

Forest biomass as an alternative energy source in Finland

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The wood-based fuels count for 20 % of the primary energy consumption in Finland. This volume equal to 20 million green tons of biomass was mostly made up of a variety of residues from forest industries. The ratification of Kioto protocol by European Union, *the EU-Renewable Energy Road Map* (10.1.2007) and *the RES-directive* (23.01.2008) have put an emphasis on the further increase of renewable energy sources. As a result R&D work has concentrated on the fuel wood harvest and recovery from conventional forestry operations. The aim is to increase the share of renewable energy sources to 38% by the year 2020. Reaching this goal requires residue, stump and small-sized tree recovery from hundreds of thousands of hectares of forest land annually. This raises forest management and environmental concerns such as how forest regeneration, site fertility and round wood yield be affected, how the increased recovery affects the pest populations and biodiversity, and how about recreational values?

Residue recovery on clear cut areas has been shown to improve site preparation. As a result planting can be carried out 1-2 years earlier than if the residues were left on the site and plantations will also be uniform in stocking. The loss of nutrients by the residue recovery, however, has not been shown to affect the height growth of *Pinus sylvestris*, the major timber species in Nordic countries, but *Picea abies* having been shown to suffer a two-year height growth during the first 15 years.

Whole tree harvesting from first commercial thinnings take place when the stand nutrient demand is the highest. The removal of nitrogen rich needle mass from the site will result in growth losses. As a result young spruce stands have been shown to suffer a 12 % reduction in basal area growth over the ten year period following the thinning. Respectively Scots pine basal area growth was reduced by 7 %. However, results are very variable and the problem stands have not been identified.

On a large scale the residue removal from clear cut areas and whole trees from pre-commercial thinnings doesn't seem to have an effect on pest and fungal outbreaks. However, it should be noted that removal of small-sized trees from the stand may prevent the colonization of some devastating insects.

Clear cutting will dramatically change the species composition on a clear cut site. Many of the species common in mature forest will yield to those species prevailing in first successional stages of a young forest. A further removal of residual biomass does not change the biodiversity to a great degree. Furthermore, the rare plant and animal species are mostly found on so called 'key biotopes', already protected by a number of conservation and forestry acts. As a result residue harvesting is not seen a threat to

biodiversity as long as the large diameter, dead standing and grounded trees are not removed.

The presentation will give an introduction to the energy wood harvesting chains used in Finland. Both large and small scale operations are viewed. Machinery, logistics and fuel characteristics will be reported.