

Potential Biomass Resource Contained in Pre-commercial and Production Thinning Residues

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Figure 1 - Trees of this size are frequently thinned to waste. How much is potentially available as a biomass resource?

Introduction

When assessments of the potential amount of in-forest material available for use as bio-energy fuels are being made, it is important to include material generated by pre-commercial or waste thinnings and production thinnings as well as that generated by clearfell harvest and wood processing industries.

There are two reasons to include this material:

- it is part of the greenhouse gas balance
- it may make the difference between a regions residue resource being economically viable for use or not. This is because the systems used to recover this material often require substantial volumes to justify the purchase and operation of specialist equipment.

This technical note presents the results of an assessment of the volumes of radiata pine pre-commercial and production thinnings material potentially available in New Zealand over the next 5 years.

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Methods

The estimates were derived from two principle sources of information. The first being the DRYMAT model (Hollinger *et al* 1993), which gives an estimate of radiata pine tree biomass (including stem wood, branches and needles) by age. The second being the National Exotic Forest Description –1999 (NEFD) which gives estimates of forest area being managed for thinning by region.

Results

The DRYMAT model was run to determine the amount of dry matter in an average stand by age. The model was run twice, once for a regime with a heavy pre-commercial thinning and once for a regime with production thinning. The results were:

- pre-commercial thinning – 18 m³ per hectare of whole tree thinnings residue were estimated
- production thinnings – 32 m³ per hectare of residues were estimated (10% of stem volume and all the branch material)

These figures were used along with the data from the NEFD in Tables 1 and 2 to derive regional resource estimates for biomass from thinnings over the next 5 years.

Table 1 - Pre-commercial thinnings- area and potentially extractable volume

Region	Area (ha) of forests aged 1 to 5 *	Estimated area (ha) per annum	% Steep terrain	% Rolling terrain	Area (ha) Extractable thinnings	Rounded Down	Extractable Volume (m ³) per annum
Northland	49,940	9,988	67	33	3,296	3,200	40,320
Auckland	13,231	2,646	58	42	1,111	1,100	13,860
CNI	138,350	27,670	35	65	17,986	17,500	220,500
East Coast	48,614	9,723	90	10	778	700	8,820
Hawkes Bay	43,404	8,681	65	35	3,472	3,400	42,840
Southern NI	60,414	12,083	90	10	725	700	8,820
Nelson/ Marlborough	46,742	9,348	82	18	1,683	1,600	20,160
West Coast	9,018	1,804	90	10	18	0	0
Canterbury	35,671	7,134	58	42	2,996	2,900	36,540
Otago	33,169	6,634	85	15	995	900	11,340
Southland	30,921	6,184	88	12	742	700	8,820
Total							412,020

* National Exotic Forest Description (NEFD, 1999).

The volume per annum of waste thinnings (Table 1) is based on:

- a volume per hectare of 18 m³, with 70% of the total volumes of the available material being extracted
- the area of rolling terrain. The steep terrain was not included in the calculations as the material on steep terrain was considered to be unrecoverable.

The regions with the most potential (terrain and subsequently volume) for extraction of pre-commercial thinnings are the Central North Island, Northland, Hawke's Bay and Canterbury.

There will be substantial variation around the figure of 18 m³ per hectare based on site variations such as site index, GF rating and silvicultural regime. The figure may vary from 12 m³ to 24 m³ per hectare.

Table 2 – Residues from production thinnings – area and potentially recoverable volume

Region	Area (ha) of forest aged 11 to 15	Estimated area (ha) thinned per annum	Rounded Down	Extractable volume (m ³) per annum
Northland	7,158	1,432	1400	31,360
Auckland	597	119	100	2,240
CNI	27,988	5,598	5500	123,200
East Coast	332	66	60	1,344
Hawkes Bay	1,925	385	350	7,840
Southern NI	3,719	744	700	15,680
Nelson Marlborough	841	168	150	3,360
West Coast	0	0	0	
Canterbury	2,425	485	450	10,080
Otago	925	185	150	3,360
Southland	445	89	50	1,120
Total				199,584

Source - NEFD (1999)

The volume per hectare of residues from production thinnings is calculated from a figure of 32 m³ per hectare of residues (this figure may vary as per the waste thinnings, with a likely range of 24 m³ to 40 m³ per hectare).

Regions with significant potential to recover residues from production thinnings are the Central North Island and Northland.

Table 3 – Biomass resource from thinnings - regional totals

Region	Total thinnings residue volume (m ³) per annum (2000-2005)
Northland	71,680
Auckland	16,100
CNI	343,700
East Coast	10,164
Hawkes Bay	50,680
Southern NI	24,500
Nelson Marlborough	23,520
West Coast	0
Canterbury	46,620
Otago	14,700
Southland	9,940
Total	611,604

When the two potential biomass resources from thinnings are totaled (Table 3) the regions with substantial resources are the Central North Island and Northland. Hawkes Bay and Canterbury also have reasonable resources.

However, the collection of these residues is likely to be expensive as a stand-alone operation and therefore uneconomic with current costing structures and low values placed on such residues. This technical note is intended to outline the potential volume that could be available for bio-energy if collection of this material was economically viable.

Summary

One of the limiting factors in the installation of biomass fuelled power plants is the availability of large quantities of fuel. A medium sized power plant (20 MW) might require 200,000 green tonnes per annum. Given the scale of operations in New Zealand, it is often going to be difficult to obtain this much material from one source. Therefore, all the potential biomass resources need to be considered on a regional basis to determine the total potential fuel supply.

The figures from this report could be combined with data in previous reports (Hall 1998, 1999 a, b, Hall and Gifford 2000) to estimate the total amount of in-forest residues available in New Zealand.

Regions with significant volumes of residues potentially available from thinnings over the next five years are the Central North Island and Northland.

References

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