

# Forest sustainability in Sweden

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Project No.: 130373

October 2017

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## 1. Introduction

The combustion of wood for energy purpose is not considered to contribute to the augmentation of greenhouse gases concentration in the atmosphere, as long as the CO<sub>2</sub> emissions released during the combustion of wood are balanced by the growth of new trees. It is therefore essential to investigate if the forests in the region where the wood used for energy purpose are managed in a sustainable way, avoiding resources associated with overexploitation of forests, land use change, depletion of carbon stocks, etc...

In this framework, literature research was carried out to produce a summary of forest management in Sweden, including general condition, management and sustainability assessment.

## 2. Sweden forests overview

### 2.1. Location and distribution

Sweden is a country part of Scandinavia that borders Norway to the west and north and Finland to the east. It has a maritime border with Denmark, Germany, Poland, Russia, Lithuania, Latvia and Estonia. It is the third largest country of the European Union with an area of 449,964 km<sup>2</sup>. The country is separated from Norway with the Scandinavian mountain chain ("Skanderna"). Its highest point is Kebnekaise at 2,111 m above sea level and its lowest lies at -2.41 m below sea level.

Sweden has 25 provinces ("landskap") based on culture, geography and history; they play an important role in people's self identity. On an administrative subdivision, the country is divided into 21 counties (Table 1 and Figure 2). Each county contains a number of municipalities ("kommuner"), the existence of which is partly at the discretion of the central government. Their number is 290. Every county counts a county administrative board with a governor appointed by the government at its head, as well as a separate county council. The purpose of the county administrative board is to coordinate the political goals with the central government; the county council takes care of public healthcare, public transport and culture. Other government agencies are organized on a county basis such as the police, employment, social insurance and forestry services<sup>1</sup>.

**Table 1 : Administrative regions of Sweden**

| ISO-code | County       | Administrative centre | Area in km <sup>2</sup> | Population in 2016 |
|----------|--------------|-----------------------|-------------------------|--------------------|
| AB       | Stockholm    | Stockholm             | 6,519.3                 | 2,269,060          |
| C        | Uppsala      | Uppsala               | 8,207.2                 | 361,373            |
| D        | Södermanland | Nyköping              | 6,102.3                 | 288,097            |
| E        | Östergötland | Linköping             | 10,602                  | 452,105            |
| F        | Jönköping    | Jönköping             | 10,495.1                | 352,735            |
| G        | Kronoberg    | Växjö                 | 8,466                   | 194,628            |
| H        | Kalmar       | Kalmar                | 11,217.8                | 242,301            |
| I        | Gotland      | Visby                 | 3,151.4                 | 58,003             |
| K        | Blekinge     | Karlskrona            | 2,946.4                 | 158,453            |
| M        | Skåne        | Malmö                 | 11,034.5                | 1,324,565          |
| N        | Halland      | Halmstad              | 5,460.7                 | 320,333            |

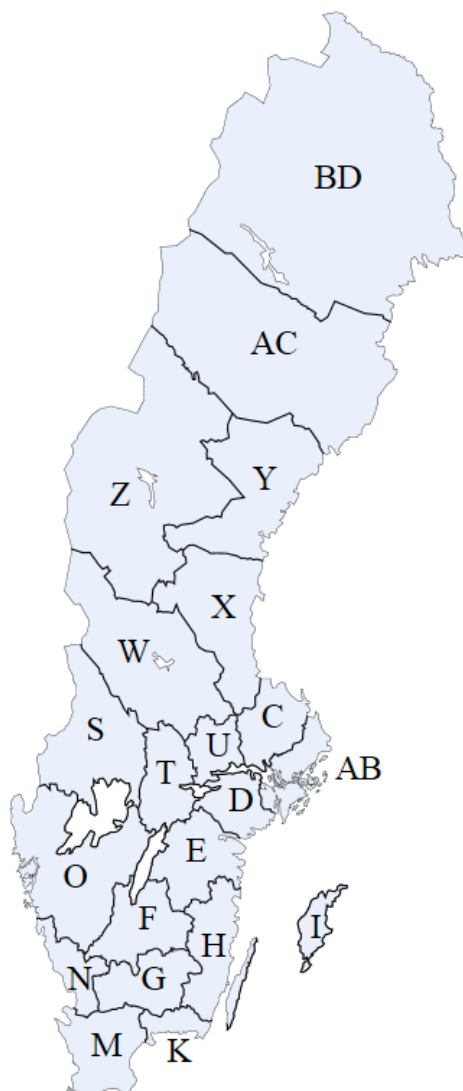
<sup>1</sup> [https://en.wikipedia.org/wiki/Counties\\_of\\_Sweden](https://en.wikipedia.org/wiki/Counties_of_Sweden)

|    |                 |           |          |           |
|----|-----------------|-----------|----------|-----------|
| O  | Västra Götaland | Göteborg  | 23,948.8 | 1,671,783 |
| S  | Värmland        | Karlstad  | 17,591   | 279,334   |
| T  | Örebro          | Örebro    | 8,545.6  | 294,941   |
| U  | Västmanland     | Västerås  | 5,145.8  | 267,629   |
| W  | Dalarna         | Falun     | 28,188.8 | 284,531   |
| X  | Gälvborg        | Gälv      | 18,198.9 | 284,586   |
| Y  | Västernorrland  | Härnösand | 21,683.8 | 245,572   |
| Z  | Jämtland        | Östersund | 49,341.2 | 128,673   |
| AC | Västerbotten    | Umeå      | 55,186.2 | 265,881   |
| BD | Norrbotten      | Luleå     | 98,244.8 | 250,570   |

Source : [http://en.wikipedia.org/wiki/Counties\\_of\\_Sweden](http://en.wikipedia.org/wiki/Counties_of_Sweden)

Figure 1 : General map of Sweden

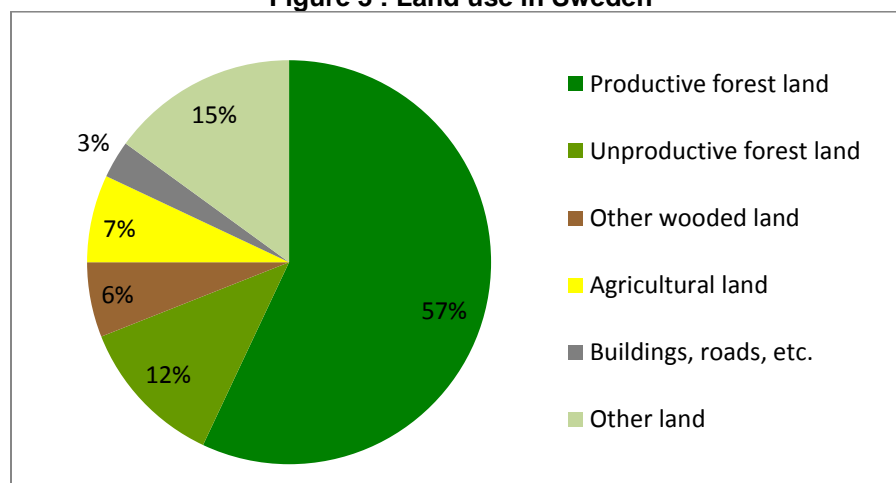


**Figure 2 : Map of Swedish counties**

Source: [http://en.wikipedia.org/wiki/Counties\\_of\\_Sweden](http://en.wikipedia.org/wiki/Counties_of_Sweden)

According to the Swedish National Forest Inventory (NFI) 23.2 million ha of the country's land area consists in productive forest land in 2014 (57% of total land area). Unproductive forest land occupies 4.9 million ha (12%). 2.4 million ha are covered by other wooded land (6%). Agricultural land takes up to 2.8 million ha (7%) while building, roads and other occupations only 1.2 million ha (3%). Other land covers the rest, 6.12 million ha which corresponds to 15% of the total land area<sup>2</sup>.

<sup>2</sup> Forest and Forestry in Sweden 2015

**Figure 3 : Land use in Sweden**

Source: The Swedish National Forest Inventory (NFI) 2010-2014

According to the FAO, the forested area in 2010 consisted in 28.1 million ha and other wooded land 2.4 million ha (Table 2). The forests and other wooded lands take up to 66% of the total country's territory.

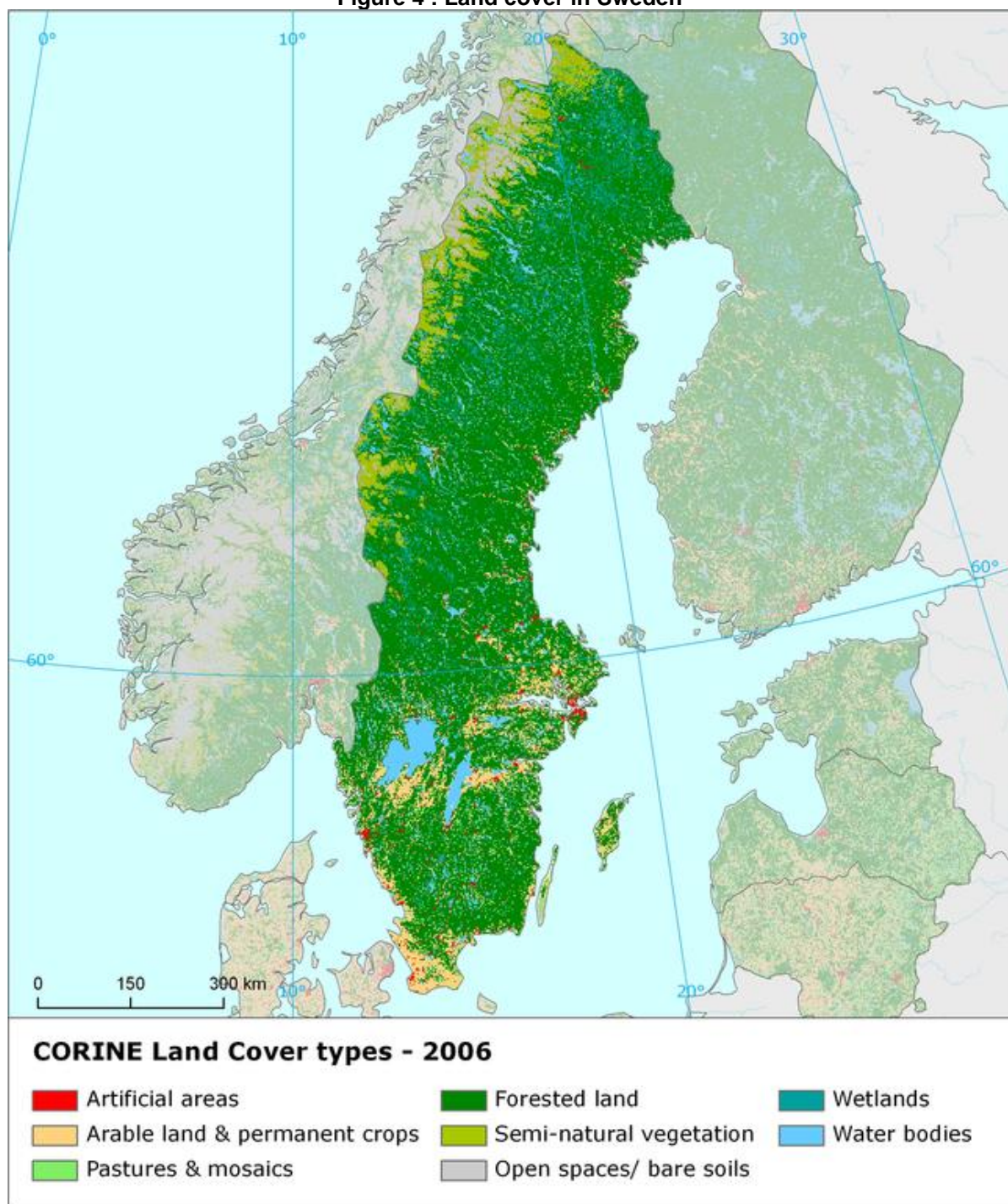
**Table 2 : Forested areas in 2010**

| Category                     | Area (000 ha) |
|------------------------------|---------------|
| Forested area                | 28073         |
| Other wooded land            | 2432          |
| Other land                   | 10529         |
| ... of which with tree cover | 864           |
| Inland water bodies          | 3996          |
| <b>TOTAL</b>                 | <b>45894</b>  |

Source : Global Forest Assessment 2015

Figure 4 presents the generalized continental land cover. As can be seen on this map, forests cover a large part of the territory and are evenly distributed across the country. Arable land and permanent crops are located in the southern part of Sweden. There are almost no pastures and mosaics to be seen. The semi-natural vegetation and bare soils located in the northwest of the country correspond to the Scandinavian mountain chain. The largest area of artificial land is Stockholm and its county area.



**Figure 4 : Land cover in Sweden**

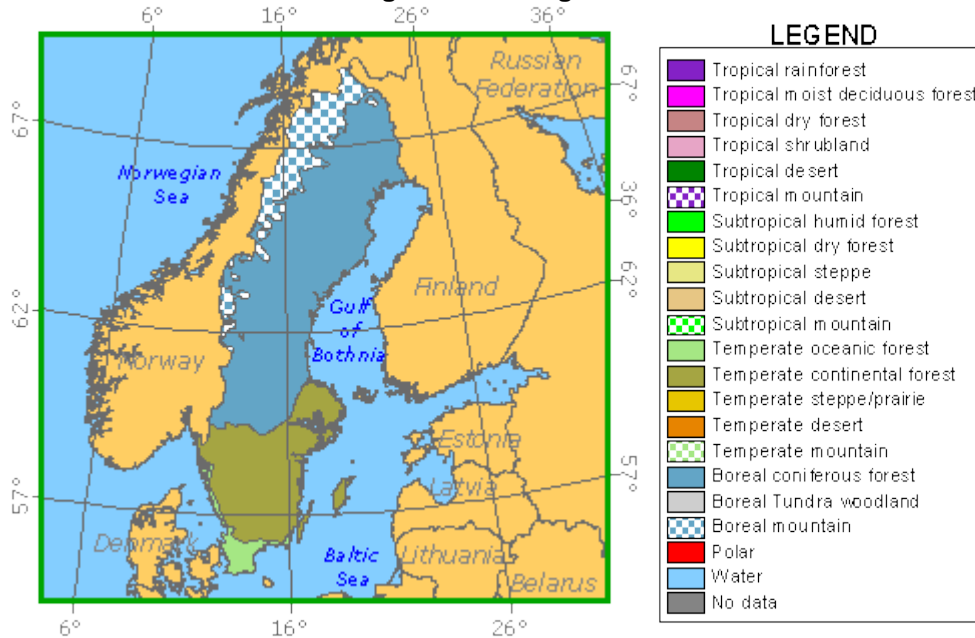
Source: [https://www.eea.europa.eu/data-and-maps/figures/land-cover-2006-and-changes/sweden/image\\_large](https://www.eea.europa.eu/data-and-maps/figures/land-cover-2006-and-changes/sweden/image_large)

## **2.2. Ecological zones**

Despite its high latitudes, most of Sweden has a temperate climate thanks to the Gulf Stream. There are four distinct seasons and mild temperatures throughout the year. The average temperatures in July average 13 to 17°C while in February, which is considered as the coldest month, the temperatures range from -22°C to -3°C. Northern Sweden lies in the Land of the Midnight Sun which also consists in

continuous daylight during summer. The average rainfall in most of Sweden ranges from 500 to 800 mm. The southwest part of the country receives between 1,000 and 1,200 mm annually while some mountain areas can see their precipitations go up to 2,000 mm.

