Report prepared for the
NSW South East and North East Forestry Hubs

Cost Benefit Analysis (SE NSW-2025-021-C)

Cost Benefit Analysis of thinning regrowth forest and developing new hardwood plantations in SE and NE NSW

Final report

This report was commissioned by the NSW South East and North East Forestry Hubs with funding from the Australian Government, Department of Agriculture, Fisheries and Forestry

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PREFACE

Indufor Asia Pacific (Australia) Pty Ltd ('Indufor') has prepared this report for the South East NSW Forestry Hub (SEFH) and North East Forestry Hub (NEFH) (collectively 'the Hub'), which are among 11 Regional Forestry Hubs established by the Australian Government under the *National Forestry Industry Plan 2018*.

The Regional Forestry Hubs ('the Hubs') work with industry, state and local governments, and other key stakeholders to prepare and provide the Australian Government with strategic planning, technical assessments and analyses that aim to support growth in the forest industries in their region.

The report provides the Hub with information to advise government, and industry, on regulatory and policy matters that will assist in prioritising investment in hardwood sawlog production.

This report was prepared between November 2025 and February 2026, and the observations and findings reflect the information available at that time.

Indufor thanks other contributors who provided valuable viewpoints and data. These contributions were provided through interviews and other forms of engagement, and collectively, they provided substantial input to this analysis. The findings, interpretations, and conclusions presented in this report do not necessarily reflect all the views of these key stakeholders; however, their support for the project and inputs to the review are gratefully appreciated.

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EXECUTIVE SUMMARY

Background and scope

A key strategic objective of the Hubs is to enhance resource security for the industry, the SEFH and NEFH are seeking to explore two alternative pathways that increase hardwood sawlog production: via either establishing new hardwood plantations or thinning of regrowth native forest. Developing new hardwood plantations in coastal NSW has been constrained by suitable land, species and technical challenges. Regrowth native forests are an existing resource that with a level of silvicultural investment could be managed to produce sawlogs in a shorter timeframe compared to new plantations.

This project compares the financial costs and benefits of establishing new hardwood plantations versus investing in thinning and management of native regrowth forests, supplemented by discussion regarding the social, and environmental impacts of either approach.

Case study areas

Three case study areas have been selected to illustrate the financial returns and associated risks of the two management options. By analysing performance across these varied settings, the assessment highlights how returns can differ under each option and identifies the key factors that influence financial risk and viability. The case study areas are described below.

Table ES1: Case Study Areas

Site / Location	Native regrowth	Plantation
Site 1. SE NSW – Towamba (Eden)	Silvertop Ash even-aged regrowth • Current age 35 to be commercially thinned • Age 7 to be non-commercially thinned	Sydney Blue Gum / Spotted Gum - 40 year rotation with thinning at age 24
Site 2. NE NSW - Ellangowan (Casino)	Spotted/Ironbark/Grey Box • Age 35 to be commercially thinned • Age 7 to be non-commercially thinned	Spotted Gum - 40 year rotation with thinning at age 24
Site 3. NE NSW - Barranganyatti (Kempsey)	Blackbutt • Age 35 to be commercially thinned • Age 7 to be non-commercially thinned	Blackbutt - 40 year rotation with thinning at age 18

Assumptions

Determining potential returns from plantations and managing regrowth forests is highly dependent on productivity assumptions. There is inherent uncertainty in modelling growth and yield of hardwood plantations and native forests. A moderate view of productivity in this analysis has been adopted, whilst results are also highly dependent on the specific site characteristics, regimes adopted, and costs and log prices assumed. Empirical yield data was limited for both plantations in the Eden region (South Coast), and for regrowth forests on all sites. Product allocations were derived from industry sources and verified from published data. It is assumed in this analysis that the hardwood plantations would be eligible for carbon credits. ACCU yields have been estimated for the three case study areas and incorporated into the model.

Modelling assumptions are tabled below.

Table ES2: Plantation - scenario regimes and modelling timeframe (yrs)

Plantation	Eden	Ellangowan	Barranganyatti
Species	*Spotted Gum*	*Spotted Gum*	*Blackbutt*
Scenario	*1*	*2*	*3*
Thin age (yrs)	24	24	18
CF age (yrs)	40	40	40
Modelled MAI (m^3/ha/yr)	8	8	12

Table ES3: Regrowth - scenario regimes and modelling timeframe (yrs)

Regrowth	Eden		Ellangowan		Barranganyatti	
Species	*Silvertop Ash*		*Spotted Gum*		*Blackbutt*	
	Advanced regrowth	*Young regrowth*	*Advanced regrowth*	*Young regrowth*	*Advanced regrowth*	*Young regrowth*
Scenario	*4*	*5*	*6*	*7*	*8*	*9*
Current age	35	7	35	7	35	5
Espacement age	n.a.	7	n,a.	7	n.a.	5
Commercial thin age	35	25	35	25	35	20
Final harvest age	60	50	60	50	60	50
Modelled MAI	4	6	2	4	8	10

n.a. – not applicable. MAI – mean annual increment

Industry benchmarks have been used to derive establishment, roading, harvesting and transport costs. Transport distance strongly influences thinning profitability. The base case assumes sawlog markets are within 30 kilometre (km), and pulp markets reflect current haulage distances for Eden (<50 km) and the North Coast (>200 km). Site-specific distances test sensitivity to market access, particularly for pulpwood.

Management overheads, annual costs and land cost assumptions also have a significant impact on returns. A land cost for new plantations has been assumed at $5000 per hectare (ha), while native forests could be seen to carry no holding cost, but for the purposes of this comparison are charged at $500 per ha. Log prices have been benchmarked against industry sources.

Financial comparison

Applying the base assumptions where land is charged to the plantation via a notional rent, and haulage distances are set at 30km for sawlog and 50km to 290km for pulplogs, returns can be calculated for each scenario. The table below sets out a series of measures for each scenario encompassing net present value (NPV), internal rate of return (IRR) and a cost-benefit ratio (CBR).

