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2. Wood Energy and Environment

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2.1 Forest energy and greenhouse effect

2.1.1 Forest and carbon cycle

The green plants store carbon to their biomass as long as the photosynthesis process produces more biomass than the cell respiration process relases. All combustion and decaying processes of biomass release carbon dioxide to the atmosphere.

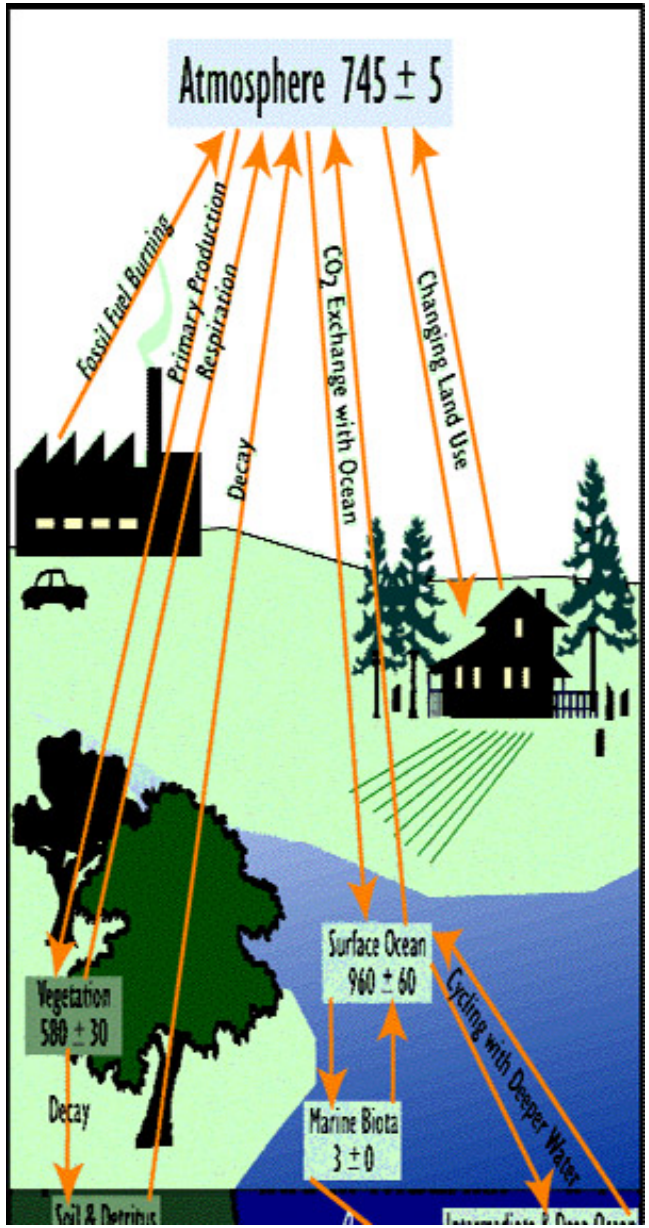
Forests behave the same way. As long as the carbon assimilation of green plants is stronger than the respiration and decomposition of vegetation, the ecosystem functions as a carbon sink.

One hectare of Middle-European forest will take an average of 7.5 tonnes of carbon out of the air each year during the first 20-60 years depending on the species and site productivity.

Recent evidence suggests that expanding forest cover worldwide could absorb a considerable amount of carbon dioxide from the atmosphere (Pearce 1992).

If, in general, the wood is harvested at a sustainable rate, using it for energy purpose does not result in any net increase in atmospheric carbon dioxide. In most European countries the net volume growth of forests is positive.

Theoretically, the long-lifecycle wood products such as wood used for construction would fix carbon and keep it away from the atmosphere for a long time. In general the energy wood is mainly low-value timber with no alternative use.



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The sources of information:

Savolainen Berggren (editors): Wood Fuels Basic Information Pack Jyväskylä 2000

Puhakka et. al.: Hakelämmitysopas Joensuu 2001

Kärkkäinen: Puutiede. Hämeenlinna 1985

Hakkila: Puun ja puutavaran ominaisuuksia, Tapion Taskukirja, 19. painos Helsinki 1993

Pohjonen: Puu energialähteenä. Tapion Taskukirja, 22. uudistettu painos, Helsinki 1994

Wilen et al: Biomass feedstock analyses, VTT Publication 282, Espoo 1996

2.1.2 Old Growth Forests

There has never been any pressure to utilise mature forests for energy production purposes. However, some aspects are worth mentioning here.

In a climax-type ecosystem, such as mature rainforest the carbon balance is close to zero, and most of the carbon is stored as the stemwood biomass. The assimilation rate may be high, but the decomposition and respiration are also rapid.

In some northern boreal forests the forest cover creates a cool and humid microclimate which favors the accumulation of the peat. If the forest cover is removed the decomposition of peat may follow releasing CO_2 to the atmosphere.

Some studies also indicate that old-growth forest continues to remove carbon even when fully mature, and that old and wild forests are better than plantations at removing carbon dioxide from the atmosphere.

Soils in undisturbed tropical rain forests and temperate woodlands contain carbon derived from fallen leaves, twigs and buried roots that can bind to soil particles. When such forests are cut, the trees' roots decay and soil is disrupted, releasing the carbon dioxide.

2.1.3 Conclusions

Reforestation processes create areas which can act as carbon sinks for decades. The removals from thinnings can be burned without large-scale effect to the carbon balance.

Clearcuts of old forests can lead to large CO_2 emissions from forest soils.

Any energy production using wood biomass is likely to replace the use of fossile fuels thus reducing the total emissions of greenhouse gases.

As in all burning processes, the most effective way to reduce the amount of greenhouse gas emissions of energy production is to use as

Carbon Cycle. The figures indicate the amount of carbon in gigatonnes (GT) (Image by Wheeling Jesuit University/NASA)

The extensive disturbance may lead to increased CO_2 emissions from soil (image by Markus Huhtinen).

Nurmi : Heating values of whole-tree biomass in young forests in Finland. Acta Forestalia Fennica 236. Tampere 1993

efficient methods as possible. The co-production of electricity and heat at so-called CHP plants can have an efficiency rate of over 90 %, whereas the electricity production efficiency rate with wood burners (condensing powerplants) usually falls below 45%. :

2.2.Emissions

All burning processes release CO2 to the atmosphere

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