Project partners





Eaculty of Economics and

SWEDEN Swedish University of Agricultural Sciences Bracke - Forest





Slovenian forestry institute Faculty of Economics and Business,



SPAIN Universidad Politécnica de Madrid



FINLAND University of Eastern Finland, School of Forest Sciences

ForestValue



The European Commission support for the production of this publication does not constitute an endorsement of the contents, which reflect the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information cannot contained therein. Small Diameter Wood Utilization With Innovative Stand Management for Multifunctional Forests and a Growing Sustainable Bio-economy

The pathway for efficient utilization of small diameter wood

The overall objective of SMALLWOOD project is to develop and evaluate new technologies and new business and operational models that can support sustainable management and utilization of different types of smalldiameter wood.

Our hypothesis was that Small Diameter Stand management and the studied techniques have an interesting innovation potential in terms of economy, social acceptance, sustainability, SME business opportunities and rural development, especially if identified bottlenecks are solved.

In the long-term, our aims are to:

- improve the techniques and work methods up to the level where a profitable business can be built on Small Diameter Stand management and utilisation,
- develop strategies for Small Diameter Stand management that is sustainable, with a positive environmental profile, and long-term added values for a number of actors in the society.

Three types of technologies were studied:

- Multi-tree harvesting technique combined with the working method "Boom corridor Thinning."
- Combined harvesting and chipping technique
- Combined harvesting and bundling technique

Harvesting, extraction and logistics systems for innovative and sustainable management of multifunctional SDS

Field studies were conducted in Sweden, Finland, Slovenia and Spain using a Bracke C16c accumulating felling head with a new support for more easy handling of tall trees. In dense young stands, two working methods, boom corridor thinning (BCT) and standard selective thinning (ST), were compared in terms of felling productivity and whole tree bunching, as well as the quality of the remaining stand. On average, no differences in remaining stand quality were found between BCT and ST. Total time consumption per tree was lower on average for BCT. The number of trees felled per crane cycle was higher on average at BCT. Harvest productivity at BCT averaged 4.4 - 5.4 dry ton biomass per productive machine hour, about 16% higher on average than at ST. Thinning in dense stands with small diameter results in quite large volumes (from 25 to 60 dry tons of biomass per ha).

Environmental assessment of the Small Diameter Stand

management

Tree and soil damages, emissions during harvesting and fire risk assessments was compared for boom corridor thinning (BCT) and selective thinning (ST).The number of stem damages was in average lower for BCT than for ST. The main damage cause was the felling head movement. The average stump heights was in average 25 to 38 cm. In terms of greenhouse gas emissions, BCT harvesting emissions were 9 to 29% lower than ST. Damages on soil, the average stump height, the tree damage characteristics and the main cause of tree damages were similar in both working methods. BCT seems to be more energy efficient than ST due to a lower time consumption, and therefore less fuel consumed per volume wood harvested. In general mechanized whole-tree thinning does not increase surface woody fuel loads and no difference was found between BCT and ST. The only trial in which there has been an increase in the woody fuel load has been in thinning on high density beech stands







Small Diameter Wood Utilization With Innovative Stand Management for Multifunctional Forests and a Growing Sustainable Bio-economy Trees from Small.

In Spain, the special machines Retrobio and Biobaler were tested. The Retrabio is designed for mulching and collecting shrubs and very small trees in a 2 m wide strip in a 24 m3 container. It was tested in a very dense willow coppice (36.000 stems/ha) and in a regeneration of maritime pines after a forest fire (4.100 stems/ha, height 1.9 m). The productivity ranged from 1.6 (willow) to 2.3 (pine) ODt/PM15h, but, about as much as 2.3 to 3.9 ODt/PM15h was at the same time left on the ground because of low collection efficiency. The Biobaler mulcher-bundler collects woody material up to 10 cm in diameter and uses a continuous technology of mulching in 2 m wide strips and bundling in bales 1.2 m wide and 1.2 m in diameter. The process was studied in a 2 m tall maritime pine stand regenerated after a forest fire. Average Productivity was 1,41 ODt/SMH or 0,75 ha/SMH.

Socio-economic aspects of the Small Diameter Stand management

The management of small diameter tree stands depends on forest owners and their forest management objectives. We examined forest owners' perceptions of small-diameter tree stand management, including home consumption, self-active work, and commercial forestry services. We design a survey in all participating countries to identify key factors influencing forest owners' motivation for biomass mobilisation from small diameter stands.

Willingness to utilise biomass from small-diameter tree stands and participate in the market was shaped by forest owners' silvicultural knowledge, economic and socio-cultural motivations, and sensitivity to service offerings. This study improves the understanding of forest owners' motivating factors for mobilising biomass from small diameter stands.

Overall analyses of the economic, social and environmental

values of the Small Diameter Stand management

A multi-criteria analysis framework was established that included economic, environmental, socio-cultural, and value creation dimensions. The main findings of the results from SMALLWOOD's harvesting productivity and environmental impacts were assessed by experts and stakeholders. In Slovenia, the Bracke C16.c multi-tree harvesting head was considered to carry high economic performance and notable business model renewal. In Sweden, sustainability and value creation impacts were rated moderately positive in all dimensions. In Spain, the impact was rated as particularly positive in economic terms, but more negative in terms of the silvicultural dimension. In Finland, sustainability and value creation impacts were rated moderately positive in all dimensions. In Spain, Biobaler received a high rating for value creation potential, while Retrabio was rated as relatively good in terms of its environmental, socio-cultural and value creation impacts.