our calculations departing from the balance between the two land cover maps
Figures corresponding to the data on the afforested land in Catalonia. Allocated to managed forests
Figures corresponding to the direct comparison of the two land cover maps

Table 4.1.5. Afforested land in the accounting period 2005-2009 in Catalonia (ha)

AFFORESTATIONS (ha)				
	2005	2006	2007	TOTAL
conifers	372.34	237.59	235.82	845.75
broadleaved	162.39	61.83	48.48	272.70

Source: Generalitat de Catalunya

Table 4.1.6. Cleared land (conversion from forest to agricultural land) in the accounting period 2005-2009 in Catalonia (ha)

CLEARINGS/conversion into agricultural land (ha)					
2005	2006	2007	2008	2009	TOTAL
575.5	0	388.8	538.4	356.5	1859.2

Source: Generalitat de Catalunya

Table 4.1.7. Burnt forest area in the accounting period 2005-2009 in Catalonia (ha)

	BURNT AREA BY FOREST FIRES (ha)					
	2005	2006	2007	2008	2009	TOTAL
Forest land	3602.26	1810.66	847.54	189.82	1684.71	8134.99
Conifers	3273.59	1322.56	731.94	32.00	783.92	6144.01
Broadleaved	0	136	0	105.81	314.06	555.87
Forest composition not mentioned	328.67	352.10	115.60	52.01	586.73	1435.11
Other wooded land	1892.81	1594.02	764.71	387.58	1768.26	6407.38

Table 4.1.8. Matrix of correspondence between <u>total percentages in 2005 land cover classes</u> (columns) and 2009 land cover classes (rows). It shows the destiny of total 2005 classes with respect to 2009 classes (in red some of the changes most remarkable)**.**

	2005 LAND USE CATEGORIES (TOTAL)										
2009 LAND USE CATEGORIES (RELATIVE)	Dense forests	Riparian dense forests	Populus plantations	Platanus plantations	Open forests	Open riparian forests	Shrubland	Meadows	Burnt areas	Bare forest land	Agricultural land
Dense forests	99.0	0.1	0.1	0.1	**1.8**	0.3	**1.5**	0.2	**3.0**	0.2	0.0
Riparian dense forests	0.0	98.5	0.1	0.1	0.0	**4.3**	0.0	0.0	0.0	0.1	0.0
Populus plantations	0.0	0.0	86.2	0.6	0.0	0.0	0.0	0.1	0.0	0.1	0.0
Platanus plantations	0.0	0.0	0.2	95.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Open forests	0.2	0.0	0.0	0.0	97.4	0.3	**0.8**	0.1	0.7	0.0	0.0
Open riparian forests	0.0	0.1	0.0	0.0	0.0	92.6	0.0	0.0	0.0	0.0	0.0
Shrubland	0.4	0.2	**1.1**	0.2	0.3	1.0	95.7	**3.0**	**89.3**	**2.7**	0.2
Meadows	0.1	0.2	**6.7**	**1.4**	0.1	0.3	**0.6**	92.9	**5.4**	**9.9**	0.5
Burnt areas	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.6	0.0	0.0
Bare forest land	0.0	0.1	0.3	0.3	0.0	0.2	0.2	0.4	0.2	77.1	0.1
Agricultural land	0.1	0.1	**4.0**	1.0	0.2	0.2	**0.6**	**1.6**	0.3	**3.7**	98.3
	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: provided by CREAF (Autonomous University of Barcelona)

Table 4.1.9. Matrix of correspondence between <u>total percentages in 2009 land cover classes</u> (rows) and 2005 land cover classes (columns). It shows the origin of 2009 classes with respect to 2005 classes (in red some of the most remarkable changes)**.**

		2005 LAND USE CATEGORIES (RELATIVE)											
		Dense forests	Riparian dense forests	Populus plantations	Platanus plantations	Open forests	Open riparian forests	Shrubland	Meadows	Burnt areas	Bare forest land	Agricultural land	Total
2009 LAND USE CATEGORIES (TOTAL)	Dense forests	99.2	0.0	0.0	0.0	0.1	0.0	**0.6**	0.0	0.0	0.0	0.0	100.0
	Riparian dense forests	0.1	99.2	0.0	0.0	0.0	0.1	0.4	0.1	0.0	0.0	0.0	100.0
	Populus plantations	0.1	0.1	94.9	0.2	0.0	0.0	0.5	**3.2**	0.0	0.2	**0.8**	100.0
	Platanus plantations	0.1	0.1	0.7	98.2	0.0	0.0	0.1	0.7	0.0	0.0	0.3	100.0
	Open forests	**2.9**	0.0	0.0	0.0	93.2	0.0	**3.5**	0.2	0.0	0.0	0.2	100.0
	Open riparian forests	0.2	5.5	0.4	0.1	0.0	75.6	**14.3**	**2.8**	0.0	0.5	0.4	100.0
	Shrubland	**1.0**	0.0	0.0	0.0	0.1	0.0	96.8	**1.1**	0.4	0.1	0.4	100.0
	Meadows	**1.0**	0.0	0.3	0.0	0.1	0.0	**1.7**	92.3	0.1	1.0	**2.8**	100.0
	Burnt areas	**48.4**	0.0	0.0	0.0	**8.9**	0.0	**39.2**	0.7	2.5	0.0	0.3	100.0
	Bare forest land	**1.6**	0.1	0.1	0.1	0.3	0.0	**4.6**	**4.2**	0.0	79.3	**7.0**	100.0
	Agricultural land	0.1	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.0	0.1	99.1	100.0

Source: provided by CREAF (Autonomous University of Barcelona)

4.1.3 SEEA monetary timber account

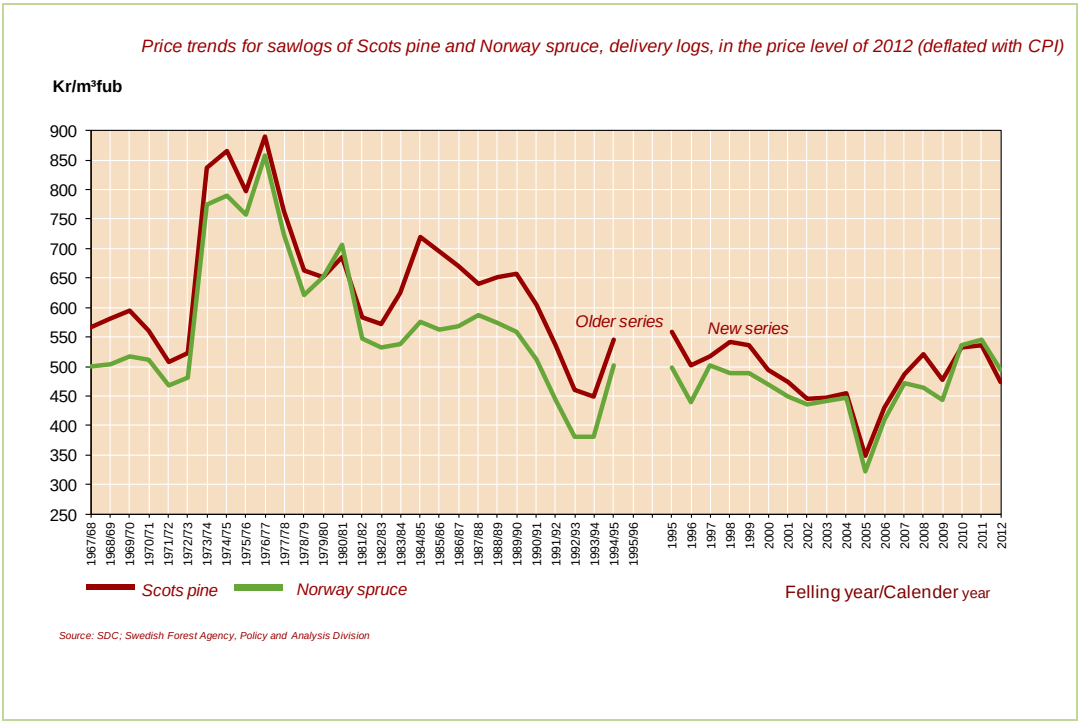
4.1.3.1 Sweden

The proposed monetary timber table from the SEEA manual has a similar layout as the physical timber table. The only difference is that the monetary is somewhat simplified, lacking the two categories available for wood supply and not available for wood supply. This is somewhat unfortunate as it was previously discussed about the physical timber account that while available/not available for wood supply could be provided using some compromises, cultivated/natural is difficult to measure in the field and there is no alternative data for this.