Table ES4: Base case (land cost included) – comparative returns

Location	Eden			Ellangowan			Barranganyatti		
Forest type	Plant'n	Adv Reg	Young Reg	Plant'n	Adv Reg	Young Reg	Plant'n	Adv Reg	Young Reg
NPV	-5 078	4 993	-397	-6 952	935	-1 738	-981	-1 676	-1 005
IRR	-	20.4%	5.4%	-	10.4%	2.2%	5.4%	3.2%	4.3%
CBR*	0.57	1.69	0.89	0.45	1.14	0.51	0.93	0.94	0.82

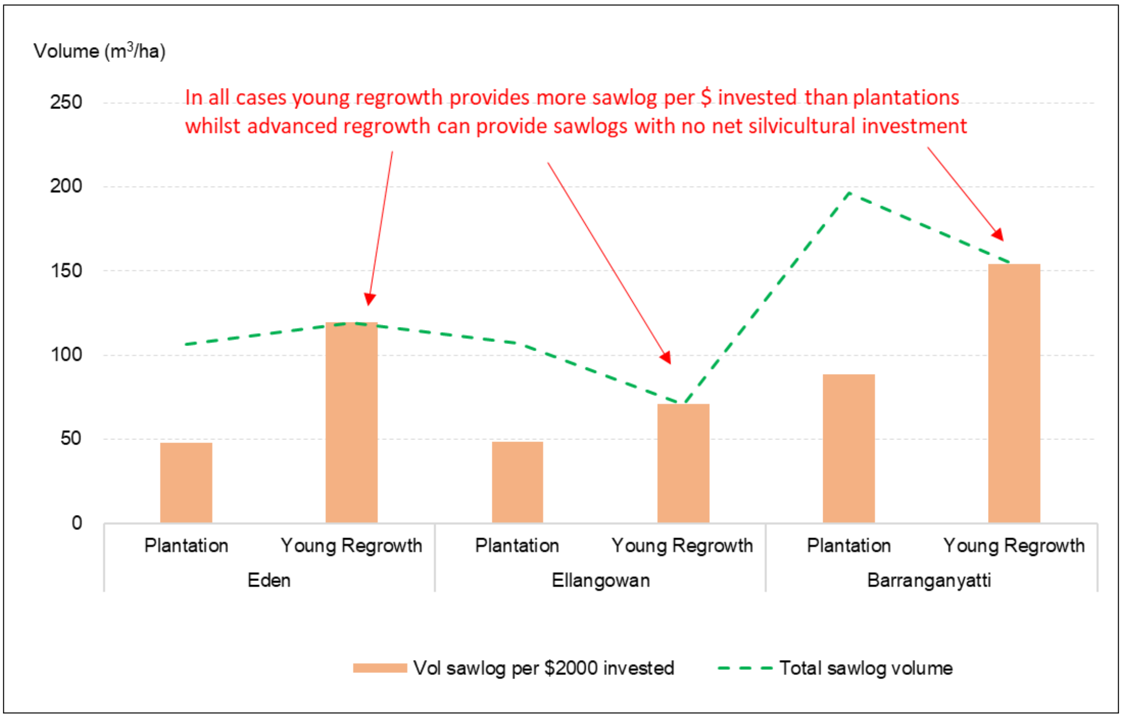
*Cost-Benefit Ratio – PV of all revenues / PV of all costs. Where >1 benefits exceed costs.

Sensitivity analysis demonstrates that:

- access to markets within 80km is a key to ensuring thinnings can be undertaken profitably and hence provide positive cashflows early in the investment timeframe.
- Removing or reducing land costs and offering a high carbon price only provides significant benefits to plantations when productivity is relatively high.
- Although there is considerable uncertainty in terms of productivity and thinning growth responses across all the scenarios, the analysis does not suggest altering productivity assumptions within +/- 25% will have a significant impact on returns overall.

The major advantage in managing existing native forest regrowth for hardwood sawlog production is the low input costs required and capacity to utilise an existing resource. Figure ES4 demonstrates the returns in sawlog volume per ha for $2000 invested in silvicultural works.

Figure ES4: Comparison of total sawlog volume and investment impact



Social impacts

The most pronounced social implications from plantations arise from visible land-use change. Plantations on cleared farmland generally face fewer regulatory hurdles but can encounter local community concerns. Intensive native forest management, while often subject to greater scrutiny, benefits from established governance systems, and potentially a history of low impact management with an existing and stable land use.

Overall comparison

The following summaries the effects of the differing approaches.

Table ES5: Comparative summary

Aspect	New Hardwood Plantation	Regrowth Native Forest
Investment summary	***Capital-intensive, long-duration investment with persistent negative cash flows***	***Low-carrying-cost investment with minimal interim exposure and value concentrated at maturity.***
Base case NPV ($ per ha)	***-$900 to -$6900***	***-$1700 to $5000***
Cost benefit ratio	***0.45 to 0.93***	***0.51 to 1.69***
Key drivers of Returns	Returns highly dependent on land cost and carbon price	Returns highly dependent on access to pulp / low grade markets for thinnings
Upfront Cost	High establishment and early-stage management costs.	Low upfront cost; forest already established, but improvement such as espacement may be needed.
Time to Returns	Predictable rotations but long delay before first harvest.	Potentially shorter if regrowth is mature; yields variable.
Silvicultural Control	Full control over species, genetics, spacing and management should provide higher productivity.	Limited control over genetics, spacing and uniformity; relies on stand improvement.
Timber Quality	Consistent, predictable wood quality and form.	Potential for high-value sawlogs but variable form and higher levels of defect.
Environmental & Biodiversity	Lower biodiversity at establishment; simpler but less diverse stand structure.	Maintains existing biodiversity and habitat structure; strong ecological value.
Risk Profile	High early-stage risks (mortality, drought), but more predictable long-term risk management.	No establishment risk, but higher exposure to natural disturbances and variable stand condition.
Regulatory Settings	Clearer regulatory pathway on cleared land; may involve land-use change approvals.	Often highly regulated with public scrutiny; current approvals (e.g. PNF Plans max term of 15 years).
Carbon Profile	Current method, relatively low yields	High existing carbon stocks; no current pathway

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ABBREVIATIONS

ACCU	Australian Carbon Credit Units
CBR	Cost Benefit Ratio
FCNSW	Forestry Corporation of NSW
IRR	Internal Rate of Return
MAI	Mean Annual Increment
NEFH	North East Forestry Hub
NSW	New South Wales
NPV	Net Present Value
PNF	Private Native Forest
SEFH	South East Forestry Hub

1. INTRODUCTION

This report investigates the operational (direct) economic, social and environmental costs and benefits of thinning regrowth forests compared to developing new hardwood plantations.

