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Next Generation Plantation Investment Research Project

Land Capability Assessment

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Report 3. Next Generation Forest Plantation Investment Research Project

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Summary

Results are presented in this report from a study in Victoria to assess private land for the establishment of commercial timber trees integrated with existing rural land uses. Four existing timber processing facilities are used as focal points for the assessment.

Land capability for plantation development was described in the model by combining availability and suitability as follows:

- Non-relevant land uses, zones and other land types were excluded to isolate the potentially available land; and
- That land was ranked for plantation suitability using approximate net harvest returns, referred to as a Plantation Investment Index (PII, \$/ha).

Plantation growth rates were provided by CSIRO for three different wood-production scenarios:-

- hardwood sawlog,
- softwood sawlog, and
- hardwood pulp.

Results

Approximately 6.21 M ha of private land in Victoria had annual rainfall greater than 600mm, was cleared and not in planning zones that restrict integrated timber plantation establishment. Between 1.92 and 2.56 M ha of potentially available land across Victoria had greater than \$2000/ha net harvest returns (net present value at a discount rate of 7%) for the different wood production scenarios. There was much greater variability between processing centres in potentially available high PII land than for low PII land (Table 1). Net harvest returns were limited by distance to the processing centres used in the study.

Processor/locality	PII >\$2,0000/ha	PII >\$4,000/ha	PII>\$6,000/ha
<i>Australian Paper/Gippsland Hardwood pulp</i>	361,590	197,630	170,280
<i>Midway Ltd/Geelong Hardwood pulp</i>	380,370	57,770	9,580
<i>AKD Softwoods/Colac Softwood sawlog</i>	359,940	157,330	218,360
<i>One Forty One/Mt. Gambier Softwood sawlog</i>	251,870	96,650	30,370

Table 1 Stand alone areas of potentially suitable land for integrated production with zones and management regimes within 200 km of different processors

Predominant land-uses in the higher-return regions were mixed farming and livestock. The proportions of cattle, sheep and mixed farming vary between the PII categories. It is therefore probable that the feasibility of plantations for integration into those different categories will also vary.

Abbreviations

GMT	Green Metric Tonne
MAI	Mean Annual Increment (m ³ /ha/year)
PII	Plantation Investment Index (\$/ha, Net Present Value at 7% discount rate)

Introduction

The Next Generation Forest Plantation Investment Research Project (the NGPI project) states that there is “a considerable area of farmland in Australia suitable for integrating trees into agricultural systems...”.

The potential availability of land, and its suitability for integrated plantation development are collectively referred to in this study as land capability. The aim of this study was to develop a spatial model for identifying the afore-mentioned farmland and apply it to Victoria.

The model

The processing steps within the land capability assessment model are shown in Figure 1, and the values assigned to parameters are listed in Appendix 3. The conceptual steps are:

- Potentially available private land is identified, and then
- The suitability of the land is ranked using a financial index (Plantation Investment Index, PII).

The elements considered within each of the steps in the model are described below Figure 1.

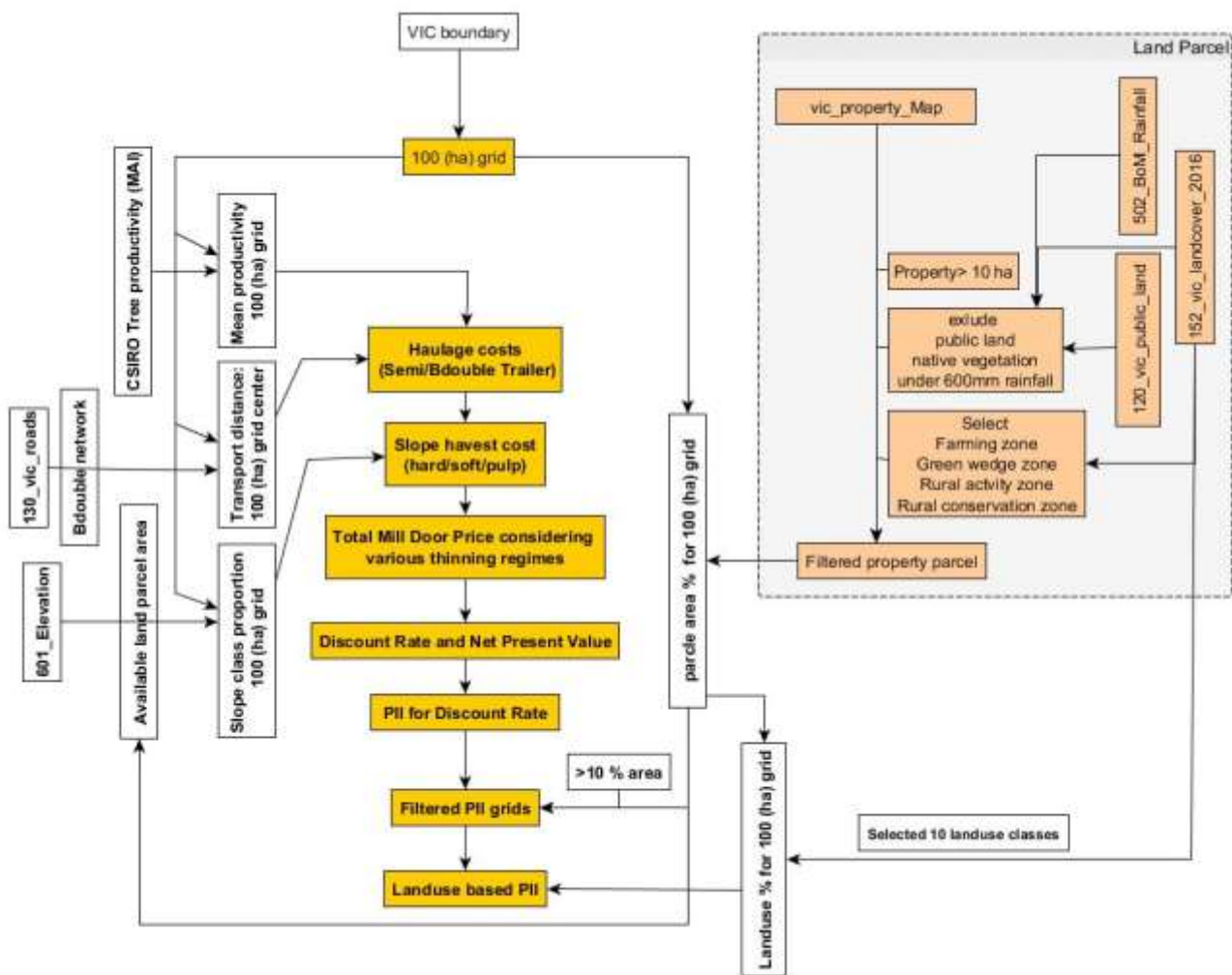


Figure 1 Land capability assessment GIS flowchart

Identifying potentially available private land

Data processing comprised the following steps:

- Zoning and land tenure information were used to make exclusions;
- Spatial data layers were cast on to a 1 x 1 km grid layer¹, bringing multi-scale data layer to a single unit size, through geoprocessing using ArcGIS software;
- The transport distance to the four timber processing sites from each grid was calculated using spatial network analysis (see below regarding the 200 km limit); and
- One of four harvesting slope classes (0-10°, 10-20°, 20-30° and >30°) was calculated for each grid.

Ten spatial data layers were used to identify potentially available land (Figure 2). All layers except the Digital Elevation Model (slope) and rainfall are accessible via the Victorian Government's open data portal² and are referenced in Appendix 3. To identify potentially available land the following elements were removed:

- Property parcels less than 10 ha;
- Areas of public land;
- Areas of non-relevant land-use and existing plantation³. Land-use areas that remain include:
 - Farming zone
 - Green wedge zone
 - Rural activity zone
 - Rural conservation zone
- Areas of native vegetation;
- Watercourses and buffers;
- Gas and fuel pipelines; and
- Land area under 600 mm (long-term average) rainfall.

Buffers were placed on streams and pipelines, but not on powerlines or residential zones and homes. This was due to the processing required, and the likely limited reduction in total area at the state-wide scale.

The study was initially focussed within 200km of the major processing facilities associated with the NGPI Project. The >600 mm rainfall cut off identified a similar range and therefore, no explicit distance-limit criterium is applied to the potentially available land.

The number of land-use classes shown in the Department of Environment, Land, Water and Planning 2016 land-use map was greatly reduced by combining non-relevant land-uses into a single class (Other) and the multiple horticultural land-uses under another class (Horticulture). A full list of the land-use reclassification is shown in Appendix 5.

¹ This grid size was selected to match the CSIRO 3-PG2 model.

² Access via www.data.vic.gov.au

³ A list of excluded land-uses is provided in the Appendix 5.

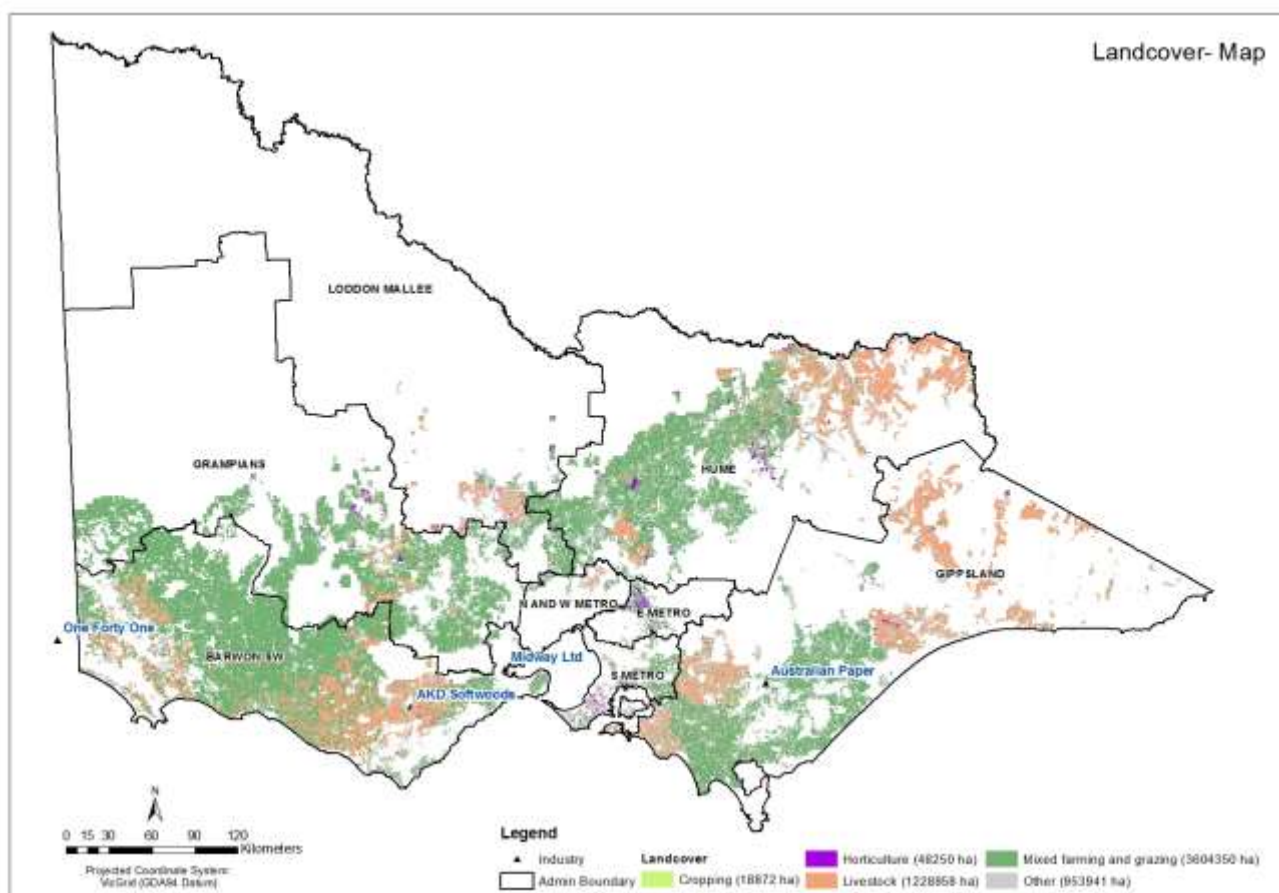


Figure 2 Private land potentially available for plantation according to land-use.

Plantation Investment Index (PII)

Land suitability was ranked according to PII (Figure 3) derived for each grid using programming in R software. PII is the Gross Harvest Return in dollars taking into account harvest losses.

The **Plantation Investment Index** uses three factors (described in the following sub-sections):

$$PII = \text{Productivity (Tree growth} \times \text{Product values)} - \text{Haulage Cost} - \text{Harvest Cost}$$

The **Gross Harvest Return** was calculated based on the price in dollars per GMT.

$$GMT = MAI * hl * R * ConF$$

Where: hl = harvest loss of 10%

R = years to thinning or clearfall operation

ConF = Conversion factor for volume to weight (Figure 7)

Figure 3 Plantation Investment Index and Gross Harvest Return calculations

DISCOUNT RATE

Plantation Investment Index was calculated as net present value to account for the impact of rotation length on returns, by applying a discount rate. The equation used was:

$$PII^{npv} = \left(\frac{1}{1 + dr} \right)^R$$

Where:

dr = Discount rate

R = Rotation years

The discount rate has a large impact on net present value, and subsequently the area of potentially available land with a PII greater than \$2000/ha. For example, increasing the discount rate from 5 to 7%, reduced the PII>\$2000 area for hardwood sawlogs by between 35 and 70% (Table 2). Feedback from the project partners informed the decision to use the more conservative 7% discount rate.

