STUMP POTENTIAL AND ITS DISTRIBUTION IN FINLAND

Stumps and roots of trees form a potential raw material source for biorefining. Currently in Finland, mainly spruce stumps are harvested and burned for energy. On a national level, there is unused potential of spruce stumps, but also stumps of other tree species could be included in the overall below-ground biomass potential. Since stumps are only extracted from final fellings, their potential depends on the current and future harvesting levels.

HARVESTABLE STUMPS

The quantity of harvestable stumps is tied to the wood consumption of forest industries i.e. to the amount of final fellings. Harvesting levels fluctuate considerably between years, which have a direct impact on annual stump potentials. Between years 2002–2011 harvestings of saw-timber varied within 17–28 million m^3. The volumes of harvestable stumps for the major tree species were estimated on the basis of harvested roundwood volumes using expansion factors, tree species distribution information on a municipal level and considering certain ecological restrictions for stump harvesting.

Estimated from the average harvesting level of a ten year period from 2002 to 2011, the total stump potential was 6.7 million m^3 in the whole country. Norway spruce formed 3.0 million m^3 of the total potential, Scots pine 2.5 million m^3 and broadleaf species (mainly birches) 1.3 million m^3.

The maximum harvestable stump potential was also estimated on the basis of harvesting suggestions (final fellings) in the national forest inventory data (10^{th} NFI). On the basis of the inventory data, the maximum harvestable stump potential would be 8.0 million m^3 (3.5 million m^3 of spruce stumps, 3.0 million m^3 of pine and 1.5 million m^3 of broadleaf species).

CURRENT UTILIZATION

In 2011, 1.3 million m^3 of stump biomass was used in energy production in Finland. The used volume is less than one fifth of the total stump potential based on the average harvesting level of 2002 – 2011. However, commonly only spruce stumps have been extracted from clear-cuts, which means that the pine and broadleaf stump potentials remain unexploited. The remaining potential of spruce stumps has been estimated by extracting the use of stumps (in the year 2011) from the stump potential estimated from the 2002-2011 average harvesting level. This results in a free potential of 1.6 million m^3 for the whole country.

GEOGRAPHICAL DISTRIBUTION OF STUMP POTENTIAL

Depending on the estimation basis, the geographical distribution of potentially available stump biomass varies. Based on the average harvesting levels, spruce and broadleaf stumps are most abundant in Southern and Eastern Finland – pine stumps are additionally concentrated in the Western parts of the country. Estimated from the NFI data, the maximum stump potential of all tree species appear to be focused in the Western coastal areas in addition to the Eastern and Southern parts of the country. The free potential of spruce stumps is limited to Southern and Eastern Finland. In Western Finland, the potential of spruce stumps is in full use on the basis of the average harvesting levels.

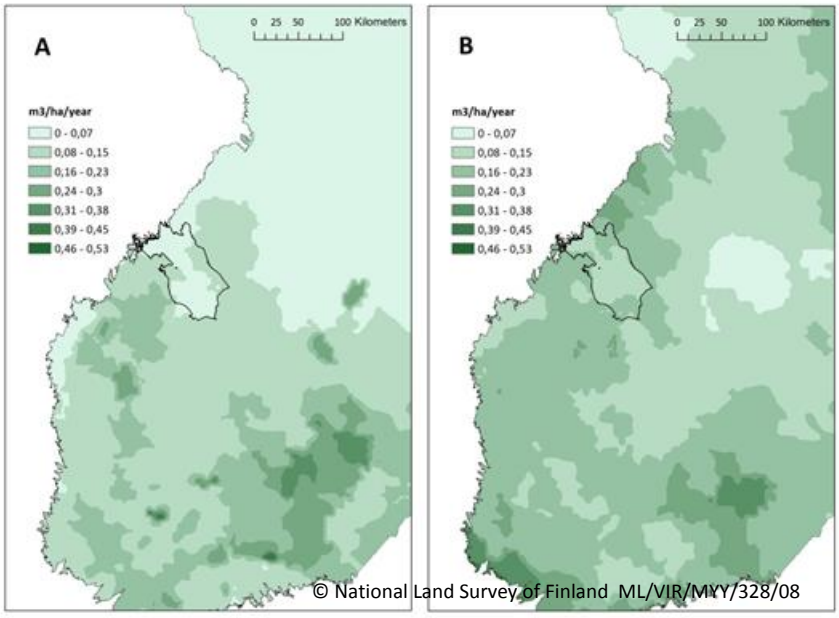

Figure 1. [A]: Volume (per hectare of forest land) of harvestable Scots pine stumps on the basis of the average harvesting level for 2002-2011; [B]: Technical harvesting potential of pine stumps as estimated on the basis of 10^{th} NFI; Total pine stump volumes in the province of Central Osthrobotnia (outlined in the maps): 32 400 m^3 in [A] and 59 400 m^3 in [B]. Harvesting statistics [A]: Metla/MetINFO