1.1 Background to Regional Forestry Hubs

The Regional Forestry Hubs were established as part of the Australian Government policy *Growing a Better Australia, A billion trees for jobs and growth*[1]. One of the key roles of the Hubs is to provide advice to the Commonwealth Government that will assist in addressing regional issues in the forestry sector and to stimulate growth.

The South East Forestry Hub (SEFH) covers the NSW region east of the Great Dividing Range north of the Victorian Border and south of Goulburn to the coast. Contained within the Hub are the NSW forestry towns of Bombala, Eden and Narooma. The Hub region contains native forests which extend from the top of the coastal range to the coastline. Forests of note include the spotted gum forests between Narooma and Nowra and stringybark-messmate and ash forests in the south and west. Pine plantations are concentrated around the Bombala area in the south, with smaller areas in the ACT, and around Moss Vale and Tallaganda in the north of the Hub.

The North East Forestry Hub (NEFH), established in April 2019, covers the NSW region from Sydney north to the Queensland border. It comprises significant areas of native forests, hardwood and softwood plantations, with a number of forestry towns including Wauchope, Kempsey, Herons Creek, Grafton and Kyogle.

1.2 Project background

A key strategic objective of the Hubs is to enhance resource security for the industry, the SEFH and NEFH are seeking to explore two alternative pathways that increase hardwood sawlog production: via either establishing new hardwood plantations or thinning of regrowth native forest.

The alternatives have distinctly different characteristics. New hardwood plantations generally require access to good quality grazing land, incur significant capital to purchase land and establish, and take three to four decades to produce sawlogs.

Developing new hardwood plantations in coastal NSW is challenged with previous attempts affected by species and silviculture research limitations. Whilst substantial areas of plantation have been established on the NSW North Coast, success has been highly variable and very much site and species specific.

Regrowth is an existing resource that with a level of silvicultural investment could be managed to produce sawlogs in a shorter timeframe compared to new plantations. Studies in Victoria have demonstrated that intensively managed forests may produce an equivalent quantity of sawlogs at 50 years as unmanaged stands might realise at 80 years.

Private landowners and Forestry Corporation of NSW (FCNSW) own and manage around 40% of the natural forests in the SEFH, and around 60% in the NEFH. Given the cost and risk of developing new hardwood plantations, a question arises is there a more cost-efficient option to a region if funds are invested in the thinning and management of natural regrowth forests compared to the development of new plantations? The project purpose is therefore to compare the direct economic, social and environmental costs and benefits of these timber growing options.

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[1] Department of Agriculture and Water Resources (2018) *Growing a better Australia – A billion trees for jobs and growth*, Canberra. CC BY 4.0. ISBN 978-1-76003-174-9 (printed)

1.3 Study scope and approach

The following defines the project methodology to investigate the direct economic, social and environmental costs and benefits of thinning regrowth forests compared to developing new hardwood plantations.

1.3.1 Financial analysis

The financial analysis entails the development of simple modelling of the expected log yields and timing, and related cashflows and returns from the two options.

The analysis has developed representative yields based on the following:

- Hardwood plantation
  - Derivation of yields representative of the SE Hub region from industry sources including through the use of FullCAM[2] derived yields
  - Derivation of yields representative of the NE NSW Hub region from industry sources supported through the use of FullCAM derived yields
- Thinning of regrowth native forests
  - Derivation of yields of thinning response yields reported in a black and grey literature review (see Annex 1), along with industry sources.

Costs and prices have been sourced from industry and Indufor internal databases, applying benchmark rates representative of the South East (SE) and North Coast forests.

This analysis also includes limited sensitivity analysis to test the impacts of:

- costs of establishment of plantations;
- commerciality of thinning regrowth, and the degree to which positive stumpages could be generated, and the impact of thinning age on commerciality;
- including / excluding carbon revenue;
- differing land costs; and
- productivity assumptions.

Returns are compared on a Benefit-Cost Ratio (BCR), Net Present Value (NPV) and Internal Rate of Return (IRR) basis, as well as illustrative metrics such as potential area treated or volume produced given a specified level of investment.

1.3.2 Social impacts

The potential impacts on local communities are considered in a short review of the potential impacts of implementing a program of moderate scale under the two alternatives. This has involved a synthesis of published reports on the social impacts of plantation development and low-intensity native forest harvesting.

1.3.3 Risk analysis

The final component of the project is a risk analysis that considers the economic, social and environmental risks of the options. This includes the areas of uncertainty in terms of cost inputs, productivity, carbon and timber yields, markets and prices.

[2] FullCAM – Full carbon accounting model
https://www.dcceew.gov.au/climate-change/publications/full-carbon-accounting-model-fullcam

2. CASE STUDY DETAILS

Three case study areas have been selected to illustrate the financial returns and associated risks of the two management options. Each area represents a distinct combination of forest type, site productivity and operational context, allowing the comparison to capture a realistic range of economic outcomes. By analysing performance across these varied settings, the assessment highlights how returns can differ under each option and identifies the key factors that influence financial risk and viability. The case study areas are described below.