**Figure 5 : Ecological zones in Sweden**



Source : <http://www.fao.org/forestry/country/19971/en/swel/>

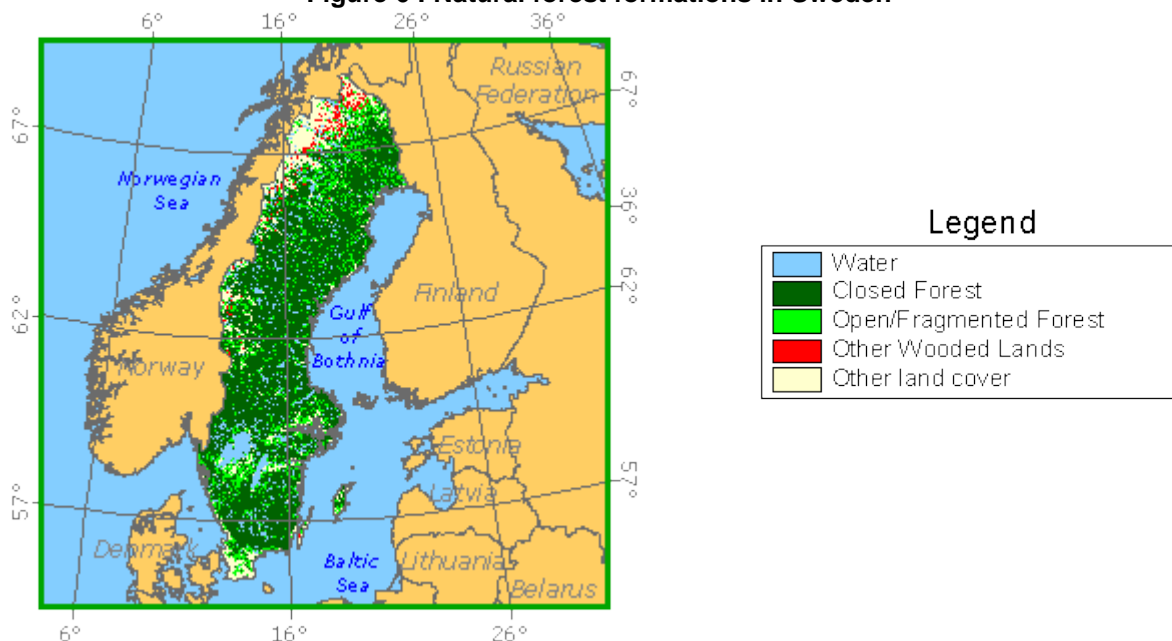
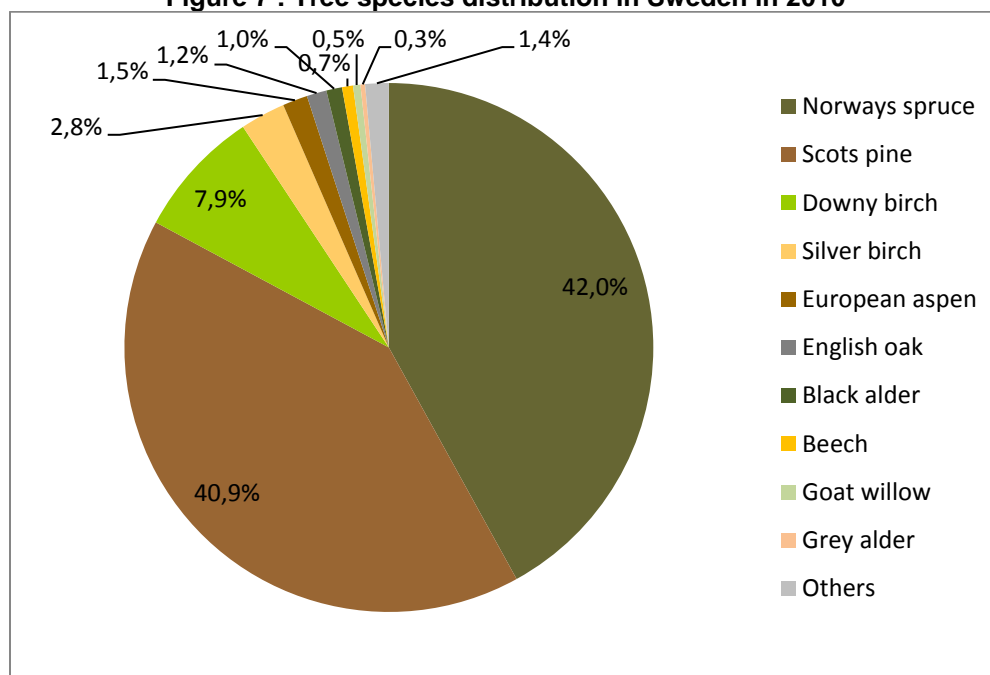
According to FAO, the country is divided in four ecological zones: Temperate oceanic forest, temperate continental forest, Boreal coniferous forest and Boreal mountain (Figure 5). The variation in climate and ecological zone is due to the large north-south extent of the country.

Figure 6 presents the forest cover. Most of the forests are considered as closed zones. Open or fragmented forests are more present in the north and in the south of the country and other wooded lands can be seen in the northern part close to the Scandinavian mountain chain.

Because of the repeated glaciations, the number of species is small compared to similar ecosystems in other parts of the world<sup>3</sup>. Coniferous trees clearly dominate the Swedish forests with more than 80% of the forest stand volume. The last 20% are distributed among hard hardwood and soft hardwood.

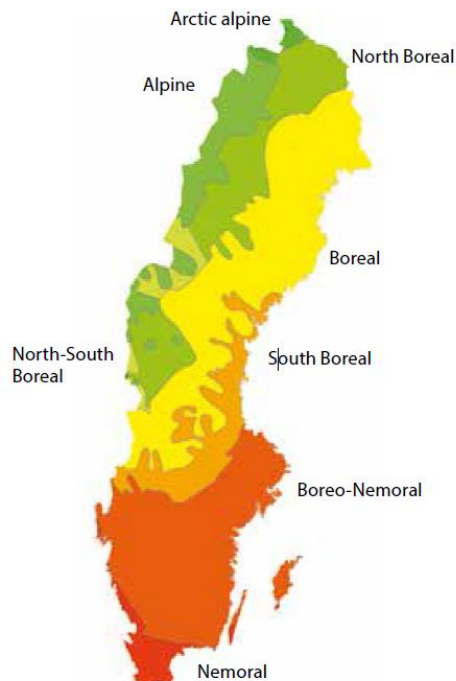
The distribution of the forests tree species can be seen in Figure 7. Norway spruce is the dominating tree species with 42% of the forest stand volume. It is closely followed by Scots pine (41%). Downy birch and Silver birch correspond to 11%, the rest is split among English oak, Black alder, Beech, Goat willow, Grey alder and others.

<sup>3</sup> Forests and forestry in Sweden 2015

**Figure 6 : Natural forest formations in Sweden****Figure 7 : Tree species distribution in Sweden in 2010**

Source : Global forest assessment 2015

The coniferous forests dominate the boreal zone and its sub-zones. The nemoral zone in the south sees its area dominated by deciduous forests (Figure 8).

**Figure 8 : Zones in Sweden**

Source : Forests and forestry in Sweden 2015

According to FAO in 2010, the forest is composed very largely by naturally regenerated forest (42.5%) and planted forest (48.9%) and with a lower proportion by primary forest (8.6 %).

**Table 3 : Forested area in Sweden (2010)**

|                                    | Forest area (000 ha) | Percentage of the total forested land |
|------------------------------------|----------------------|---------------------------------------|
| Primary forest                     | 2,417                | 8.6%                                  |
| Other naturally regenerated forest | 11,919               | 42.5%                                 |
| Planted forest                     | 13,737               | 48.9%                                 |
| ...of which of introduced species  | 693                  | 2.5%                                  |
| <b>TOTAL</b>                       | <b>28,073</b>        | <b>100.0%</b>                         |

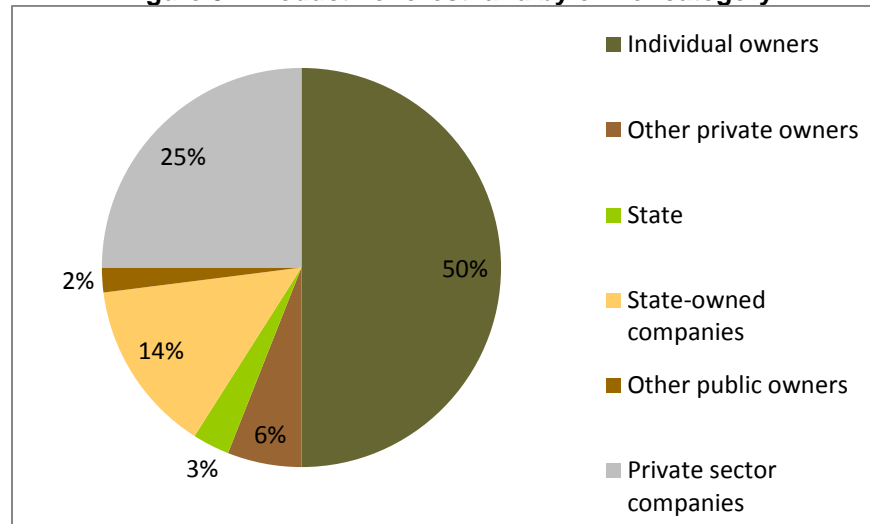
Source: Global Forest Resources Assessment 2015

### 2.3. Forest ownership

Sweden contrasts sharply with forest ownership in the rest of continental Europe. The ownership structure is a combination of family enterprises and widespread corporate ownership, with most state-owned forests managed commercially.

Private ownership of forests has been well established in Sweden for centuries. It has been a basis for sustainable land use and long term planning and investments in the regeneration of forests. Private ownership is based on possession rights while the other two are based on user rights.

**Figure 9 : Productive forest land by owner category**

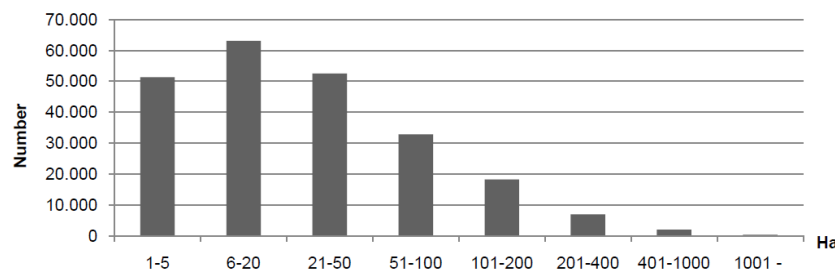


Source : Forests and forestry in Sweden 2015

Family enterprises are the biggest owners of forests with more than 50% of all forest lands. 200,000 families own an area greater than five hectares. The average holding is 50 ha but the size varies greatly. Those enterprises also practice agriculture. Farms are passed from one generation to the next. Family enterprises also own industrial facilities, mostly pulp mills, saw mills and installations in the energy sector.

A small number of large industrial forest enterprises own around 25% of all forest land. The state-owned company Sveaskog owns 14% of the forested land and consists in most of state forest belongs. 3% are directly owned by the state and 2% by other public bodies.

**Figure 10 : Number of holdings owned by individual owners distributed on size class**

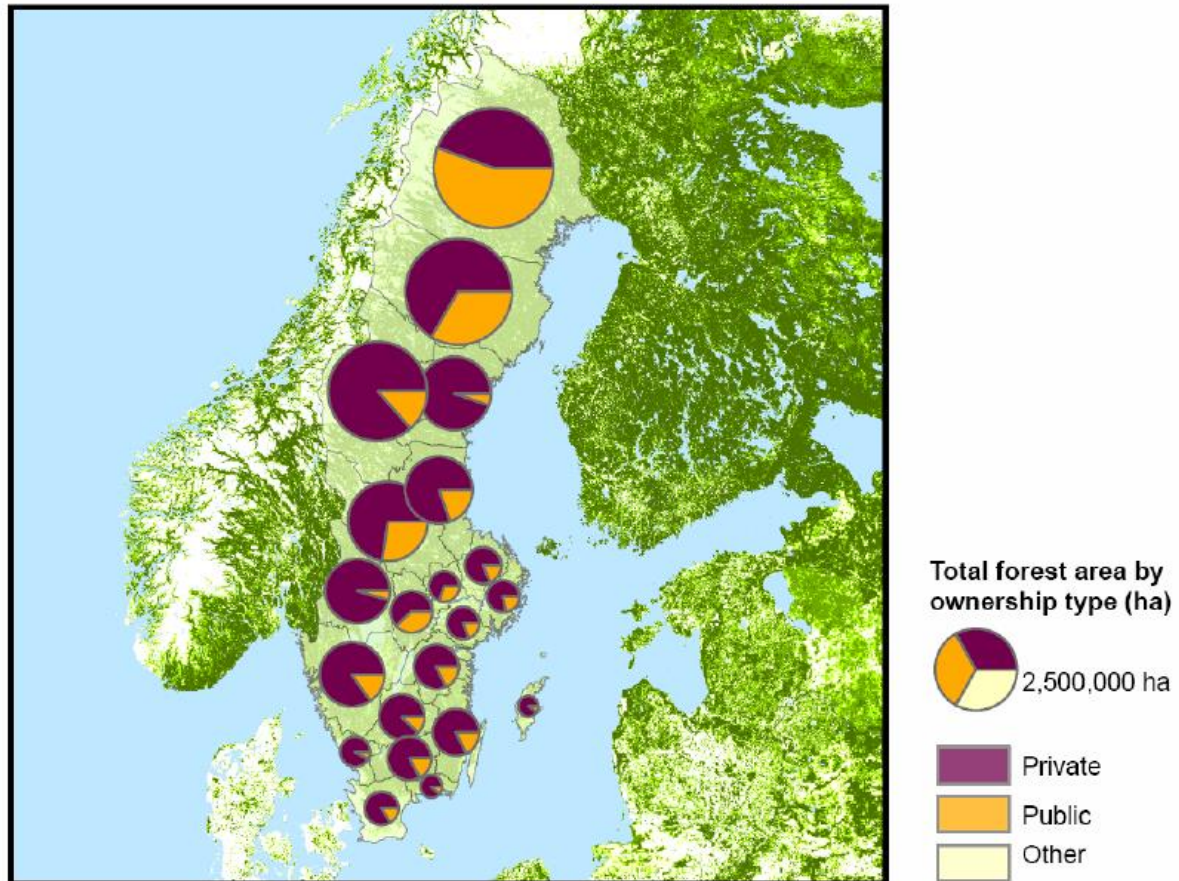


Source : Forest Land Ownership Change in Sweden



According to the European Forest Institute, most of the individually owned forest lands do not exceed 50 ha and the average holding has an area of 47 ha.

