Precision forestry: new challenge to Nordic logging

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Abstract. Precision forestry is a fairly new concept in logging industry. It deals with the possibilities of utilizing accurately measured forestry data and information to improve operations and processes. It relies heavily on the innovations in information and communication technology, on better and more accurate measurement of both raw material and processes. The effects of the operations to the environment are also in key role when considering the benefits of precision forestry concept. The socio-economic impacts of the concept need not to be neglected since media and general public forms their opinion according to the quality of the operations.

Key words: logging, wood procurement, forest operations, information technology, precision forestry

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Precision forestry concept

In the beginning the first definition stated “Precision Forestry uses high technology sensing and analytical tools to support site-specific economic and environmental decision making for the forestry sector”.

The concept emerged in late 1990’s in Washington State, USA. In the year 2000, Precision Forestry Co-operative was formed (Schiess, 2006) and since then it has organized Precision Forestry Conferences in Seattle, WA, every second year. It’s activity was extented to South Africa in 2006, where the latest conference was held.

According to Warkotsch (2006) “Precision Forestry uses high technology sensing and analytical tools to support site-specific, economic, environmental, and sustainable decision-making for the forestry sector supporting the forestry value chain from bare land to the customer buying a sheet of paper or board”.

Warkotsch extended the concept to include the whole value chain and all actors within it.

After all, the question is about the information, it’s accuracy and how it can be measured, transferred and used to benefit the society when converting it to knowledge and innovations.

There is a number of new technologies emerged over the last two decades that are now mature enough to be used in forest operations.

These technologies include remote sensing and geographic information systems (GIS) that rely on very accurate images taken from space or aircraft on different spectrum of radio magnetic radiation. Mapping and cartographic systems and programs use this data. Accurate location of this data has become possible through global positioning systems (GPS). It can be used to locate not only the borders but also navigate
vehicles and other moving objects under the forest canopy with amazing accuracy. Many countries have created communication network infrastructure that to allow fast transfer of information in mobile environment.

RFID (Radio Frequency Identification) is one of the latest technologies introduced in forest operations. It can be used to track the raw material flow in real time. Acoustic measurement of wood quality already in forest is another promising area.

Not only the above mentioned areas of technology have gained the development of new tools but also machine construction and engine technology, accurate measurement tools for forests, trees and wood, soil and environmental factors etc. The list is almost endless.

Development in visualization hardware and software has brought all this to an easily understandable form for the professionals, decision makers and the general public, too.

**Precision forestry concept applied to Nordic logging**

**Forest measurements, planning and inventory**

For forest measurement or traditional surveying, has gained the development of new measurement tools such as laser relascope and electronic callipers. The length measurement of standing trees with laser technology as well as ability to measure upper dimensions of the stem from a distance accurately have improved the quality of the estimates. (Kalliovirta, 2005)

The rapid development of the image processing has made possible to combine digital stereoscopic picture information so that the aerial or even satellite photos can be used to find the tops of the trees, estimate tree lengths, DBH sizes and thus volumes. (Korpela, 2004). In addition this information can be used for finding exact location of an object under canopy.

The images need not necessarily be taken from the space or airplane. Utilizing radar scanning technology even different tree species, their location etc. can be identified.
when taking images in the forest with a camera sitting on the machine. Survey and inventory data form the basis for cutting decisions and also for assortment estimates of individual stands. This information maybe transferred and used by the onboard computers of logging machines as start tables for applying cross-cutting rules to optimize assortment output.

**Wood volume measurement applications**
High tech solutions for wood volume measurements have been around already for quite a while. Individual stem or log measurement on harvesters and processors, the laser based frame measurement of log bundles on a moving truck, photocell based measurement of moving logs at a measurement station etc. Quality of raw material, for instance decay in logs can detected by ultrasonic device and knots with x-ray scanning. They all can be regarded as precision forestry applications.

**Forest operations’ technology applications**
For site preparation and silviculture operations such as scarification, planting and brushing the new accurate GPS based location of the places where the actual work has been done gives new possibilities to monitor the quality of the operations. One can find in the data base the exact tracks of the work machine, the planting holes and cleaned areas, for instance. This accurate information can later be utilized in decision making what to do in that particular area.

Harvesting in thinning and final fellings can utilize GPS in similar way and combine that automatically to map data drawn from GIS. Thus the operability of the machines can be much more efficient, risk for environmental hazards becomes smaller and the productivity higher. The whole harvesting chain is better because it is all the time known how much have been produced, where different assortments at certain point of time are etc. This allows much more precise planning and cuts costs.

Monitoring forest machinery and equipment can be made through collecting data directly from the CAN buss of the forest machines. The data can be processed so that both the operation condition of the equipment is monitored and the production figures calculated.

**Transportation and supply chain**
Off-road transportation with forwarders can utilize the data produced by harvesters and that is transferred to forwarder via mobile phones directly. This includes in addition to volume by assortments also the location of the piles in forest. If the machine are equipped with GPS then they can utilize also GIS and avoid sensitive areas.

Long distance transportation utilizes the information of the location of the piles and drivers can find them according that.

Supply chain logistics connects the forest information to market demands and facilitates added value creation in processes by bringing the raw material just in time to the mills.

Measuring environmental effects accurately allows better planning and thus to avoid damages.

Measuring work environment and health effects with high tech tools mean possibility to improve operations from the human point of view, too.

**Conclusions**
Number of areas has been set forth above where the precision forestry tools can be used to improve operations. Since the cut-to-length method and machinery are pre-
vailing in Nordic logging, they also give a challenge to developers. The technology is already there but the question remains how to most efficiently us it in this context.

References


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