Table 2-1: Case Study Areas

Site / Location	Native regrowth	Plantation
Site 1. SE NSW – Towamba (Eden)	Silvertop Ash even-aged regrowth • Current age 35 to be commercially thinned • Age 7 to be non-commercially thinned	Sydney Blue Gum / Spotted Gum - 40 year rotation with thinning at age 24
Site 2. NE NSW - Ellangowan (Casino)	Spotted/Ironbark/Grey Box • Age 35 to be commercially thinned • Age 7 to be non-commercially thinned	Spotted Gum - 40 year rotation with thinning at age 24
Site 3. NE NSW - Barranganyatti (Kempsey)	Blackbutt • Age 35 to be commercially thinned • Age 7 to be non-commercially thinned	Blackbutt - 40 year rotation with thinning at age 18

2.1 Key assumptions

A full list of modelling assumptions is tabled in Annexure 2. This section tables and discusses the most critical inputs into the analysis. It is noted that determining potential returns from plantations and managing regrowth forests is highly dependent on productivity assumptions. There is inherent uncertainty in modelling growth and yield of hardwood plantations and native forests. A number of sources have been used to derive what might be considered a reasonable (neither optimistic or conservative) view of productivity in this analysis, whilst results are also highly dependent on the specific site characteristics, regimes adopted, and costs and log prices assumed.

Because plantation development and regrowth treatment costs, management and production costs, and log prices have been held constant across sites, the results are most meaningful for comparing alternate pathways rather than for absolute evaluation of any single pathway.

The modelled scenarios, based on the case study areas and selected species are set out in Table 2-2 and Table 2-3 below. While yields have been modelled over 40 years for plantations, 60 years for advanced regrowth and 50 years for young regrowth, the financial analysis will be compared over a timeframe of up to 40 years, with plantations established in Year 1, whilst regrowth forests are currently assumed to be young (7 years) or advanced (35 years).

Table 2-2: Plantation - scenario regimes and modelling timeframe (yrs)

Plantation	Eden	Ellangowan	Barranganyatti
Species	*Spotted Gum*	*Spotted Gum*	*Blackbutt*
Scenario	*1*	*2*	*3*
Thin age (yrs)	24	24	18
CF age (yrs)	40	40	40
Modelled MAI (m^3/ha/yr)	8	8	12

Table 2-3: Regrowth - scenario regimes and modelling timeframe (yrs)

Regrowth	Eden		Ellangowan		Barranganyatti	
Species	*Silvertop Ash*		*Spotted Gum*		*Blackbutt*	
	Advanced regrowth	*Young regrowth*	*Advanced regrowth*	*Young regrowth*	*Advanced regrowth*	*Young regrowth*
Scenario	*4*	*5*	*6*	*7*	*8*	*9*
Current age	35	7	35	7	35	5
Espacement age	n.a.	7	n,a.	7	n.a.	5
Commercial thin age	35	25	35	25	35	20
Final harvest age	60	50	60	50	60	50
Modelled MAI	4	6	2	4	8	10

n.a. – not applicable

2.1.1 Establishment and production costs (direct)

Industry benchmarks have been used to derive establishment, roading, harvesting and transport costs. These are listed in Table 2-4 for the two forest types below. While regrowth espacement data is not readily available, a sum of $2000 per ha has been adopted as a reasonable estimate of what might be required to mechanically thin young regrowth and is also equivalent to the current SPE[3] grants available from the Australian Government for plantation establishment in Australia.

Roading, harvesting and transport costs are all assumed to be marginally higher for native regrowth compared to plantations due to more challenging operating environments, however empirical data is not readily available to test the validity of this.

[3] https://www.agriculture.gov.au/agriculture-land/forestry/industries/support-plantation-establishment-program

Table 2-4: Base cost assumptions

Item	Plantation	Regrowth	Unit
Establishment (Year 0)	-3 570	0	$/ha
Establishment (Year 1)	-710	0	$/ha
Establishment (Year 2)	-150	0	$/ha
Espacement costs (Year 7 where applicable)	0	-2 000	$/ha
Establishment and Tending Total	**-4 330**	-2 000	**$/ha**
Thin 1 harvesting	-50	-60	$/m^3
Thin 2 harvesting (where applied)	-40	-50	$/m^3
CF harvesting	-35	-45	$/m^3
Roading	-5	-7	$/m^3
Transport	-0.20	-0.22	$/m^3/km

Source: Industry benchmarks

As discussed above, transport distance can have a profound impact on the profitability (and therefore the commerciality) of thinning. The base case assumes that sawlog markets are available within a 30 kilometre (km) of the case study areas, whilst pulp markets reflect current common haulage distances for Eden (less than 50km) and the North Coast (over 200km). Clearly this is highly dependent on the products produced and markets available at the time of thinning. Site specific transport distances have been assigned to each case study area to test the impact of distance to established markets, particularly pulpwood. These are set out in Table 2-5 below.

Table 2-5: Transport assumptions (base case)

Forest	Pulp (km)	Sawlog (km)
Eden	50 (Edrom)	30 (Eden)
Ellangowan	220 (Brisbane)	30 (Casino)
Barranganyatti	290 (Heatherbrae)	30 (Kempsey)

2.1.2 Annual costs including land

Annual overheads (largely indirect costs) include general management, fire trail and track maintenance, fuel, weed and pest management and fencing. It is assumed that these are less intensive (on a per ha basis) for regrowth forests than plantations. The modelled overheads are lower than industry benchmarks on the assumption that smaller forest owners would absorb many of the management costs into their existing business.

Land costs have been treated as a notional annual rent rather than an upfront capital cost. This allows a better comparison regardless of whether land is being purchased for greenfield plantation establishment or taken out of agricultural production and converted to plantation on the investors existing property. In this comparison, it is assumed that the regrowth forest has been assigned some value, to reflect how native vegetation is typically valued despite having relatively low economic potential compared to cleared agricultural land. The base assumptions are set out in Table 2-6 below.