**Figure 11 : Distribution of forest ownership for the 21 counties**



Source : Mapping the distribution of forest ownership in Europe

The distribution of forest ownership through the 21 counties of Sweden can be seen in Figure 11. The dominance of private ownership is greater in the southern part of the country. Only Norrbotten, the northern county sees more of its forest land public-owned.

During the first decades of the 20<sup>th</sup> century, forest owners established forest cooperatives or associations. In 2015 roughly 90,000 family farms were members of a forestry cooperative. The cooperatives together form a National Federation of Family Forest Owners that seeks to influence national and international forest policy<sup>4</sup>.

<sup>4</sup> Forests and forestry in Sweden 2015

## 2.4. Competent authorities

### Institution

The national authority in charge of forest-related issues is the Swedish Forest Agency. It is placed under the Ministry of Enterprise and Innovation and receive direction and goals to attain from the government as well as the financial framework for the organization.

The agency is divided in three departments: the Forest Department, the Administrative Department and the Consulting Services Department. A board is appointed by the government. Almost 800 people are employed by the Forest Agency<sup>5</sup>.

Its major tasks are ensuring observance of the relevant laws and regulations and improving capacity-building within the forest sector at large. Various inventories are performed by the Agency and an array of electronic devices to distribute information to stakeholders is used. The Forest Agency manages to improve policy implementation concerning reduction of damage, reforestation, improving retention in forest management.

Also, as Forests involve many processes, the Swedish Forest Agency cooperate with other agencies such as the Swedish Environmental Protection Agency, the Swedish National Heritage Board, the Swedish Agency for Marine and Water Management and the county administrative boards<sup>6</sup>.

### National Forest Policy

The forest policy was changed in 1993 in order to integrate ecological considerations. It focuses on two major objectives: one for production and one for environmental concerns. The intention of this policy is, in line with international agreements, to ensure sustainable forest management.

The National Forest Policy is considered more demanding than the legal demands on forest management, mainly set by the Forestry Act and the Environmental Code<sup>7</sup>.

The short-term detailed forest goals are summarized in three groups<sup>8</sup>:

- *High availability of valuable forest raw material: the forests natural productive capacity, forest regeneration quality, area of pre-commercial thinning, the balance of forests and game.*
- *Rich forest environment: protection of ecologically valuable forest areas, extent of dead wood, extent of old forests and older deciduous forests and regenerations of deciduous species, environmental considerations at final harvests, water and soils in balance, forest roads and wetlands.*
- *Multiple use and social values: forestry and reindeer management, old heritage and cultural objects, recreation adjusted forest management close to settlements.*

<sup>5</sup> <https://www.skogsstyrelsen.se/en/about-us/>

<sup>6</sup> Forests and Forestry in Sweden 2015

<sup>7</sup> Forests and Forestry in Sweden 2015

<sup>8</sup> Nilsson S., Future Swedish Forest Policy Process

In parallel to this change in policy, the management of Swedish forests has become influenced by market-driven processes of forest certification in which the practices of forests owners are assessed against certification standards.

Both the EU regulations and International agreements influence Swedish forest and environmental policies. For example, concerning EU regulations, the EU timber Regulation; the Habitats Directive and the Water Framework Directive are being implemented. The influencing international agreements are the Convention on biological Diversity, the UN Framework Convention on Climate Change and the United Nations Forum on Forests<sup>9</sup>.

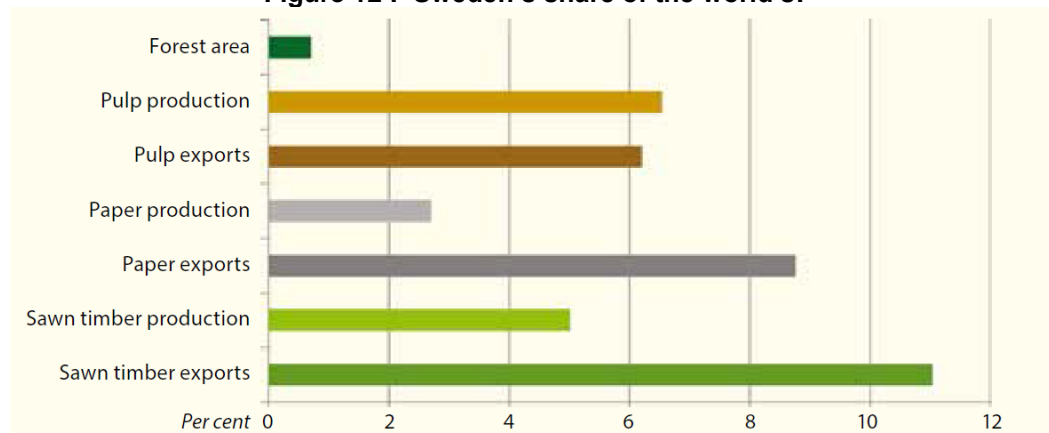
## 2.5. Overview of wood-related industry

It exists some 50 pulp and paper manufacturers in a total of 23 groups of companies. There are 115 sawmills in a total of 60 groups/ companies. Industrial enterprises tend to buy wood from private forest owners as only a small number of large industrial forest enterprises own some 25% of all forest land.

The forest products industry is important in the Swedish economy as it ranges between 9 and 12 percent of industry's total employment, exports, sales and added value<sup>10</sup>.

Figure 12 presents the Sweden's share of world's forest related figures. As it accounts for less than 1% of the World's forest area, the pulp production and export exceed 6%. Paper production is less than 3% of total production but the exports consist in more than 8% of world's exports. Around 5% of the world's saw timber is produced in Sweden where the exports account for more than 11%.

**Figure 12 : Sweden's share of the world's:**



Source : The Swedish Forest Industries Federation, The Swedish Forest Agency, PPI, FAO

According to the FAO, in 2011, the forest industry in Sweden contributed to the Gross Domestic Product<sup>11</sup> at a percentage of 2.9%<sup>12</sup>. Since 1990, this percentage has slightly increased to decrease afterward and stabilize from 2005 to 2011 (Figure 13).

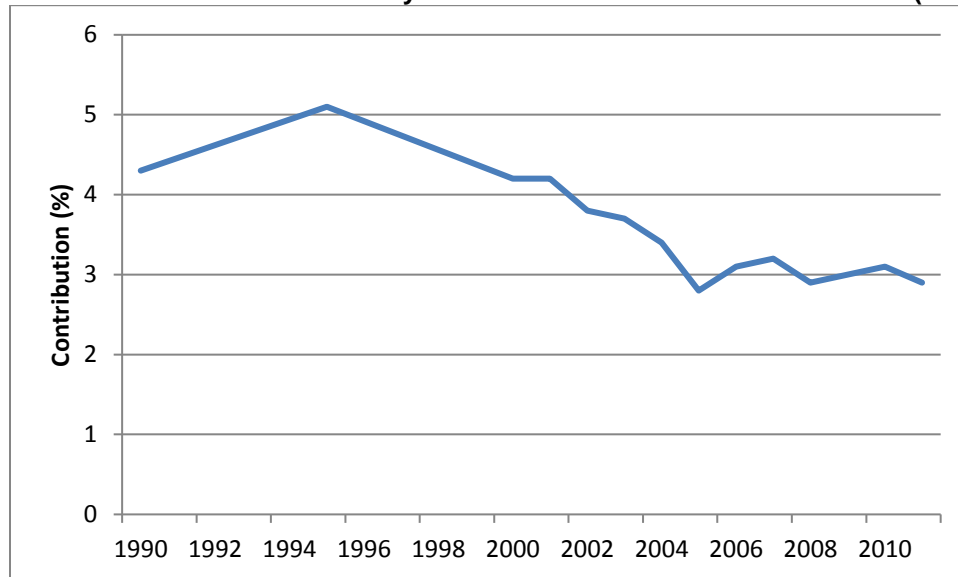
<sup>9</sup> Forests and Forestry in Sweden 2015

<sup>10</sup> Forests and Forestry in Sweden 2015

<sup>11</sup> contribution of forest sector to GDP indicated as gross value added of forestry in percentage of total gross value added.

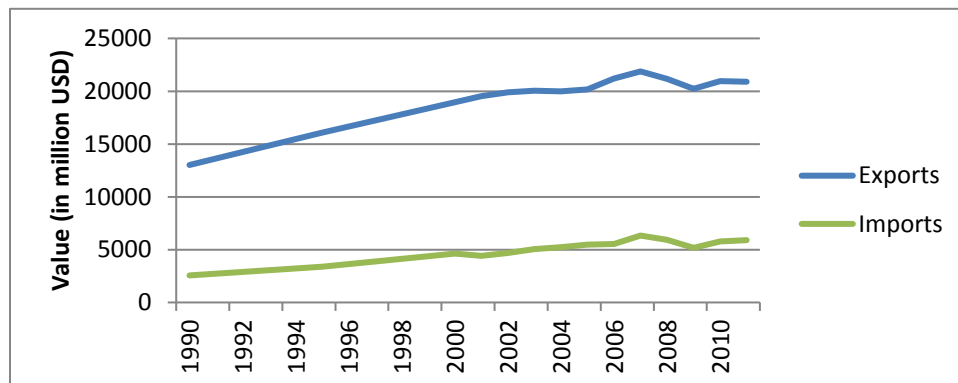
<sup>12</sup> FAO. 2014. *Contribution of the forestry sector to national economies, 1990-2011*, by A. Lebedys and Y. Li. Forest Finance Working Paper FSFM/ACC/09. FAO, Rome.



**Figure 13 : Contribution of the forestry sector to the Gross Domestic Product (1990-2011)**

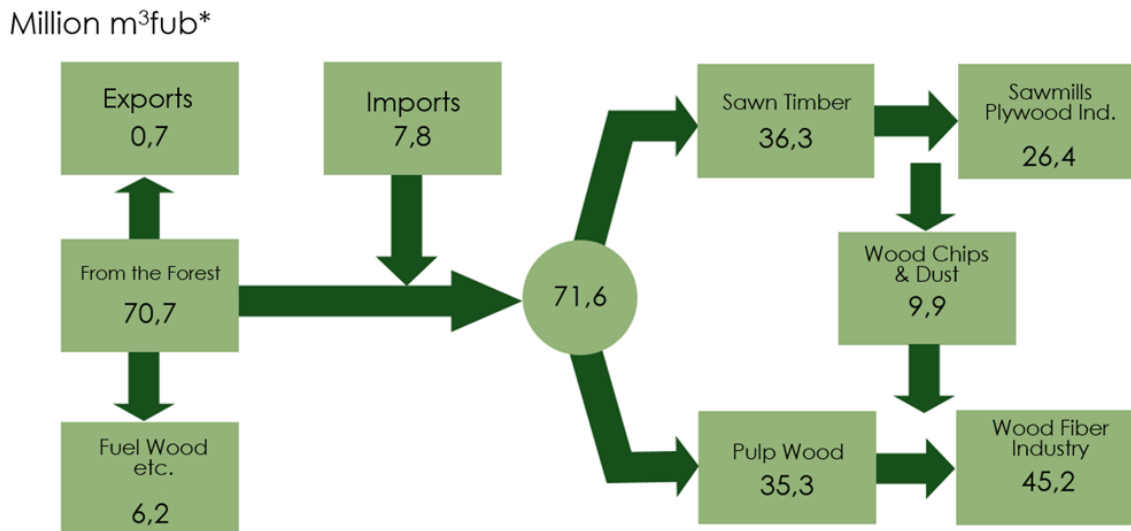
Source : Contribution of the Forestry Sector to National Economies, 1990-2011

The imports and exports value of products from the forestry are presented in Figure 14. For both the exports and the imports, the values increase with time. It only presents a decline in 2008. The exports and imports respectively reached 20.9 billion USD and 5.9 billion USD in 2011.

**Figure 14 : Value of products from the forestry (in million USD at 2011 prices and exchange rates)**

Source : Contribution of the Forestry Sector to National Economies (1990-2011)

The wood flow for the Forest Industry in 2014 can be seen in Figure 15. From what is harvested in the forests (70.7 million m<sup>3</sup>) only 0.7 million is exported and 6.2 million m<sup>3</sup> is used as fuelwood. With the imports, the volume is cut in half, one part is transformed in sawn timber (36.3 million m<sup>3</sup>) while the other is transformed into pulp wood (35.3 million m<sup>3</sup>). From sawmills and plywood industries, 9.9 million m<sup>3</sup> is transformed in wood chips and dust that can be utilized by the wood fiber industry which produces a volume of 45.2 million m<sup>3</sup>.

**Figure 15 : Wood Flow for the Forest Industries (2014)**

\*Cubic Meters under Bark

Source : VMR/SDC

In 2013, the revenues from exportation and importation can be summarized in the Table 4.

The total value of exports equals 118.5 billion SEK, which correspond to 13.4 billion Euros (exchange rate at the date of 31 December 2013). Newsprint is the biggest contributor to the value of total exports, it accounts for more than 50% of the value. Sawn and planed wood products contribute up to 18.5% of the value. Most of the exportation business is oriented towards pulp and paper products.

The total value of imports equals 28.7 billion SEK, which correspond to 3.2 billion Euros (exchange rate at the date of 31 December 2013). Paper and paperboard is the main importation with 22% of the total value. In terms of quantity and value, the imports of wood chips, pellets, sawdust particles and wood residues, as well as wood in rough, wood-based panels and other wood products are greater than exports.

