Estimating potential stump harvest from multiple data sources - an example from a county in southern Sweden

B. Nilsson\textsuperscript{a}, R. Trubins\textsuperscript{b}, O. Sallnäs\textsuperscript{b} and B. Dahlin\textsuperscript{a, c}

\textsuperscript{a}Linneus University, Växjö, Sweden  
\textsuperscript{b}SLU, Alnarp, Sweden  
\textsuperscript{c}University of Helsinki, Helsinki, Finland

Corresponding author: bo.dahlin@helsinki.fi

Abstract

Stumps have become a potential resource for bioenergy. In Finland more than a million m\textsuperscript{3} is harvested annually. In Sweden this resource is still not utilised to any significant degree. As stump utilisation requires some major investments at the power-plant and for the supply chain, it is desirable to estimate what volumes could be procured at different costs and for different restrictions. The study was conducted in the county of Kronoberg in southern Sweden. The county has 646 000 ha of productive forest.

Figure 1: Finnish stump-lifting device.

The conditions of Swedish forests have been assessed by SLU at a 25x25 m pixel resolution. The assessment is made by combining satellite data with NFI-plots. Standing volume, age and species composition are some of the variables that are estimated. The pixels may be combined into stands by automatic segmentation. All stump harvesting starts with a regular final felling. In order to create plausible harvest areas, a number of stands were chosen randomly from among stands that were eligible for final felling (above a certain age). The area was chosen so as to correspond to the approximate area of final harvest during the last five years. In order to study the influence of probability in harvest allocation, five five-year harvest areas were generated.
From the generated harvest areas, stands that were considered suitable for stump harvesting were chosen. For Nordic conditions, stump harvesting is more or less restricted to Norway spruce (Picea abies). The volume of the stumps can be estimated from the stem volumes. Different restrictions can be applied to the stump harvesting, e.g. buffer zones to water and conservation areas. Economic restrictions must also be considered such as minimum volume per ha and extraction distance. The digital land-use map as well as the digital road map were utilised to construct buffer zones close to lakes and streams and to estimate the extraction distance to the closest road. In this study all stumps were presumed to be utilised by a power-plant in the largest city of the county (Växjö) which is also located relatively centrally. The hauling distances for the stumps were estimated. Thus, it is possible to give fair estimates of potential stump harvesting volumes and the cost structures for those volumes.

Figure 3: Map (detail) with potential harvesting sites indicated in black. Grey colour represents forest and the hatched areas are waterbodies.

The major proportion (80%) of the forest in Kronoberg county is owned by non-industrial private forest (NIPF) owners, the average size of an estate being ca. 40 ha. If the owners are interested to let anyone utilise their stumps (and at what price) is another question which this study does not address.