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Table 2-6: Base annual costs (including land charge)

Item	Plantation	Regrowth
Area-based overheads ($ per ha per year)	-75	-15
Assumed land value ($ per ha)	*5 000*	*500*
Annual land rent % (per year)	*3.5%*	*3.5%*
Land rent including rates ($ per ha per year)	-195	-20
Annual costs total ($ per ha per year)	**-270**	**-35**

Source: Industry benchmarks

Note. The latest data on farmland values for the respective case study areas price cleared farmland at between $12,000 and $16,000 per ha[4]. A conservative view of prices has been adopted in this analysis to convey an optimistic view of plantation returns in the comparison.

2.1.3 Thinning – commercial or non-commercial

A target final stand density of 150–400 stems per hectare (sph) is maintained at harvest to promote the production of a balanced log mix, including a sufficient proportion of larger-diameter trees suitable for sawlog recovery[5]. Plantations are typically established at 1000 to 1200 (sph) with an objective to thin to 250 sph prior to final harvest. Naturally regenerating regrowth forests have been estimated to contain as many as 85,000 sph within 6 months of a fire and 30,000 sph at age 9[6].

Responses to thinning vary according to stand age, genotype, climate, soils, understorey competition, and thinning intensity. The primary growth responses arise from increased water availability and improved access to light and nutrients. Thinning generally increases diameter growth of the retained trees with little reduction in total stand volume, particularly when undertaken soon after crown closure in fast-growing species such as Silvertop Ash. Timing is less critical for persistent (shade tolerant) species[7].

Thinning spans a continuum from early, high-cost treatments with strong growth responses to later, lower-response interventions that may be commercially self-funding. Optimal timing balances diminishing growth response against improving harvesting economics. These economics are driven by:

- Harvesting costs – will decrease as tree size increases with age and productivity
- Terrain, ground conditions, machinery type and operating scale
- The type and yield of products produced and available markets
- Transport distance.

Non-commercial thinning (espacement)

Early thinning is particularly advantageous in densely stocked, fast-growing eucalypt forests such as blackbutt. Early non-commercial thinning reallocates site resources to fewer stems, accelerating diameter growth and shortening the time required to reach commercial size. Evidence from regrowth *E.regnans* in Victoria showed that forests thinned at five years and

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[4] 2025 Australian Farmland Values Report, Bendigo Bank Agribusiness

[5] Environment Protection Authority. (2010). Silvicultural guidelines (DECCW 2010/177) [PDF]. NSW Government. https://www.epa.nsw.gov.au/sites/default/files/10177silviculture.pdf

[6] DAFF (2005). Yield equations for regrowth forests regenerated from fire on the southeast coast of New South Wales. Canberra: Australian Government Department of Agriculture, Fisheries and Forestry

[7] Connell, M (unpub). Report on growth and yield for use in developing the VicForests Thinning Strategy (VicForests, 2005)

again at 20 years can, by age 50, produce nearly as much sawlog volume as unthinned stands do at 80 years[8].

Non-commercial thinning, often referred to as *espacement*, is the selective removal of trees in a young stand without generating saleable products, with the aim of improving spacing, growth rates, stem form, and overall stand quality. Unlike commercial thinning, no revenue is generated at the time of treatment and therefore is treated as an investment in future stand performance. In this analysis, young regrowth across all three regrowth forest types is assumed to be non-commercially thinned at age 7 yrs (current age), with a theoretical objective of reducing stand density to around 700 sph.

Commercial thinning, final harvest and other production costs

A forest thinning operation that generates revenue from the production and sale of forest products is considered to be 'commercial' even though in some cases it might need to be subsided in order to achieve a silvicultural benefit. This analysis assumes that all plantations are commercially thinned between 18 and 24 years, and regrowth forests receive a single commercial thin (assumed to be around age 35) in the first year of the financial analysis. Final harvest logging costs will vary depending upon terrain, yields and tree size so will generally be significantly less than thinning costs.

Roading costs will again be highly site specific, however it is assumed that plantation costs might be a little less than native forests due to higher yields per ha and the potential for existing access to be in place.

Table 2-7: Production costs

Item	Plantation	Regrowth
First thinning ($ per m^3)	-60.00	-70.00
Final harvest ($ per m^3)	-50.00	-60.00
Roading ($ per m^3)	-5.00	-7.00
Transport ($ per m^3 per km)	-$0.20	-$0.22

Source: Industry benchmarks

2.1.4 Log prices

Assumed log prices can be highly variable for a given quality based on whether they reflect current or future demand, the potential end use including engineered wood products, and whether plantation products might command a premium over native regrowth due to consistency of genetics and management history. The following prices have been adopted from the NEFH Report (July 2024)[9], and adjusted slightly to account for future demand and current premiums understood to be payable for private property supply.

[8] Environment Protection Authority. (2010). Silvicultural guidelines (DECCW 2010/177) [PDF]. NSW Government. https://www.epa.nsw.gov.au/sites/default/files/10177silviculture.pdf
[9] North East NSW Forestry Hub (July 2024) Evaluation of the financial performance of existing hardwood plantations in North East New South Wales (Mia Cassidy and Graeme Palmer, SCU)

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Table 2-8: Log price assumptions

Log grade / type		Eden ($ per m^3) Benchmark Stumpage	Eden ($ per m^3) Assumed MDP	Benchmark Stumpage	North Coast ($ per m^3) Assumed MDP
Pulp		20	90	n/a	90
Low Quality Sawlog (LQ)		30	100	30	100
High Quality Sawlog	> 20cm SED (HQ20)	40	110	40	110
	> 30cm SED (HQ30)	70	140	70	140
	> 40cm SED (HQ40)	150	220	150	220

Source: NEFH, industry sources. Note – MDP – mill door price

2.1.5 Yields

Empirical data was limited for both plantations in the Eden region (South Coast), and for regrowth forests on all sites. Yields curves have been generated for each location and scenario, and calibrated against available data, including product allocations. FullCAM provides an indication of potential site productivity values via the reported standing stem volume, which has been converted to a merchantable MAI[10] for each site. This data has been cross-referenced from independent sources and there is clearly a significant and impactful range. The results have been modified to reflect expected productivity for each site based on mid-range estimates.

