

## Forestry and CO<sub>2</sub>- what can the forestry sector do to mitigate climate change?

### Introduction

How large impact might forestry have to mitigate carbon emission through forestry activities?

Statistics concerning the worlds forests are incomplete and in often of low quality. In the following the data that has been used have been collected from FAO:s report on global forest resources (FAO 2006, Global Forest Resources Assessment 2005, FAO Forestry Paper 147).

In the FAO Report "production forests" is separated from other types of forests. The forested area is approximately 4 billion ha, and the area of production forests was about half of that area. On the other half, i.e environmental, economic or social concerns are considered more important than production forestry.

The standing volume of the world forests was in 2005 estimated to about 440 billion m<sup>3</sup> or 110 m<sup>3</sup> per ha. The volume of the production forest were about half of that.

There is no good statistics of the annual growth of the worlds forests which makes is difficult to estimate the potential for carbon uptake. The figures for annual cutting on a global basis is as low as ca 3 billion m<sup>3</sup> or about 1,5 m<sup>3</sup>/ha,year in the production forests. As a reference, the annual cutting in the Scandinavian forests is about 3 m<sup>3</sup> per year, a cutting that is considerable lower than the annual growth.

Below is some figures as a background (billion ton of C Source: IPCC 2007; Climate Change 2007)

#### *Sources for CO<sub>2</sub>*

|                                 |     |
|---------------------------------|-----|
| Fossil fuels, cement production | 7,2 |
|---------------------------------|-----|

#### *Sinks for CO<sub>2</sub>*

|                                |     |
|--------------------------------|-----|
| Accumulation in the atmosphere | 4,1 |
| Oceans                         | 2,2 |
| Land vegetation                | 0,9 |

#### *Pools of carbon*

|                 |       |
|-----------------|-------|
| Atmosphere      | 760   |
| Land vegetation | 2200  |
| Fossil fuels    | 3500  |
| Oceans          | 38000 |

**Calculation of potential increased uptake in forests**

It is not possible to achieve reliable global figures about forest growth. In the following a calculation is made using a model based on historical data from Swedish forest and forestry. The aim of the calculation was to answer the question: What would happen if the world's production forests were managed in the same way as the Swedish?

The following transformations were used:

- Carbon content in stem wood (when cutting) 1 m<sup>3</sup> stem wood = 0,2 ton C
- Carbon content in ecosystem (trees, dead wood, coal in soils, etc 1m<sup>3</sup> stem wood = 0,7 ton C

*Deforestation/ afforestation – change in forest cover*

According to FAO deforestation equals to ca 7,3 million ha/year, which equals ca 0,2 % av the forest area. In Sweden the historical figure (Swedish National Forest Inventory) is an afforestation of ca 0.1 % per/year. In the calculation it is assumed that no deforestation takes place.

Calculation: 7.3 million ha \* 110 m<sup>3</sup>/ha \* 0.7 (transformation of m<sup>3</sup> to ton C according to FAO) = 0.6 billion ton C per/year. The calculated figure is low compared to what is reported elsewhere (e.g. Canadell and Raupach 2008) who reports a potential of ca 1.5 billion ton C per/year. However, that figure covers all deforestation, and it is assumed that 13 million ha is deforested each year.

*Reduced damage*

Each year ca 100 million of the world's forests ha are damaged, of which ca 30 % by fire.

Forest damage globally are considerably larger than in the Swedish. For example, large insect outbreaks and forest fires in Canada has turned its forests from a sink to a source probably for decades (Canadell and Raupach 2008). However, a situation where no damage occurs is not realistic. In the calculation it is assumed that damage could be reduced to the half of today's and that the damage on that area gives a CO<sub>2</sub>-emission of 30 % of what is totally bound in the forest.

Calculation: 50 million ha \* 110 m<sup>3</sup> \* 0.7 \* 0.3 (correction se above) = 1.2 billion ton C.

*Increased volume and cutting*

The standing volume in Sweden has as a mean increased by 1% per year since the 1920-ies (Swedish National Forest Inventory). The figure is similar as a mean for Western Europe (Ciais et al 2008).

Annual growth and cutting have both increased with 1.3 % during the last ca 50 years in Sweden.

It is possible to use wood to substitute for fossil fuels. Waste and wood products after use can be effectively used for energy production. Wood as building material can substitute for more energy consuming materials, such as concrete, aluminium and iron. Slash and stumps can also be harvested and used as bio energy, a resource that is little used today.

In the calculation it is assumed that the growth in the global production forests increase by 1 % per year and that annual cutting increases with 1.3%. The substitution effect has been set as the carbon (energy) content of the stem wood.

*Calculated standing volume of C, and increased amount of C in the worlds production forests (The calculation refers to change in the whole ecosystem, where 1m<sup>3</sup> equals to 0.7 ton C)*

|   | Today | Year 10 | Year 20 | Year 30 |
|---|-------|---------|---------|---------|
| Standing volume, billion m <sup>3</sup> | 220   | 243     | 269     | 297     |
| Billion ton C                           | 154   | 170     | 188     | 208     |
| Sequestration of C, billion ton C/year  |       | 1,6     | 1,8     | 2,0     |

*Calculated change in annual cutting (The calculation refers to stem wood only, 1m<sup>3</sup>=0.2 ton C)*

|                                 | Today | Year 10 | Year 20 | Year 30 |
|---------------------------------|-------|---------|---------|---------|
| Cutting, billion m <sup>3</sup> | 3,0   | 3,4     | 3,9     | 4,4     |
| Billion ton C                   | 0,6   | 0,68    | 0,78    | 0,88    |
| Substitution billion ton C      |       | 0,08    | 0,18    | 0,28    |

### Summary, conclusion

*This can be achieved in 30 years (billion ton C/year)*

|   | Billion ton C/year |
|---|--------------------|
| Deforestation/ afforestation in balance | 0,6                |
| Reduced damage                          | 1,2                |
| Increased standing volume               | 2,0                |
| Substitution by increased cutting       | 0,3                |
| Sum                                     | 4,0                |

The effect of a managing the forests the "Swedish way" would approximately be about the same as the total accumulation in the atmosphere.