Inventory and analysis of commercial use of white hardwood

Project Background

Energy and energy raw materials affect growth locally, nationally and internationally. Fossil energy use is now generally accepted to have negative consequences on the environment, through the release of carbon dioxide. Bio energy can offset the release by taking up carbon dioxide during the growing period. With respect to bio energy there are many resources that are poorly investigated and mapped.

Biomass based on pine, spruce and birch converted to chips and pellets is today a relatively well known energy raw material and has already a large area of application. Other hardwood species are a by-product from harvesting the above named species, and without a market for their use are they seen as "scrap" and a waste product that must be disposed of.

This white hardwood material includes aspen, alm, and mountain ash all of which can occur locally in large volumes. In northern Europe there are many areas of underutilised forest which are regarded as having no commercial value due to the lack of relevant utilisation methods for these fast growing tree sorts.

Project goals

Through increased knowledge on the supply of and utilisation areas for white hardwood:

* Create strategic planning tools for the aforementioned tree types
* Create new areas of utilisation for available and fast growing biomass
* Offer planning tools to existing base-industry (pulp mills and sawmills)
* Optimise biomass from a sustainable perspective.

The project has a concrete goal to specify areas of utilisation and activity within production based on white hardwood biomass. It is important that the utilisation is harmonised with the existing environmental goals, and does not damage the resources and the environment.

Financing

Interreg IIIA Nord Nordkalotten with local government co-financing from Norrbottens länslandsting; Länstyrelsen i Norrbottenslän; Nordland fylkeskommune and Troms fylkeskommune. Contributions are also made by the project participants.

Planned activities

* Map and analyse different types of areas of utilisation based processing, on total volume, accessibility, infrastructure as well as current commercial aspects.
* Create new planning tools which build on practical trials and theoretical models regarding the areas of utilisation for white hardwood biomass
* Analysis of possibilities for production of liquid fuels based on white hardwood biomass
* Generate local growth through development of SME (Small-Medium Enterprises) businesses.
* Perform a lifecycle analysis for the energy production from agriculture, in order to show the complete contribution to CO2 release together with waste handling and fertilising demand.
* Obtain data over the yield, production costs and market to allow an economic evaluation of the concept.
* Document and transfer knowledge that is created in the project.

Forest resources in Norway, Sweden and Russia

In Northern Norway the forest is dominated by birch –which accounts for 45% of the annual growth in Nordland and 87% in Troms. There is virtually no industrial utilisation of birch in the region, but it is used widely for household heating, mainly as firewood.

Northern Norway

Northern Sweden

The other important aspect of the forest resource in northern Norway is that the harvesting is made difficult by the steep terrain and distance to forest roads. About one third of the annual growth can be classified as readily accessible, but the current utilisation of firewood approximately corresponds to this amount. Therefore in order to increase the utilisation of forest bio energy in Northern Norway needs development in harvesting techniques.

Norrbotten region in northern Sweden has a much larger forest volume, but also has a larger forest industry that uses a large part of the accessible annual growth. However there is also a large quantity of wood biomass that can be extracted from the wood waste, thinnings, branches and tree roots. This could form the basis of a bio energy industry, but the extraction costs are likely to be higher than for normal tree harvesting. There can be other advantages, such as the root removal being integrated with ground preparation for re-foresting.

In Leningrads oblast there is a large annual growth, and far from all of this is currently used today. This could form the basis for a bio energy industry, either for local use or for export. Further investigations are needed to examine the accessibility of the resource.

Advantages of Hardwood

* Hardwood species grow well in the region, despite the cold climate.

* Generally high density and high heating value. The moisture content however varies as does the ease of drying.
* In some areas it is subject to few other competing uses.

One of the common tree species in Leningrads oblast is aspen, which grows quickly especially in wet areas. There is little utilisation of aspen, and it is regarded as being of low value. Therefore a trial was made to investigate the properties of pellets made from aspen.

Table 1: Comparison of aspen and softwood

	Aspen	Softwood
Heating value MJ/kg	18,3	18,1
Moisture, %	8,1	5-8
Ash	1,0	~0,3
Sulphur, mg/kg	134	46
CaO, mg/kg	0,354	0,093
K_2O, mg/kg	0,171	0,047
Copper, mg/kg	2,03	0,643
Lead, mg/kg	0,744	<0,05
Zinc, mg/kg	36,1	9,03

The results showed that a good heating value can be obtained from aspen pellets, but it is somewhat higher in content of heavy metals. It seems encouraging to investigate further the potential for developing bio energy resources based on white hardwood from Russia. Apart from the domestic market there is also potential to export to northern Norway and Sweden. Processing of the hardwood biomass to pellets in Russia is advantageous in terms of handling and reducing transport costs.

Another possible solid fuel is the generation of charcoal from controlled pyrolysis of the hardwood. This has potential as a valuable product.

The project is also investigation the potential for production of liquid fuels from hardwood. Of special interest are processes that can be implemented on small scale, or as mobile plants in order to reduce transport costs. Processes being evaluated within the project for the production of liquid fuels include

* Catalytic depolymerisation
  - Alfakat KDV (www.alfakat.de)
  - Green Power (www.cleanenergyprojects.com)
* Gasification/ catalytic reforming
  - Range Fuels (www.rangefuels.com)
  - Aviosol (Fischer Tropsch), Över Kalix
  - BCRT-AIST (www.aist.go.jp)
* Ethanol:
  - Biotech Progress, Czech Republic www.biotech-pro.com
  - Celunol (www.celunol.com)
* Microwave pyrolysis UMB (http://biomotive.no)

Green Energy BCT process (now Range Fuels)

Project Participants

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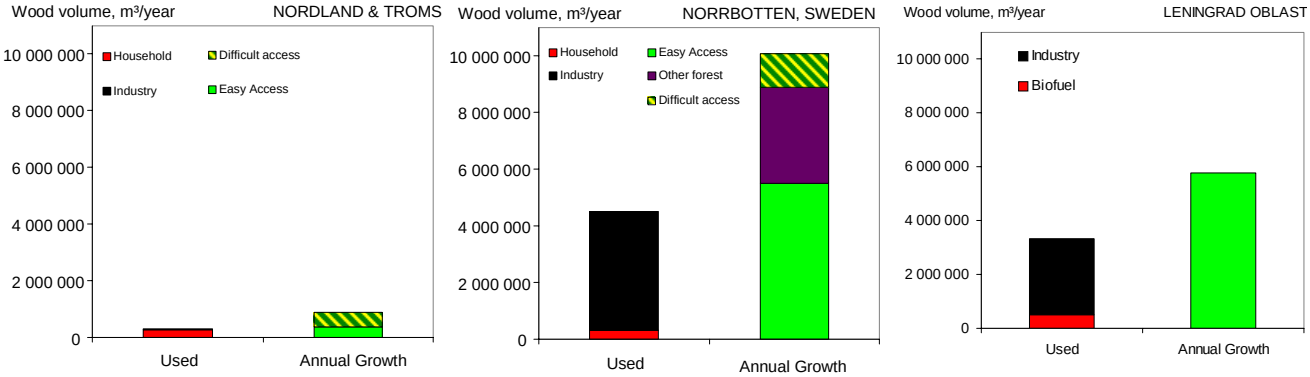

Fig 2: Utilisation and annual growth in northern Norway (hardwood), Sweden and Leningrad (all species).

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