Table 2-9: Productivity assumptions for each scenario

Scenario	1	2	3	4	5	6
Location	Eden		Ellangowan		Barranganyatti	
Forest Type	Plantation	Regrowth	Plantation	Regrowth	Plantation	Regrowth
Species	*Spotted Gum*	*E.sieberi*	*Spotted Gum*	*Spotted Gum*	*Blackbutt*	*Blackbutt*
Modelled FullCAM species	*E.clad*	*Tall Open Forest*	*CCV**	*Tall Open Forest*	*Blackbutt*	*Tall Open Forest*
Benchmark range[11]	*2 to 10*	*3 to 14*	*2 to 10*	*1 to 4*	*5 to 12*	*8 to 11*
Modelled MAI	***8***	***4 to 6***	***8***	***2 to 4***	***12***	***8 to 10***

Source: Refer to footnote 9, industry benchmarks

* *Corymbia citriodora subsp. variegata*

Product allocations were derived from industry sources and verified from published data including FCNSW harvest plans. For plantation and regrowth forests. Log classes adopted are outlined in Table 2-10.

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[10] Mean Annual Increment (m^3/ha/yr) based on 40 years for plantation and 50 years for regrowth forests

[11] Regrowth data sourced from Venn, T., Lewis, T., Timperley, M., Baynes, J., Covey Associates Pty Ltd, Ryan, S., & Kathuria, A. (2024). *Recognising the carbon sequestration potential in native regrowth forests: A report for the North East NSW, South East NSW, South & Central QLD and North QLD Regional Forestry Hubs*. North East NSW Forestry Hub & partner forestry hubs.
Plantation data from confidential industry sources and cross referenced from North East NSW Forestry Hub (July 2024) *Evaluation of the financial performance of existing hardwood plantations in north east New South Wales* (Mia Cassidy and Graeme Palmer, SCU)

Table 2-10: Log classes modelled

Log Type	Thinning	Clearfall
High Quality Sawlog >40cm	Th_HQ40	CF_HQ40
High Quality Sawlog >30cm	Th_HQ30	CF_HQ30
High Quality Sawlog >20cm	Th_HQ20	CF_HQ20
Low Quality Sawlog >20cm	Th_LQ	CF_LQ
Pulplog	Th_Pulp	CF_Pulp

As the regrowth forests are modelled to be thinned around age 35, thinning product allocations were the same as those adopted for plantations at ages 18 – 24. This is in recognition of the regrowth forest carrying a much higher stocking (assuming an unmanaged regime to date).

Regrowth forests have also been modelled on the basis that a reasonable level of stocking would be retained after final harvest for environmental benefits and to provide seed and cover for a regeneration crop.

Table 2-11: Modelled yields by scenario and operation

Location	Eden			Ellangowan			Barranganyatti		
Forest type	Plant'n	Adv Reg	Young Reg	Plant'n	Adv Reg	Young Reg	Plant'n	Adv Reg	Young Reg
Modelled MAI	7.9	4.3	6.2	7.8	2.6	3.7	12.9	8.7	9.1
Age (years)									
Current	0	35	7	0	35	7	0	35	5
Thinning	24	35	25	24	35	25	18	35	20
Final harvest	40	60	50	40	60	40	40	60	50
Yields (m^3 per ha)									
T1 Pulp	79	60	56	66	36	33	86	124	86
T1 Sawlog	29	22	21	24	13	12	27	39	27
CF Pulp	130	103	135	140	63	80	232	229	216
CF Sawlog	77	75	99	83	46	59	169	129	127

2.1.6 Carbon

Under the ACCU Scheme Plantation Forestry Method, carbon credits may be available for plantations, subject to the project meeting key criteria. It is assumed in this analysis that the hardwood plantations would meet the criteria for Schedule 1 ACCU Scheme projects (new plantations). ACCU yields have been estimated for the three case study areas and incorporated into the model. A carbon price has been conservatively adopted at $35 per ACCU (held flat real), being the average recent spot price.

2.1.7 Discount rate

For the purposes of a comparison of returns on an NPV basis, a real pre-tax discount rate **of 6%** has been adopted for both plantation and native regrowth. This is at the low end of the current range used by commercial forest owners in Australia to value assets and evaluate investment opportunities. It could be argued that the rate for managing regrowth could be lower to reflect the level of risk associated with managing an existing, established asset that does not require a large capital upfront investment, compared to a greenfield plantation. It might also be argued that a private landholder that is utilising existing land to diversity income might accept a lower rate of return. However, there are counterbalancing market and productivity risks associated with native forestry that suggest a simple discount rate applied to all scenarios might be adequate.

2.2 Comparison of financial returns

The most common metric for comparing forest management options is standard NPV and IRR values. These may not be that useful in this context as the modelled cashflow profiles are markedly different between the scenarios, with returns from hardwood plantations typically strongly negative and, in some cases, never generate cumulative positive cashflows. Several other measures have been applied that may provide a better indication of the relative returns and the most critical assumptions that drive sensitivity of the analysis.

Base assumptions

Applying the base assumptions where land is charged to the plantation via a notional rent, and haulage distances are set at 30km for sawlog and 50km to 290km for pulplogs, NPVs can be calculated for each scenario. Table 2-12 sets out a series of measures for each scenario encompassing NPV, IRR and a cost-benefit ratio (CBR).