Table 2 Reduction in land area* by increasing the discount rate from 5 to 7%, for four processing centres⁴

	hardwood Sawlog	softwood Sawlog	hardwood Pulp
<i>Australian Paper</i>	35%	46%	45%
<i>Midway</i>	70%	68%	69%
<i>AKD</i>	47%	43%	43%
<i>One Forty One</i>	68%	70%	70%
<i>Average Difference</i>	55%	57%	57%

* estimated area of suitable land with a PII>\$2000

TREE GROWTH

Growth (Mean Annual Increment, MAI) data for three timber production “scenarios” (regimes, Figure 4), developed by CSIRO⁵ using the 3-PG² growth model⁶ and provided under a data-sharing agreement, were assessed in this analysis:

- hardwood sawlog,
- softwood sawlog, and
- hardwood pulp.

Due to the interests of the industry partners, the hardwood and softwood species assessed were *Eucalyptus globulus* (blue gum) and *Pinus radiata* (radiata pine).

⁴ Next Generation Plantation Investment Land Assessment Methodology Report Feb 2018

⁵ Polglase *et al* 2008 “Regional opportunities for agroforestry systems in Australia” RIRDC o8/176

⁶ Landsberg, J.J. and Waring, R.H. (1997). A generalised model of forest productivity using simplified concepts of radiation-use efficiency, carbon balance and partitioning. *Forest Ecology and Management* 95, 209-228

Feedback from the project partners indicated concern that 3-PG2 over-estimates growth rates. The 3-PG2 radiata sawlog MAI values were compared to measured MAI data provided by the project partners. The blue gum pulp 3-PG2 values were compared to measured values for blue gum and *E. nitens* (shining gum, considered a higher-elevation analogue of blue gum) pulp. No hardwood sawlog MAI data was made available for comparison purposes in this study.

The results varied for radiata sawlog (Figure 5), with a possible regional effect not accounted for (Figure 6). Productivity was overestimated in Gippsland (Strezlecki ranges), but mostly underestimated in western and North East Victoria.

Blue gum MAI was generally underestimated (Figure 5), and more so as measured MAI values increased. Many of the measured MAI values were for pulp rotations between 10 and 15 years, while the 3-PG2 scenario is ten years normalised to 20 years. However, a separate check of MAI against age (data not shown) indicated rotation length was not the major source of variability in this data set.

Figures are based on the original CSIRO layer, to conservatively rank land suitability for each scenario, rather than attempting to accurately compare between scenarios. Further growth model calibration and financial model detail would be required to realistically compare softwood sawlog to hardwood pulp returns, including decisions on how to handle re-establishment and management of subsequent pulp rotations.

CSIRO 3-PG2 model MAI

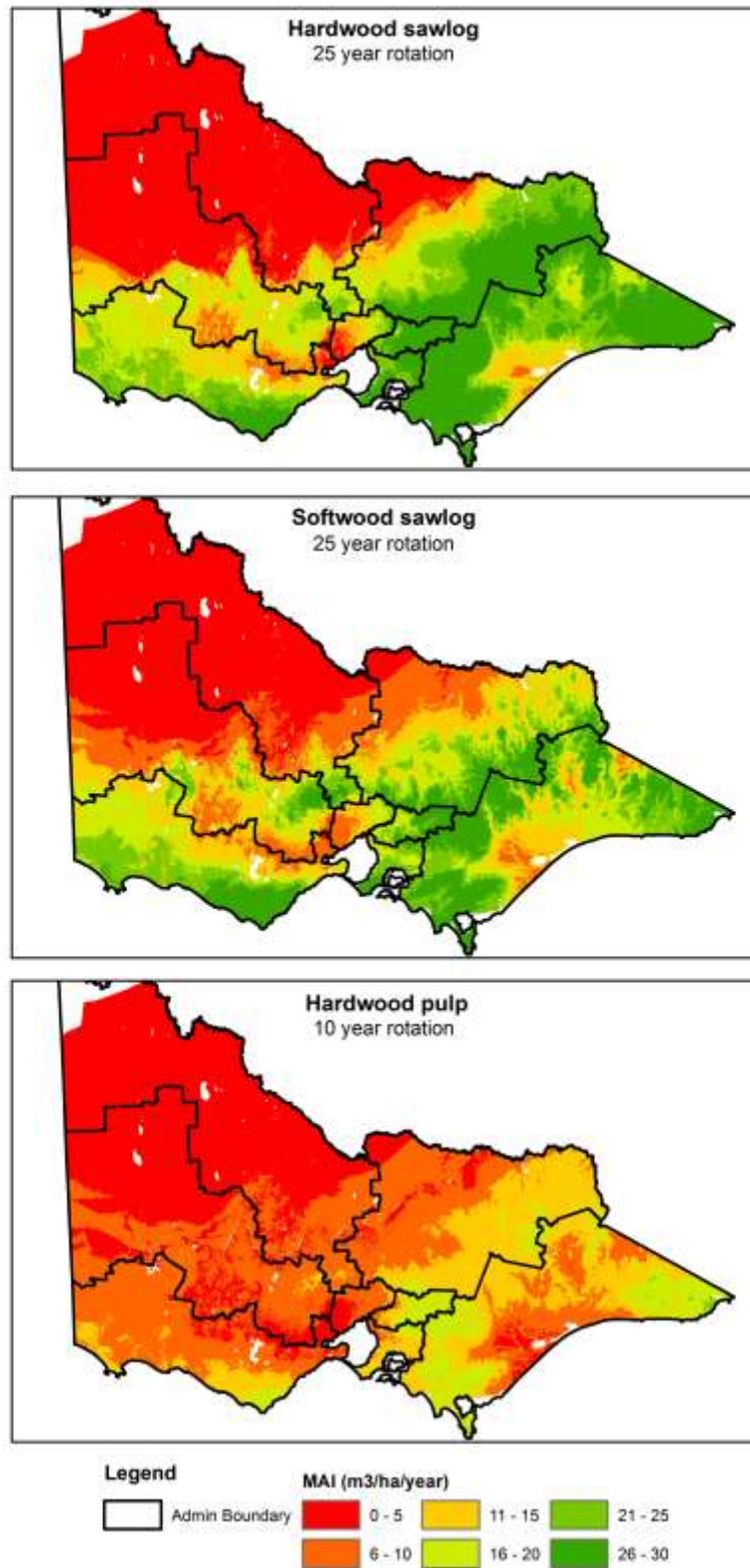


Figure 4 MAI for three wood-production scenarios provided by CSIRO (ex Polglase et al 2008): hardwood sawlog, softwood sawlog and hardwood pulp (all MAI values "normalised" to a 20 year rotation length).

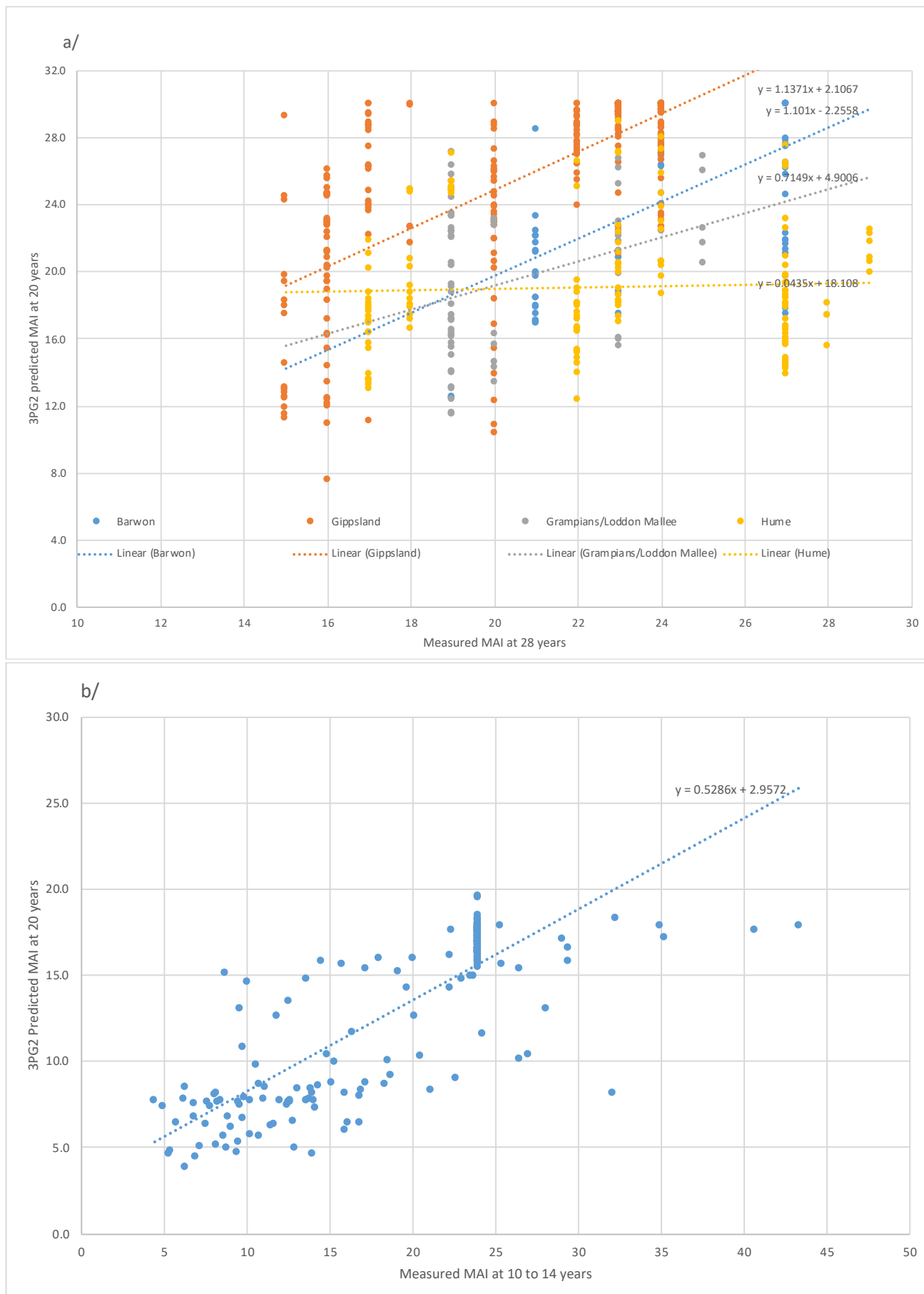


Figure 5 MAI measured v. modelled with linear relationships a/ radiata sawlog split by region and b/ bluegum/nitens pulp