Market transactions are supposed to occur only for timber available for wood supply. The category available for wood supply from the physical timber account can therefore be used as a total from which the total in the monetary table can be formed. This provides a starting point for valuation.

Statistics on prices of forest products is published by the Swedish Forest Agency. Prices are divided on type of tree, type of forest product (sawlogs and pulpwood). Prices are collected as early as possible in the supply chain. The SEEA CF uses stumpage prices to be sure to be in the first line of the supply chain. In Sweden, statistics on stumpage prices are no longer produced due to low quality of data. Instead only price statistics on sawlogs and pulpwood are published. National Accounts in Sweden have solved this by assuming the stumpage prices have followed the same price development as sawlogs and pulpwood, and use indexes to extrapolate the latest values of stumpage prices from early 2000s.

Figure 4.1: Examples of price trends for two species in Sweden



Using the price statistics from the Forest Agency will make it possible for an average price to be calculated and then used to transform the physical data into monetary data.

Such an average price can be constructed in several ways. A quick solution is to simply get an average that spans across types of forest products and tree types. A more advanced solution will take into account the relative size of each category in terms of volume, this is called a weighted average. An example would be if 60 percent of all sold forest products are sawlogs and 40 percent are pulpwood. Then the weighted average should contain those proportions and not the equal shares of an ordinary average. A problem with both of these approaches is that they use market prices of *felled* timber, it has to be decided in each case whether market prices are appropriate to also value *standing* timber.

Another issue is the lack of coherence between the SEEA tables and available market price categories. Because the SEEA tables are not categorized by either tree type or forest product and from the price statistics it is not possible to get differences between cultivated/natural, age and diameter class. Using one average for the whole table will result in the monetary table having the exact same proportions as the physical table. The proposition from the SEEA CF is to use current prices for the flow variables (additions and reductions) and use discounted values of the expected future harvests as stock variables (opening and closing stock)[4].

The forest account is a satellite account to the national accounts, thus coherence between the two should be maintained as much as possible. National accounts already have methods for valuing the flow (additions minus reductions) in timber stock, but the value of the stock variables are not considered. In this report a simple method will be chosen for valuation, which is to use the same stumpage price as the national accounts in Sweden, both for the flow variables and the stock variables. The average stumpage price for the time period 2007-2011 is 387 SEK per cubic meter timber.

Using this simplified approach is not realistic for several reasons. Foremost, using a current market price to value the complete stock of timber resources assumes that if all the timber was removed from the forest that current market price would remain unchanged. This is not true, as the market price would very likely decrease as the supply of timber resource would outreach demand by far.

A more advanced solution is to calculate the net present value (NPV) as proposed by the SEEA CF in the sections mentioned above in footnote 4. This would require an average age for when trees are felled, and a reasonable discounting rate, also the current age of all standing timber assets. This information is available for Sweden but since the forest growth rate and management methods vary across the large country the model will quickly become advanced and will require a report of its own. Also, choosing discounting rates is essential to the quality of the model, and this choice is not an easy one[5]. Therefore, to give an example, in this report the simplified valuation was applied (Table 4.1.10).

[4] Descriptions of how this can be done is given in section 5.8.4 and Annex A5.1 of the SEEA CF.

[5] Government authorities might have recommendations for what discounting rates to use. Other examples are long term interest rates or the rates insurance companies use for their long term calculations. Discounting rates are discussed in Lecoq and Hourcade (2004).

Table 4.1.10 SEEA monetary timber account, yearly average 2007-2011, billion SEK1, (na= not available)

	Type of timber resource		
	Cultivated timber resources	Natural timber resources (available for wood supply)	Total
Opening stock of timber resources	na	na	**1148**
Additions to stock			
Natural growth	na	na	40
Reclassification	na	na	
Total additions to stock	na	na	40
Reductions in stock			
Removals	na	na	28
Natural losses	na	na	3
Catastrophic losses			
Reclassification	na	na	4
Total reductions in stock	na	na	35
Revaluations			
Closing stock of timber resources	na	na	**1153**

[1] The average exchange rate for September 2013 was 8.7 SEK per EUR.

4.1.3.2 Catalonia

In this report, we propose a first attempt to use the NPV approach. We use a rough estimation of the forest dynamic in Catalonia, under the hypothesis that the resource behaves as a mature irregular forest. The change in structure resulting from under-harvest leads to over-maturation, but not to notable increase in value. Therefore, in this first approach of the value of standing timber, we do consider maturity.

We calculate the opening stock as the net present value of the timber that is available for wood supply under two hypotheses: (1) the market price is the one at the date of the opening and it will increase as fast as the inflation, and (2) the management practices will be similar, which means that harvest intensity will stay the same and the uses of wood in the various sectors stays the same. The second hypothesis can be considered in the Catalonian case because the quantity of wood harvested every year is lower than the net annual increment of the resource.

The change in forest structure resulting from the aging of the unmanaged forests and the new resources from afforested areas should be taken into account in the estimate of the present value of the wood resource. This would be possible using a resource modeling approach but it lies beyond the scope of the project.

Market perspectives and anticipation are not considered either. It leads to an underestimation of the value of standing wood compared to an anticipated increase of the market (e.g. in the case of firewood in Europe) or an overestimation otherwise.

To avoid double-counting resulting from land account, we subtract from the present value of the management of the forest an estimate of the land expected value (LEV). To estimate the LEV, we assume that the land is covered by the optimum species today and we calculate the time T needed to produce a tree composition similar on average to the

status of the resources. We then consider that it is possible to harvest as much as today. The LEV corresponds then to a scenario in which there is no harvest before T and then the average quantity of harvested wood products corresponds to the current production.
An alternative hypothesis is that the estimated production in the future could be the maximum sustainable production, which would correspond to nearly 90% of the net annual growth. This value is higher in the Catalonian case than the one we apply (3 times lower because of a harvest intensity of 32%), however, it is hard to know how the market would react to such a production.

The present value of wood in forests not available for wood supply is null because it will never be harvested[6]. Interestingly, with this approach, if part of the wood currently not available becomes available thanks to an increase in wood price, the development of techniques to lower harvesting costs or the creation of forest roads, the total value of standing wood will increase.

The dynamics in unmanaged forests and cultivated forests are different. Therefore, the present value of the volume is different for these two categories.

Some timber resources such as Douglas fir and hybrid Plane were not mature at the time of the opening of the accounts. At the time of the opening, these resources have value, as they are expected to be harvested in the near future (planted tree species). We therefore consider the present value of the timber production at the time of the opening (2000), subject to the fact that the production starts in 2005.

We considered that self-consumed wood is used as a substitute for fuel wood. With this hypothesis, we tend to underestimate its value. However, the effect might be limited since the majority of the wood that does not enter the market is used for energy.

To split the resource into cultivated and natural resources, we used the rates in each category presented in the physical accounts.