**Table 4 : Import and export of forest industry products in 2013**

| Product  | Unit          | Exports  |                | Imports  |                |
|--|---------------|----------|----------------|----------|----------------|
|  |               | Quantity | Value 1,000 Kr | Quantity | Value 1,000 Kr |
| Fuelwood and charcoal                                    | 1,000 t       | 15       | 29,087         | 393      | 289,782        |
| Wood chips, pellets, sawdust particles and wood residues | 1,000 m³ u.b. | 517      | 377,835        | 3,096    | 1,505,779      |
| Wood chips etc. of coniferous                            | 1,000 m³ u.b. | 144      | 63,601         | 984      | 471,161        |
| Wood chips etc. of non-coniferous                        | 1,000 m³ u.b. | 14       | 5,680          | 112      | 32,967         |
| Pellets  | 1,000 m³ u.b. | 285      | 217,467        | 1,191    | 754,376        |
| Sawdust, particle and wood residues etc.                 | 1,000 m³ u.b. | 60       | 74,719         | 40       | 29,876         |
| Particles and wood residues etc.                         | 1,000 m³ u.b. | 14       | 16,368         | /        | /              |
| Industrial Wood in rough                                 | 1,000 t       | 761      | 791,805        | 7,261    | 3,752,721      |

|  |                      |              |                    |              |                   |
|--|----------------------|--------------|--------------------|--------------|-------------------|
| <b>Industrial Wood in rough</b>                  | <b>1,000 m³ u.b.</b> | <b>915</b>   | <b>791,805</b>     | <b>7,542</b> | <b>3,747,137</b>  |
| <i>Sawlogs of coniferous</i>                     | 1,000 m³ u.b.        | 328          | 259,103            | 1,124        | 756,478           |
| <i>Sawlogs of non-coniferous</i>                 | 1,000 m³ u.b.        | 3            | 2,596              | 20           | 39,522            |
| <i>Pulpwood of coniferous</i>                    | 1,000 m³ u.b.        | 415          | 199,779            | 3,752        | 1,690,328         |
| <i>Pulpwood of non-coniferous</i>                | 1,000 m³ u.b.        | 9            | 14,041             | 1,676        | 846,132           |
| <i>Others</i>                                    | 1,000 m³ u.b.        | 159          | 316,286            | 969          | 414,677           |
| <b>Sawn and planed wood products</b>             | <b>1,000 t</b>       | <b>5,961</b> | <b>21,919,587</b>  | <b>252</b>   | <b>1,330,099</b>  |
| <i>Sawn and planed products</i>                  | 1,000 m³             | 11,620       | 21,919,587         | 455          | 1,330,099         |
| <i>Coniferous</i>                                | 1,000 m³             | 11,612       | 21,788,980         | 405          | 991,320           |
| <i>Non-coniferous</i>                            | 1,000 m³             | 8            | 130,607            | 50           | 338,779           |
| <b>Wood pulp and waste paper</b>                 | <b>1,000 t</b>       | <b>3,985</b> | <b>17,360,012</b>  | <b>1,073</b> | <b>2,695,315</b>  |
| <i>Mechanical pulp</i>                           | 1,000 t              | 52           | 182,925            | 426          | 2,045,451         |
| <i>semi-chemical pulp</i>                        | 1,000 t              | 216          | 757,050            |              |                   |
| <i>Chemical pulp</i>                             | 1,000 t              | 2,676        | 12,439,176         |              |                   |
| <i>Sulphate pulp, unbleached</i>                 | 1,000 t              | 115          | 500,892            |              |                   |
| <i>Sulphate pulp, bleached</i>                   | 1,000 t              | 2,543        | 11,841,933         |              |                   |
| <i>Sulphite pulp, unbleached</i>                 | 1,000 t              | 0            | 40                 |              |                   |
| <i>Sulphite pulp, bleached</i>                   | 1,000 t              | 19           | 96,311             |              |                   |
| <i>Recovered paper</i>                           | 1,000 t              | 490          | 3,478,538          | 608          | 649,864           |
| <b>Wood-based panels</b>                         | <b>1,000 t</b>       | <b>450</b>   | <b>500,739</b>     | <b>606</b>   | <b>3,252,837</b>  |
| <i>Particle board</i>                            | 1,000 m³             | 135          | 1,237,884          | 480          | 1,183,542         |
| <i>Fibreboard</i>                                | 1,000 m³             | 58           | 175,692            | 302          | 1,127,402         |
| <i>Plywood</i>                                   | 1,000 m³             | 87           | 712,080            | 155          | 729,313           |
| <b>Other wood products</b>                       | <b>1,000 t</b>       | <b>42</b>    | <b>158,689</b>     | <b>238</b>   | <b>3,402,844</b>  |
| <b>Paper and paperboard</b>                      | <b>1,000 t</b>       | <b>246</b>   | <b>4,375,566</b>   | <b>881</b>   | <b>6,378,065</b>  |
| <i>Newsprint</i>                                 | 1,000 t              | 10,183       | 63,956,067         | 42           | 192,405           |
| <i>Printing and writing paper</i>                | 1,000 t              | 1,193        | 4,979,083          | 288          | 2,047,257         |
| <i>Other paper and paperboard</i>                | 1,000 t              | 5,879        | 39,464,792         | 551          | 4,138,403         |
| <b>Products of woodpulp, paper or paperboard</b> | <b>1,000 t</b>       | <b>379</b>   | <b>8,483,398</b>   | <b>329</b>   | <b>6,056,354</b>  |
| <b>TOTAL VALUE</b>                               |                      |              | <b>118,531,241</b> |              | <b>28,663,796</b> |

u.b. = under bark

Source : Swedish Statistical Yearbook of Forestry 2014

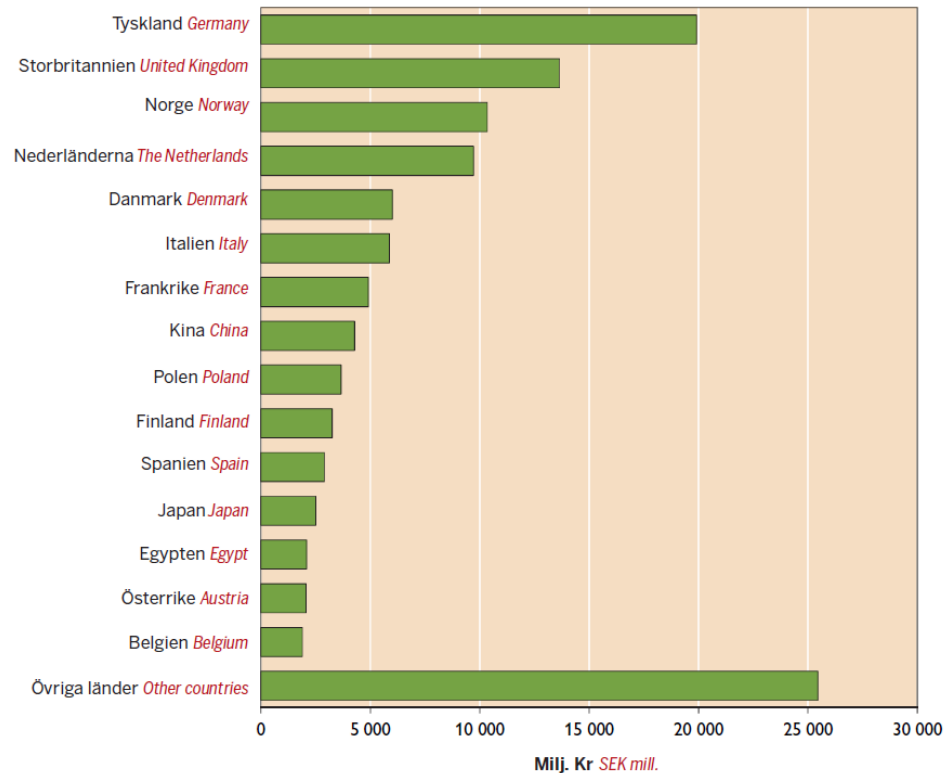
The countries of European Union are the export markets of Sweden (75% of the total export value in 2013). By sectors, statistics report that:

- Swedish sawn and planed softwood products export markets were mainly United Kingdom, Germany, Norway, Egypt, Japan, the Netherlands and Denmark.
- The importing countries for Wood pulp and waste paper were Germany, the Netherlands, China, Italy and United Kingdom.
- Concerning Mechanical and semi-chemical wood pulp, it was mainly exported to China, India, Italy and Germany.
- The main importing countries of sulphate pulp were the Netherlands, Germany, United Kingdom and Italy.
- The majority of importing countries of recovered paper and waste paper were within the EU.

- The biggest importer of paper and paperboard is Germany, followed by United Kingdom, The Netherlands, Italy and China.
- Concerning Newsprint, the main importing countries are Germany, United Kingdom and the Netherlands.

The value of Swedish exports of forest and forest industry products by importing country is presented in Figure 16. Of all the European countries, Germany is the biggest importer of Swedish wood products. Except for China, Japan and Egypt, all the other countries are within Europe.

**Figure 16 : Value of Swedish exports forest and forest industry products by importing country (2013)**



Source : Swedish Statistical Yearbook of Forestry 2014

According to the Business register 2013, there were 27,800 persons employed at companies producing wood and wood products and 29,000 persons employed at companies producing paper and paper products<sup>13</sup>.

The number of employees in large-scale forestry, by type of employment in 2013 can be seen in Table 5. The total number of employees was almost 2,000 employees when it approximated 13,500 employees in 1993. The number drastically declined until 2006 followed by a continuous decrease at a smaller rate. In 2013, Females employees accounted for 17% of the total employees.

<sup>13</sup> Swedish Statistical Yearbook of Forestry 2014

**Table 5 : Number of employees in large-scale forestry, by type of employment and gender**

|      | <i>Permanent employees</i> |                |              | <i>Temporary employees</i> |                |              | <i>Both categories</i> |                |              |
|------|----------------------------|----------------|--------------|----------------------------|----------------|--------------|------------------------|----------------|--------------|
|      | <i>Males</i>               | <i>Females</i> | <i>total</i> | <i>Males</i>               | <i>Females</i> | <i>total</i> | <i>Males</i>           | <i>Females</i> | <i>total</i> |
| 1993 | 5549                       | 134            | <b>5683</b>  | 6311                       | 1478           | <b>7789</b>  | 11860                  | 1612           | <b>13472</b> |
| 1994 | 4516                       | 142            | <b>4658</b>  | 7681                       | 1146           | <b>8827</b>  | 12197                  | 1288           | <b>13485</b> |
| 1995 | 4127                       | 154            | <b>4281</b>  | 6026                       | 1272           | <b>7298</b>  | 10153                  | 1426           | <b>11579</b> |
| 1996 | 3217                       | 97             | <b>3314</b>  | 4664                       | 1118           | <b>5782</b>  | 7881                   | 1215           | <b>9096</b>  |
| 1997 | 3179                       | 106            | <b>3285</b>  | 4322                       | 971            | <b>5293</b>  | 7501                   | 1077           | <b>8578</b>  |
| 1998 | 2808                       | 85             | <b>2893</b>  | 3830                       | 909            | <b>4739</b>  | 6638                   | 994            | <b>7632</b>  |
| 1999 | 2319                       | 79             | <b>2398</b>  | 3122                       | 808            | <b>3930</b>  | 5441                   | 887            | <b>6328</b>  |
| 2000 | 1814                       | 70             | <b>1884</b>  | 2807                       | 682            | <b>3489</b>  | 4621                   | 752            | <b>5373</b>  |
| 2001 | 1639                       | 64             | <b>1703</b>  | 2589                       | 658            | <b>3247</b>  | 4228                   | 722            | <b>4950</b>  |
| 2002 | 1529                       | 92             | <b>1621</b>  | 1962                       | 722            | <b>2684</b>  | 3491                   | 814            | <b>4305</b>  |
| 2003 | 1532                       | 60             | <b>1592</b>  | 3161                       | 739            | <b>3900</b>  | 4693                   | 799            | <b>5492</b>  |
| 2004 | 1601                       | 93             | <b>1694</b>  | 2992                       | 717            | <b>3709</b>  | 4593                   | 810            | <b>5403</b>  |
| 2005 | 1232                       | 63             | <b>1295</b>  | 2485                       | 555            | <b>3040</b>  | 3717                   | 618            | <b>4335</b>  |
| 2006 | 1060                       | 77             | <b>1137</b>  | 1413                       | 408            | <b>1821</b>  | 2473                   | 485            | <b>2958</b>  |
| 2007 | 1022                       | 78             | <b>1100</b>  | 1255                       | 366            | <b>1621</b>  | 2277                   | 444            | <b>2721</b>  |
| 2008 | 871                        | 41             | <b>912</b>   | 1195                       | 361            | <b>1556</b>  | 2066                   | 402            | <b>2468</b>  |
| 2009 | 867                        | 42             | <b>909</b>   | 999                        | 319            | <b>1318</b>  | 1866                   | 361            | <b>2227</b>  |
| 2010 | 845                        | 40             | <b>885</b>   | 1017                       | 327            | <b>1344</b>  | 1862                   | 367            | <b>2229</b>  |
| 2011 | 810                        | 46             | <b>856</b>   | 1018                       | 323            | <b>1341</b>  | 1828                   | 369            | <b>2197</b>  |
| 2012 | 768                        | 54             | <b>822</b>   | 803                        | 257            | <b>1060</b>  | 1571                   | 311            | <b>1882</b>  |
| 2013 | 764                        | 45             | <b>809</b>   | 874                        | 293            | <b>1167</b>  | 1638                   | 338            | <b>1976</b>  |

Source : Swedish Statistical Yearbook of Forestry 2014

The number of forest entrepreneurs and their employees (2013) is presented in Table 6. In contrast to Table 5, the total number of workers increases between 1993 and 2013; from 4,877 to almost 14,000. In 2013, the number of owners and its family members was 5,606 and the number of employees was 8,322. The percentage of working females was only 3% of the total worker number.

**Table 6 : Number of forest entrepreneurs and their employees (2013)**

|      | <i>Owners and family members</i> |                |              | <i>employees</i> |                |              | <i>total</i> |                |              |
|------|----------------------------------|----------------|--------------|------------------|----------------|--------------|--------------|----------------|--------------|
|      | <i>Males</i>                     | <i>Females</i> | <i>total</i> | <i>Males</i>     | <i>Females</i> | <i>total</i> | <i>Males</i> | <i>Females</i> | <i>total</i> |
| 1993 | /                                | /              | <b>2541</b>  | /                | /              | <b>2336</b>  | 4758         | 119            | <b>4877</b>  |
| 1994 | /                                | /              | <b>2922</b>  | /                | /              | <b>3057</b>  | 5713         | 266            | <b>5979</b>  |
| 1995 | /                                | /              | <b>3085</b>  | /                | /              | <b>3744</b>  | 6570         | 259            | <b>6829</b>  |
| 1996 | /                                | /              | <b>2486</b>  | /                | /              | <b>3353</b>  | 5692         | 147            | <b>5839</b>  |
| 1997 | /                                | /              | <b>2552</b>  | /                | /              | <b>3478</b>  | 5904         | 126            | <b>6030</b>  |
| 1998 | /                                | /              | <b>2521</b>  | /                | /              | <b>3895</b>  | 6203         | 213            | <b>6416</b>  |
| 1999 | /                                | /              | <b>2455</b>  | /                | /              | <b>4139</b>  | 6479         | 114            | <b>6593</b>  |
| 2000 | /                                | /              | <b>2511</b>  | /                | /              | <b>3989</b>  | 6371         | 129            | <b>6500</b>  |
| 2001 | /                                | /              | <b>2563</b>  | /                | /              | <b>4978</b>  | 7180         | 361            | <b>7541</b>  |
| 2002 | /                                | /              | <b>2752</b>  | /                | /              | <b>4435</b>  | 6832         | 355            | <b>7187</b>  |
| 2003 | /                                | /              | <b>3031</b>  | /                | /              | <b>6069</b>  | 8741         | 359            | <b>9100</b>  |
| 2004 | /                                | /              | <b>3769</b>  | /                | /              | <b>6110</b>  | 9373         | 506            | <b>9879</b>  |
| 2005 | /                                | /              | <b>3496</b>  | /                | /              | <b>7501</b>  | 10457        | 540            | <b>10997</b> |
| 2006 | /                                | /              | <b>4019</b>  | /                | /              | <b>7127</b>  | 10628        | 518            | <b>11146</b> |
| 2007 | /                                | /              | <b>3429</b>  | /                | /              | <b>6627</b>  | 10509        | 448            | <b>10957</b> |

|      |      |     |             |      |     |             |       |     |              |
|------|------|-----|-------------|------|-----|-------------|-------|-----|--------------|
| 2008 | /    | /   | <b>4573</b> | /    | /   | <b>7151</b> | 11279 | 445 | <b>11724</b> |
| 2009 | /    | /   | <b>4679</b> | /    | /   | <b>7992</b> | 12103 | 568 | <b>12671</b> |
| 2010 | /    | /   | <b>5212</b> | /    | /   | <b>9519</b> | 14202 | 529 | <b>14731</b> |
| 2011 | /    | /   | <b>5474</b> | /    | /   | <b>8569</b> | 13527 | 516 | <b>14043</b> |
| 2012 | /    | /   | <b>5813</b> | /    | /   | <b>7979</b> | 13287 | 505 | <b>13792</b> |
| 2013 | 5405 | 201 | <b>5606</b> | 8026 | 296 | <b>8322</b> | 13431 | 498 | <b>13929</b> |

Source : Swedish Statistical Yearbook of Forestry 2014

### 3. Sustainability of Sweden forest

#### 3.1. Evolution of forest area and risk of conversion

Between 1990 and 2015, according to the FAO, forest and other wooded land have been rather stable (Table 7). The total area of both forests and other wooded lands oscillated around 30.5 million ha between 1990 and 2015. It only grew a little in 2005 up to 30.6 million ha. One of the reason explaining this situation is that forested lands already occupy a large area of the country's territory.

