15. Forest management on permafrost

Michael Köhl

University of Hamburg and Federal Research Centre for Forestry and Forest Products, Hamburg
e-mail: michael.koehl@gmx.net

Abstract

The dominating land cover type of the boreal regions is forests, followed by grasslands dominating the north part. Due to its geographic position at the north hemisphere and being mainly located inside of large continents, the majority the boreal region is covered by permanent frosted soil or temporarily frosted soils. These permafrost layers have up to several hundred meter depth and have been frozen for several thousand years. Nowadays global climatic changes and increasing land use activities leads to degradation of permanently frosted soils and thereby to emission of gases relevant for global warming, like for example carbon dioxide and methane.
Majority of Russian forest stocks on permafrost soils in Siberia (~400 Million hectare of 776 Million hectare forested land in Russia). With 224 Million hectare having very loos covered by forest and 134 Million hectares having very low productivity. Only about 40 Million hectares are manageable forest land, stocked mainly by *Larix gmelinii* in central- and east Siberia.
Traditionally single trees are harvested as fuel and construction wood to supply needs of local population. In the former Sowjetunion parts of the forest, in Irkutsk where the largest wood processing industry of the world and next to Baikalsee-Amur-Magistrale, were harvested and exported to the european part of Russia. Nowadays utilisation increased further and wood export to neighbour countries become important too. In the federal region of east Siberia, which contains 54 Billion m_ stocking wood, in 2002 about 6,4 Million m_ lumber and 47.000 t pulp have been produced. Further illegal harvesting took place in the near past in regions close to neighbour countries. Official statistics estimates for 1996 about 400.000 m_ and in 2001 more than one million m_ wood to be cut illegally. Very often the wood is taken by very well equipped and heavily armed thieves.

Commercial valuable forest stocks on temporarily frosted or transitional permafrost soils, which are affected by climatic changes first. Utilisation of forest increases the effect of perma frost degradation for the following reasons:

- Ruination of covering vegetation as result of forest management activities can lead to thermo cast phenomena, especially if harvesting takes place in summer times when the soil top part of the soil is melted.
- After harvesting, solar radiation can heat up the soil directly, which increases the melting depth of the soil and results is changes of the hydrology.
- Mostly harvesting is done in clear cuts and natural regeneration follows. This leads to long periods, including several intermediate states until the forest can be harvested again. Each intermediate type of forest has its specific impact on the soil.

- Forest managements needs road infrastructure, which enables people to goes into remote areas and very often people causes forest fires. After harvesting forest fires occur very often or forest get the permission to be harvested after they were affected by fire. In the last year the proportion of fires, mainly man made, increases and these fires destroy also the top layer of the vegetation which result in further melting of the soil.

For a quantification of permafrost degradation and changes in forest carbon stocks to support international treaties on reporting scientific finding need to be extrapolated by inventory results. At the moment only one map of the main tree species, produced in 1990 based on terrestrial investigation, satellite and airborne images exits. Forest inventories, funded by the government, are carried out on 10 to 20 years term, which is not sufficient to fulfil the needs of international treaties.

Coming scientific work should focus on quantitative investigations of the impact of forest management to permafrost soil degradation and on the development of methods for carbon flux inventories.