Removals are estimated in terms of the market value at the time of harvest. We do not use the NPV approach for this term because the land is supposed to be regenerated after the harvest and this regeneration is included in the natural growth term.

Natural losses mainly concerns dominated or senescent trees which should have been removed before death. We consider that the value of these trees is the one that would have been

Catastrophic losses incur in all maturity classes. Part of the trees are lost, but not necessarily all of them.. It leads to a loss not only in the value of the standing timber at the time of the catastrophic event, but also in the loss of future value of these trees if they could have been harvested in duly time. The loss can then be calculated as a loss in time of about half the average revolution time for the production of timber.

[6] Trees in these forests have value because of the carbon they store and the biodiversity habitat they contribute to.

The reclassification term from natural to cultivated forests is calculated in terms of the value of the natural wood available for wood supply and then reallocated to the cultivated forests.
The closing stock is estimated similarly to the opening stock using the average market prices and standard management practices at the date of the closing.

The reevaluation term is estimated after all the calculation to balance the table.

Table 4.1.11 SEEA monetary timber account for Catalonia, yearly average 2000-2010, billion euros

	Cultivated		Natural	
			Available for wood supply	
	Conifers	Broadleaved	Conifers	Broadleaved
Opening stock 2000	139.7	94.1	94.1	53.5
Additions to stock	NA			
Natural growth	54.5	44.5	25.0	12.8
Reclassifications	35.2	29.2	-	-
Total additions to stock	*89.8*	*73.7*	*25.0*	*12.8*
Reductions in stock				
Removals	44.4	16.0	33.3	29.3
Felling residues	NA			
Natural losses	12.9	3.9	4.3	2.7
Catastrophic losses	1.1	0.6	1.5	0.3
Reclassifications	-	-	35.2	29.2
Total reductions in stock	*58.5*	*20.6*	*74.4*	*61.5*
Reevaluation	39.7	-15.8	18.9	37.1
Closing stock 2010	210.7	131.4	63.6	41.8

In this table, the opening stock in the cultivated forest is greater than in the natural forests available for wood supply. This comes from the productive and highly valuable species planted in cultivated areas (radiata pine, Douglas fir, poplar, eucalyptus). Although some of these species are not mature in the opening, there is an anticipated value for these species.

The reduction in the stumpage value of the eucalyptus, and to a lesser extent, of the poplar between the opening and the closing of the period, plus the reclassification of a large part of natural forests available for wood supply into cultivated forests creates a negative reevaluation at the end of the period. This result might also come from the allocation of a too small part of the harvest in reallocated forests to the cultivated class.

4.1.4 SEEA monetary land account

4.1.4.1 Sweden

Real estate prices are reported regularly for all sales in Sweden. Statistics Sweden publishes aggregated data from these individual observations[7]. The disaggregated sales data can be linked to the Real Estate Assessment Registry. This registry contains an approximation of how large share of the real estate's assessment value is from standing

[7] Prices do not include transaction costs e.g. fees to real estate agents.

timber and forest land (a forest share of the land). This can be used, together with the price of the sold real estate, to get the value of the forest share of the property by multiplying the share from the registry with the price of the sold land.

These values can be used to calculate average values for forest land in different parts of the country. This is provided in table 4.1.12.

Table 4.1.12: Prices[1] for sold productive forest land for agriculture and forestry real estates, 2010

County/region	Number of purchases	Purchase price	Value of standing timber and forest land	Productive forest land
		Average (SEK 1 000s)	Average (SEK 1 000s)	SEK/hectare
N Norrland	228	1 059	478	21 741
S Norrland	262	1 433	609	30 115
Svealand	336	1 497	612	49 016
Götaland	604	2 387	1 049	77 173
Entire country	1 430	1 791	775	53 097

[1] *Refers to ordinary purchases, i.e. No purchases made by family/relatives or special purchase not regarded as representing the market value. Refers to purchases where the value of standing timber and productive forest land is 34-100 percent of the entire assessed value.*

[2] *Value of standing timber and of productive forest land is a part of the total value which is decided through the General and simplified Assessment of Real Estate. Value of standing timber and of productive forest land above is based on the latest available Assessment of Real Estate.*

[3] *The price per hectare is not the total price per hectare. The price has been calculated using the proportion of value of standing timber and productive forest land to the total assessed value and then divided by forest area. I.e. If value of standing timber and productive forest land represents 75% of the total assessed value, 75% of the purchase price set in relation to the area of productive forest land. Source: Statistics Sweden*

Furthermore, price statistics (price per ha) on the county level is available (Sweden has 21 greater counties). If matching these prices with the forest land areas per county, we obtain the table 4.1.13.

Table 4.1.13 SEEA monetary forest land account, accounting period 2007-2011, billion SEK[1]

	Forest land including timber
Opening value of stock of land	1128
Additions to stock	
Acquisitions of land	5
Reclassifications	
Total additions to stock	5
Reductions in stock	
Disposals of land	3
Reclassification	
Total reductions in stock	3
Revaluations	
Closing stock of forest and other wooded land	1130

[1] The average exchange rate for September 2013 was 8.7 SEK per EUR.

A problem with market prices for land is that they include both the land and timber stock values. Since the value of the standing timber is already accounted for in the monetary

timber account, having it also in the monetary land account would mean double counting. On the other hand, since the standing timber is valued in another table, this value can be subtracted from the market price land plus timber value to create a value of the land alone. This also provides a control for the valuation of the standing timber, which should not be greater than the land market price (which should include both).

A quick glance at the previously presented table on a monetary timber account shows that in fact the value of the timber is greater than the value of the forest land. This further proves that a more advanced method for valuation of the timber account is required than the simple one exemplified in this report. As they are now, the tables are not consistent and cannot be used together.

Another issue is what to do with the other wooded land category from the physical account. For Sweden there are no market prices available for other wooded land and it is unclear whether it should be included in the monetary account at all from the SEEA CF. Clearer instructions on how the OWL category should be valued would be welcomed. Since prices are not available specifically for OWL it was chosen to not include it in the monetary table, so the table 4.1.13 only includes 92 percent of the forest land in Sweden. This might be another explanation why the monetary timber account value is higher than the monetary land account value.

4.1.4.2 Catalonia

Differently from the agricultural land market (where detailed data on land prices depending on the crops grown is published periodically), there are no publically accessible records of forest land prices. Thus, we asked the cadastral office to provide aggregated cadastre values for different types of forest properties. Unfortunately, the cadastre authorities denied our petition and requested additional proofs of the aim of the data use. EFI has already re-submitted the application, providing the requested information to the four Catalan provinces, as each of them run their own cadastrial register.

An amendment to this deliverable will be made when data from the cadastre is obtained to make the appropriate estimations.

4.2 State of Europe indicators and their inclusion in the accounting framework

In the CREEA deliverable 5.2 we proposed 5 indicators for enhancing the SEEA 2012 forest accounting framework. This section presents the practical application of these indicators to the SEEA tables. More specifically, advantages/disadvantages are discussed as well as the difficulties that may be faced in their application.

4.2.1 Forest land: boundaries

SEEA 2012 proposes a forest land classification that divides forest land into naturally regenerated (Primary and Other naturally regenerated forests) and planted forests:

- Naturally regenerated forest
    - Primary forest
    - Other naturally regenerated forest
- Planted forest

Our proposal consisted in expanding this classification so that for each of these categories the main forest types would be reported:

- Conifers
- Broadleaves
- Mixed
- Bamboo and palms

For Catalonia we were able to establish such classification both for timber and land accounts (see Tables 4.1.2 and 4.1.4), although the flows in the latter could be tracked at the conifer-broadleaved level. Accounting for the difference between conifer and broadleaved forests would provide a better picture of the situation, due to the different dynamics these two types of forests face (e.g., their differential regeneration processes after catastrophic events, different destination of their removals). However, mixed forests were not reported, due to the difficulties of recording their flows (e.g., annual increment). Therefore, only the classification into conifers and broadleaved was possible. However, we would still recommend applying this classification.

