

Internal Project Information Note 31/08 - Extended summary  
**Woodfuel Production from Pine Thinnings**

Two studies were undertaken to investigate the cutting of woodfuel from mechanised pine thinnings in the Wyre forest. Studies were undertaken of sites undergoing a second, and a fourth thinning.

- The second thinning was in a stand of p.77 Corsican pine. The stand had a stocking of 1018 trees/ha and a mean tree volume of 0.28 m<sup>3</sup> and was thinned from a basal area of 35 to 21 m<sup>2</sup>/ha. The study produced 4 m length woodfuel and compared harvesting of conventional products, woodfuel exclusively, and a conventional/woodfuel mix.
- The fourth thinning was in a stand of p.48 Scots pine. The stand had a stocking of 444 trees/ha and a mean tree volume of 0.90 m<sup>3</sup> and was thinned from a basal area of 39 to 29 m<sup>2</sup>/ha. The study produced 5 m length woodfuel and compared harvesting of conventional products to a conventional/woodfuel mix.

Cutting woodfuel was found to increase the proportion of standing volume recovered by 9-26% in the second thinning study and by 17% in the fourth thinning.

The cutting of 4 m length woodfuel in the second thinning provided a reasonable compromise between easier processing and handling, and the manoeuvring room limitations within the crop and brittleness of the stems. The 5 m length woodfuel in the fourth thin was successful, simplifying and speeding processing and forwarding.

The product specifications were:

	Log		Short Log		Rail		Stake		Chip		Woodfuel			
Length (m)	3.75		2.5		3.75		1.70		2.80		4.00±			
Top diameter range(cm)	16+		16+		10 - 14		2.5 - 13		5+		-			
Price at roadside (£/m <sup>3</sup> )	30		30		25		35		14		-			
Thinning	2 <sup>nd</sup>	4 <sup>th</sup>	2 <sup>nd</sup>	4 <sup>th</sup>	2 <sup>nd</sup>	4 <sup>th</sup>	2 <sup>nd</sup>	4 <sup>th</sup>	2 <sup>nd</sup>	4 <sup>th</sup>	2 <sup>nd</sup>	4 <sup>th</sup>	2 <sup>nd</sup>	4 <sup>th</sup>
Mean volume (m <sup>3</sup> )	0.112	0.147	-	0.128	0.049	0.056	0.013	0.016	0.054	0.045	0.044	0.102		
	Proportion of cut volume (%)												Proportion of Conventional Volume Utilisation (%)	
Conventional	3.2	67.2	-	6.7	6.9	1.7	16.0	0.9	73.9	23.5	-	-	100	100
Mix	1.4	-	-	-	3.2	-	-	-	-	-	95.4	-	126	-
Woodfuel	-	58.9	-	3.5	-	0.2	-	0.6	-	-	100.0	36.8	109	117



Cut woodfuel; 4 m (left) and 5 m (right)

Harvester productivity was found to increase with the simplified woodfuel cutting in the fourth thinning study, output rising from 17.5 m<sup>3</sup>/shr to 20.2 m<sup>3</sup>/shr, but was found to be very similar between treatments in the second thinning ranging between 9.2 m<sup>3</sup>/shr and 9.7 m<sup>3</sup>/shr.

Forwarder output was higher in woodfuel treatments due to fewer product types being handled. The 5 m woodfuel cut in the fourth thin fully utilised both forwarder bunks and simplified loading and unloading, producing machine outputs of 12.2 m<sup>3</sup>/shr compared to 9.1 m<sup>3</sup>/shr in conventional working. The handling of 4 m woodfuel in the second thinning increased output from 4.8 m<sup>3</sup>/shr in conventional working to 5.9 m<sup>3</sup>/shr in conventional/woodfuel mix and 7.2 m<sup>3</sup>/shr in woodfuel.

Outputs and Costs	Conventional		Mix		Woodfuel	
	2 <sup>nd</sup> Thin	4 <sup>th</sup> Thin	2 <sup>nd</sup> Thin	4 <sup>th</sup> Thin	2 <sup>nd</sup> Thin	4 <sup>th</sup> Thin
Harvesting output (m <sup>3</sup> /shr)	9.70	17.45	9.22	-	9.19	20.22
Harvesting hourly cost (£/hr)	66.25					
<b>Harvesting cost (£/m<sup>3</sup>)</b>	<b>6.83</b>	<b>3.80</b>	<b>7.19</b>	-	<b>7.21</b>	<b>3.28</b>
Extraction output per 100m (m <sup>3</sup> /shr)	4.81	9.08	5.89	-	7.24	12.15
Extraction hourly costs (£/hr)	49.16					
<b>Extraction costs (£/m<sup>3</sup>)</b>	<b>10.22</b>	<b>5.41</b>	<b>8.35</b>	-	<b>6.79</b>	<b>4.05</b>
<b>Total costs to roadside (£/m<sup>3</sup>)</b> (Equivalent to £/tonne at 60% MC)	<b>17.05</b>	<b>9.21</b>	<b>15.53</b>	-	<b>14.00</b>	<b>7.32</b>

The break-even point for woodfuel in the second thin stand was slightly higher than the roadside chip price; between £15.45 and £16.32/m<sup>3</sup>. The relationship was very price sensitive due to the large proportion of woodfuel. The break-even point for woodfuel was nearly half the chip price in the fourth thin stand; £7.64/m<sup>3</sup>, making it particularly financially favourable for the specified products and prices. The relationship was less price sensitive due to the smaller proportion of woodfuel.

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#### Other related work

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 harvested from sustainably managed forests in the UK. Other reports related to mechanised woodfuel harvesting are IPIN 35/08 Woodfuel production from mixed Scots and Corsican pine, IPIN 34/08 Wyre Forest woodfuel production from small diameter coppice stems, 30/07 Woodfuel production from a thinning operation (Sitka spruce), 07/07 Rumster Forest Northern Wood Heat woodfuel cutting trial (Sitka spruce and lodgepole pine clear fell) and 15/06 Wood fuel trial Rivox, Ae Forest District (Sitka spruce clearfell).