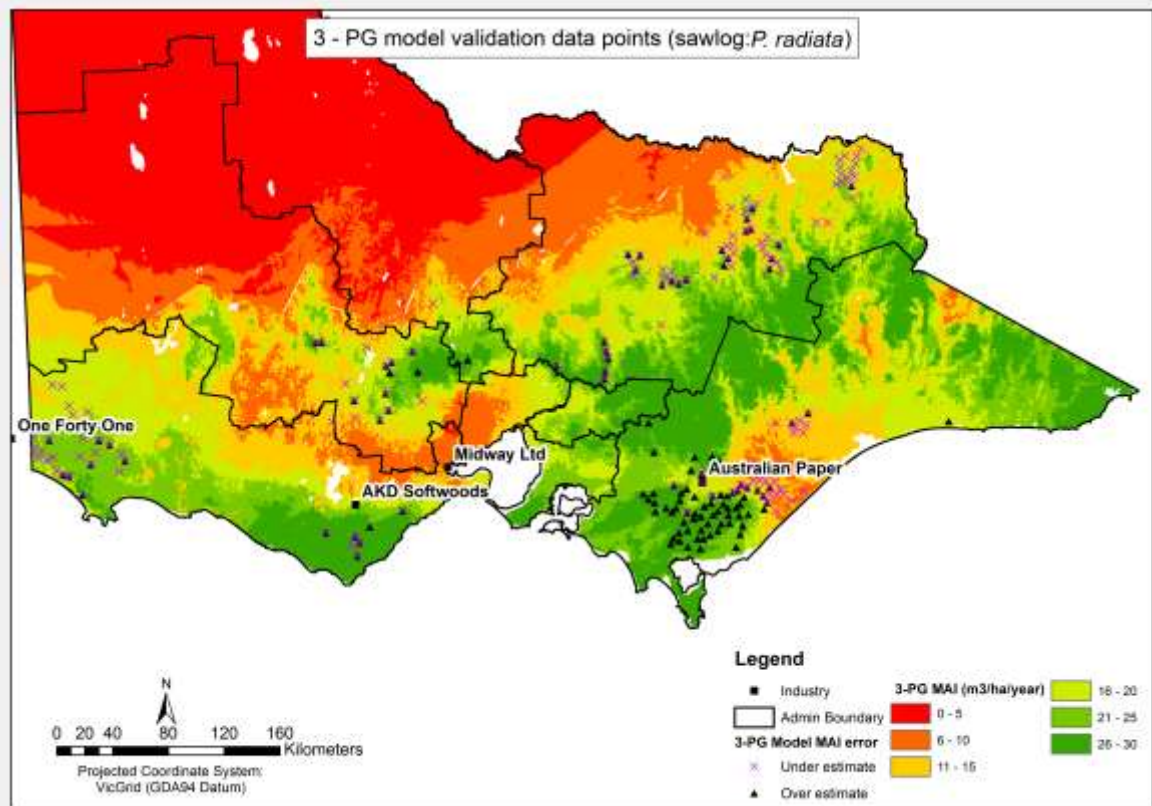
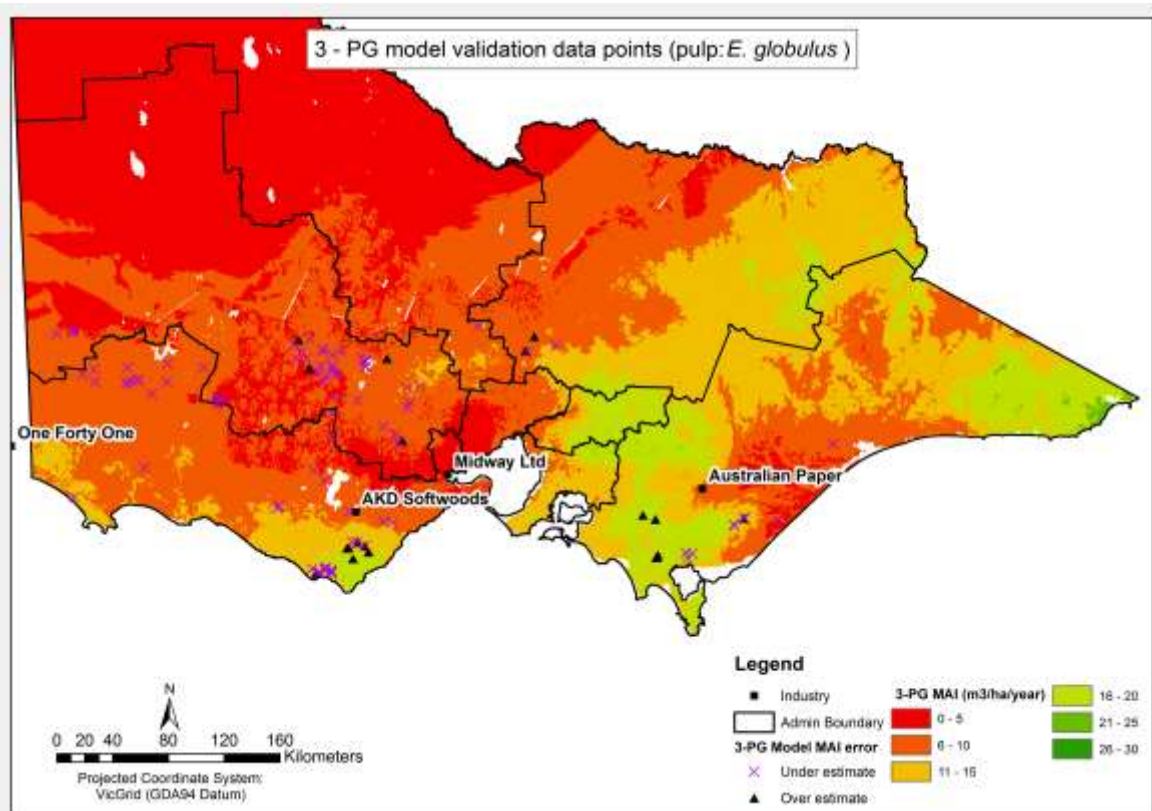


Figure 6 Spatial representation of 3-PG2 ("3-PG") model predictions for radiata-sawlog MAI

PRODUCT VALUES

Harvest regime assumptions, and an indicative price for the log and pulp products removed through the thinning and clear-fall regimes, are detailed in Table 3. For this analysis, a single sawlog price (\$100/GMT) and pulp price (\$70/GMT) were used, with the aim being to rank land for each scenario rather than to compare accurately between scenarios.

Haulage and harvest costs were deducted for each harvest based on the proportions of product removed, which were also the same for each regime. Therefore, the difference in the productivity index between regimes is primarily due to the relative growth of the different species over the 25-year (saw log) or 10-year (pulp) rotation length. For this analysis, the hardwood- and softwood-sawlog harvest schedules and product splits were the same.

Table 3: Product split and silvicultural regime assumptions including stocking, harvest timing, and % removal for first and second commercial thinning (T1, T2) and clear-fall (CF)

Operation	Year	% standing vol removed	1. Hardwood sawlogs	2. Softwood sawlogs	3. Pulpwood
Stocking (stems/ha)	0	-	1000	1500	1000
Pulp CF	10	100	na		100% pulp
T1	16	33	Sawlog:Pulp = 0:100		
T2	20	25	Sawlog:Pulp = 20:80		
CF	25*	100	Sawlog:Pulp = 60:40		
Price (\$/GMT)			Sawlog = 100		Pulp = 70
			Pulp = 70		

* softwood rotation length set at 25 years to provide a conservative estimate compared to industry standard 28- to 32-year rotations.

CONVERTING VOLUME TO WEIGHT

To standardise productivity between the regimes, MAI in cubic metres was converted to green metric tonnes (GMT) using estimates of basic density which vary for species, and wood harvested at thinning and clear-fall. A universal 10% harvest loss was applied.

	Hardwood sawlog			Softwood Sawlog			Pulp
Measurement	T1	T2	CF	T1	T2	CF	CF
Basic density (kg/m3)	550	600	650	350	375	400	550
Moisture content (%GREEN)	50%	50%	50%	50%	50%	50%	50%
Conversion factor (GMT/m3)	1.1	1.2	1.3	0.7	0.75	0.8	1.1

Figure 7 Converting wood volume to weight using basic density and assuming 50% moisture

HAULAGE COST

Distance from the four processing centres was calculated for each grid cell using the Network Analysts extension in ArcGIS. Road data was derived from the Vicmap Transport (id: ANZV10803002595) dataset using road classes less than 6, where Road Class 0 = Freeway and Road Class 6 = Two-wheel drive. Mount Gambier was linked to the Victorian road network via the Princes Highway.

Primary distance was calculated as having B-double access using the B-double road layer, counting any grid with in a 5km-radius from the B-double road network as accessible. Victoria road network was used to calculate the transport distance to grids in the B-double exclusion zone.

Haulage costs (\$/km/GMT) were calculated for the cost of full trucks using the equations⁷:

$$\text{Semi-trailer haulage cost} = (\text{distance} * 0.158) + 6.1774$$

$$\text{B-double haulage cost} = (\text{kms} * 0.1215) + 4.7518$$

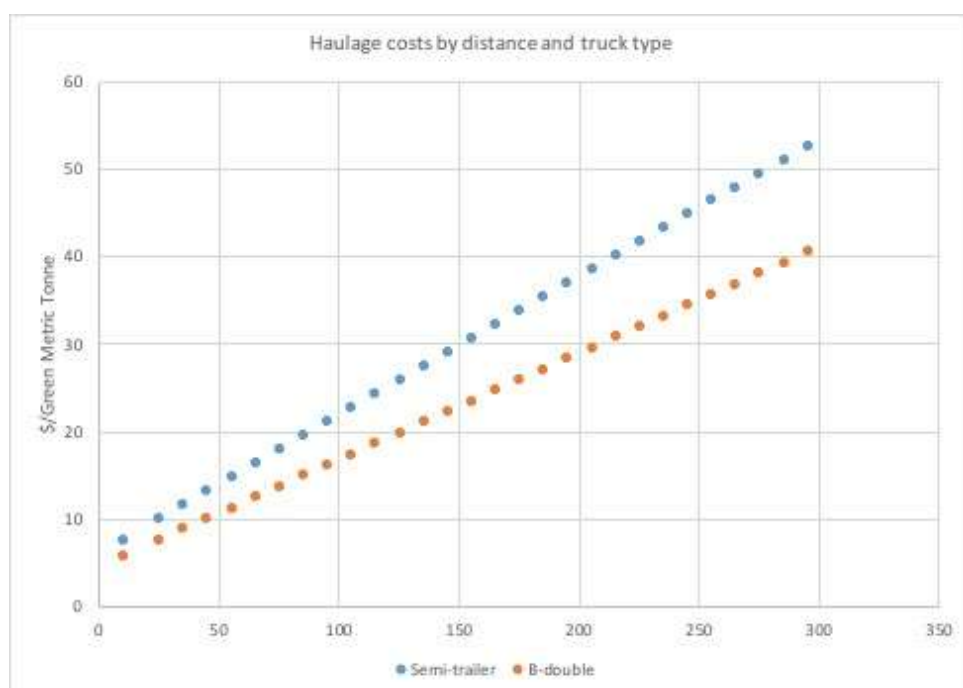


Figure 8 Effect of truck-type and distance on haulage (\$/GMT)

HARVEST COST

Harvest costs are a function of slope and harvest event (thinning or clearfall). A 20m Digital Elevation Model was used to determine four slope classes: 0-10°, 10-20°, 20-30° and >30°. These classes relate to the capacity to use different types of harvesting equipment and the cost of harvesting (Figure 9). The proportion of each slope class was assigned to each 100 ha grid using the Tabulate Area extension in ArcGIS.

Therefore, the harvest cost for each grid cell represents a single, weighted cost derived from the range of slope classes in each cell. Harvest costs were not applied to T1 or T2 at slope classes 20-30° and >30°. For these slope classes, it is assumed harvest will occur at clear-fall only. Harvest costs were assigned per GMT.

The high potential cost of roading for harvest operations was noted in the methodology project partner feedback (Appendix 6), and comprehensive data on roading costs was provided. These costs will be utilised in the next phase of property-level plantation design phase.

⁷ Haulage model based on Sylva Systems Pty. Ltd. datasets of Australian harvest and haulage costs. These were deemed conservative based on feedback from the project partners.

PII CLASSES

For the purpose of presenting the data and ranking land suitability, it was assumed that the minimum acceptable PII was \$2,000 per ha. A **low** plantation development potential net present value could be \$2,000 - \$4,000, **moderate** \$4,000 to \$6,000 and **high** >\$6,000.

These PII classes were intersected with the simplified land-use classification to identify dominant existing land-uses in the most highly suitable areas.

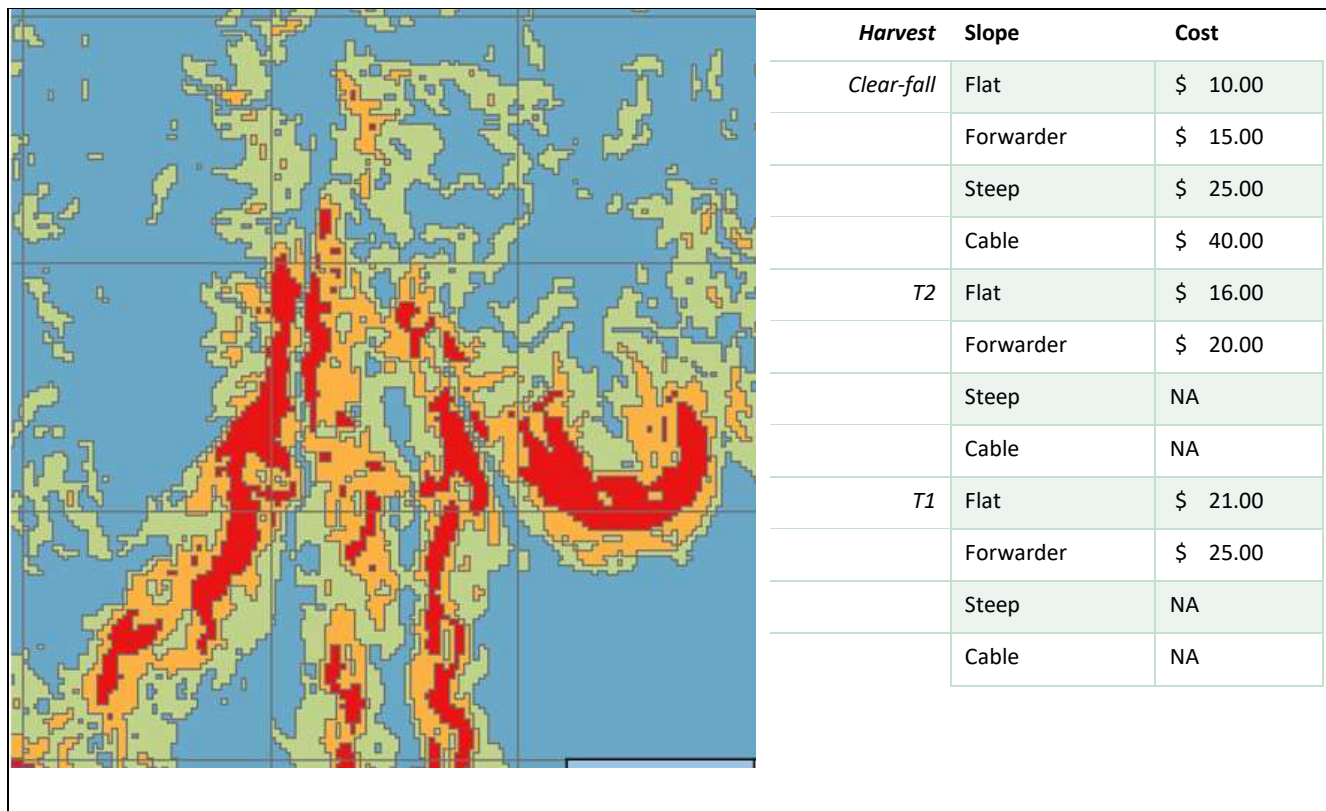


Figure 9: An indicative area (approx. 900ha) showing four slope classes with 1km (100ha) grid cells (left). The proportion of each slope class was calculated across each cell and a single harvest cost (right) applied to each grid cell.