4.2.2 Hazards related to forests

SEEA 2012 suggests that, because of increasing impact of hazards (e.g., storms, fires, diseases) on forests, the activities aimed to preserve and protect the environment from these events should be recorded. However, no additional guidance is provided in SEEA. Thus, in CREEA we proposed a classification to report these activities, according to four hazard types: fire, storms, wind and snow, insects and diseases, and wildlife. The activities undertaken would be further classified according to the aspect they focus on: prevention, mitigation or restoration.

Already in the responses to our questionnaires (see Deliverable 5.2), the experts raised their concern about the applicability of the proposed classification. The lack of data and the multipurpose nature of forest management activities would make it difficult to separate forest and hazards management activities. Furthermore, some management activities are multi-hazard oriented, hence double counting would be likely to exist.

Our experience from the case studies shows that the databases where these activities are recorded may lack the detail and accuracy needed to obtain such information. Most times forest related projects are recorded without splitting the activities undertaken under these classes. However, and differently from other countries (e.g. France) in Catalonia all forest management activities are recorded, and in the case of private forest owners, a permission has to be given. Therefore, it would be a matter of enhancing the recording process and the databases. This way database queries could be made and some type of assumptions could be adopted in the allocation of the budget for different management activities.

Nowadays, it is only the national association of forest enterprises (ASEMFO) that performs such type of analysis on Spanish forest sector investments at the regional level (17 autonomous communities). ASEMFO compiles the information from the forest departments. Table 4.2.3 reflects the investments related to hazards as they appear in the reports of ASEMFO. As it can be seen, forest fires are separated into prevention, communication and suppression activities, while pests and diseases are presented all together, without differentiating in preventive or mitigating activities.

Table 4.2.3. Investments in forest hazard related activities in Catalonia (2010)

INVESTMENT SECTOR	Total investment (in 2010 €)
Forest fire prevention	1,343,584
Forest fire suppression	2,707,262
Pests and diseases	930,063

Source: ASEMFO

4.2.3 Forest management account

SEEA 2003 recommends establishing a Forest Resource Management Account where the expenditures in forest management would be recorded. This specific account would comprise among others, the following activities: forest management, pest control and regulation, afforestation including net acquisitions of land, forest inventories, development of forests for recreational use, forest-related research, education, training and information activities.

As in the case of forest related hazards, experts considered this as an interesting idea, but the lack of data would most likely hinder the establishment of such accounts. The experience gained in our case studies shows that the data are recorded and it would be more a question of re-organizing, rather than a matter of compiling new data. Data on timber permits for example, lack of a depuration of the databases; data inaccuracies were found that show that these data are hardly employed for purposes beyond recording. Furthermore, guaranteeing the accessibility to these data through the webpage of Catalonia statistics or the environment department would allow researchers to elaborate on them and provide a clearer picture of the forest sector.

The report of ASEMFO on the Spanish forest sector investments could serve as a guidance to establish a common framework for this type of analysis. In our opinion it should correspond to the forest administration to guarantee the availability and improvement of this data. It would allow to have a clearer picture of the forest sector and would provide useful information for forest policy and management.

In fact this account would comprise also the information on the hazard-related expenditures. Table 4.2.3 reflects the investments per forest sector as they appear in the reports of ASEMFO. This certainly could be a good starting point for Catalonia and the rest of the Spanish regions to perform their management accounts

Table 4.2.4. Investments in the forest related sector in Catalonia (2010)

INVESTMENT SECTOR	Total investment (in 2010 €)
Afforestations	171,355
Hydrologic protection	1,787,588
Selvicultural activities	15,174,830
Forest fire prevention	1,343,584
Communication on forest fires	220,000
Forest fire suppression	2,707,262
Pests and diseases	930,063
Protected areas	346,264

INVESTMENT SECTOR	Total investment (in 2010 €)
Forest Planning and management	51,738
Improvement of pastures	94,418
Building and maintenance of forest roads	941,573
Fauna and flora protection	49,999
Recreational uses, social participation	1,285,664
Forest related research	502,512
Demarcation of forest properties	295,667
Subsidies	19,324,189
TOTAL	45,226,713

Source: ASEMFO

4.2.4 Non wood forest products

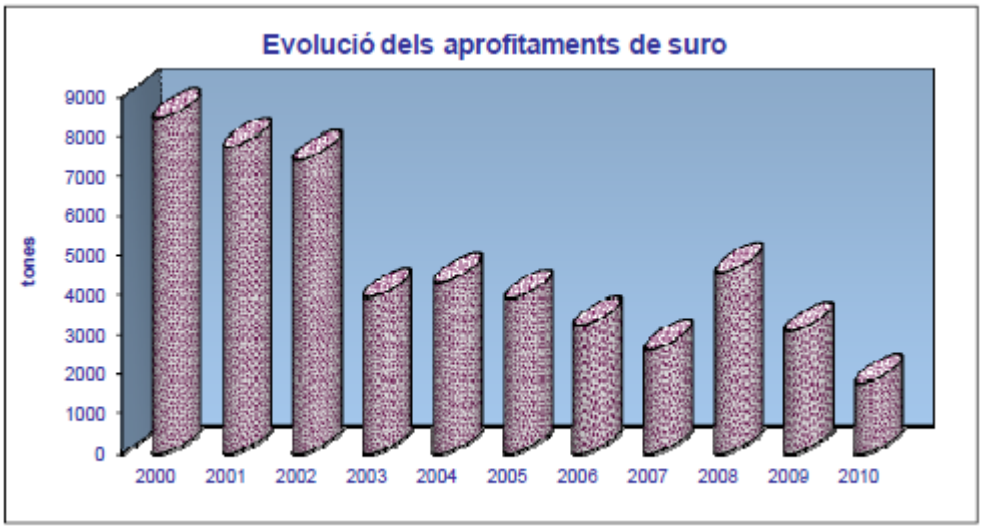
The non-wood forest products (NWFP) are a broad category of forest products (e.g., mushrooms, cork, berries) that are likely to represent a substantial source of income in many regions.

However, there are important challenges in measuring the flow and the economic contribution of these goods. A common situation in many countries is that the share of self consumption (i.e., the amount of NWFP collected for personal use of the collectors) represents a significant share of the total production. Our proposal in the questionnaire was to include a specific entry for NWFP within the SEEA to reflect their relevancy to the economy.

In the case of Catalonia, non-wood forest products are more relevant than timber or fuel wood. For example, for cork the extractions are recorded as it has a well established market and it would be relatively easy to have an specific account for cork.

The figure 4.2.1 shows the evolution of the cork removals in Catalonia. The production has experienced a decrease caused by a drilling insect (*Coraebus undatus*) that together with the death of trees by the likely effects of climate change and droughts has diminished the quality and the removals. Still this is akey product of Mediterranean and Catalan forests. The prices of cork (Llotja de Vic, 2013) per ton are of 1800 € for the planks and 400€/ton of virgin cork.

Figure 4.2.1 Evolution of cork production in Catalonia



Source: IDESCAT (2010)

Mushrooms are other key non-wood forest product in Catalonia. However, in this case, the self-consumption share and the informal markets in place make it difficult to estimate its production. However, ongoing research projects may provide insights that should be taken into account when trying to include this NWFP in the accounting environment (http://www.star-tree.eu).