**Table 7 : Forest area evolution from 1990 to 2010**

| <b>Area (000 ha)</b>        | <b>1990</b>   | <b>2000</b>   | <b>2005</b>   | <b>2010</b>   | <b>2015</b>   |
|-----------------------------|---------------|---------------|---------------|---------------|---------------|
| Forest                      | 28,063        | 28,163        | 28,218        | 28,073        | 28,073        |
| Other wooded land           | 2,432         | 2,432         | 2,432         | 2,432         | 2,432         |
| <b>Total area</b>           | <b>30,495</b> | <b>30,595</b> | <b>30,650</b> | <b>30,505</b> | <b>30,505</b> |
| Percentage of forested area | 67.72%        | 67.94%        | 68.07%        | 67.74%        | 67.74%        |
| Evolution of forested area  | /             | 100           | 55            | -145          | 0             |
| Annual change               | /             | 10            | 11            | -29           | 0             |
| Annual change rate          | /             | 0.03%         | 0.04%         | -0.09%        | 0.00%         |

Source : Calculated from FAO (Global Forest Resources Assessment 2010)

The variation of forest expansion, deforestation and reforestation are presented in Table 8. Even though the periods 2000 and 2005 are not presented, the forest expansion seems to be rather stable at an annual increment between 20,000 and 25,000 ha. The afforestation appears to be minimal compared to natural expansion of forest. The annual deforestation area decreases with time as it was equivalent to 23,900 ha in 1990 and 14,000 ha in 2010. The all of deforestation is induced by humans. The annual reforestation area diminished from the period 1990 to the period 2010, from 248,800 ha to 172,400 ha. Most of this reforestation is artificial, it accounted for 76% of total reforestation in 1990 and 80.2% in 2010.

**Table 8 : Annual forest establishment/loss (000 ha per year)**

| <b>Area (000 ha)</b>                    | <b>1990</b>  | <b>2000</b>  | <b>2005</b>  | <b>2010</b>  |
|---|--------------|--------------|--------------|--------------|
| <b>Forest expansion</b>                 | <b>20,5</b>  | <b>/</b>     | <b>/</b>     | <b>24,7</b>  |
| ...of which afforestation               | 0,43         | /            | /            | 0,03         |
| ...of which natural expansion of forest | 20           | /            | /            | 24,6         |
| <b>Deforestation</b>                    | <b>23,9</b>  | <b>/</b>     | <b>/</b>     | <b>14</b>    |
| ...of which human induced               | 23,9         | /            | /            | 14           |
| <b>Reforestation</b>                    | <b>248,8</b> | <b>197,8</b> | <b>185,2</b> | <b>172,4</b> |
| ...of which artificial                  | 189,2        | 122,8        | 136,6        | 138,3        |

Source : Global Forest Resources Assessment 2015

The FSC risk assessment platform [www.globalforestregistry.org](http://www.globalforestregistry.org) considers that Sweden is at low risk in terms of conversion of forest to other land uses, because the following criterion is verified at the country level:

- There is no net loss AND no significant rate of loss ( $> 0.5\%$  per year) of natural forests and other naturally wooded ecosystems such as savannahs taking place in the eco-region in question.

### 3.2. Living wood volumes and removals

Table 9 shows the evolution volume of live trees in Sweden according to Eurostat (1990 to 2010).

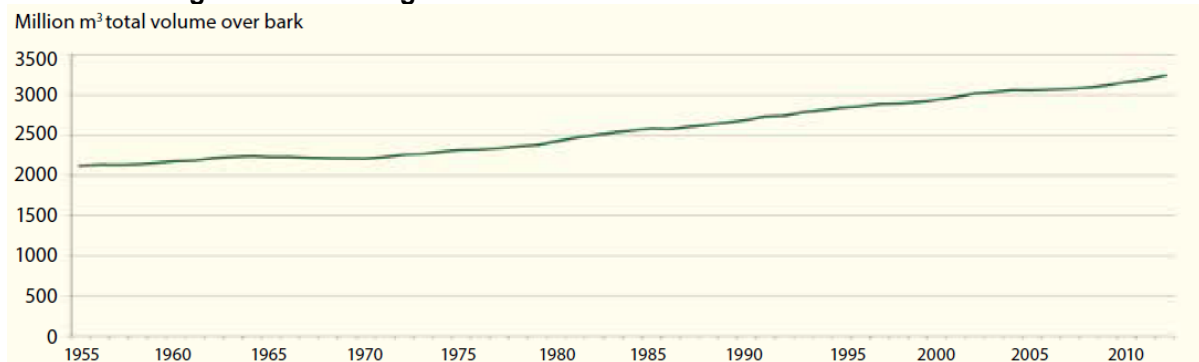
**Table 9 : Evolution of wood volume from 1990 to 2010 (volume in 1000m<sup>3</sup>)**

|  | 1990      | 2000      | 2005      | 2010      | 2015      |
|--|-----------|-----------|-----------|-----------|-----------|
| Growing stock in forests and on other wooded land  | 2,507,400 | 2,709,700 | 2,913,900 | 2,953,100 | 2,995,500 |
| Growing stock of forests                           | 2,501,400 | 2,703,200 | 2,906,900 | 2,947,700 | 2,988,500 |
| Growing stock of other wooded land                 | 6,000     | 6,500     | 7,000     | 5,400     | 7,000     |
| Growing stock in forests available for wood supply | 2,211,000 | 2,268,000 | 2,396,770 | 2,413,885 | 2,389,692 |
| Increment in forests available for wood supply     | 91,951.46 | 86,682.65 | 74,159.67 | 79,346.85 | /         |
| Felling in forests available for wood supply       | 60,400    | 71,200    | 87,700    | 80,800    | /         |
| Felling in percent of net increment                | 65.69%    | 82.14%    | 118.26%   | 101.83%   | /         |
| Felling in percent of net increment for EU 28      | 56.10%    | 61.00%    | 65.00%    | 62.70%    | /         |

Source : <http://epp.eurostat.ec.europa.eu>

Even though the forested land area does not change much for the same period, the growing stock in the Swedish forests and on other wooded land increases from 2.5 billion m<sup>3</sup> to 3.0 billion m<sup>3</sup>. The volume of growing stock on other wooded land remains small compared to the stock in forests as it accounts for 0.2% of the total growing stock volume for the whole period. The volume of growing stock available for wood supply increases between 1990 and 2010 and begins to decrease since 2010, its percentage of the total growing stock volume declines from 88.2% to 79.8% of the total volume. According to Eurostat, the increment in forests available for wood supply decreases with time as felling in the same forests increases. The ratio of felling in percent of net increment goes from 65.7% in 1990 to 101.83% in 2010. It means felling exceeds increment and the volume of wood available for wood supply decreases.

**Figure 17 : Growing stock in Swedish forests between 1955 and 2014**



Source : The Swedish National Forest Inventory 2010-2014

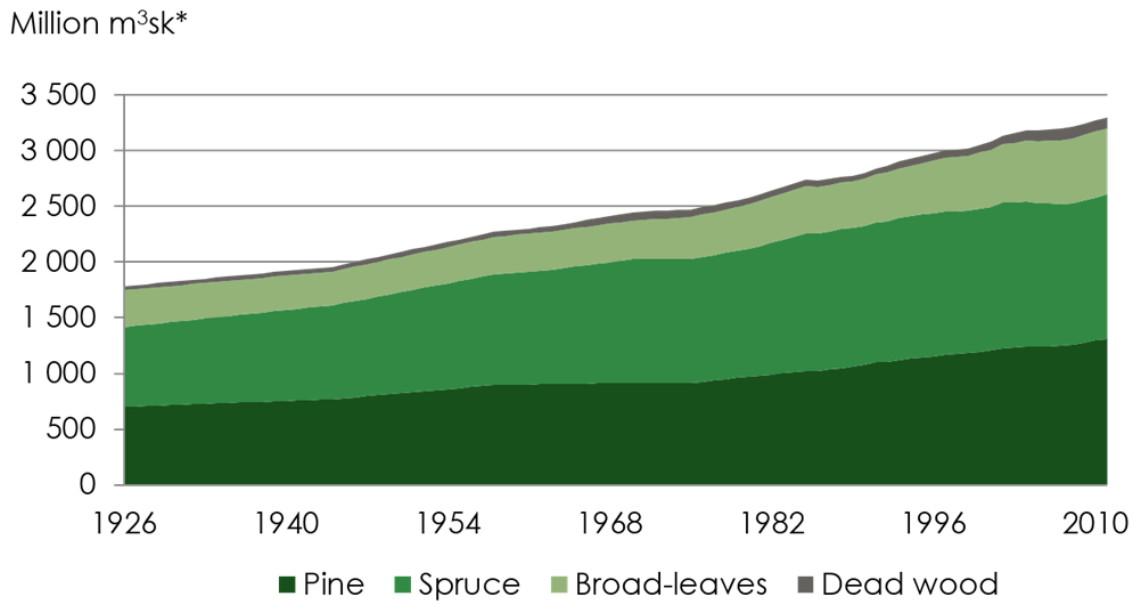
The growing stock in Sweden has always been growing since 1955. The curve of the growth is stable since 1970 (Figure 17).

The development of the Swedish standing of timber can be seen in Figure 18. It shows the evolution of the growing stock volume by specie. Since 1926, pines and spruces have been the dominant



species. It appears that they grew better than the broad-leaves species as their proportion has increased.

**Figure 18 : Development of the Swedish standing of timber (1926-2010)**



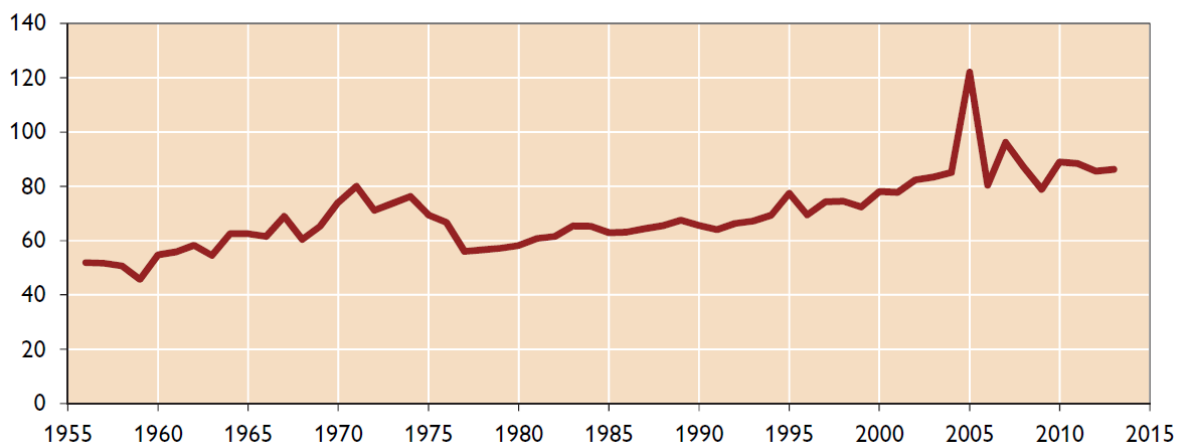
\* m<sup>3</sup>sk = Forest Cubic Meters

Source : The Swedish Forest Industry

Annual gross felling volumes according to the Swedish Forest Agency can be found in Figure 19. Since 1977, the growth has been stable except for an oscillating period between 2004 and 2010. It seems the trend has stabilized above 80 million m<sup>3</sup> for the recent years.

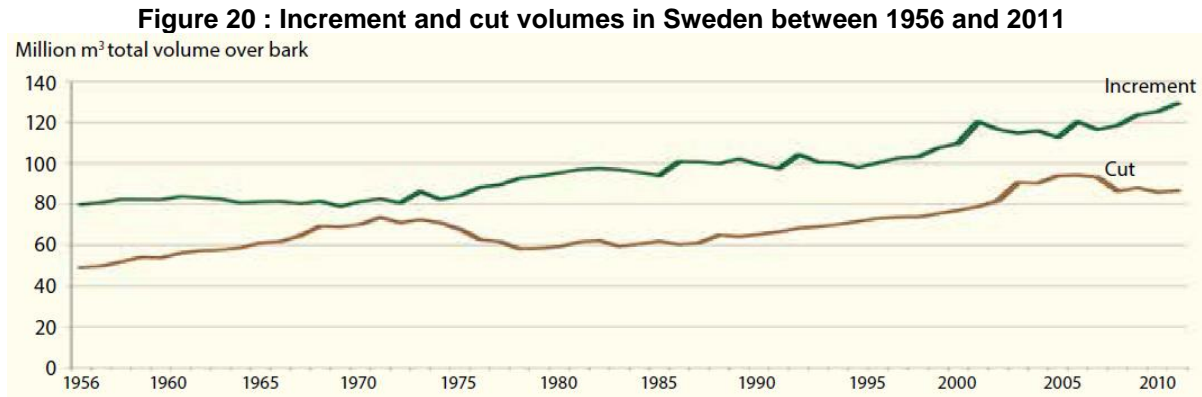
**Figure 19 : Annual gross felling volumes in Sweden between 1956 and 2014**

Mill. m<sup>3</sup>sk Mill. m<sup>3</sup> standing volume included bark



Source : Swedish Forest Agency

Figure 20 presents the increment and felling volumes from the Swedish National Forest Inventory. It differs from the figures of Eurostat (Table 9), it is shown that the increment of wood is greater than the cuts. It is not specified if it concerns all the growing stock volume or only the forests available for wood supply. If it concerns all the growing stock volume, the increment can be achieved on land that is not concerned by felling. This explains the growth of the total growing stock volumes.



### Forest damage

The main causes of forest damage are fungi, insects, mammals, weather and climate change.

Fungi are a threat to forests in the form of root rot, mainly on spruce, caused by “*Heterobasidion annosum*”. Different fungi affect coniferous trees and broadleaved trees.

Insect pests kill many newly planted seedlings. They can damage mature spruce trees, especially in years following major storms when dead and weakened trees provide feeding and nesting opportunities.

The biggest mammal threat to forests is moose that damage young trees. The regeneration of deciduous species such as rowan and aspen is restrained because of the browsing of moose.

Frost can affect the growing of trees but the biggest abiotic threat is storms that cause substantial damage at irregular intervals.