Results

Potentially available land

6.21 million ha of private land in Victoria is potentially available for integrated plantation establishment on existing farmland (Appendix 1). This land-base is comprised of properties greater than 10 ha, receiving more than 600 mm long-term annual rainfall, with no existing native vegetation or other major exclusions.

Plantation Investment Index ranking and areas of opportunity

For all three wood-production scenarios (hardwood and softwood sawlog, and hardwood pulp), approximately one third of the potentially available 6.21M ha was shown to be above the nominal PII break-even threshold of \$2000/ha, based on land productivity, harvesting costs and proximity to market.

Applying the convention of 10% of farmland under trees not affecting agricultural productivity to the potentially available land area figures in Appendix 1, this equates to approximately 256 000 ha (hardwood sawlog), 209 000 ha (softwood sawlog) and 192 000 ha (hardwood pulp) across Victoria.

Comparisons cannot be drawn between the scenarios, mainly due to differences in rotation length, and uncertainties related to growth and markets for hardwood sawlogs, and management costs for successive hardwood pulp rotations. Hardwood pulp appears to have the least opportunity by area, however this may more reflect that the harvest returns are for a shorter 10-year rotation, rather than the 25-year rotation length used for the sawlog alternatives. As such, the opportunity may be greater than what it currently appears.

Hardwood sawlog appears to have the greatest opportunity by area. However, because log prices, rotation length and harvesting costs are set the same as for softwood sawlog, the greater area is likely due to higher modelled MAI than for softwood, which wasn't able to be confirmed and is likely to be optimistic judging by the measured hardwood pulp MAI comparison.

Growth data for an alternate hardwood species scenario such as *Corymbia maculata* (spotted gum) would make a strong comparison when carbon value is included, as spotted gum can sequester far greater amounts of carbon per m³ than radiata or blue gum. A method does exist under the Carbon Farming Initiative for generating carbon credits from harvested plantations, and the inclusion of returns from carbon credits could change the relative PII rankings for the different wood production scenarios. However, there are currently significant administrative barriers to entry to the carbon market for small individual growers, and great uncertainty around the future of the domestic carbon market and carbon prices under the Emissions Reduction Fund, meaning the market is largely theoretical at this time.

Figure 10 shows the overlap of two processing centres' 200km radii, highlighting the potential in some regions to be more flexible with species choice in plantation design, and have greater market access.

The highest PII areas are used for mixed farming, and beef and dairy cattle (Figure 11). Sheep and other livestock use increases proportionally as PII decreases. There may be more complementarity of trees and other land uses in lower PII areas. There was less area identified in cropping regions or horticulture. Cropping and dairy cattle were the two land use categories for which potentially available area increased with increasing PII.

The greatest opportunities by region are in Barwon South-West, Gippsland and Grampians. The Metro regions were lower PII classes. However, this land is also likely to be expensive, and mean more competition from higher value land use such as urban growth.

Combined Plantation Investment Index Discount rate: 7%

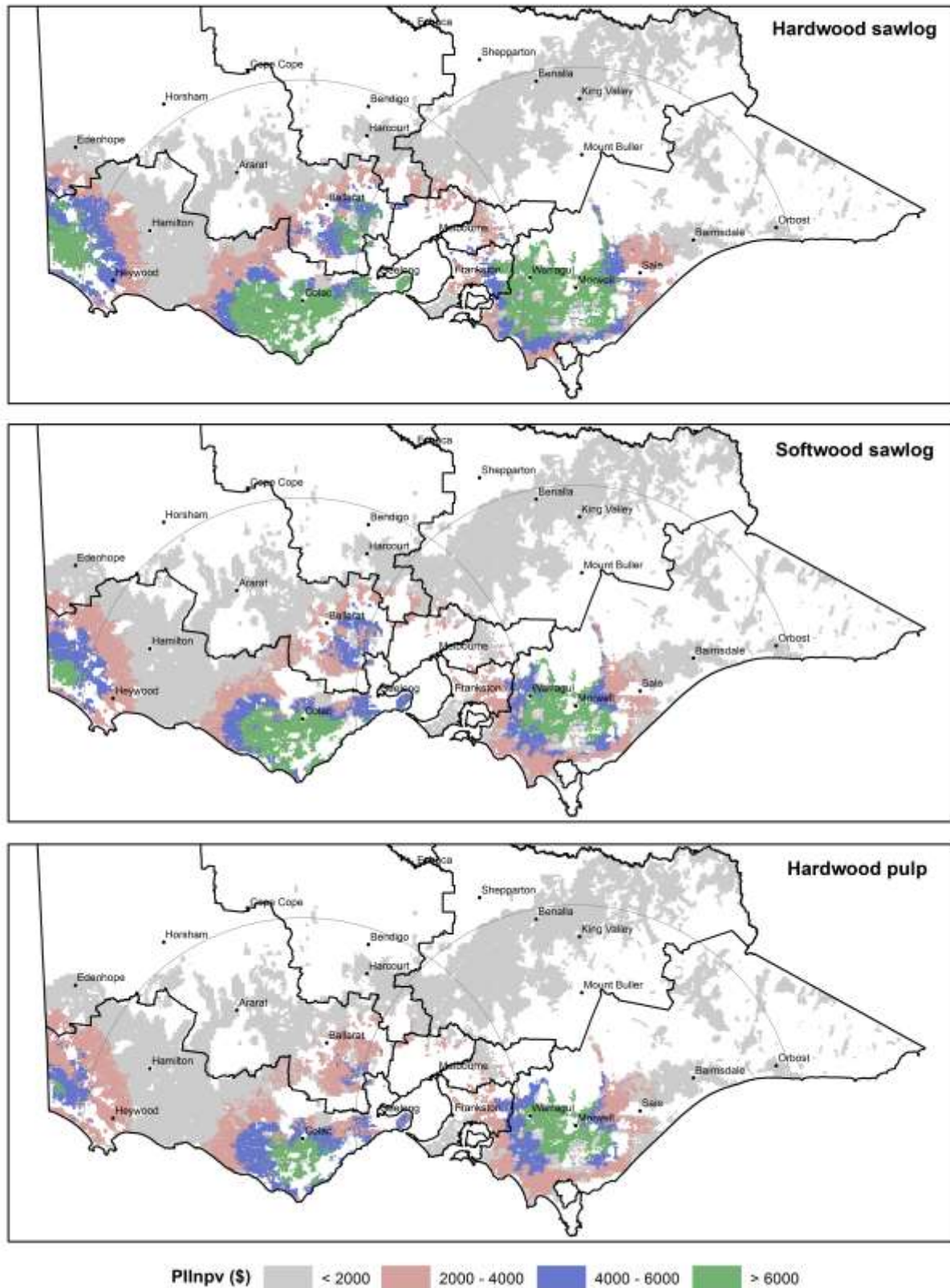


Figure 10 State-wide maximum PII (\$) for three wood production scenarios

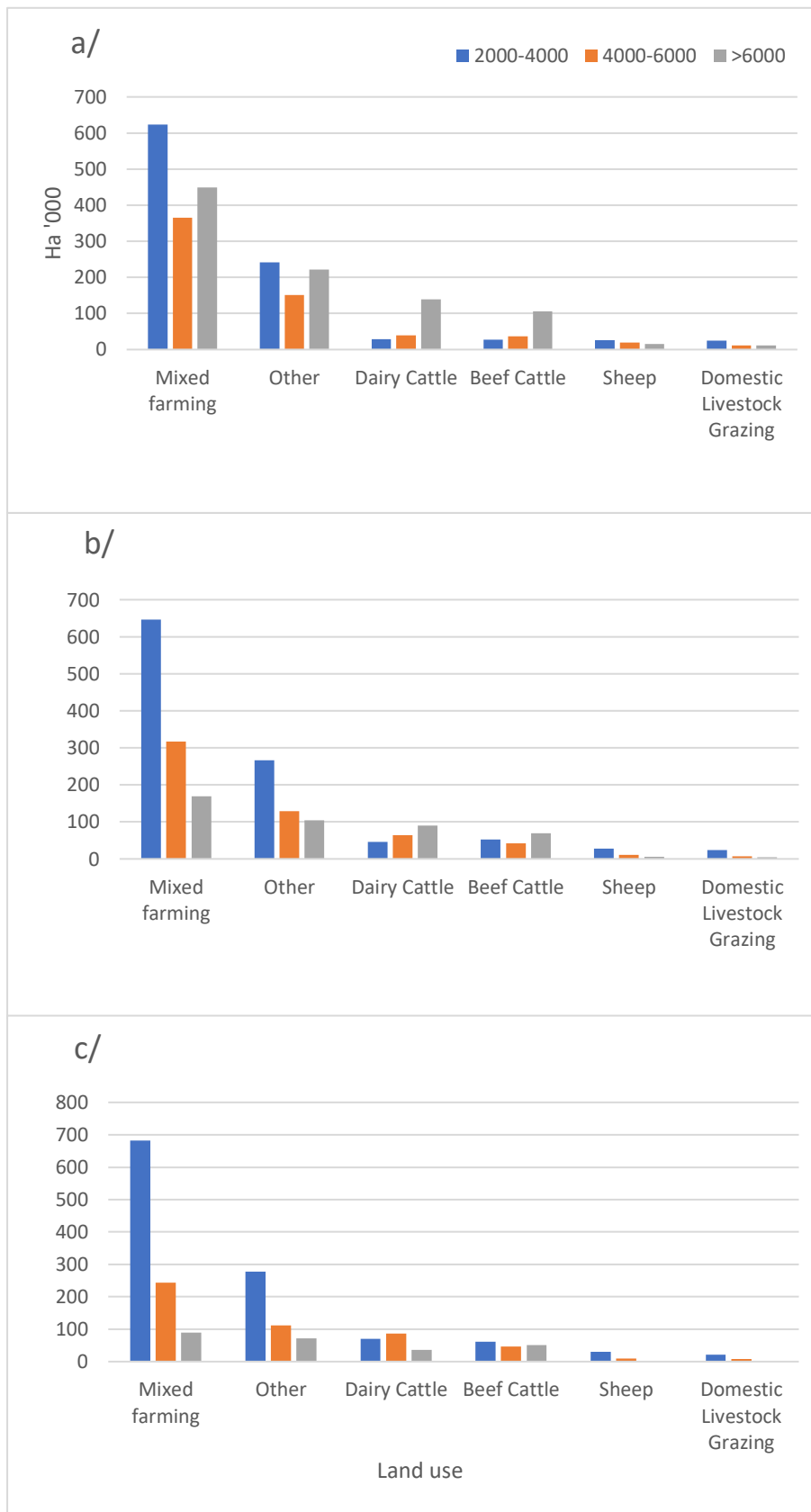


Figure 11 Area of land with PII>2000 in Victoria within land use categories for three wood production scenarios a/ hardwood sawlog b/ softwood sawlog and c/ hardwood pulp

Limitations

Lack of buffers on powerlines may mean that an additional reduction in total area. This could potentially be estimated by sampling smaller areas across the estate. It will to some extent be illustrated in the next step of this study, conducting property-level assessments. The same applies to local areas of shallow soil, waterlogged areas and other physical limits that can't be accounted for at the higher level.

The potentially available and suitable areas are spread across a large number of properties, for example there are over 15,000 individual properties with radiata sawlog PII >4000.

There is much anecdotal evidence of variation in Local Government Authority attitudes, concerns and attention to plantation forest development, management and roading issues. However they are essentially applying Code of Practice for Timber Production (The State of Victoria Department of Environment and Primary Industries 2014) with varying degrees of diligence. The Code itself has moved from away from being prescriptive, leaving very little that can be generalised across Victoria. At a property level, there are likely to be areas considered too prone to erosion, and slope concerns that affect access and area available.

Blue gum pulp and radiata sawlog show decreasing proportions of land with increasing PII, but hardwood sawlog has almost as much land area in the >6000 as in the 2000-4000 category.

Conclusions

The GIS model which was developed was able to identify private land potentially available for plantation development, and rank its suitability taking into account existing processing centres in Victoria. Project-partner feedback was used to generate modified outputs and confirm that model parameters were conservative.