4.2.5 Depletion indicators

Depletion of forest resources has traditionally been measured by estimating the share of timber harvested compared with the annual increment. SEEA already considers this aspect in the timber accounting table. The evolution of the forest land can also be monitored in the physical land accounting table. Hence, both the timber and the land stock accounts provide some evidence on the depletion of forest resources. However, not only the quantity, but also the quality of these resources is important. Thus, we proposed a list of indicators to enhance the assessment of depletion in the accounting framework. The proposed indicators were based on SoEF 2011 indicators.

4.2.5.1 Forest structure

The SoEF indicator 1.3 reports the forest areas according to age classes:

- *Un-even aged*
- *Even-aged:*
  - *<20 years*
  - *21-80 years*
  - *>80 years*

This classification could be incorporated in the SEEA standing timber physical account, as it would show more clearly the situation of the stands (e.g. whether the removals are more focused on old trees, if the stands are composed of very young trees). On the other hand, this classification is difficult to apply to irregular (un-even aged) stands composed of trees of different age. That is why in some cases a shift from ages to diameters would be more advisable and easy to achieve.

In the case of Catalonia (source Spanish NFI), the forest stands are described in terms of the number of trees or cubic meters in each diameter class. However, our experience shows that using such detailed information wouldn't be possible for tracking stock flows, as the removals and losses are not recorded according to tree ages/diameters. However, employing this classification, would allow a more straightforward calculation of the standing timber value in the monetary account, enhance the informative potential of physical accounts, and facilitate the calculation of the land values.

4.2.5.2 Protected forests

The SoEF indicator 4.9 shows the share of protected areas according to four protection classes: conservation of biodiversity through no active intervention, conservation of biodiversity through minimum intervention, conservation of biodiversity through active management, and landscape conservation.

Protected forests in the timber physical account classify as natural forests not available for wood supply. However, this accounting category encompasses also forests without any type of protection, which have limited access and hence timber extraction is not possible or profitable. This categorization doesn't allow tracking the evolution of the protected areas. Hence, we would propose a differentiation for the no available for wood supply class, separating the unavailable resources due to protection from forests unavailable due to other reasons (i.e. access). In the case of Catalonia, the protected areas where timber is not removed is very small. it is only the National Park of Aigües Tortes that falls into this category. National Parks achieve the highest level of resource protection no extractive activity can be undertaken within its boundaries. The rest of protected areas in Catalonia have an active management and timber removal is allowed. In the case of Catalonia, differentiating the National Park form the rest of natural areas may not be so useful as the standing timber on it represents a small share, as table 4.2.5 shows and because the protection regime is quite strong and these areas are expected to remain stable along the years. However, we consider that recording this differentiation in the natural class would be useful for countries where the forest law enforcement is still limited.

Table 4.2.5. Share of the natural class in the opening stock of the timber account belonging to protected areas

	Natural class in the timber physical account (10^3 m^3)					
	Not available for wood supply in protected areas (National park)		Total NOT available for wood supply		Total NOT available for wood supply	
	Conifers	Broadleaved	Conifers	Broadleaved	Conifers	Broadleaved
Opening stock 2000	522	0.9	35,078	25,516	35,600	21,517

4.2.5.3 Introduced species

The SoEF indicator 4.4 reports the share of forest area dominated by introduced species. This type of information could be included in the timber account table when relevant. Apart from differentiating between conifers and broadleaved species, some introduced species play an important role in plantations and represent an important share of the removals in some countries. In Catalonia for example, *Pseudotsuga menziesii* is one of the more profitable species and is important for the timber industry. The removals of Pseudotsuga account for 1.43% of the total conifer wood removed in 2010. However, this

tree species' market prices are much higher than for other conifers (trunks of more than 30cm in diameter have market prices between 75 and 87 €/ton, while for most pine species it is bellow 50€/ton). Hence, tracking it extend would add relevant information to better understand the development of forest resources.

4.2.5.4 Deadwood

Indicator 4.5 of SoEF records the average volume of standing and laying deadwood (m^3/ha). The amount of deadwood in forests is seen as a valuable indicator to estimate biological diversity within forests for both current state and development over time. Deadwood is already recorded in the timber account within the natural or either catastrophic losses class, so the accounting framework does already offer possibilities to track the evolution of deadwood, although it is as a lump sum that will just give an overview on the issue. However, from our experience in applying the accounting framework, this record would suffice to provide some information while a more detailed assessment of deadwood quality should be undertaken outside of the realms of the accounts.

In the case of Catalonia, the amount of deadwood was calculated based on mortality rate data from the NFI. However, this data is rather general. In the case of Catalonia, the Centre for Ecological Research and Forestry Applications (CREAF), performed some complementary data collection on selected plots. Some of these were related to the measurement of deadwood with the purpose of establishing vegetation fuel models. Deadwood in Mediterranean forests plays a crucial role in determining the vulnerability of the landscape to forest fires. It is expected that the NFI measurements on deadwood in the forest will be improved in the already ongoing NFI 4, incorporating new measurements such as different deadwood types and decay stages (Torras et al,. 2009).

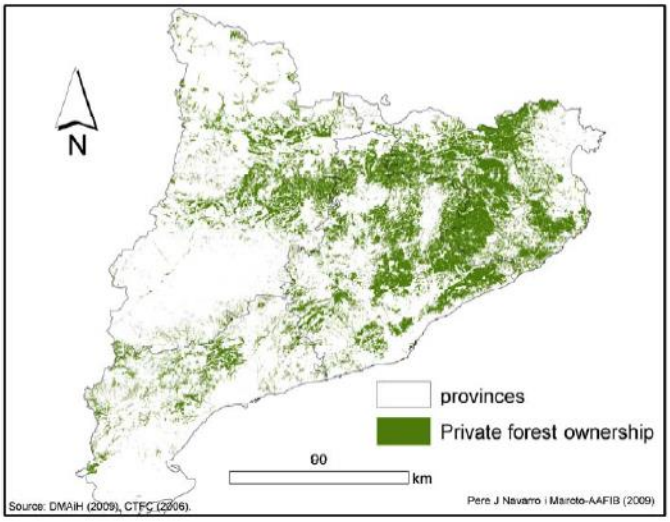
4.2.5.5 Forest holdings

The number of forest holdings, their sizes and ownership types are assumed to have implications on forest management practices and the provision of forest goods and services. Therefore, monitoring changes of ownership structures may give indications about the potential for sustainable forest management, for example with respect to production of timber and other goods and services, employment and other socio economic developments. In the Deliverable 5.2 this aspects is further discussed.

In the case of Catalonia, around 87% of the land is owned by private forest owners. The average forest area per owner is 6.84 ha while the average area per property is 2.71 ha, meaning that the average owner has two forest stands. About 89% of owners have properties with less than 10ha, representing 31.22% of the total private forest land. Typically, the central-north and north-eastern parts of Catalonia have larger properties (>25ha), while the fragmented properties are in the less productive areas of Catalonia (Navarro et al., 2010). Table 4.2.6 shows the distribution of the forest ownership according to the size of the properties. Considering these aspects both in the land and timber accounts would allow disentangling the role the different type of properties play in the flow of timber products, providing with valuable information to design, for example, timber mobilization policies. It would also be useful to monitor changes in the property

and also on the values of the land according to the ownership, especially in countries where land is going through changes on it.