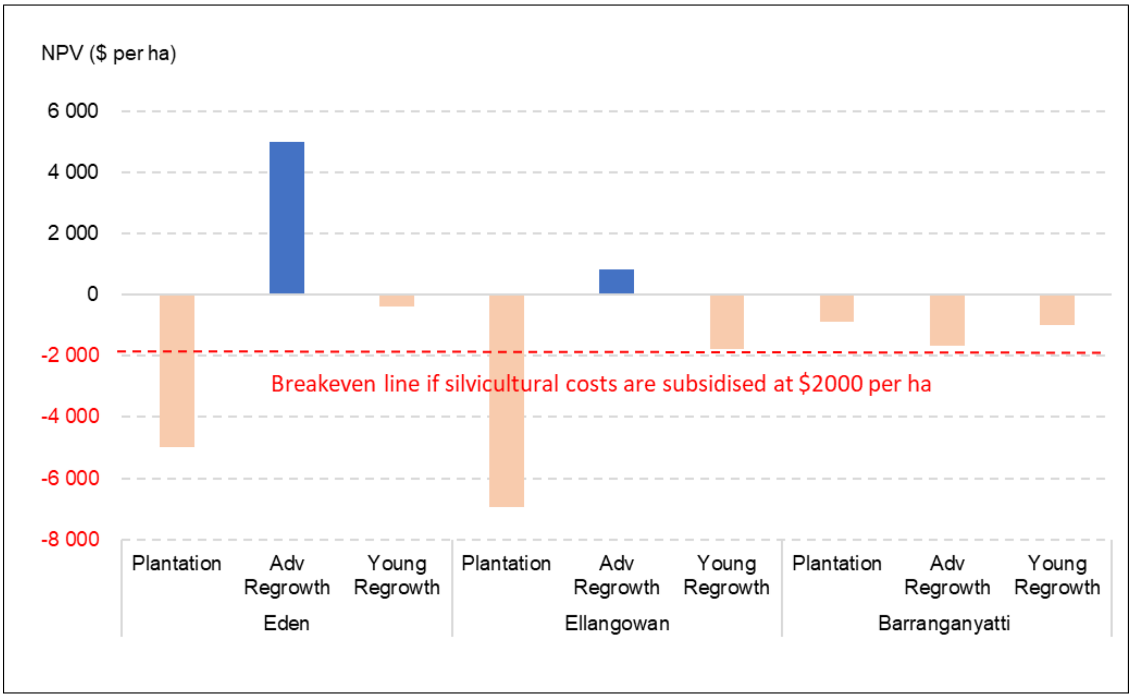
Table 2-12: Base case (land cost included) – comparative returns

Location	Eden			Ellangowan			Barranganyatti		
Forest type	Plant'n	Adv Reg	Young Reg	Plant'n	Adv Reg	Young Reg	Plant'n	Adv Reg	Young Reg
NPV	-5 078	4 993	-397	-6 952	935	-1 738	-981	-1 676	-1 005
IRR	-	20.4%	5.4%	-	10.4%	2.2%	5.4%	3.2%	4.3%
CBR*	0.57	1.69	0.89	0.45	1.14	0.51	0.93	0.94	0.82

*Cost-Benefit Ratio – PV of all revenues / PV of all costs. Where >1 benefits exceed costs.

Figure 2-1 provides a simplified comparison of returns as measured by net present value (NPV). It illustrates that all plantation operations are strongly negative even when establishment costs are subsidised. Advanced regrowth forests generate a positive NPV except for Baranganyatti that suffers from a long distance to pulp markets. Were silvicultural grants made available, all young regrowth scenarios would generate a positive return.

Figure 2-1: NPV Summary by scenario including the impact of a $2000 silvicultural grant

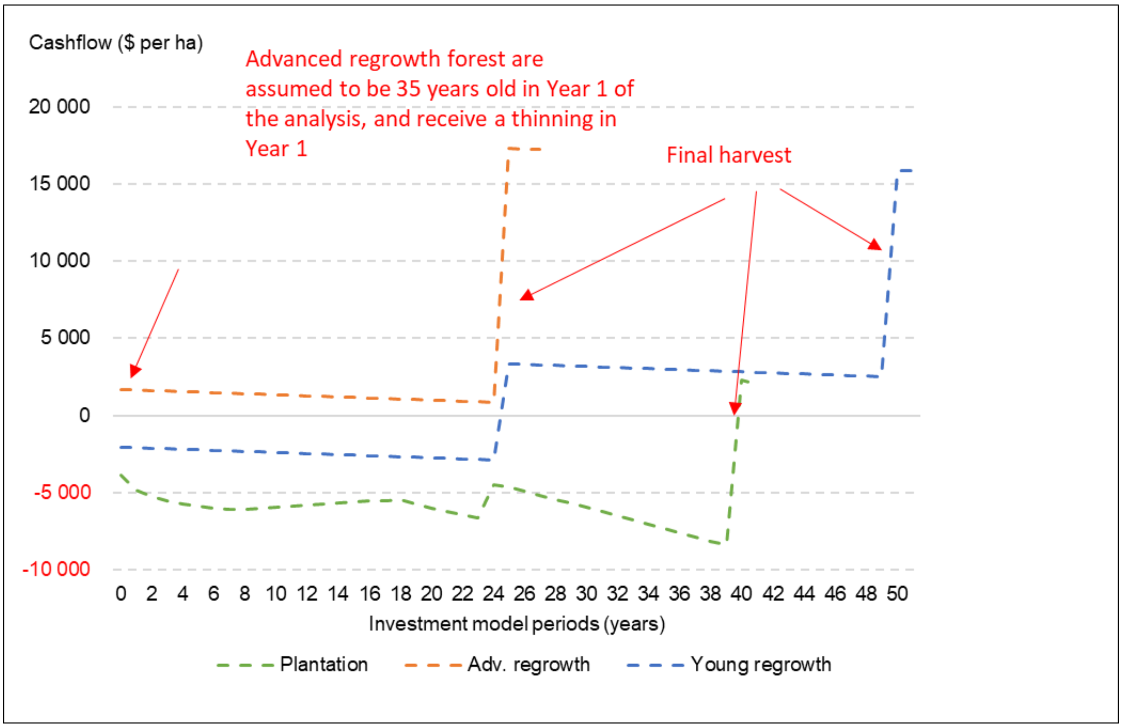


By far the biggest influence on NPV is the cost of establishment for plantations, and the positive impact of timber revenue achieved at thinning of the advanced regrowth forests (which occurs in the first year of the analysis).