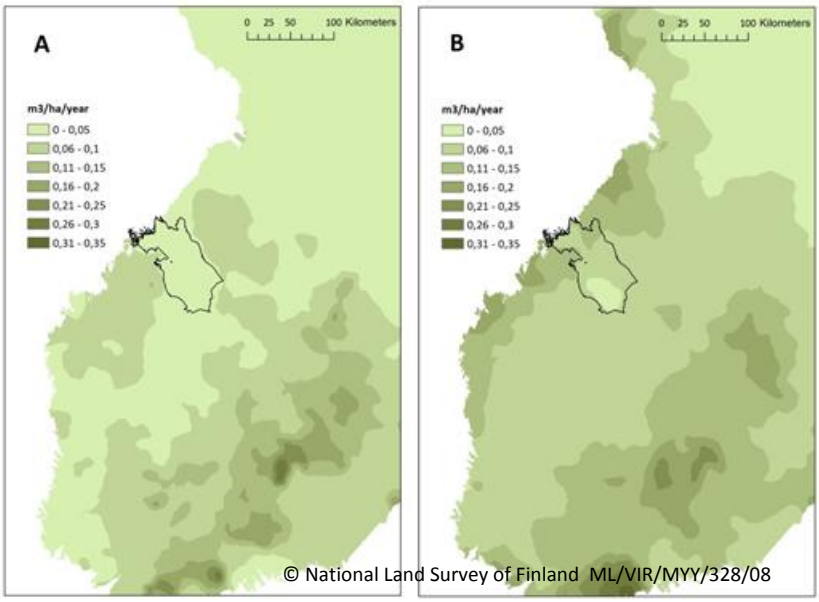

Figure 2. [A]: Volume (per hectare of forest land) of harvestable broadleaf tree (mainly birch) stumps on the basis of the average harvesting level of 2002-2011; [B]: Technical harvesting potential of broadleaf stumps as estimated on the basis of 10th NFI; Total broadleaf stump volumes in the province of Central Osthrobotnia (outlined in the maps): 12 800 m^3 in [A] and 24 200 m^3 in [B]. Harvesting statistics [A]: Metla/MetINFO.

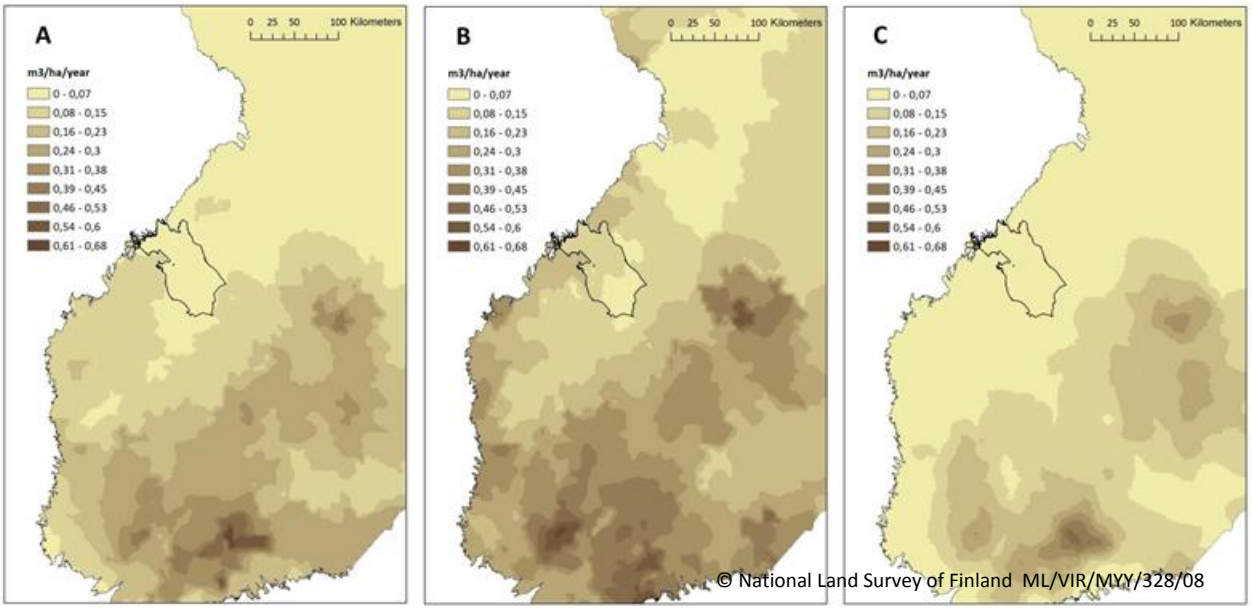

Figure 3. [A]: Volume (per hectare of forest land) of harvestable Norway spruce stumps on the basis of the average harvesting level of 2002-2011; [B]: Technical harvesting potential of spruce stumps as estimated on the basis of 10th NFI; [C]: Potential of spruce stumps when the current utilization of stumps is extracted from the average harvestable volumes in [A]. Total spruce stump volumes in the province of Central Osthrobotnia (outlined in the maps): 17 100 m^3 in [A], 32 400 m^3 in [B] and 0 m^3 in [C]. Harvesting statistics [A]: Metla/MetINFO. The geographical distribution of stump utilization was estimated by Anttila et al. (2013)

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3.12.2013

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