Figure 4.2.2 Map of distribution of private forests in Catalonia



Source: CPFC, 2012

Table 4.2.6. Forest ownership in Catalonia according the size of the properties

Area	Number of owners	Share of private forest owners	Forest land(ha)	Share of area
< 0.5 ha	62,405	35.71%	42,398	3.54%
0.5-1 ha	26,298	15.05%	44,078	3.68%
1.1-5 ha	53,869	30.82%	178,982	14.95%
5.1-10 ha	13,405	7.67%	108,233	9.04%
Total	155,977	89.24%	373,693	31.22%

Source: Navarro et al. 2010

4.2.5.6 Forest use

FRA2010 reports the following classes for primary designated functions of forests:

- Production
- Protection of soil and water
- Conservation of biodiversity
- Social services
- Multiple use
- Other

This classification, similarly to the previous, could be applied to forest land. It would provide a better overview of the functions forest land fulfils in the different countries, and by including them in monetary accounts would demonstrate their value. However, we are aware that countries may find it difficult to report the main forest functions.

In the case of Catalonia, and similarly to most Mediterranean regions, forests fulfil several functions, being therefore difficult to stick to one of the above classes the forest areas. The NFI3 provides with some information on recreational uses, but this corresponds to the recreational areas where there are picnic facilities or the like, so it

does not really reflect the forest area under recreational uses. The total area covered by these facilities is 54 ha in Catalonia, over 1.9 million ha of total forest land. Also, the data from the NFI3 on forest areas with a primary soil conservation purpose contemplates the areas where specific projects on hydrologic correction measures have been developed. These areas amount for 12,449 ha, what represents 0.64% of the total forest area. Table 4.2.7 shows the total protected area in Catalonia that could be allocated (although fulfilling also very important recreational functions) to biodiversity conservation purposes. It amounts for more than 44% of the forest land. Finally, the area of plantations according to the land cover map of 2009 amounts for 44256 ha, what would represent 2.29%of the total forest area and it would be allocated to productive functions.

To summarize, elaborating clear criteria for allocating Catalan forest land into these classes would be needed as a way to unveil the functions forest land fulfils for the society. Also incorporating these classes into the land accounts would allow for a better assessment of the uses of the land and the changes it experiences along the time.

Table 4.2.7. Forest protected areas in Catalonia that would classify as conservation for biodiversity use

FOREST AREA UNDER PROTECTION WITH NATURA 2000 NETWORK AND/OR PROTECTION FIGURES (HA)			
Forest	Other wooded land	TOTAL FOWL	%PROTECTED FOWL
662,276	197,462	859,738	44,37%

Source: MARM 2008

5 Discussion and conclusions

5.1 Discussion: Overview of the data collection and accounting building process

Catalonia and Sweden differ significantly in terms of forests. The Catalan forests are characterized by low timber volumes, while Sweden is one of the most forest rich countries (e.g., 2nd position in the EU-27 in terms of standing timber per capita), with a forestry sector that has a significant role in the national economy. See table 5.1 for more details.

Table 5.1. Standing timber in forest area (wooded land) and per capita in the two selected case studies and related to the EU-27 averages. 2005 data.

	Total growing stock (m^3)	m^3/ha	m^3/citizen
Europe-27 average	19,702,000	127	40
Sweden	3,104,600	111	344
Catalonia	118,157	73	16

Source: SECF, 2010

The following sections present some of the most important issues related to the compilation of data for forest accounts. Furthermore, we highlight what we considered positive contributions of the SEEA 2012 compared to the previous version, but also flagging critical points in the SEEA applicability. When possible, we attempt to propose ways of enhancing the current framework.

Suitability of the SEEA framework

Although there are significant differences in the importance and organisation of the forest sector, it seems that the SEEA accounting framework facilitates the comparison between the countries, and is well suited to monitor the situation of forest land development. Furthermore, it seems also suited to monitor cases where the forest land is undergoing significant changes (i.e. land use changes towards agricultural and urban land). However, when dealing with forest areas where timber is not the main forest product (e.g., Mediterranean countries) not accounting for non-wood forest products or relevant ecosystem services produces an undervaluation of these forests, which is exactly one of the aspects that environmental accounts try to overcome. Hence, for such countries/regions the implementation of forest accounts might be not so appealing.

The timber physical account

The timber physical account table in SEEA 2012, differently from SEEA 2003 and also differently from the Integrated Environmental and Economic Accounting Framework (IEEAF) set up by EUROSTAT, records volumes of timber instead of timber areas. This change can be interpreted as a willingness to consider forest land separately from timber, what might represent a first step in considering forests beyond timber. However, establishing an account on timber volumes proved to be a difficult task, due to the composite nature of the forest asset (timber and land). Hence, setting up a timber account in m^3 usually requires accounting first for the land where the standing timber grows, classify it according to the timber classes and translate finally the hectares into cubic metres. Furthermore, it implies adopting certain assumptions to classify forests into

natural and cultivated. Therefore, the timber account is closely related to the land where the trees grow and this is not made so apparent in the current description of the SEEA accounts. In most cases NFI data on average standing stock (e.g., m^3/ha) are a good proxy for transferring hectares into cubic meters. However, in the case of catastrophic events (e.g., forest fires, storms) the significant changes in the standing volume can hardly be reflected in timber account, as most of the records of these events show burnt area, but not in terms of m3 affected (e.g., forest fires are recorded in terms of affected area, but data on the timber burnt is not reported).

In the Catalan and Swedish pilot cases we tried to go beyond the initial SEEA timber classification , establishing some additional classes to gain some insight, such as the division into conifers and broadleaved species or the presentation according to age classes. More specifically, it would be very useful to present losses according to age classes (or diameter classes) for the main tree species. As the Swedish case study shows, such an approach would allow getting a better picture of the situation and the long term sustainability (e.g., the lack of mature trees). Furthermore, establishing such a differentiation in the physical timber account would allow for a better and more informative translation of the physical account into the monetary account.

The monetary accounts in SEEA

One of the added values of the forest accounts would be expressing in monetary units the value of the standing timber. When the resources are presented in monetary units, the economic impact of the policies can be easier presented to policy makers. However, the translation of physical into monetary units is rather challenging. For example, in the case of Spain, information on stumpage prices is almost totally lacking or is not reliable, what somehow shows that timber markets lack transparency. Furthermore due to the long term rotation periods that typically timber products have, the discount rate will play a fundamental role in the estimating the present value of future transactions. High discount rates will favour shorter rotation periods, while low discount rate will suggest longer rotation periods.

The net present value (NPV) approach intends to estimate the value of wood products that will be harvested in the future. This is particularly relevant in forestry: The total stock cannot be harvested in one year for various reasons, which include the long period of tree growth, the non-linearity of the growth in value. Compared to the multiplication of the standing timber by the stumpage price, the NVP approach take into account that the timber cannot be harvested at once because the market would then collapse, and that the standing timber has a future value which can be higher than the present one (young forests) or lower (over aged forest). A major issue concerns the risk of double counting: the NPV is composed of both the timber future value and the land expected value, which would correspond to the land rent. In the Catalonian case study, an attempt was made to calculate the NPV and the LEV. The difference was then considered as the effective value of the standing trees

Despite SEEA 2012 explicitly states that the objective is to estimate the value of the asset *in situ* rather than of its removals, the monetary accounts recommend to remove the monetary estimates of the standing timber non available for wood supply. In conversations with SEEA editors, they stressed that the importance of the stock accounts lies in the possibility of linking the origin of the timber with the timber products that

enter into the economy. From this approach, excluding the timber not available for wood supply from the monetary accounts would be recommended.