It is possible that in the future, climate change will increase the range of threats to forests. New types pests are likely to appear and an increase in the frequency of storms and drought is forecast<sup>14</sup>.

The estimated area of damaged forest by cause can be seen in Table 10. According to Forest Europe, in 2015, the main cause of damage to forest is wildlife and grazing that damages 407,450 ha. Insects and diseases are second with 275,480 ha. Weather threats damage 122,400 ha. 45,840 ha are damaged by forest operations conducted by human. The rest of the areas are damaged by forest fires and unspecified damage. The total area in 2015 was 893,050 ha or 3% of the total forest land area.

<sup>14</sup> Forest and Forestry in Sweden 2015

**Table 10 : Area of damage to forests**

|                      | <i>Total area of forest with damage</i> | <i>Biotic agent</i>        |                             | <i>Abiotic agents</i>          | <i>Human induced</i>     |              | <i>Primarily damaged by fire</i> |                               | <i>Unspecified/ mixed damage</i> |
|----------------------|---|----------------------------|-----------------------------|--------------------------------|--------------------------|--------------|----------------------------------|-------------------------------|----------------------------------|
|                      |   | <i>Insects and disease</i> | <i>Wildlife and grazing</i> | <i>Storm, wind, snow, etc.</i> | <i>Forest operations</i> | <i>Other</i> | <i>Total</i>                     | <i>Of which human induced</i> |                                  |
| <b>Area (1000ha)</b> | 893.05                                  | 275.48                     | 407.45                      | 122.4                          | 45.84                    | 0            | 0.5                              | /                             | 45.91                            |

Source : State of Europe's forests 2015

### 3.3. Protection of ecosystems and biodiversity

The protection of forest biodiversity model is a combination of general conservation consideration in the forest management and the designation of strictly protected forest areas<sup>15</sup>.

The area types of high value for diversity are defined as follow<sup>16</sup>:

- *National park: A large area of contiguous land protected to "preserve a certain type of landscape in its natural state or in essentially unspoiled condition". The Swedish parliament and government decide on the establishment of national parks. A fundamental requirement is that the land is owned by the state.*
- *Nature reserve: The most prevalent type of legal protection. Municipalities and county administrative boards are empowered to make decisions on the establishment of nature reserves. According to Part 7, §4 of the Swedish Environment Protection Act, the purpose of nature reserves is to preserve biological diversity, conserve and maintain valuable natural habitats, satisfy needs for outdoor recreation, and/or to protect, restore or create natural environments and valuable habitats for particular species.*
- *Nature conservation area: A form of protection no longer in use. The degree of protection for such an area is weaker than for a nature reserve, since it includes the condition that pre-existing land uses may not be impeded. This form of protection was removed when the Swedish Environment Protection Act went into effect on 1 January 1999. Some of the already established nature conservation areas have been converted to nature reserves.*
- *Habitat protection area: Relatively small area of land or water that provides habitat to plants or animals threatened with extinction, or which are worthy of protection for some other reason. Commercial activities that might damage the natural environment may not be conducted on such sites. County administrative boards decide on the establishment of habitat protection areas on agricultural land. For those on forest land it is usually the Swedish Forest Agency that decides; but county administrative boards are now empowered to do so as well. In most cases, this form of protection is used to protect key habitats.*
- *Nature conservation agreement: Agreement between landowner and the state or a municipality by which, for example, timber production is restricted on a small section of forest for the benefit of biodiversity. The agreement is based on the voluntary co-operation of the landowner; the maximum term is 50 years.*

<sup>15</sup> Forest and Forestry in Sweden 2015

<sup>16</sup> Swedish Statistical Yearbook of Forestry 2014, p.96

- *Forest land voluntarily set aside for conservation purposes: A contiguous area of at least 0.5 hectares productive forest land on which the landowner has voluntarily decided to refrain from any activity that might harm its natural, social and/or cultural heritage value. The area shall be specified in a land use plan or other document. Voluntary means that the forest owner made the decision to refrain from activity without any obligations to the state or municipality.*
- *Key habitat: An area of forest which – based on a combined assessment of its structure, species composition, history and physical characteristics – has great significance for forest dwelling species. It contains or can be expected to contain species on the red list.*
- *Natura 2000 site: Part of a network of protection-worthy sites within the European Union. County administrative boards select sites that are suitable for inclusion in the network, based on criteria of the EU's Wild Birds and Habitats directives. The work is coordinated by the Swedish Environmental Protection Agency. Natura 2000 sites may be used for commercial and other purposes as long as a "favorable preservation status" is accorded to the species and habitats to be protected.*

An illustration of the different protected areas can be seen below.

**Figure 21 : Formally protected areas illustration**

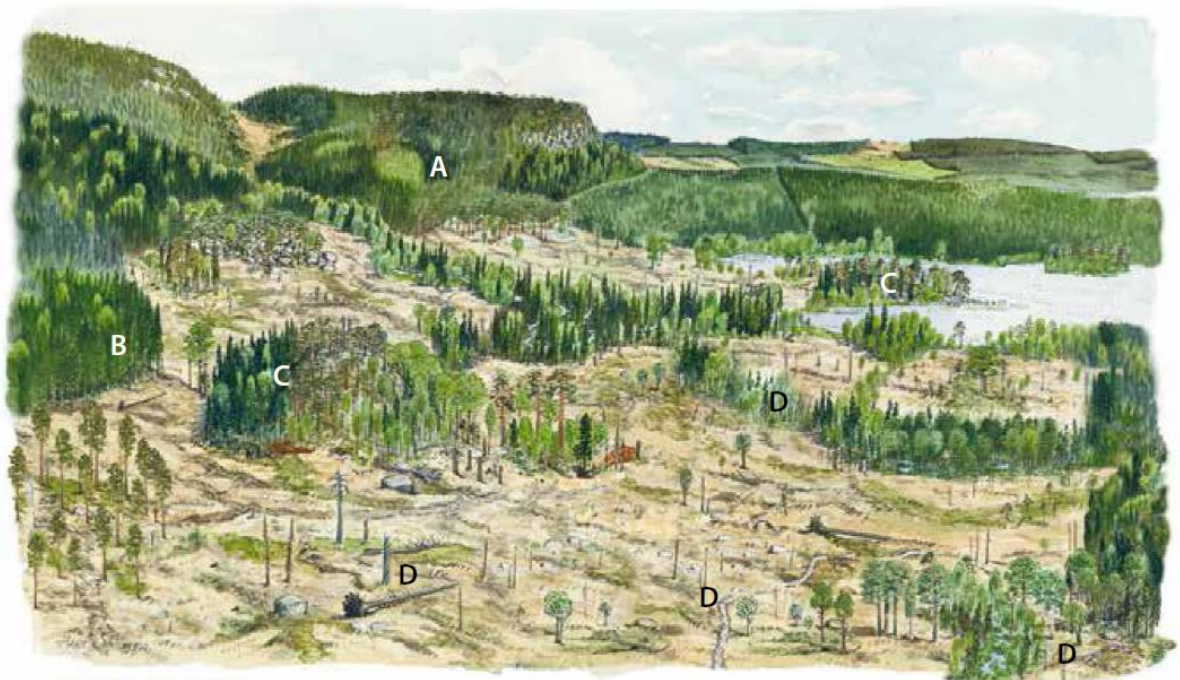


Illustration: Martin Holmer

Formally protected areas: National parks and nature reserves (A), and habitat protection areas and nature conservation agreements (B).

Forest land voluntarily set aside for conservation purposes (C).

General consideration for high nature values and cultural heritage in forest operations (D).

Source : Forests and forestry in Sweden 2015

According to these definitions, the areas of forest exempt from forestry for the year 2011 are presented on Table 11.

**Table 11 : Forest exempt from forestry (2011)**

| <i>Area (1000 ha)</i>  | <i>Regions</i>        |                       |                 |                 | <i>Entire country</i> |
|--|-----------------------|-----------------------|-----------------|-----------------|-----------------------|
|  | <i>Norra Norrland</i> | <i>Södra Norrland</i> | <i>Svealand</i> | <i>Götaland</i> |                       |
| <b><i>Productive forest land, total area</i></b>   | <b>7,126</b>          | <b>5,744</b>          | <b>5,335</b>    | <b>5,018</b>    | <b>23,223</b>         |
| of which is:   |                       |                       |                 |                 |                       |
| a. National park, nature reserve and nature conservation area  | 450                   | 113                   | 140             | 92              | 795                   |
| b. of which is submontane  | 113                   | 53                    | 106             | 92              | 364                   |
| c. Habitat protection area and nature conservation agreement   | 8                     | 8                     | 16              | 16              | 49                    |
| d. of which is submontane  | 8                     | 8                     | 16              | 16              | 49                    |
| Total area of formally protected productive forest land (a+c)  | 458                   | 121                   | 156             | 108             | 844                   |
| of which submontane (b+d)  | 121                   | 61                    | 122             | 108             | 413                   |
| Proportion of formally protected productive forest land  | 6,4%                  | 2,1%                  | 2,9%            | 2,2%            | 3,6%                  |
| e. Forest land voluntarily set aside for conservation purposes, submontane   | 331                   | 261                   | 255             | 200             | 1112                  |
| Proportion of productive forest land exempted from forestry  | 11,1%                 | 6,7%                  | 7,7%            | 6,1%            | 8,4%                  |
| <b><i>Forest land, total area</i></b>  | <b>9,843</b>          | <b>6,991</b>          | <b>5,970</b>    | <b>5,472</b>    | <b>28,276</b>         |
| of which is:   |                       |                       |                 |                 |                       |
| g. National park and nature reserves   | 1,423                 | 216                   | 185             | 101             | 1,924                 |
| h. of which is submontane  | 128                   | 61                    | 118             | 101             | 408                   |
| i. Habitat protection area and nature conservation agreement   | 9                     | 10                    | 17              | 18              | 54                    |
| Total amount of formally protected forest land (g+i)   | 1,432                 | 226                   | 202             | 119             | 1,978                 |
| Proportion of formally protected forest land (g+i)   | 14,5%                 | 3,2%                  | 3,4%            | 2,2%            | 7,0%                  |
| e. Forest land voluntarily set aside for conservation purposes, submontane   | 331                   | 261                   | 255             | 200             | 1,112                 |
| j. Improductive forest land outside national park, nature reserve, habitat protection area and nature conservation agreement | 1,911                 | 110                   | 551             | 433             | 3,995                 |
| <b>Total amount of area (e+g+i+j)</b>  | <b>3,674</b>          | <b>1,587</b>          | <b>1,008</b>    | <b>752</b>      | <b>7,085</b>          |
| <b>Proportion (e+g+i+j) of the forest land exempted from forestry</b>  | <b>37,3%</b>          | <b>22,7%</b>          | <b>16,9%</b>    | <b>13,7%</b>    | <b>25,0%</b>          |

Source : Swedish Statistical Yearbook of Forestry 2014

According to the Swedish Statistical Yearbook of Forestry 2014, the total area of forest exempt from forestry is 7.1 million ha, which represents 25% of the total forest area.

In Sweden there are:

- 29 national parks
- 4,340 nature reserves
- 91 nature conservation areas
- 7,516 habitat protection areas, in forest land
- 101 habitat protection areas, other land

**Table 12 : Protected areas in Sweden 2015**

| <i>Type of protection</i>                                    | <i>Number</i> | <i>Total area (ha)</i> | <i>Land area (ha)</i> | <i>Share (%) of total land area</i> |
|--|---------------|------------------------|-----------------------|-------------------------------------|
| National parks   | 29            | 739,450                | 631,325               | 1,50%                               |
| Nature reserves  | 4,340         | 4,599,280              | 3,771,090             | 9,30%                               |
| Nature conservation areas                                    | 91            | 108,826                | 73,104                | 0,20%                               |
| Habitat protection areas in forest land                      | 7,516         | 26,124                 | 26,066                | 0,10%                               |
| Habitat protection areas, other                              | 101           | 246                    | 243                   | 0,00%                               |
| <b>Total 2015</b>  | <b>12,077</b> | <b>5,472,564</b>       | <b>4,500,533</b>      | <b>11%</b>                          |
| Total 2014   | 11,746        | 5,442,793              | 4,479,549             | 11%                                 |
| Natura 2000  | 4,530         | 6,678,565              | 4,768,459             | 11,70%                              |
| Natura 2000 areas not included in protection specified above |               | 1,899,244              | 730,647               | 1,80%                               |

Source : [http://www.scb.se/en\\_/Finding-statistics/Statistics-by-subject-area/Environment/Land-use/Protected-nature/Aktuell-Pong/24548/Behallare-for-Press/403465/](http://www.scb.se/en_/Finding-statistics/Statistics-by-subject-area/Environment/Land-use/Protected-nature/Aktuell-Pong/24548/Behallare-for-Press/403465/)

According to the official statistics of Sweden, national parks consist in 631,325 ha (1.5% of land area). Nature reserves occupy 3,771,090 ha or 9.3% of the total land area. Nature conservation areas equals 73,104 ha (0.2%), 26,066 ha of forests (0.1%) and 243 ha (0.0%) of other land are covered by habitat protection areas. The total area under protection in Sweden was 4,500,533 ha in 2015, which represents 11% of the country's territory<sup>17</sup>.

The total land area covered by Natura 2000 sites corresponds to 4,768,459 ha or 11.7% of the land area.

All the locations of protected forests and Natura 2000 sites are presented in the following figures.