Next Steps

The information presented in this report will be used for finer scale analysis to examine operability and other constraints for land in target PII classes, in different land-use categories and different regions. This phase of the analysis will seek to more accurately identify the area of land attainable within individual properties for plantation investment, which is likely to be a significantly smaller area than that determined using the initial coarse assessment.

This analysis could consider:

- Linking with the social research component;
- Variations in plantation configurations in different land-uses;
- The influence of slope and harvest cost at finer scale;
- Proximity to roads and the requirement for new road construction;
- Opportunities, constraints and variations related to the planning scheme across the different municipalities; and
- Land values and variation across land-uses.

Appendix 1 Suitable land area (ha) by PII and land-use

a/ hardwood sawlog 25-year rotation b/ softwood sawlog 25-year rotation and c/ hardwood pulp 10-year rotation

a/	Land-use / PII	<2000	2000-4000	4000-6000	>6000	Total	Total >2000
	Mixed farming and grazing	2,184,900	624,000	365,200	448,500	3,622,600	1,437,700
	Other	666,500	241,000	151,000	222,300	1,280,800	614,200
	Livestock Production (Dairy Cattle)	58,000	28,700	39,700	139,400	265,700	207,700
	Livestock Production (Beef Cattle)	95,800	27,600	37,300	105,800	266,600	170,700
	Livestock Production (Sheep)	56,800	26,200	18,900	15,100	117,000	60,200
	Domestic Livestock Grazing	522,700	24,700	10,800	11,400	569,600	46,900
	Horticulture	38,300	8,600	1,100	2,300	50,300	11,900
	Livestock (Other)	9,400	2,800	2,100	2,500	16,800	7,400
	Cropping	9,500	1,400	1,000	4,100	16,000	6,500
		3,642,000	984,900	627,000	951,300	6,205,300	2,563,300

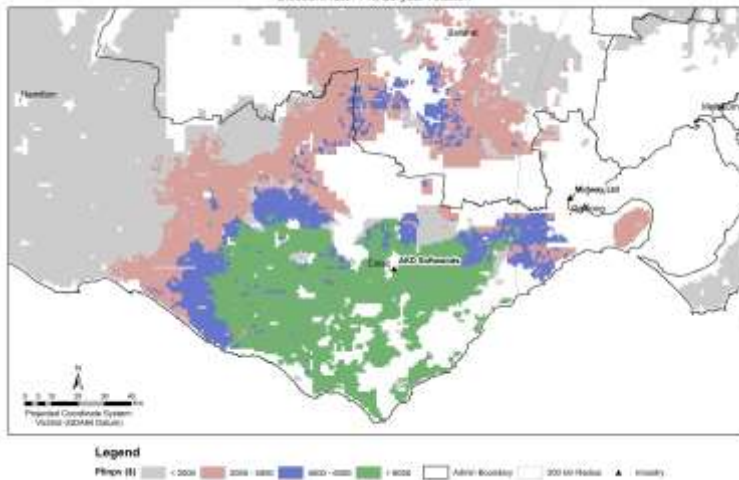
b/	Land-use / PII	<2000	2000-4000	4000-6000	>6000	Total	Total >2000
	Mixed farming and grazing	2,490,500	645,700	317,600	168,800	3,622,600	1,132,100
	Other	781,000	266,600	129,200	104,000	1,280,800	499,800
	Livestock Production (Dairy Cattle)	65,200	46,600	63,500	90,400	265,700	200,500
	Livestock Production (Beef Cattle)	103,300	52,300	42,100	68,800	266,600	163,300
	Livestock Production (Sheep)	72,100	28,000	11,500	5,400	117,000	44,900
	Domestic Livestock Grazing	534,300	23,700	7,600	4,000	569,600	35,300
	Livestock (Other)	10,700	4,000	1,700	300	16,800	6,000
	Cropping	10,700	1,000	1,600	2,600	16,000	5,300
	Horticulture	46,100	1,500	1,200	1,500	50,300	4,100
		4,113,800	1,069,400	576,100	445,900	6,205,300	2,091,500

c/	Land-use / PII	<2000	2000-4000	4000-6000	>6000	Total	Total >2000
	Mixed farming and grazing	2,607,600	681,800	243,300	89,900	3,622,600	1,015,000
	Other	819,800	277,200	112,000	71,700	1,280,800	461,000
	Livestock Production (Dairy Cattle)	72,600	70,700	86,000	36,500	265,700	193,200
	Livestock Production (Beef Cattle)	106,700	61,800	46,600	51,500	266,600	159,900
	Livestock Production (Sheep)	75,100	30,300	10,100	1,500	117,000	41,900
	Domestic Livestock Grazing	539,000	21,200	7,700	1,800	569,600	30,600
	Livestock (Other)	11,300	3,600	1,500	300	16,800	5,400
	Cropping	10,700	1,400	1,600	2,400	16,000	5,300
	Horticulture	45,700	2,500	900	1,100	50,300	4,600
		4,288,400	1,150,500	509,700	256,700	6,205,300	1,916,900

Appendix 2 Land capability analysis by processing centre

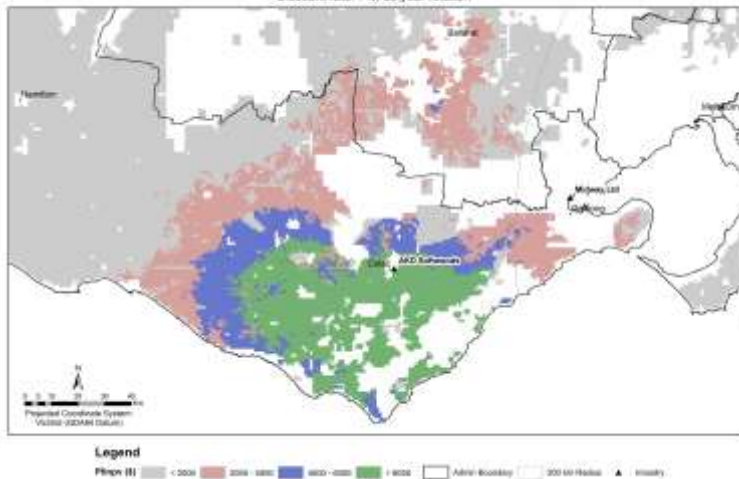
1. AKD Softwoods

AKD Softwoods: Plantation Investment Index (Hardwood sawlog)
Discount rate: 7%, 25 year rotation



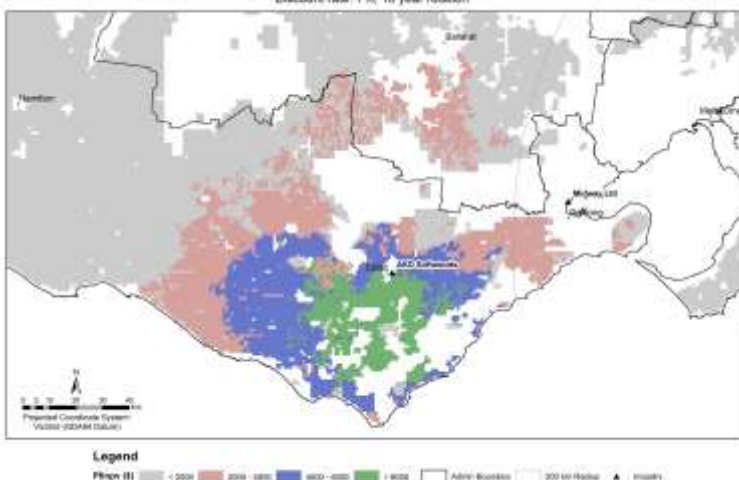
Land-use\PII	2000-4000	4000-6000	>6000	Total
Mixed farming	295,800	104,230	109,630	509,660
Dairy Cattle	20,300	28,660	116,520	165,480
Other	65,030	30,130	50,910	146,070
Beef Cattle	1,060	5,170	40,340	46,570
Sheep	15,540	3,100	8,670	27,310
Domestic Grazing	14,200	6,890	1,840	22,930
Cropping	530	860	1,270	2,660
Livestock Other	1,300	580	210	2,090
Horticulture	580	210	1,150	1,940
	414,340	179,830	330,540	924,710

AKD Softwoods: Plantation Investment Index (Softwood sawlog)
Discount rate: 7%, 25 year rotation



Land-use\PII	2000-4000	4000-6000	>6000	Total
Mixed farming	241,900	63,690	67,080	372,670
Dairy Cattle	29,470	52,500	79,270	161,240
Other	60,850	21,420	35,340	117,610
Beef Cattle	3,460	10,700	31,790	45,950
Domestic Grazing	16,110	1,890	320	18,320
Sheep	5,480	5,710	3,140	14,330
Cropping	730	1,150	310	2,190
Horticulture	550	100	1,100	1,750
Livestock Other	1,390	170	10	1,570
	359,940	157,330	218,360	735,630

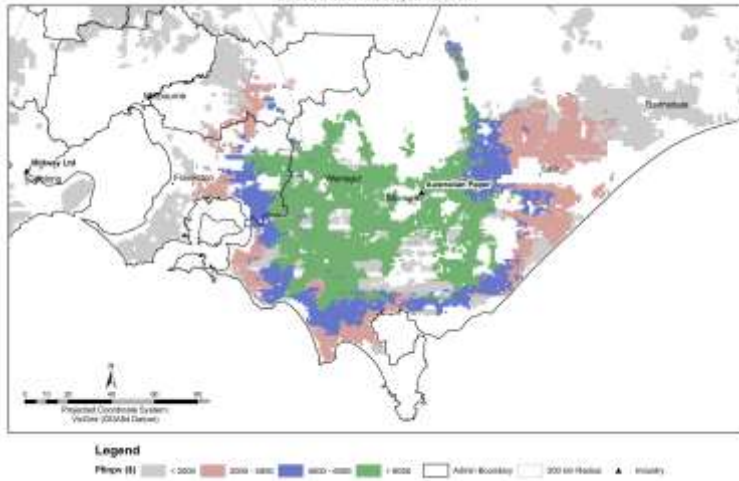
AKD Softwoods: Plantation Investment Index (Hardwood pulp)
Discount rate: 7%, 10 year rotation



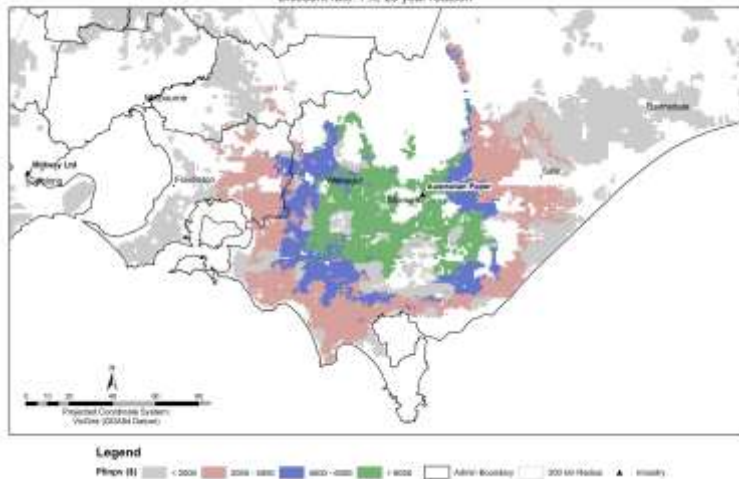
Land-use\PII	2000-4000	4000-6000	>6000	Total
Mixed farming	217,990	70,290	18,410	306,690
Dairy Cattle	54,170	77,110	23,960	155,240
Other	55,350	28,400	15,820	99,570
Beef Cattle	9,200	15,660	21,000	45,860
Domestic Grazing	13,120	1,070	0	14,190
Sheep	6,200	6,420	540	13,160
Cropping	1,020	1,140	NA	2,160
Horticulture	420	370	770	1,560
Livestock Other	1,370	10	0	1,380
	358,840	200,470	80,500	639,810

2. Australian Paper

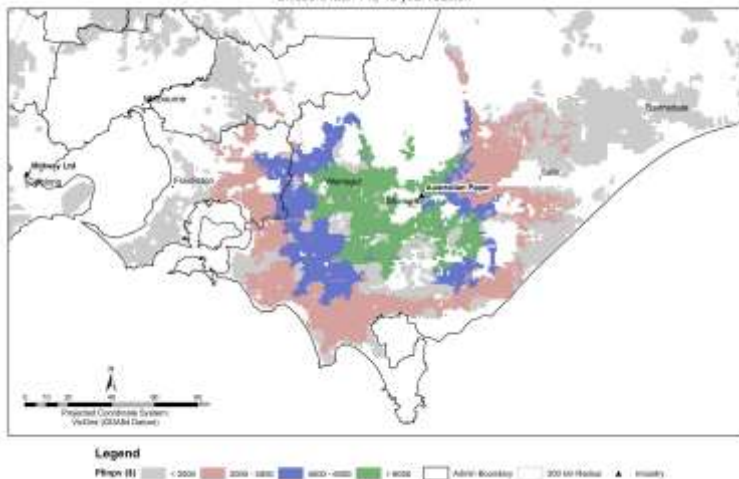
Australian Paper: Plantation Investment Index (Hardwood sawlog)
Discount rate: 7%, 25 year rotation