In the physical accounting, the harvested wood products are issued from the cultivated forests and the forests available for wood supply. When giving a monetary value to the standing timber, we only consider the part of timber that can enter the economy, which corresponds to timber in these two categories. This ensures coherence between physical and monetary accounting.
To estimate the net present value of the standing timber, we considered that the management practices that are currently used in Catalonia would remain the same to the infinite. This could be realistic because only a small part of the net annual growth of the growing stock is harvested. However, global warming will change the productivity and the dynamic of the forests and measures taken towards an increased use of renewable energy and material will reshape the wood market. A reference scenario that would take into account the market trends as well as the structure of the resource (maturity) would be more appropriate.
The NVP estimation was based on current levels of harvesting and not the potential of harvest. An estimate of the potential harvest might have been a better proxy to estimate the NPV, however, it would have been complex to estimate the variation in the stumpage value of timber related to more intensive harvesting.
The wood prices were considered as stable over a long period. This is very unlikely; however, we did not have means to predict the change in price during the next years.
The land expected value was estimated as the function of the current harvest, but with a delay corresponding to the average time needed to produce the currently existing resource regardless of the structure of the resource. This simple approach is easy to estimate and is a function of the net productivity of the forests with the currently existing resources. It does not make use of the production potential of the forest land which would require information on the site indices and the most economically productive species that can be grown in these areas. The LEV it therefore probably underestimated, however, it is less demanding in terms of data and it takes into account cultural and social constraints on the forest types.

To solve the question of the structure of the timber resource and the trend in wood harvests and prices, a deep work with the forest inventories, forest modellers and macro-economists is required. However, the tools are available in very few countries and there is a risk for huge heterogeneity between reporting countries.

In this case study, we used a discount rate of 2%. This rate is quite low compared to recommendations for usual public investments (3.5% in Norway, 5% in the European Union in 2012). However, with this rate, we wanted to integrate the concern about the sustainability of the management of the forests. This rate has to be harmonized with the ones used for other natural resources.

It would not make sense to estimate that the price of timber will increase as fast as the discount rate as in the case of some non-renewable resources except if the resource is too intensively managed and might become scarce in the coming decades.

The value determined using a NPV approach highlights that wood resources are progressively harvested over a long period. With very low discount rates, sustainably managed forests will have a greater value than too intensively harvested forests.

However, in most cases, the discount rate will be at least 2%. The preservation of production capacities after 100 years will have very little value compared to an intensive use of the forest during the first 20 to 30 years. More work is still required to give value to the sustainable use of the resources.

Degree of comparability across case studies

The possibilities of establishing comparisons across our case studies was limited due to lack of data. The two case study regions count on National Forest Inventories that constitute a vast and complete source of information on forests. However the NFI data has to be merged with data on: (i) management (cultivated/natural classes); (ii) availability of forests for wood supply (this can for example be determined by slope, which is recorded in the NFI but also by the distance to forest roads, not recorded in Spanish NFI); (iii) natural losses (e.g., pests, forest fires); and (iV) removals. Differently from the NFI data, these info are compiled in databases that are hardly used to make any type of analysis, but are more a tracking document where for example, the removals are recorded. These databases are not public and the information kindly provided by the databases' managers was sometimes incomplete or contains errors deriving from the lack of use.

Another aspect that hindered the comparison across case studies was the different assumptions that had to be made in setting the boundaries for the accounting classes. These assumptions differ between the two case studies because, as SEEA states, countries have to set their own boundaries (for example between cultivated and natural) in accordance to their situation. This is partly also due to the problems encountered in dealing with the SEEA terminology. This aspect is further discussed below. Therefore, the SEEA framework could mainly be a good basis in comparing the situation over time for a particular area or between similar countries/regions where the available information and the way it is organized follows similar criteria, but it doesn't seem suitable to compare two situations so different such as the Catalan and Sweden case studies.

Experiences regarding data compilation

The SEEA Central Framework (SEEA CF) discusses the issue of **cultivated vs natural**[8] **forests**. There seems to be an underlying implication that whit existing data it should be possible to differentiate between planted or naturally regenerated forests, and whether a forest is actively managed or not. However, to our best knowledge and having discussed the issue with the data providers, the existing data does not allow to make these distinctions for the Swedish forests. Thus, to accomplish the requirements of the SEEA 2012 framework, new forest characteristics parameters would have to be included into the national forest inventory. Given the problems encountered, it is not easy to see how such parameters could be developed. Similarly, in the Catalan case study, a proxy was adopted to split the standing timber in these two classes. However, having a management plan doesn't guarantee that the land is actively managed.

According to SEEA, the key consideration to differentiate between cultivated/non cultivated areas is that the cultivation processes must form part of economic production. The term ''production'' usually indicates an activity carried out under the responsibility, control and management of an institutional unit, that uses inputs of labour, capital and goods and services to produce outputs of other goods and services (UN, 2001). Hence, in

[8] Section 5.353-5.357

the first case (cultivated land), standing timber is defined as productive activity and the added value, corresponding to timber growth, is included in the GDP. In practical terms, this boundary is defined based on the classes of forest defined by FAO with timber resources in primary forests being considered natural and timber resources in other naturally regenerated and planted forests being considered cultivated. Applying this classification in the Mediterranean would automatically classify all forests as cultivated. However, in the Mediterranean context primary forests are absent and instead, in the northern rim, important forest areas lack management due to their low profitability. Such a straightforward identification of SEEA and FAO classes would lead to erroneous conclusions, and not reflecting the trends on a key aspect of northern Mediterranean forests such as land abandonment and lack of forest management.

To establish the production boundary between cultivated and non cultivated forests we considered the ownership share in Catalonia. Therefore, all public forests under public management were classify as cultivated, assuming that continuous management and timber extraction takes place in these forests. Only the national Park of Aigüestortes classifies as natural due to its integral protection that forbids any extractive uses. Regarding private forests, we have relied on the CPF data on private forests with a management plan. These have been classified as cultivated areas, while the remaining private forest land, where classified as natural. Hence, the existence of an approved management plan has been used as a proxy for the existence of an timber productive activity. This is a significant assumption as having a management plan doesn't necessarily preclude a process of economic production. Furthermore, this process has to be related to timber. However, in the Mediterranean timber is not the main good obtained from the forests. Extensive grazing, hunting or mushroom production are many times more relevant and very frequently all these productions take place simultaneously.

In the case of the forest land account, its implementation was possible due to the information existing for Catalonia where a specific land cover map with a high degree of detail and *ad-hoc* categories has been developed. However, other data bases such as CORINE land cover, SIOSE (http://www.siose.es/siose/presentacion.html), national forest map (http://www.magrama.gob.es/es/biodiversidad/servicios/banco-datos-naturaleza/informacion-disponible/mfe50.aspx) or NFI data are available. The difficulty however, would remain in deciding which of them would be more suitable for establishing the accounts and it would also raise the question of the comparability across countries. In addition, the information providers should make sure that the comparability across the different versions of the land use maps is preserved. Otherwise, comparison analysis would be hindered. Furthermore, the land account per se would be little informative on the quality of the forest land. In addition, in European countries where primary forests are few or missing, it would be needed to more adequately classify "other wooded land", which could provide some further insights into the development of forests.

Finally, this **terminology creates some misunderstandings**, especially when trying to convey these concepts to a "non-accounting" audience (e.g., foresters). Intensive plantations are the closest forest type data collectors have in mind when being confronted with the term "cultivated". Second, the term "natural" is often confused with primary forests, that are also very rare or even absent in Europe. Further, the concept "natural" and "naturalization" are object of deep and hot debates among ecologists, so their use is unfortunate when approaching the forest sector. From our experience, such classes should be renamed with more informative terms avoiding their resemblance with

ecologic terms when the underpinning philosophy is making a distinction based on economic grounds. A proposal such as "actively managed" forests and forests "without continued management" could be some of the alternative names for the classes.

Our experience leads us to consider that the elaboration of the accounts should take place jointly with foresters and data collectors. This would help to know which proxies can be used for the accounts, and in planning future data collection campaigns that could provide information that may help in determining more precisely these boundaries. Therefore, finding a best suited terminology in the accounts would help to bridge this gap between accountants and foresters.

