

Internal Project Information Note 03/08 - Extended summary  
**Mechanised stump harvesting**

To meet the increasing demands for woodfuel in the United Kingdom, new biomass sources are being sought. Scandinavian experience has indicated that stump harvesting can generate additional biomass from clear fell operations.

A stump harvesting trial was carried out at Blazehill forest, on a site managed by UPM Tilhill forestry, on a Sitka spruce clearfell site. Some of the brash had been baled and extracted, but some brash had also been retained for forwarder travel when extracting bales and stumps. The soil type was brown earth with areas of peaty gley.

The pulling/digging and splitting of stumps was carried out using a Daewoo 225LC tracked excavator fitted with an Anbert 'destumping' head. The heel plate (left hand side below) is designed to be forced into the soil under the stump and roots and the shear (right hand side below) is used to assist in stump lifting from the ground with a clamping action. The shear is also used to split the stump after removal to dislodge soil and aid stump drying.



Anbert destumping head

### Operational protocol

UPM Tilhill implemented the following protocol: do not harvest

- more than 70% of the stumps within any one coupe (for experimental purposes a 100% harvesting method was trialled as part of this study) <sup>1</sup>
- older rotten stumps and smaller stumps from thinning operations
- stumps within 10 m of watercourses and riparian buffer zones and 3 m from existing forest drains.
- stumps within five metres of ancient woodlands, dead wood areas and long term retentions or coupe edges
- stumps within three metres of ancient monuments or dead trees.

### Trial objectives

The trial objectives were to:

- carry out a time study to calculate outputs and costs.
- record operational methods and comment on method improvements.
- advise on the most practical method of payment for the operation.
- time study subsequent stump extraction to roadside with load weights measured by a forwarder based system
- take wood samples at time of extraction to determine moisture content of extracted stumps

The following measurements were taken: number of stumps per ha, stumps top diameter and mean top diameter, number of stumps harvested and extracted per hour, machine distance travelled, weight of stumps extracted per ha, moisture content of stumps.

No ground disturbance assessment was carried out with the exception of general comments on method.

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<sup>1</sup> When buffer zones are taken into account 100% stump removal will equate to about 'real' 70% removal and 70% stump removal will equate to about 50% 'real' stump removal when related to gross coupe area.

## Work method

The excavator operator removed stumps from the ground and split stumps over 30 cm in diameter. He then removed as much soil as possible by shaking the stumps and stacked them in a windrow adjacent to the brush mat. The drift width of the destumping excavator was between 12 and 13 m.

The stumps were then transported to roadside by a Valmet 860-3 forwarder. After stump extraction the site was backfilled and levelled.



Windrow stack of stumps with stump harvested area in middle foreground

## Results

- Stump harvesting was technically successful.
- One eight wheeled lorry load of stumps was weighed with and without soil (soil removed by pressure washing) and it was found that soil weight accounted for 17% of the unwashed load.
- Some roots retained a core of soil under the stump which may be linked to root formation within a ploughed furrow.
- The machine operators made an effort to remove soil during the operation;
  - the excavator elements associated with shaking soil and splitting stumps accounted for 57% of excavator time on 100% stump removal and 60% of time on 70% stump removal.
  - the forwarder elements associated with shaking soil from stumps accounted for 19% of forwarder time with 100% stump removal and 20% of time with 70% stump removal.
- The weight of stumps excluding soil is thought to be about 154 tonnes per hectare for 70% removal and 232 tonnes per hectare for 100% removal.
- The outputs and costs were as follows:

	70% stump removal	100% stump removal
Excavator output ha/shr	0.038	0.036
Excavator cost £/green tonne <sup>2</sup>	8.60	6.00
Forwarder output green tonne/shr	5.90	6.40
Forwarder cost £/green tonne <sup>3</sup>	8.50	7.90
<b>Total cost £/green tonne</b>	<b>17.10</b>	<b>13.90</b>

- The moisture content wet basis at the time of stump harvesting for main crop stumps was 59% and for previously thinned dead stumps 64%.

The work summarised here is part of an ongoing programme of research funded by the Forestry Commission aimed at improving the efficiency with which fuel is produced from sustainably managed forests in the UK. For further information on this project and related work:

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<sup>2</sup> A factor of 1.334, 16% for rest and 15% for other work was added to basic time

<sup>3</sup> A factor of 1.3455, 15% for rest and 17% for other work was added to basic time