Australian Paper: Plantation Investment Index (Softwood sawlog)
Discount rate: 7%, 25 year rotation



Australian Paper: Plantation Investment Index (Hardwood pulp)
Discount rate: 7%, 10 year rotation



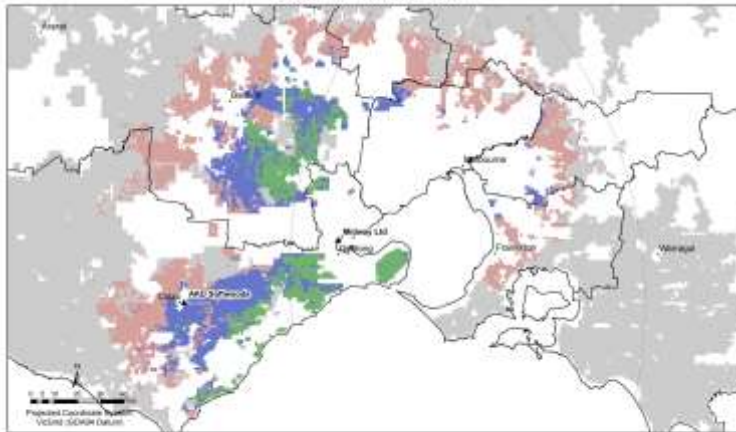
<i>Land-use\PII</i>	2000-4000	4000-6000	>6000	Total
<i>Mixed farming</i>	163,500	131,250	220,120	514,870
<i>Other</i>	78,000	57,660	122,100	257,760
<i>Beef Cattle</i>	8,670	9,040	46,140	63,850
<i>Dairy Cattle</i>	2,400	3,910	22,060	28,370
<i>Domestic Grazing</i>	4,070	1,940	7,210	13,220
<i>Horticulture</i>	2,340	440	620	3,400
<i>Cropping</i>	20	160	2,800	2,980
<i>Livestock other</i>	370	660	1,110	2,140
<i>Sheep</i>	450	NA	1,230	1,680
	259,820	205,060	423,390	888,270

<i>Land-use\PII</i>	2000-4000	4000-6000	>6000	Total
<i>Mixed farming</i>	219,820	111,160	86,410	417,390
<i>Other</i>	100,790	48,700	59,830	209,320
<i>Beef Cattle</i>	17,170	16,220	27,140	60,530
<i>Dairy Cattle</i>	6,680	9,110	11,130	26,920
<i>Domestic Grazing</i>	3,130	3,690	2,760	9,580
<i>Cropping</i>	140	490	2,340	2,970
<i>Livestock other</i>	1,160	430	250	1,840
<i>Horticulture</i>	840	190	340	1,370
<i>Sheep</i>	NA	20	1,210	1,230
	349,730	190,010	191,410	731,150

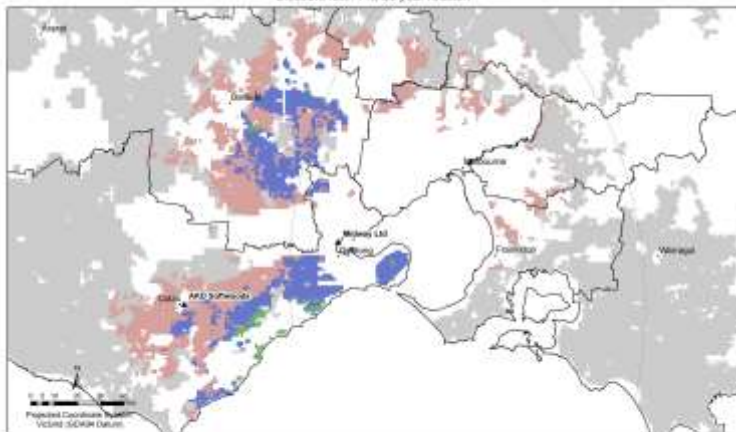
<i>Land-use\PII</i>	2000-4000	4000-6000	>6000	Total
<i>Mixed farming</i>	233,470	112,420	69,100	414,990
<i>Other</i>	101,370	53,720	54,960	210,050
<i>Beef Cattle</i>	15,470	16,770	28,120	60,360
<i>Dairy Cattle</i>	5,800	8,580	12,520	26,900
<i>Domestic Grazing</i>	3,490	4,330	1,790	9,610
<i>Cropping</i>	180	410	2,390	2,980
<i>Livestock other</i>	880	700	280	1,860
<i>Horticulture</i>	930	250	340	1,520
<i>Sheep</i>	NA	450	780	1,230
	361,590	197,630	170,280	729,500

3. Midway Ltd

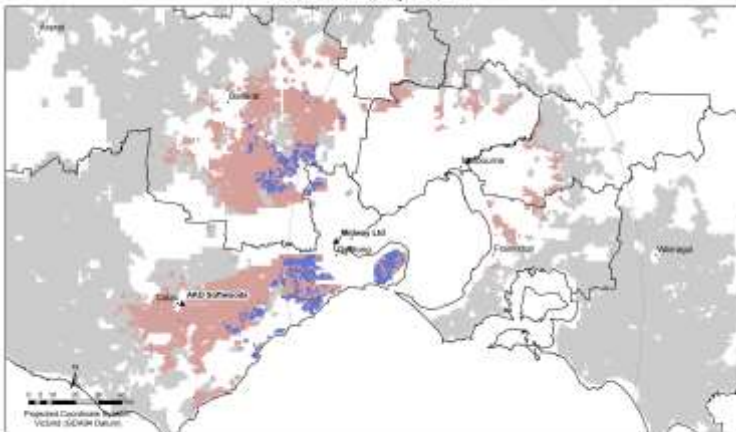
Midway Ltd: Plantation Investment Index (Hardwood sawlog)
Discount rate: 7%, 25 year rotation



Midway Ltd: Plantation Investment Index (Softwood sawlog)
Discount rate: 7%, 25 year rotation



Midway Ltd: Plantation Investment Index (Hardwood pulp)
Discount rate: 7%, 10 year rotation

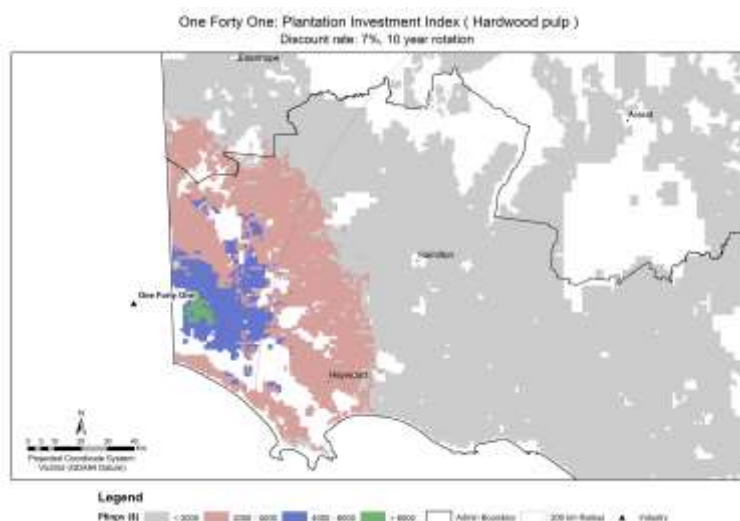
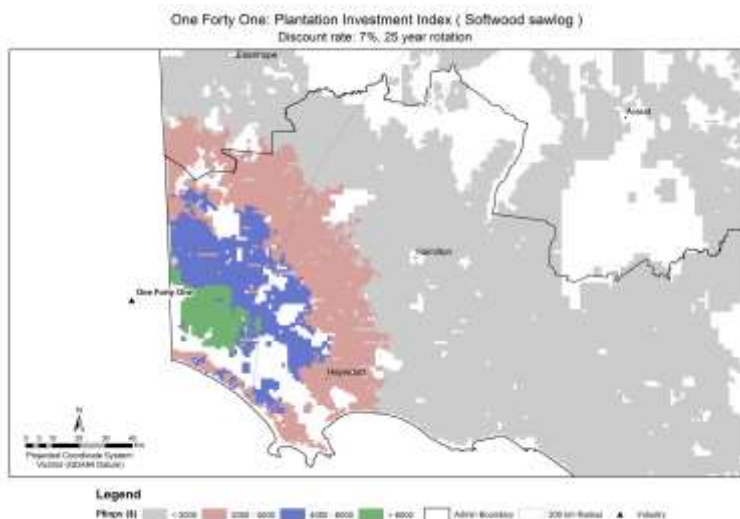
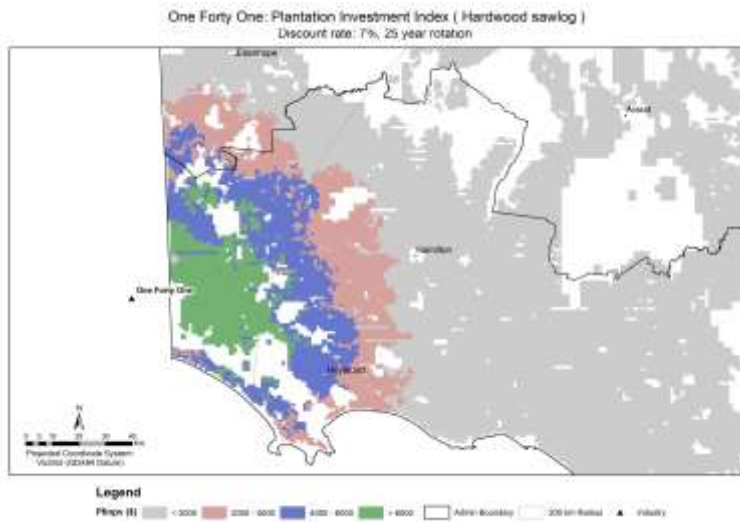


Land-use\PII	2000-4000	4000-6000	>6000	Total
Mixed farming	182,060	111,000	87,210	380,270
Other	136,180	52,210	29,410	217,800
Beef Cattle	23,610	21,590	1,210	46,410
Dairy Cattle	30,680	8,070	430	39,180
Sheep	9,320	9,130	1,340	19,790
Horticulture	7,060	1,160	610	8,830
Domestic Grazing	8,450	70	70	8,590
Livestock	2,620	1,170	1,210	5,000
Cropping	1,840	1,290	NA	3,130
	401,820	205,690	121,490	729,000

Land-use\PII	2000-4000	4000-6000	>6000	Total
Mixed farming	172,460	110,910	6,120	289,490
Other	109,330	41,180	3,430	153,940
Beef Cattle	30,410	7,580	NA	37,990
Dairy Cattle	24,990	2,130	0	27,120
Sheep	9,990	2,660	NA	12,650
Livestock	2,590	1,150	20	3,760
Domestic Grazing	2,310	70	NA	2,380
Horticulture	1,390	970	10	2,370
Cropping	1,590	260	NA	1,850
	355,060	166,910	9,580	531,550

Land-use\PII	2000-4000	4000-6000	>6000	Total
Mixed farming	201,570	39,390	6,120	247,080
Other	106,940	15,820	3,430	126,190
Beef Cattle	32,300	310	NA	32,610
Dairy Cattle	19,820	130	0	19,950
Sheep	11,340	880	NA	12,220
Livestock	2,350	830	20	3,200
Horticulture	2,310	340	10	2,660
Domestic Grazing	1,890	70	NA	1,960
Cropping	1,850	NA	NA	1,850
	380,370	57,770	9,580	447,720

4. OneFortyOne Plantations



Land-use\PII	2000-4000	4000-6000	>6000	Total
Mixed farming	145,950	72,290	43,290	261,530
Other	30,240	39,960	23,940	94,140
Beef Cattle	14,820	22,930	19,310	57,060
Sheep	8,810	15,230	3,940	27,980
Dairy Cattle	5,210	7,080	790	13,080
Domestic Grazing	1,050	1,940	2,290	5,280
Livestock	10	340	NA	350
Horticulture	NA	270	NA	270
Cropping	80	NA	NA	80
	206,170	160,040	93,560	459,770

Land-use\PII	2000-4000	4000-6000	>6000	Total
Mixed farming	131,950	47,200	12,110	191,260
Other	54,120	25,950	6,310	86,380
Beef Cattle	30,780	15,150	9,910	55,840
Sheep	22,320	4,250	1,080	27,650
Dairy Cattle	9,980	1,890	NA	11,870
Domestic Grazing	2,250	1,980	960	5,190
Livestock	340	10	NA	350
Horticulture	50	220	NA	270
Cropping	80	NA	NA	80
	251,870	96,650	30,370	378,890

Land-use\PII	2000-4000	4000-6000	>6000	Total
Mixed farming	132,520	24,580	2,410	159,510
Other	64,100	15,360	940	80,400
Beef Cattle	36,430	14,090	2,390	52,910
Sheep	23,510	2,350	140	26,000
Dairy Cattle	10,640	320	NA	10,960
Domestic Grazing	2,740	2,200	NA	4,940
Livestock	350	NA	NA	350
Horticulture	270	NA	NA	270
Cropping	80	NA	NA	80
	270,640	58,900	5,880	335,420