Reflexions on the accounting framework

The current classification employed by SEEA is important to distinguish the production boundary and the processes linked to timber production that enter into the economy. However, we see a need to discuss the demand for the classification currently employed for the timber account What is the underlying information and the questions that the system is aiming to answer? Is it aiming to create a more complete data set for economic policy by pin pointing that the natural resources can be better used? Is there an underlying assumption that economically productive forests should be more prominent in the country's economic policies? It does not seem to be designed to answer questions about the state of the forest itself. Furthermore, the terminology is confusing and it doesn't contribute to bridge the gap between foresters and accountants.

In the Catalan case study some results show interesting trends, such as the extraction of an important amount of broadleaves timber from non managed forests. Such development could have negative impacts on the sustainability of these forests. However, the physical timber accounting table as such wouldn't be informative enough on these aspects to arrive to some general conclusions. In this respect, our proposal of exploring some of the indicators currently used in Forest Europe may be of help in shaping up and enriching the forest accounts with somehow more informative classes. However, it might come at a cost of increasing the difficulties in collecting the required information

Another issue is the **time horizon**. When a forest that was managed in the past, but is not any longer can be reclassified as natural? The SEEA Central Framework does not foresee such cases. However, these questions both raise the issue of defining time horizons within the SEEA CF. Depending on the time horizons the statistics presented in the SEEA tables can differ greatly. Even in a country with large forest areas, like Sweden, very little forest is *completely* untouched. This could possibly be recorded in the proposed SEEA timber account table row for reclassifications but there is still the question at what point in time the reclassification should be accounted to.

Finally, when it comes to the data collection process it must be highlighted that it has been rather time consuming. This has hindered the possibility of advancing in data analysis and production of better data.

5.2 Conclusions

Accounting is not about collecting new information but it can influence the way information is collected. If initiatives similar to SEEA were put in place on a regular basis and its findings would be decisive when developing forests policies, the data would be collected more accurately and in ways compatible with the accounting needs.

While the previous version of SEEA (2003) was not a standard but a collection of good practices, this updated version (SEEA 2012) is an internationally recognized statistical standard. However, SEEA 2012 implements a more narrow view on most of the issues.

Any socioeconomic sector that wants to reflect its level of impact on the national economy and society has to rely on an accurate and trustful information system. This would pave the way for enhancing such a sector and consolidate its economic influence.

The forest sector in Catalonia was traditionally characterized for lacking stable and complete sources of information. The reasons for such a situation are related to the dispersal of competencies among different public administrations, but also to the difficulty of obtaining data from the forestry sector and the division of the sector among public administration, industries and services provider enterprises. This dispersal and lack of solid data has been clearly shown in the data compilation process.

In the case of Sweden, the problem to fill in the SEEA timber accounting table resides in the difficulty of making the division into natural and cultivated classes. But there is a good availability of statistics on production, growth, stocks and other economic variables, possibly better than any other industry (except agriculture), these statistics have been produced regularly for many years so they can be considered stable. The lack of data concerns to environmental issues, biodiversity and ecosystem services.

Environmental accounts aim at recording the processes that take place beyond the SNA. The forest section of the accounts is still rather limited in scope, where timber is the only asset considered, while the multiplicity of goods and services provided by forests are absent. This clearly indicates that forest accounts are still in their "infancy" and still toned to be significantly improved.

To boost the evolution of forest accounts towards a more complete reflection of the situation and complexity of forests, it will be essential to consider what are the questions that we intend to address with these accounts. However, this would require that the accounts are rather developed according to the ecosystem accounting logic, which are still in an experimental phase.

Finally, and despite the need for a broader and deeper development of the forest accounts, we consider the accounts can provide a complementary view on forests. The use of forest accounts might not so much be within the forest sector, but rather beyond, at the inter-sectorial level, when comparisons with other sectors are made and priorities among sectors are set.

6 Guidelines for practitioners/data providers

The first observation is that the definitions suggested in the SEEA were not applicable in practical measurement work. Most prominently, the definition of natural versus planted forests is not readily applicable and has caused many discussions about what would be the most reliable assumptions to be made to align the biophysical data with the accounting logic. In order to produce forest accounts, we recommend to rely on definitions that are used in the inventories.

Most of the adaptations needed to meet SEEA 2012 requirements have to do with the timber accounts and with the necessity of estimating standing volumes when data is usually provided in terms of hectares/surface covered. The current data from NFI doesn't suffice to create the classes for standing timber and the annual records from environmental/forestry departments would be needed. A general recommendation for Catalonia would be to improve the accuracy of these records where data is sometimes introduced but not revised and cleared up to guarantee its consistency, by using it for economic analysis.

A nationwide criteria should be adopted to distinguish managed from unmanaged forest properties. For this purpose, data on the existing forest holdings and the management activities that are performed in these holdings along a given period of time, e.g. 10 years, could serve as a guidance for ascribing these holdings either in the cultivated or natural classes depending on their activities. So a clear record of activities per holding would be needed. From our experience, the Catalonian databases on the existing forest holdings and their features , i.e. species and standing volumes, have improved in the last years, but still important room exists for their improvement. The most important improvement to be achieved would be collecting good estimates of standing volumes in the forest holdings. This is still rather inaccurate and hence estimates have to be based on average estimates from the NFI.

Data from removals are usually estimated based on timber permits, but not on the real extracted volumes. Therefore, when data is revised in the national accounts, disparities exist between the recorded extractions and what is in the real market. Improving the records of extracted volumes would require a tight control from forestry departments or remote sensing based estimations. However, some sampling could be conducted to have an estimate of the standard deviation between the quantities extracted and the volumes recorded in timber permits. An alternative would be employing data from the national accounts records that record more accurately the timber that is placed on the market. The discrepancies between these data sources may not be a problem if the main use is to compare in time rather than to find the absolute number, if the relative difference is believed to be of the same size.

So to summarize, the communication between forest account experts and forest inventory experts needs to be improved to make the forest accounts results relevant for both communities. Both accountants and foresters would benefit from an improved understanding as the accounts would be performed more easily and therefore would be

able to cover topics beyond timber allowing for a stronger presence of forest issues in relevant policy arenas out of the forest sector.

One example of the potential influence this cooperation may have, is shown by the increasing demand on forest data that EUROSTAT is facing from different European institutions such as DG Agri, the Commission or the European Parliament to better inform their decision making. These institutions are demanding yearly estimates of changes in forests. This is in contrast with the periodicity of National Forest Inventories, that are the main source of information and which provide information on 5 to 10 years intervals. The forest sector loses its impact on policy making not being able to provide annual data. When economic estimates are produced every year and have to be confronted with average physical data, the estimates are far from being clear and don't reflect accurately the impact of the economy on the forests. It is precisely in this type of scenarios where the alliances between accountants and foresters would be promising.

Nevertheless, the realm of the forest accounts, as they are performed nowadays has to be well delimited. In this respect, the SEEA framework is useful to observe quantitative changes (e.g., diminishing stock of timber) and it is an instrument when transferring the physical units into monetary ones, so the flows from the physical to the economic systems can be tracked. However, the accounts as they are performed nowadays are very limited for assessing the quality of the forests (e.g., biodiversity).

Finally, there is a need to discuss how the forest accounts will give new information that is not already published elsewhere. For the Swedish national economic accounts there is a valuation done, which considers the growing stock. The reporting for Forest Resource Assessment and State of Europe's Forests also provides country data on a wide range of variables. For the forest accounts to be useful it needs to provide new knowledge that is nowadays demanded not by the forest sector itself but by policy makers in areas that are beyond the forest sector itself and encompassing transversal policies.

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