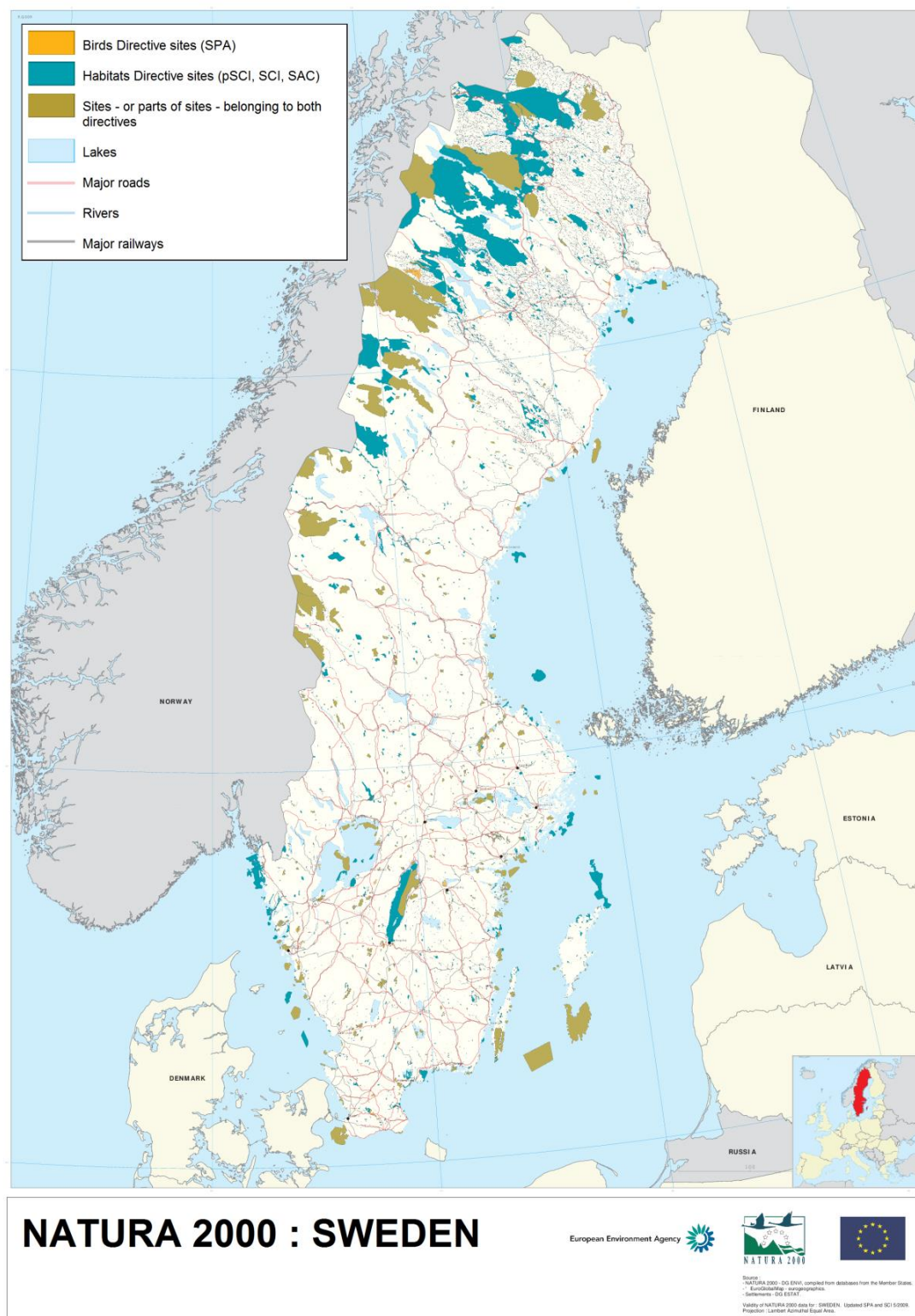
<sup>17</sup> <http://www.scb.se/>

**Figure 22 : Location of the protected forests in Sweden**



Source : <http://www.sveaskog.se/en/forestry-the-swedish-way/short-facts/brief-facts-5/>



**Figure 23 : Location of the Natura 2000 areas in Sweden**

Source : [http://ec.europa.eu/environment/nature/natura2000/data/index\\_en.htm](http://ec.europa.eu/environment/nature/natura2000/data/index_en.htm) (modified by SGS)



The MCPFE (Ministerial Conference on the Protection of Forests in Europe) has produced Assessment Guidelines for Protected and Protective Forest and Other Wooded Land in Europe. The total extend of forested protected area in Sweden recorded by MCPFE in 2015 is around 2,168,700 ha (classes 1.1.- 1.3 & 2.)<sup>18</sup>. This is about 7.7% of the forest land. This figure is lower than protection areas presented by Swedish Statistical Yearbook of Forestry 2014.

**Table 13 : Identification of the MCPFE Classes**

|  |   |
|--|---|
| 1. Main Management Objective<br>"Biodiversity"   | 1.1: "No Active Intervention"                 |
|  | 1.2: "Minimum Intervention"                   |
|  | 1.3. "Conservation Through Active Management" |
| 2. Main Management Objective: "Protection of Landscapes and Specific Natural Elements" |   |
| 3. Main Management Objective : "Protective Functions"                                  |   |

Source: MCPFE assessment guidelines for protected and protective forest and other wooded land in Europe

### National strategies

As it is stated on the site of the government:

*The Government wants to safeguard economic and inalienable values in biodiversity and ecosystem services. The long-term strategy for biodiversity and ecosystem services presents the work on strengthening biodiversity and safeguarding ecosystem services such as water purification, production of food and fibres, and recreation and outdoor activities.*

*The strategy covers everything from the protection of land and the sea, measures for endangered plant and animal species, genetic diversity, natural and cultural environment considerations in land and water use to increased cooperation with industry. The proposals in the bill will help achieve the Swedish environmental quality objectives, the generational goal, the targets in the EU Biodiversity Strategy to 2020, and the international Aichi Biodiversity Targets within the UN Convention on Biological Diversity (CBD).*

*Work to give visibility to the value of ecosystem services and biodiversity will still have high priority. This primarily involves integrating their values into political and economic policy positions and other decisions. For example, ecosystem services must be included in environmental accounting, planning and decisions on land use by public authorities, the design of economic instruments and the development of business models, innovations and standards. The Government also considers that properly designed compensatory measures can be an important tool for strengthening biodiversity and ecosystem services.*

*The Government wants to make it easier for companies to assess their dependency on ecosystem services and make it easier for investors to get information about a company's full value. Business opportunities that are directly linked to ecosystem services are found in such sectors as agriculture, forestry, the pharmaceutical industry, fisheries and tourism.*

<sup>18</sup> The State of Mediterranean Forests 2013

*It is a major challenge for Sweden to live up to the target of the UN Convention on Biological Diversity, which involves the countries cumulatively ensuring long-term protection for at least 17 per cent of terrestrial and inland water and 10 per cent of coastal and marine areas by 2020. To achieve this goal, the Government plans to increase protection of biodiversity, protect more natural forests and establish more marine reserves.*

### 3.4. Protection of water

The MCPFE (Ministerial Conference on the Protection of Forests in Europe) has defined a quantitative indicator to assess the performances of the reporting countries in terms of conservation of the forests' protective functions, especially regarding soil and water (MCPFE class 3 as per Table 13). It is based on the surface of forest land specifically dedicated to protective functions, as defined by the following criteria<sup>19</sup>:

- *The management is clearly directed to protect soil and its properties or water quality and quantity or other forest ecosystem functions, or to protect infrastructure and managed natural resources against natural hazards*
- *Forests and other wooded lands are explicitly designated to fulfill protective functions in management plans or other legally authorized equivalents*
- *Any operation negatively affecting soil or water or the ability to protect other ecosystem functions, or the ability to protect infrastructure and managed natural resources against natural hazards is prevented*

There is no distinction between the protective functions for soil, water and other forest ecosystem functions and infrastructure and managed natural resources. The table presents a combination of both.

**Table 14 : Forest land dedicated to protective functions as per MCPFE class 3**

| Area (1000 ha)           | 1990     | 2000     | 2005         | 2010         | 2015         |
|--------------------------|----------|----------|--------------|--------------|--------------|
| Forests                  | /        | /        | 3,894        | 4,032        | 4,032        |
| % of total forested land | /        | /        | 13.77%       | 14.26%       | 14.26%       |
| Other wooded land        | /        | /        | 1,432        | 1,297        | 1,297        |
| <b>TOTAL</b>             | <b>/</b> | <b>/</b> | <b>5,326</b> | <b>5,329</b> | <b>5,329</b> |

Source : Forest Europe, UNECE, FAO

### 3.5. Protection of soils

Sweden's forest soils are mainly composed of moraines sediments; those were deposited 10,000 years ago when the inland ice sap melted. The soils have a low buffering capacity, mixed with a high level of air pollution, the soil undergoes an acidification. Therefore, the level of mineral nutrients has reduced by half in recent decades. Air pollution seriously threatens the forest eco-systems and the growth of forests<sup>20</sup>. Here is why the protection of soil is important in Swedish forests.

<sup>19</sup> MCPFE assessment guidelines for protected and protective forest and other wooded land in Europe  
<http://www.unece.org/fileadmin/DAM/timber/publications/2002-guidelines-protected-forest.pdf>

<sup>20</sup> [http://www.borealforest.org/world/world\\_sweden.htm](http://www.borealforest.org/world/world_sweden.htm)

As described in the previous section, the MCPFE (Ministerial Conference on the Protection of Forests in Europe) has defined a quantitative indicator of to assess the performances of the reporting countries in terms of conservation of the forests' protective functions, especially regarding soil and water (MCPFE class 3 as per Table 13). The conservation areas are presented in Table 14.

### 3.6. Protection of carbon stocks

In forest land the carbon stocks mainly includes:

- living above ground and below ground woody biomass,
- soil organic carbon,
- carbon in litter.

Carbon stock in forests is shown in Table 15.

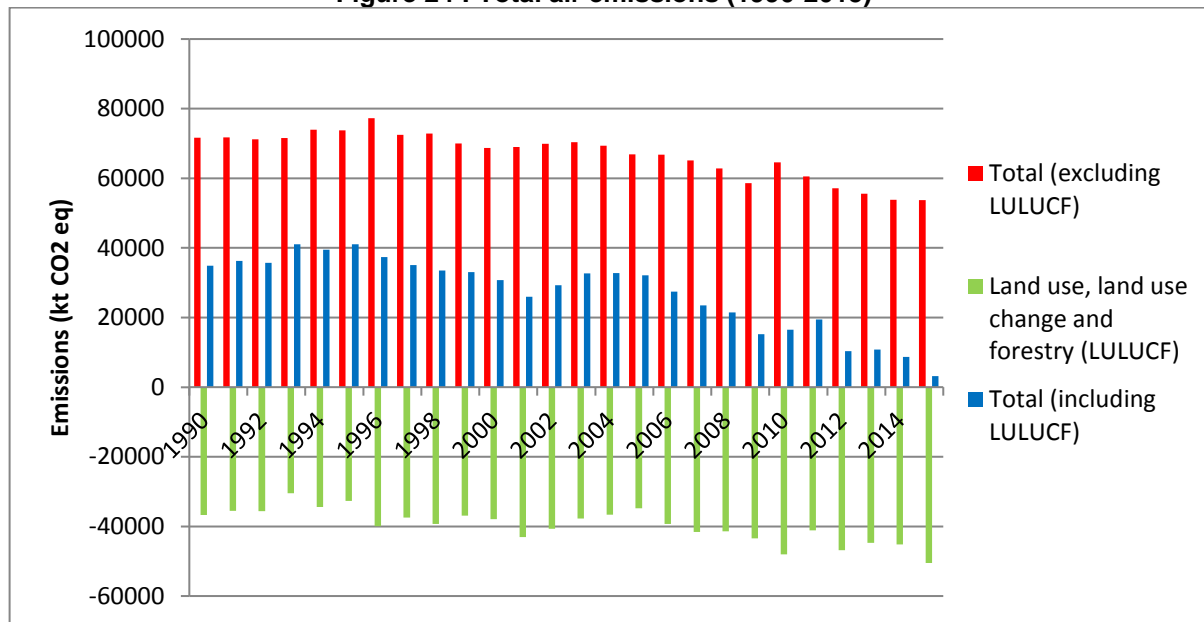
**Table 15 : Estimated carbon stock in Swedish forests (1990-2015)**

| <b>Carbon (million m<sup>3</sup>)</b> | <b>Forest</b>  |                |                |                |                | <b>Other wooded land</b> |              |              |              |              |
|---------------------------------------|----------------|----------------|----------------|----------------|----------------|--------------------------|--------------|--------------|--------------|--------------|
|                                       | <b>1990</b>    | <b>2000</b>    | <b>2005</b>    | <b>2010</b>    | <b>2015</b>    | <b>1990</b>              | <b>2000</b>  | <b>2005</b>  | <b>2010</b>  | <b>2015</b>  |
| Carbon in above ground biomass        | 713.1          | 762.5          | 818.4          | 827            | 835.6          | 2.5                      | 2.7          | 2.8          | 2.2          | 2.8          |
| Carbon in below ground biomass        | 237.2          | 253.5          | 273            | 275.8          | 278.7          | 0.8                      | 0.9          | 0.9          | 0.7          | 0.9          |
| <i>Subtotal living biomass</i>        | <i>950.3</i>   | <i>1,016</i>   | <i>1,091.4</i> | <i>1,102.8</i> | <i>1,114.3</i> | <i>3.3</i>               | <i>3.5</i>   | <i>3.8</i>   | <i>3</i>     | <i>3.8</i>   |
| Carbon in dead wood                   | 19.9           | 21.1           | 27.3           | 28.5           | 29.7           | 0.4                      | 0.4          | 0.4          | 0.3          | 0.3          |
| Carbon in litter                      | 653.2          | 645.3          | 640.3          | 633.3          | 629.7          | 56.6                     | 55.7         | 57.7         | 54.9         | 54.5         |
| <i>Subtotal Dead wood and litter</i>  | <i>673.1</i>   | <i>666.4</i>   | <i>667.6</i>   | <i>661.8</i>   | <i>659.4</i>   | <i>57</i>                | <i>56.1</i>  | <i>58.1</i>  | <i>55.2</i>  | <i>54.8</i>  |
| Soil carbon                           | 1,805.8        | 1,838.7        | 1,873.6        | 1,876.7        | 1,901.1        | 156.5                    | 158.8        | 168.9        | 162.6        | 164.7        |
| <b>TOTAL</b>                          | <b>3,429.2</b> | <b>3,521.1</b> | <b>3,632.6</b> | <b>3,641.3</b> | <b>3,674.8</b> | <b>216.8</b>             | <b>218.4</b> | <b>230.8</b> | <b>220.8</b> | <b>223.3</b> |

Source : Global Forests Resources Assessment 2015

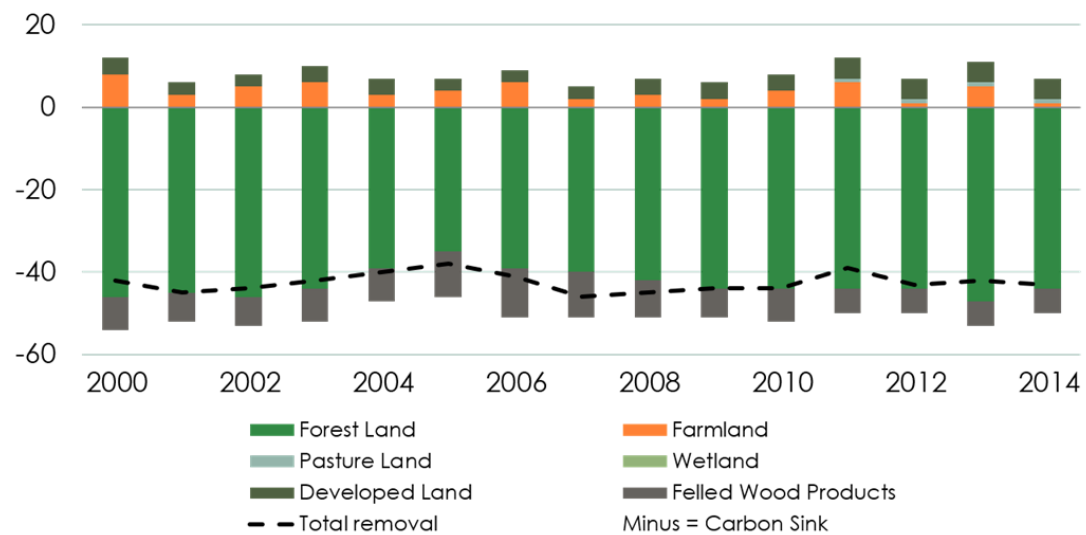
According to the FAO, the total estimated carbon stock in forested and wooded lands increased from 3.6 billion m<sup>3</sup> in 1990 to 3.9 billion m<sup>3</sup> in 2015. Considering forests, the carbon in above ground and below ground biomass, carbon in dead wood and soil carbon increased for the period where carbon in litter slightly decreased from 673.1 million m<sup>3</sup> to 659.4 million m<sup>3</sup> in 2015. The carbon in other wooded land is minimal compared to forests' one. The trend is rather stable with slight increases and slight decreases. These carbon values correlate with growth of growing stock in Swedish forests.