Appendix 3 Model Variables assigned

Assign variables

```
hl <- 0.1 # harvest loss  
dr <- 0.07 # Discount rate
```

Assign variables for softwood

```
sw_conFac <- 0.8 # Conversion factor  
sw_pulp <- 70 # Pulpwood price ($ m-3)  
swsl_a <- 100 # Sawlog grade A ($ m-3)  
swsl_b <- 80 # Sawlog grade B ($ m-3)  
swsl_c <- 75 # Sawlog grade C ($ m-3)  
swT1 <- 15 # softwood T1 year  
swT2 <- 20 # softwood T2 year  
swCF <- 25 # softwood clear fall year
```

Assign variables for hardwood

```
hw_conFac <- 1.1 # Conversion factor  
hw_pulp <- 70 # Pulpwood price ($ m-3)  
hwsl_a <- 100 # Sawlog grade A ($ m-3)  
hwsl_b <- 80 # Sawlog grade B ($ m-3)  
hwsl_c <- 75 # Sawlog grade C ($ m-3)  
hwT1 <- 15 # hardwood T1 year  
hwT2 <- 20 # hardwood T2 year  
hwCF <- 25 # hardwood clear fall year  
pulpCF <- 10 # Pulp clear fall year
```

Slope harvest costs

```
CF_sl1 <- 10 # Clear fall slope 1 (flat) cost  
CF_sl2 <- 15 # Clear fall slope 2 (forwarder) cost  
CF_sl3 <- 25 # Clear fall slope 3 (steep) cost  
CF_sl4 <- 40 # Clear fall slope 4 (cable) cost  
T2_sl1 <- 16 # T2 slope 1 cost  
T2_sl2 <- 20 # T2 slope 2 cost  
T2_sl3 <- 0 # T2 slope 3 cost  
T2_sl4 <- 0 # T2 slope 4 cost  
T1_sl1 <- 21 # T1 slope 1 cost  
T1_sl2 <- 25 # T1 slope 2 cost  
T1_sl3 <- 0 # T1 slope 3 cost  
T1_sl4 <- 0 # T1 slope 4 cost
```

Assumptions

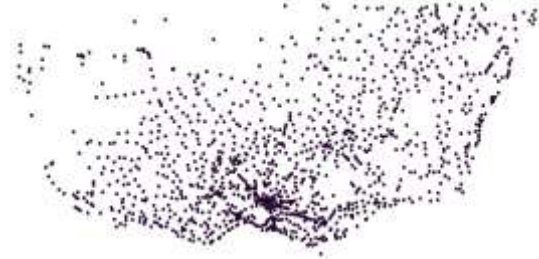
- Processing centres handle both logs and pulp of all species
- hardwood saw log market exists in all processing centres
- hardwood and soft wood saw log prices are the same
- B-double access up to 5km from b-double routes
- No establishment and management costs are considered

Appendix 3 Spatial layers used for the potential land availability analysis

Index name	124_vic_property_parcel
File name	Parcel Map Polygons - Vicmap Property Simplified 1 (VMPROP_S_PARCEL_MP/)
Unique ID	ANZVl0803002899
Layer name	parcel_mpch
Source	www.data.vic.gov.au/
Notes	Base polygon layer of property parcels in Victoria. The shapefile is stripped of all data except parcel ID and Parcel area (ha).



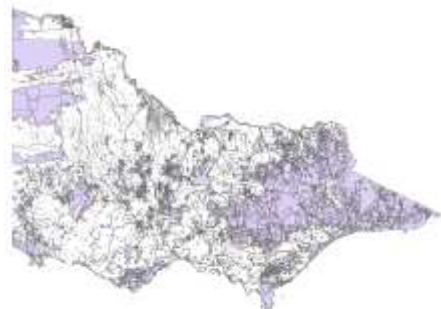
Index name	102_vic_towns
File name	Place Names, point - 1:250,000 to 1:5 million. Vicmap Lite (VMLITE_LOCALITY/)
Unique ID	ANZVl0803003531
Layer name	vmlite_locality
Source	http://www.land.vic.gov.au/
Notes	Point layer of major towns. Points of Maryvale (Gippsland) and Colac (Otways) were used as the central points from which to buffer the project area in a 200km radius.



Index name	130_vic_roads
File name	Road Network - Vicmap Transport (TR_ROAD/)
Unique ID	ANZVl0803002595
Layer name	TR_ROAD
Source	www.data.vic.gov.au/
Notes	Road classes used: 0=Freeway, 1=Highway, 2=Arterial, 3=Sub-Arterial, 4=Collector, 5=Local, 6=2wd



Index name	120_vic_public_land
File name	Public Land Management (PLM25) (PLM25/PLM25)
Unique ID	ANZVl0803003978
Layer name	plm25
Source	www.data.vic.gov.au/
Notes	Public land area polygons extracted from the project area



Index name 150_vic_landuse_2016

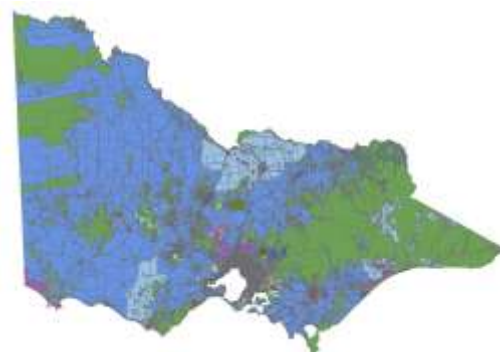
File name Victorian Land-use Information System 2016 (LANDUSE_2016/)

Unique ID ANZVI0803005718

Layer name landuse_2016

Source www.data.vic.gov.au/

Notes Morse-McNabb, E. *et al.* VLUIS, a land-use data product for Victoria, Australia, covering 2006 to 2013. Sci. Data 2:150070 doi: 10.1038/sdata.2015.70 (2015)



Index name 502_BoM_Rainfall

File name rainann_vic

Unique ID NA

Layer name rainann_vic

Source Bom.gov.au

Notes Annual rainfall is exported as a point layer and joined spatially with each parcel. Annual has been divided into three classes: < 500, 600-600, >600



Index name 601_Elevation

File name Dem_20

Unique ID NA

Layer name Dem_20

Source Unknown

Notes The Digital Elevation Model (DEM) is converted to Slope (degrees) and reclassified into three classes: <15, 15-30, >30



Index name 152_vic_landcover_2016

File name Victorian Land Cover Mapping 2016

Unique ID NA

Layer name TDLC_smoothed.tif

Source www.data.vic.gov.au/

Notes Land cover was reclassified into two classes: Woody native vegetation and Other. Woody native vegetation is then overlaid with slope >30 and removed from the land area.



Index name HY_WATER_AREA_POLYGON

File name Water Area (polygon) 1:25,000 - Vicmap Hydro (HY_WATER_AREA_POLYGON/)



Unique ID ANZVl0803002491

Layer name hy_water_area_polygon

Source <http://www.land.vic.gov.au/>

Notes This layer is part of Vicmap Hydro and contains polygon features delineating hydrological features. Includes; Lakes, Flats (subject to inundation), Wetlands, Pondages (saltpan and sewerage), Watercourse Areas, Rapids and Waterfalls
Attributed for name.
Centroid layer also available.

Index name pipeline

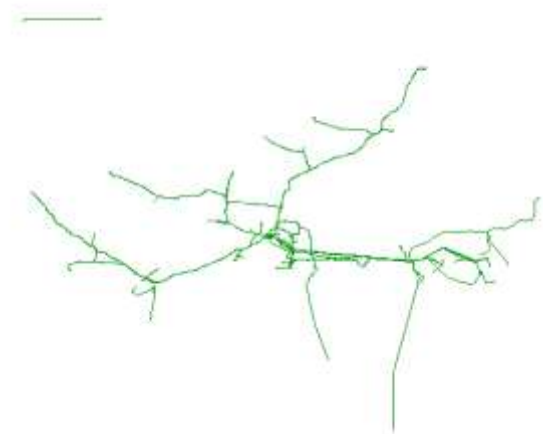
File name Gas and Fuel Pipelines - warning 75% complete (PIPELINE/)

Unique ID ANZVl0803002199

Layer name pipeline

Source <http://www.land.vic.gov.au/>

Notes Onshore and offshore, oil and gas, transmission pipelines under the following Acts:
Offshore Commonwealth waters - Offshore Petroleum and Greenhouse Gas storage Act 2006
Onshore - Pipelines Act 2005.



Appendix 5 Simplified land-use classes

2016 Land-use class	Simplified land-use class
General Cropping (generally more than 20ha plantings)	Cropping
General Cropping (generally more than 20ha plantings)	Cropping
Specialised Cropping	Cropping
Forest Reserves - Private	Forest - Native/Recreational
Cultural Heritage Centre (National/State/Regional)	Forest - Native/Recreational
Culture, recreation and sport	Forest - Native/Recreational
Culture, recreation and sport (National/State/Regional)	Forest - Native/Recreational
Native Vegetation / Bushland With Covenant/Agreement	Forest - Native/Recreational
Wilderness Area	Forest - Native/Recreational
National Park - Land	Forest - Native/Recreational
Native Vegetation / Bushland With Covenant / Agreement	Forest - Native/Recreational
Native Vegetation / Bushland Without Covenant/Agreement	Forest - Native/Recreational
Parks and Gardens	Forest - Native/Recreational
Protected Landscape - Private	Forest - Native/Recreational
Protected Landscape - Public	Forest - Native/Recreational
Regional Park	Forest - Native/Recreational
Forest Reserves - Public	Forest - Native/Recreational
State Forest	Forest - Native/Recreational
Conservation Area - Public	Forest - Native/Recreational
Nature Reserve	Forest - Native/Recreational
National Park ? Land	Forest - Native/Recreational
State Park	Forest - Native/Recreational
Conservation Area - Private	Forest - Native/Recreational
Native Vegetation / Bushland Without Covenant / Agreement	Forest - Native/Recreational
softwood Plantation	Forestry
hardwood Plantation	Forestry
Native hardwood (standing timber)	Forestry
Forestry (Commercial Timber Production)	Forestry
Commercial Flower and Plant Growing ? (outdoor)	Horticulture
Glasshouse Plant / Vegetable Production	Horticulture
Commercial Flwer and Plant Growing - (outdoor)	Horticulture
Market Garden - Vegetables (generally less than 20ha plantings)	Horticulture
Market Garden ? Vegetables	Horticulture
Market Garden ? Vegetables (generally less than 20ha plantings)	Horticulture
Orchards, Groves and Plantations	Horticulture
Vineyard	Horticulture
Plant / Tree Nursery	Horticulture
Livestock Production ? Beef Cattle	Livestock - Beef
Cattle Feed Lot	Livestock - Beef
Livestock Production (Beef Cattle)	Livestock - Beef
Livestock Production (Dairy Cattle)	Livestock - Dairy
Abattoirs	Livestock - other
Horse Stud / Training Facilities / Stables	Livestock - other
Horse Stud / Training Facilities/Stables	Livestock - other
Domestic Livestock Grazing	Livestock - other
Non-Native Animals	Livestock - other
Piggery	Livestock - other
Livestock Production ? Sheep	Livestock - Sheep
Livestock Production (Sheep)	Livestock - Sheep
Mixed farming and grazing (generally more than 20ha)	Mixed farming and grazing
Mixed farming and grazing	Mixed farming and grazing
Mixed farming and grazing (generally more than 20 ha)	Mixed farming and grazing
Poultry - Open Range	Poultry
Poultry (egg production)	Poultry
Poultry (broiler production)	Poultry
Aged Care Amenities Buildings	Other

Aged Care Complex / Special Accommodation / Nursing Home	Other
Aged Care Complex/Special Accommodation/Nursing Home	Other
Airfield (includes associated open space)	Other
Airport Hangar Building	Other
Airport Terminal Building - Passengers	Other
Airstrip	Other
Ambulance Station Facility	Other
Amusement Parks etc	Other
Ancillary structures (not capable of occupation)	Other
Aquaculture Breeding / Research Facilities / Fish Hatchery	Other
Army Barracks / Administration Base	Other
Army Barracks/Administration Base	Other
Bed and Breakfast	Other
Bike Track / Walking Trails	Other
Bike Track/Walking Trails	Other
Black or Brown Coal (open cut)	Other
Boarding House / Private Hotel / Dormitory Accommodation	Other
Botanical Gardens (National/State/Regional)	Other
Bottle Shop / Licensed Liquor Outlet	Other
Bulk Grain Storage (earthen walls and flooring - pit bunker)	Other
Bulk Grain Storage (structures)	Other
Bulk Liquid Storage Fuel Depot / Tank Farm	Other
Bus Interchange Centre / Bus Terminal	Other
Bus Maintenance Depot	Other
Cabin / Accommodation	Other
Cable Lines, Conduits and Special Purpose Below St	Other
Cable Lines, Conduits and Special Purpose Below Street Level Communication Line Tunnels ? not being sewers (through easements, freehold and public la*	Other
Car Wash	Other
Casino	Other
Cemetery	Other
Centre for the Mentally Ill	Other
Church, Temple, Synagogue, etc	Other
Civic Buildings	Other
Closed Roads	Other
Club / Gaming / stand alone	Other
Commercial Development Site	Other
Commercial Land (with buildings which add no value)	Other
Community / Neighbourhood Facility	Other
Community Health Centre	Other
Community Protection and Services Training Facility	Other
Community Service Facilities or Other	Other
Community/Neighbourhood Facility	Other
Conjoined Strata Unit / Townhouse	Other
Coolstore / Coldstore	Other
Coolstore/Coldstore	Other
Crematorium / Funeral Services	Other
Cultural Heritage Centre (Local)	Other
Day Care Centre for Children	Other
Defence Services/Military Base	Other
Detached Home	Other
Disability Housing	Other
Disused Well / Bore	Other
Drive Ins	Other
Early Childhood Development Centre - Kindergarten	Other
Early Childhood Development Centre ? Kindergarten	Other
Electricity Distribution / Reticulation Lines	Other
Electricity Power Generators - Fuel Powered	Other
Electricity Substation / Terminal	Other
Electricity Transmission Lines	Other
Emergency Services Complex	Other
Equestrian Centre	Other

Extractive industry site with permit or reserve not in use: Gravel/Stone	Other
Extractive industry site with permit or reserve not in use: Sand	Other
Extractive less than 2 Metres (unspecified)	Other
Film / Movie Theatre, Playhouse / Traditional Theatre	Other
Fire Station Facility	Other
Fish Farming - Sea Water Based	Other
Food Processing Factory	Other
Freeways	Other
Fuel Outlet / Garage / Service Station	Other
Fuel Outlet/Garage/Service Station	Other
Gas Distribution / Reticulation Pipelines	Other
Gas Production / Refinery	Other
Gas Storage	Other
Gas Transmission Pipeline	Other
General Purpose Factory	Other
General Purpose Warehouse	Other
Gold (deep shaft)	Other
Gold (open cut)	Other
Government Administration	Other
Granny Flat / Studio	Other
Gravel / Stone (Quarry)	Other
Gravel / Stone site (not in use)	Other
Ground Level Parking	Other
Guest Lodge / Back Packers / Bunkhouse / Youth Hostel	Other
Guest Lodge/Back Packers/Bunkhouse/Youth Hostel	Other
Halls and Service Clubrooms	Other
Hazardous Materials / Toxic Storage Centre	Other
Health Clinic	Other
Health Surgery	Other
Hotel-Gaming	Other
House and Flat / Studio	Other
Hydro Electricity Production	Other
Individual Car Park	Other
Individual Car Park Site	Other
Individual Flat	Other
Indoor Sports Centre etc.	Other
Indoor Sports Grounds / Complex	Other
Industrial Development Airspace	Other
Industrial Development Site	Other
Industrial Land (with buildings which add no value)	Other
Infant Welfare Centre	Other
Kennel / Cattery	Other
Kiosk	Other
Library / Archives (Local)	Other
Library / Archives (National/State/Regional)	Other
Lighthouse and Navigation Aids	Other
Local Government	Other
Low Rise Office Building	Other
Main Highways (including national routes)	Other
Major Industrial Complex	Other
Major Industrial Complex ? Special Purpose Improvements	Other
Major Sports Facility (full commercial application)	Other
Major Water Conduits	Other
Man-made Evaporation Basin	Other
Manufacturing Materials (not in use)	Other
Manufacturing Materials (Quarry)	Other
Market Stall	Other
Member Club Facility	Other
Metals (other than gold deep shaft)	Other
Metals (other than gold open cut)	Other
Miscellaneous Building on Residential Rural Land (>1 and<20ha)	Other
Miscellaneous Building on Residential Rural Land (0.4 to 20 Hectares)	Other

Miscellaneous Buildings on Residential Land	Other
Mixed Use Occupation	Other
Monument / Memorial (Local)	Other
Monument / Memorial (National/state regional)	Other
Monument/Memorial	Other
Motor Race Tracks / Speedways	Other
Motor Racing Tracks / Speedways	Other
Multi-Level Office Building	Other
Multi-Purpose Fuel Outlet	Other
Museum / Art Gallery (Local)	Other
Museum / Art Gallery (National/State/Regional)	Other
Museum/Art Gallery	Other
National Company Restaurant	Other
National Company Retail	Other
National Park - Marine	Other
Natural Monument / Feature	Other
Naval Specialised Facilities ? Ground Based	Other
Non metals (other than Uranium open cut)	Other
Office Premises	Other
Office Premises (single occupancy/single title/single stratum)	Other
Oil Refinery	Other
Open Area Storage	Other
Operating mine unspecified	Other
Other unspecified Extractive Industry	Other
Outdoor Sports - Extended Areas / Cross Country	Other
Outdoor Sports ? Extended Areas/Cross Country	Other
Outdoor Sports ? Extended Areas/Cross Country (likely some commercial application)	Other
Outdoor Sports Grounds - town or suburban facilities	Other
Outdoor Sports Grounds / Complex	Other
Parks and Gardens (Local)	Other
Petro Chemical Manufacturing	Other
Police Facility	Other
Port Dock / Berth	Other
Port Wharf / Pier and Apron	Other
Post Offices	Other
Private Hospital	Other
Pub/Tavern/Hotel/Licensed Club/Restaurant/Licensed Restaurant/Nightclub	Other
Public Conveniences	Other
Public Hospital	Other
Quarry (in use): Gravel/Stone	Other
Quarry / Mine (open cut) Exhausted (dry)	Other
Racecourse / Tracks / Showground	Other
Racecourse/Tracks/Showground (sport involving animals, likely some commercial application)	Other
Railway / Tramway Line Closed / Unused	Other
Railway Freight Terminal Facilities	Other
Railway Line Land and Improvements in use	Other
Railway Passenger Terminal Facilities	Other
Railway Passenger Terminal Facilities (including stations etc)	Other
Rectory, Mance, Presbytery	Other
Refuse Recycling	Other
Refuse Transfer Station	Other
Regional / District / Neighbourhood Shopping Complex	Other
Religious Hall	Other
Religious Study Centre	Other
Rendering Plant	Other
Research Institute - Public	Other
Reserved Land	Other
Reserved Roads / Unused Roads	Other
Reserved Roads/Unused Roads	Other
Residential College / Quarters	Other
Residential Company Share Unit	Other
Residential Development Site	Other

Residential Hotel / Motel / Apartment Hotel Complex	Other
Residential Hotel / Motel / Apartment Hotel Units	Other
Residential Hotel/Motel / Apartment Hotel Complex	Other
Residential Investment Flats	Other
Residential Land (with buildings which add no value)	Other
Residential Rural / Rural Lifestyle (0.4 to 20 Hectares)	Other
Retail Premises	Other
Retail Premises (multiple occupancies, usually single title or the parent title for stratum units)	Other
Retail Premises (single occupancy/single title/single stratum)	Other
Retirement Village Complex	Other
Retirement Village Unit	Other
Rural and Community Camps	Other
Sand (Quarry)	Other
Sand site (not in use)	Other
Sanitary Land Fill	Other
Sawmill	Other
School / College Secondary / Technical School - Public	Other
School Primary - Public/Private	Other
School Primary ? Public/Private	Other
School/College Secondary/Technical School ? Public/Private	Other
Secondary Roads	Other
Semi-Detached / Terrace Home / Row House	Other
Separate House and Curtilage	Other
Serviced Apartments / Holiday Units	Other
Sewerage / Stormwater Pipelines	Other
Sewerage / Stormwater Pipelines (through easements, freehold and public land)	Other
Sewerage / Stormwater Pump Stations	Other
Sewerage / Stormwater Treatment Plant Site	Other
Sewerage/Stormwater Pipelines (through easements, freehold and public land)	Other
Shack / Hut / Donga	Other
Short Term Holiday Accommodation	Other
Single Strata Unit / Villa Unit / Townhouse	Other
Single Unit/Villa Unit/Townhouse	Other
Ski Fields (some commercial application)	Other
Soil (Quarry)	Other
Special Needs School	Other
Special Purpose (Office)	Other
Stock sales yards	Other
Strata unit or flat	Other
Suburban and Rural Roads	Other
Tannery / Skins Depot & Drying	Other
Technical and Further Education	Other
Telecommunication Buildings / Maintenance Depots	Other
Telecommunication Towers and Aerials	Other
Telephone Exchange - Purpose Built	Other
Telephone Exchange ? Purpose Built	Other
Television / Radio Station - Purpose Built	Other
Tourism Infrastructure (Local Attractions)	Other
Tourism Infrastructure ? Local Attractions	Other
Tourist Park / Caravan Park / Camping Ground	Other
Tramway Maintenance / Terminal Storage	Other
Transport (Marine)	Other
Unclassified Private Land	Other
University - Private / Public	Other
Unspecified - Public, Education and Health Improved	Other
Unspecified - Transport, Storage, Utilities and Communication	Other
URBAN VOID	Other
Vacant Community Services Development Sites	Other
Vacant Education and Research Development Site	Other
Vacant Englobo Commercial Land	Other
Vacant Englobo Residential Subdivisional Land	Other
Vacant Government Administration Development Site	Other

Vacant In globo Residential Subdivisional Land	Other
Vacant Industrial Englobo Land	Other
Vacant Land	Other
Vacant Land mining unspecified	Other
Vacant Religious Purposes Development Site	Other
Vacant Residential Home Site / Surveyed Lot	Other
Vacant Residential Home Site/Surveyed Lot	Other
Vacant Residential Rural / Rural Lifestyle (0.4 to 20 Hectares)	Other
Vacant Residential Rural / Rural Lifestyle (0.4 to 20ha)	Other
Vacant Site - Cultural Use	Other
Vacant Site - Sporting Use	Other
Vacant Site ? Sporting Use	Other
Vehicle Sales Centre	Other
Veterinary Clinic	Other
VOID	Other
Weighbridge	Other
Wildlife Zoo / Park / Aquarium (Local)	Other
Wind Farm Electricity Generation	Other
Yabby Farming	Other
Protected Seascape - Public	Other
Wetlands	Other
Creek Reserve (fresh water)	Other
Fresh Water Lake Reserve	Other
Piers, Storages, and Slipways	Other
Water - Urban Distribution Network	Other
Water - Urban Distribution Network (through easements, freehold and public land)	Other
Water (irrigation)	Other
Water (stock and domestic)	Other
Water Catchment Area	Other
Water Catchment Dam / Reservoir	Other
Water Catchment Dam/Reservoir	Other
Boat Sheds, Bathing Boxes, Ramps and Jetties	Other
Marinas and Yacht Clubs	Other
Water Sports - Open Areas	Other
Water Sports - Swimming Pools / Aquatic Centres	Other
Water Sports ? Open Areas	Other
Water Storage Dam / Reservoir (Non-Catchment)	Other
Water Storage Dam/Reservoir (Non-Catchment)	Other
Water Storage Tanks, Pressure Control Towers and Pumping Stations	Other
Water Storage Tanks, Pressure Control Towers and Pumping Stations.	Other
Water Supply	Other
Water Treatment Plant	Other
Protected Landscape / Seascape	Other
Creek Reserve(salt water)	Other

Appendix 6 Project partner feedback to the draft model

The results presented were preliminary insofar as the final input parameters associated with log price, harvest cost etc. required confirmation from project partners. Questions to be answered related to:

- any additional constraints on potential land availability
- mill door prices by product
- the effect of slope on harvest costs
- factors determining the use of different transport options,
- the appropriate version of the index for further analysis (PII total, PII annual or PII npv),
- the appropriate discount rate for NPV analysis.
- the thresholds to classify land for investment potential.

All respondents so far have expressed concern about the reliability of the underlying 3-PG2 growth data, based on both personal experience and knowledge of the regions' expected growth rates for blue gum and radiata, and also the broader perceptions of industry and government that 3-PG2 failed the blue gum expansion companies by often grossly overestimating potential productivity, possibly in the realm of 10 MAI for both blue gum and radiata. All suggested it would be useful and important to calibrate the growth data on sites with known performance.

There were also questions around the relevance of a blue gum sawlog regime, with no well-established market, and little track record of blue gum maintaining high MAI values over rotations longer than 12 years.

There were reservations around the 600 mm rainfall cutoff being marginal for radiata and too low for blue gum, based on real-world experience. There is, however also the potential factor of the Carbon Farming Initiative Commercial Plantation methodology to consider, and as such it would be interesting to explore the financial effect of carbon pricing.

The direct relationship between rainfall, productivity, increasingly valuable competing land-uses and land value was highlighted, with both land purchase and leasing at market rates considered prohibitive to achieving ROI of at least 7 to 10%. In fact even on 2R sites where landholders were enticed to plant pine by good state government annuities, they are typically not electing to replant due to the more realistic annuities on offer.

Harvesting regimes and product recovery estimates do differ between species, companies and sites, and the current silvicultural regimes and harvesting systems lack detail and may not best reflect operational reality. The current lack of b-double haulage rates in the model is certainly hurting profitability. Road construction is also a very significant cost for accessing and harvesting trees further from the road.

There is clearly a lot of beauracracy in Victoria around planning and developing plantations in both new and existing plantation sites. There is evidently a large variation between shires in application and auditing of the Timber Production Code for private land. However, there were was little in the way of examples of hard limits or exclusions to plantation expansion beyond those in The Code, other than some shires requiring planning permits for plantations greater than 40 ha, which opens the way for objections from the public.