The total emissions of greenhouse gases can be seen in Figure 24. As the total of greenhouse gas emissions follow a declining trend and the sink from land use, land use change and forestry (LULUCF) seem to increase, the total emissions including the sinks go towards negative emissions in Sweden.

**Figure 24 : Total air emissions (1990-2015)**

Source : Swedish Environmental Protection Agency

The emissions from land use are developed in Figure 25. In total, farmland and developed land have a positive impact on the emissions. Forest land is the biggest sink of greenhouse gases emissions. Felled wood products also contribute negatively to the greenhouse gas emissions.

**Figure 25 : Emissions of greenhouse gases from land use (2000-2014)**CO<sub>2</sub>-equivalents, Million Tonnes/year

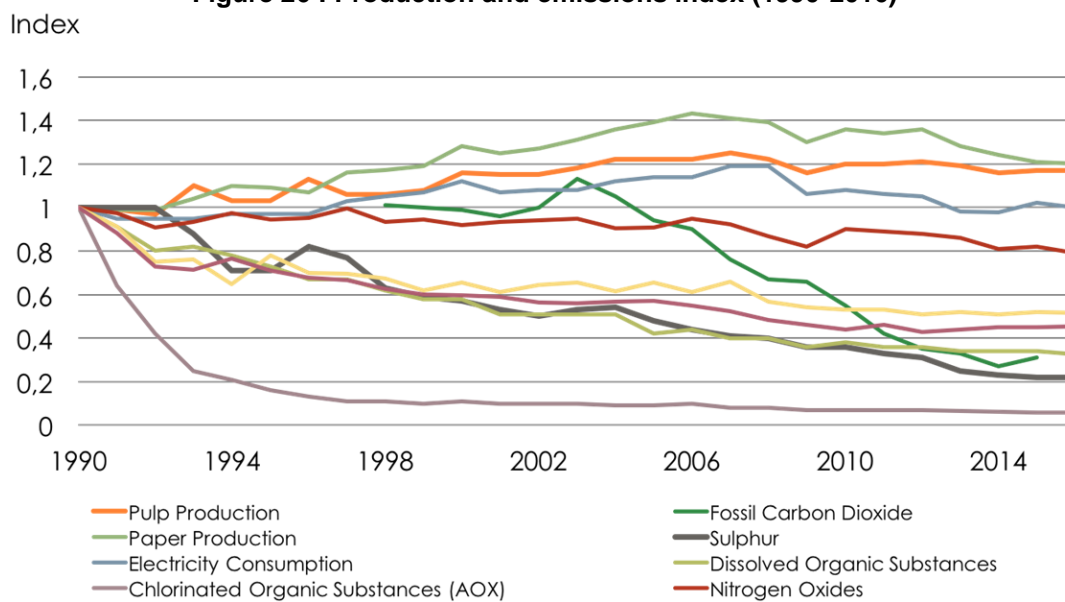
Source : Swedish Environmental Protection Agency

### 3.7. Protection of air quality

Concerning forests, impacts on the air quality come from pollutant emissions of the forest industry and forest fires; it includes wild fire (which are unintended) and prescribed fire (which is used as part of forest management under controlled conditions).

As it is presented in Figure 26, from 1990 to 2016, the production of pulp and paper increases. During that time, all the emitted pollutants decreased. The most radical decline concerns the Chlorinated Organic Substances (AOX), they go towards zero. The other pollutants decrease in a minor manner but they continue to decline.

**Figure 26 : Production and emissions index (1990-2016)**



The number and the extent of forest fires is presented on Table 16. As the number of forest fires approximates 50% of the total burned land, the areas of burned forests oscillate between 54% and 92% of the total land. Forests are the major victims of fires in Sweden. Compared to the total forest land (28,276 ha in 2011 according to official statistics), the biggest burned area, which was in 2008, corresponds to 0.02% of the total forest area. Thus, forest fires are not a major problem in Sweden.

**Table 16 : Number of forest fires (2003-2011)**

|  | 2003  | 2004  | 2005  | 2006  | 2007  | 2008  | 2009  | 2010  | 2011  |
|--|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| <b>Number:</b>                                   |       |       |       |       |       |       |       |       |       |
| Total land                                       | 8,071 | 4,886 | 4,492 | 4,610 | 3,783 | 5,420 | 4,179 | 3,120 | 4,030 |
| Forest   | 3,584 | 2,272 | 2,317 | 2,479 | 2,098 | 3,164 | 1,980 | 1,398 | 1,826 |
| percentage of burned forest to total burned land | 44,4% | 46,5% | 51,6% | 53,8% | 55,5% | 58,4% | 47,4% | 44,8% | 45,3% |
| <b>Area (1000 ha):</b>                           |       |       |       |       |       |       |       |       |       |
| Total land                                       | 4.002 | 1.883 | 1.562 | 5.709 | 1.09  | 6.113 | 0.912 | 0.54  | 0.82  |
| Forest   | 2.337 | 1.446 | 1.139 | 5.185 | 0.834 | 5.657 | 0.653 | 0.291 | 0.537 |

|  |       |       |       |       |       |       |       |       |       |
|--|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| percentage of<br>burned forest to<br>total burned land | 58,4% | 76,8% | 72,9% | 90,8% | 76,5% | 92,5% | 71,6% | 53,9% | 65,5% |
|--|-------|-------|-------|-------|-------|-------|-------|-------|-------|

Source : Global Forests Resources Assessment 2015

Concerning forest fires, it is stated on <https://www.climatechangepost.com/>:

*Forest fire risk in Sweden is limited, compared with other countries. The total annually burnt area of forest has not exceeded 5000 ha since 1950s for most years.*

*Future projections of changes in forest fire risk have been made for northern and southern Sweden, based on a regional climate model and the intermediate A1B climate change scenario. According to these results, northern Sweden is likely to be a fire-resistant region in the future climate (until 2100) where the number of days with high fire risk is found to be lower than today. In contrast, southern Sweden is projected to become a more fire-prone region with an increased number of days with a high fire risk.*

*In northern Sweden, especially autumn is found to become more prone to forest fire. This is mainly due to the increase of temperature and wind speed. For summer, today's main fire risk season, the projected moister air, increased precipitation and relatively stabilised wind speed balance out the effect of the warmer climate.*

*In southern Sweden, the most fire-prone season in future is likely to be summer, where less precipitation, warmer temperatures and higher wind speeds are projected. Until 2100, the fire risk in summer is projected to increase by 20% as the climate in the distant future becomes drier, warmer and windier.*

*Most likely, forest fires are set to increase. Preventive measures will become increasingly important. These include both communicating restrictions regarding the lighting of fires and ensuring that these restrictions are complied with. It may also be necessary to refrain from certain forestry measures during extremely dry periods. Fire monitoring is a central task for which resources should be guaranteed in the future as well, as the early discovery of fires is decisive as regards the speed with which they can be put out and the level of resources required.*

*Moreover, Sweden and other countries in Northern Europe should draw benefit from experiences in southern Europe, and develop operational preparedness and capacity by planning, participating in and contributing resources to international co-operation to a greater extent. Collaboration with eastern European countries should also be strengthened, as their climate and forest conditions in many cases resemble those found in Sweden.*

### **3.8. Illegal logging**

Illegal logging is not a serious problem in Sweden<sup>21</sup>. In 2004, an estimated less than 1% of domestic timber production was illegal ([UNECE/FAO 2004](#)). Sweden's imports of timber and timber products are subject to the requirements of the EU Timber Regulation which came into force in March 2013. Issues

<sup>21</sup> <http://www.illegal-logging.info/regions/sweden>

such as theft and bribery are estimated to be basically non-existent. Sweden in accordance with Latvia has initiated a project called “Transparent Timberflows in the Baltic Sea Region”.

The FSC risk assessment platform [www.globalforestregistry.org](http://www.globalforestregistry.org) considers Sweden as at low risk in terms of illegal logging, because the following criteria are all verified:

- Evidence of enforcement of logging related laws in the district <sup>22</sup>
- There is evidence in the district demonstrating the legality of harvests and wood purchases that includes robust and effective system for granting licenses and harvest permits <sup>23</sup>
- There is little or no evidence or reporting of illegal harvesting in the district of origin<sup>24</sup>
- There is a low perception of corruption related to the granting or issuing of harvesting permits and other areas of law enforcement related to harvesting and wood trade<sup>25</sup>

### **3.9. Civil rights and traditional rights**

The FSC risk assessment platform [www.globalforestregistry.org](http://www.globalforestregistry.org) considers Sweden as at low risk in terms of violation of civil and traditional rights, because the following criteria are all verified:

- There is no UN Security Council ban on timber exports from the country concerned<sup>26</sup>
- The country or district is not designated a source of conflict timber (e.g. USAID Type 1 conflict)  
<sup>27</sup>
- There is no evidence of child labor or violation of ILO Fundamental Principles and Rights at work taking place in forest areas in the district concerned <sup>28</sup>
- There are recognized and equitable processes in place to resolve conflicts of substantial magnitude pertaining to traditional rights including use rights, cultural interests or traditional cultural identity in the district concerned
- There is no evidence of violation of the ILO Convention 169 on Indigenous and Tribal Peoples taking place in the forest areas in the district concerned

### **3.10. Forest certification**

The main forest certification schemes used in Sweden are:

- PEFC (Programme for the Endorsement of Forest Certification), a global certification system that ensures sustainable forest management
- FSC (Forest Stewardship Council<sup>29</sup>), which is specifically suitable for small private owners

Sweden joined PEFC in 1999. The Swedish standard for forest certification according to the FSC was approved in 1998.

<sup>22</sup> [www.illegal-logging.info](http://www.illegal-logging.info) ; [www.eia-international.org](http://www.eia-international.org) ; <http://www.ahec-europe.org/>

<sup>23</sup> [www.illegal-logging.info](http://www.illegal-logging.info) ; [www.eia-international.org](http://www.eia-international.org) ; <http://www.ahec-europe.org/>

<sup>24</sup> [www.illegal-logging.info](http://www.illegal-logging.info) ; [www.eia-international.org](http://www.eia-international.org) ; <http://www.ahec-europe.org/>

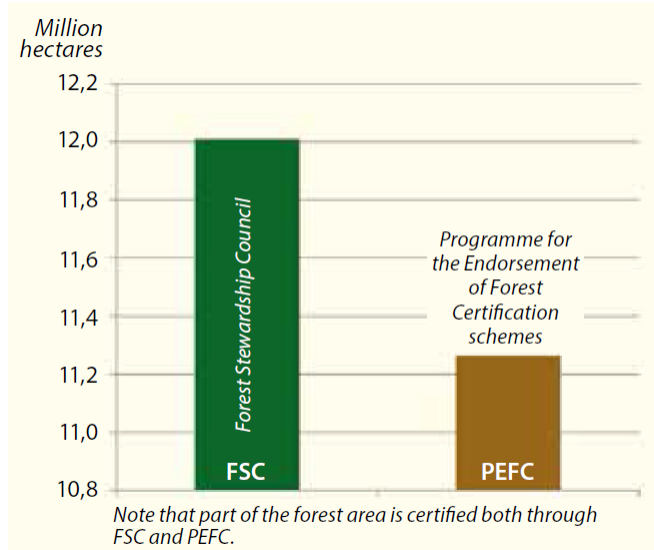
<sup>25</sup> <http://www.transparency.org/cpi2012/results>

<sup>26</sup> <http://www.globalwitness.org/pages/en/forests.html>

<sup>27</sup> Conflict Timber: Dimensions of the Problem in Asia and Africa Volume I Synthesis Report

<sup>28</sup> Global Child labor trends 2000 to 2004. ILO (International Labour Office).

<sup>29</sup> [www.fsc.org](http://www.fsc.org)

**Figure 27 : Area of forests under FSC and PEFC certifications**

Source : The Swedish Forest Industries Federation, CEPI, PPI, FAO, National Associations

The certified forests according to the FSC certification scheme approximate 12 million ha, it corresponds to 42% of all forested land in Sweden. The PEFC certified forests occupy more than 11.2 million ha or 40% of the forested land. According to Sveaskog, 7.1 million ha of forest areas are double-certified<sup>30</sup>.

## 4. Conclusions

Sweden forest land is estimated, by the FAO, to cover 28.1 million hectares, wooded lands occupy 2.4 million ha, both represent 66% of the country land area. Coniferous species dominate the forests with more than 80% of the tree species, the other 20% are broadleaved trees.

In 2015, the biggest part of forest owners was family enterprises with 50% of the owned forests. In total, a large majority of forest lands is owned by privates, around 83%, the last 17% belongs to the state and the state-owned companies.

Considering the added value of the forest industry, it grows with time even though its contribution to the total GDP of Sweden has decreased since the nineties.

According to the FAO's Global Forest Resources Assessment, the area of forest and other wooded land has been stable since 1990. It oscillated between 30.5 million and 30.6 million ha. The annual change rate is smaller than 0.1% for the period 1990-2015.

The estimated volume of growing stock in Sweden is over 3.2 billion m<sup>3</sup> in 2014, according to the official statistics. According to Eurostat, the felling of timber was greater than its increment in the growing stock available for wood supply. The official statistics of Sweden states that the increments were above 130 million m<sup>3</sup> and the cuts were under 90 million m<sup>3</sup> in 2014.

<sup>30</sup> <http://www.sveaskog.se/en/forestry-the-swedish-way/short-facts/brief-facts-7/>



Along the increase of growing stock, the carbon stocks in Sweden rise. It was estimated to be 3,674.8 million m<sup>3</sup> in 2015. Forests are a big carbon sink for greenhouse gas emissions. In 2015, all the land use, land use change and forestry accounted as a sink equal to 94% of national greenhouse gas emissions.

Sweden has various types of conservation lands dedicated to the protection of biodiversity, including reserves, parks, nature conservation areas, habitat protection areas, Natura 2000 sites and other protection status. According to the Ministerial Conference on the Protection of Forests in Europe, about 7.7% of the Swedish forests have a protection status in terms of biodiversity (MCPFE Classes 1.1-1.3 and Class 2). Protected areas as Natura 2000 have been accounted and covered 4,768,459 ha of forests (i.e. about 11.7% of the country forests) in 2015.

According to the Ministerial Conference on the Protection of Forests in Europe, forest land specifically dedicated protective functions (in accordance with MCPFE class 3 definition) covers about 14.3% of the forests in Sweden.

The air pollution concerning forests in Sweden is from the pulp and paper industry and forest fires. All the emitted pollutants are on a declining trend and forest fires remain minimal compared to other countries.

The FSC risk assessment platform [www.globalforestregistry.org](http://www.globalforestregistry.org) considers Sweden is at low risk in terms of violation of illegal logging and in terms of violation of traditional and civil rights.

The forest certification FSC and PEFC are largely developed in Sweden, with 42% and 40% of the forest land certified.

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