Cumulative cashflow comparison

Under the base case where land costs are incurred, Figure 2-2 illustrates the challenge for plantations in that cumulative cashflows remain negative until final harvest (40 years). The regrowth options (in this Eden example) incur a lower annual cost, and benefit from positive returns at thinning, and an early final harvest for the advanced regrowth scenario.

Figure 2-2: Cumulative cashflow comparison* (including land costs)



* Eden example only

2.3 Sensitivity analysis

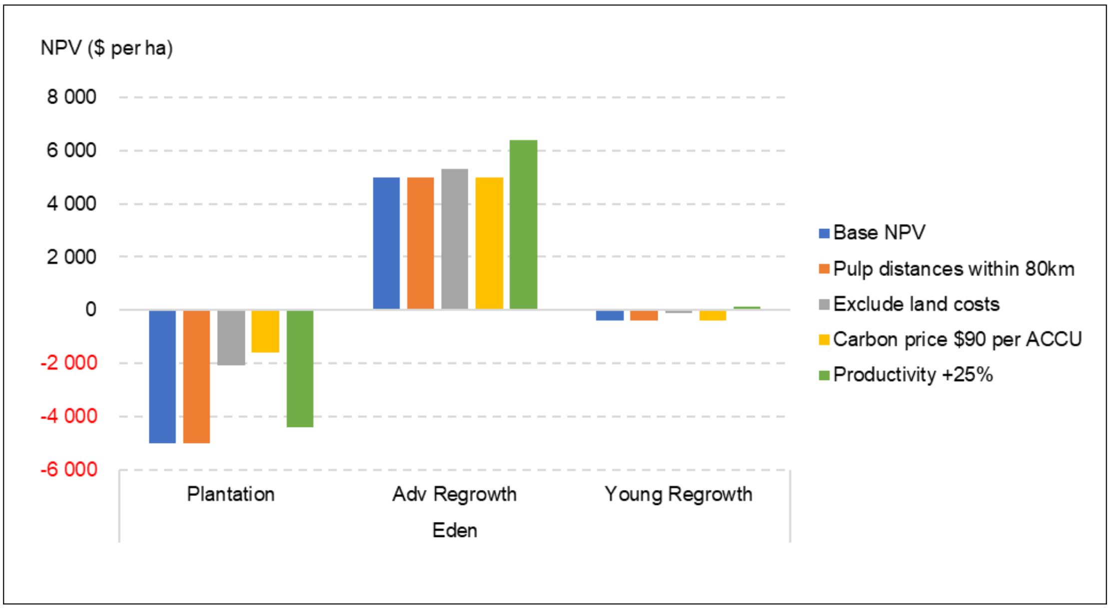
To test the impact of various assumptions, the following analysis has been conducted by varying the input variables with possible ranges that might be expected:

- commerciality of thinning regrowth, and the degree to which positive stumpages could be generated
- including / excluding carbon revenue
- differing land costs, and
- productivity assumptions.

Costs of establishment of plantations were also sensitised, however due to the low returns overall it had little influence on the outcomes for all three case study areas.

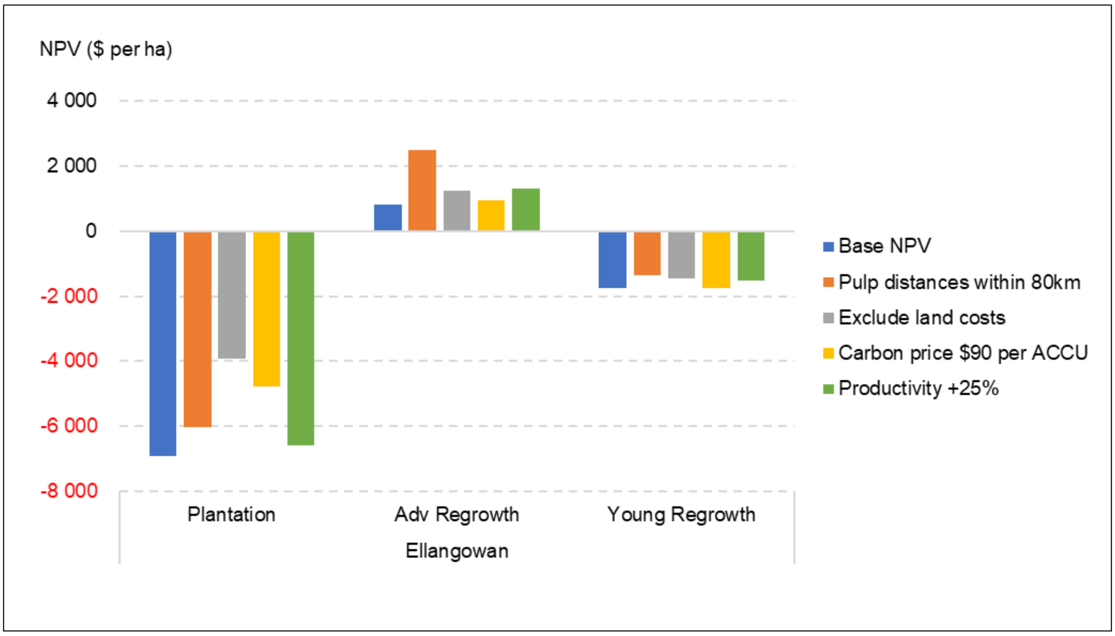
The three charts following depict the base NPV compared to the returns if each of the assumptions are changed. In Figure 2-3, changing the pulp haulage distance at **Eden** has no impact as it was assumed relatively close market was available in the base case. Removing land costs and applying a high carbon price provides a significant uplift for plantations.

Figure 2-3: Changes to NPV (@6% real) with modified assumptions (Eden)



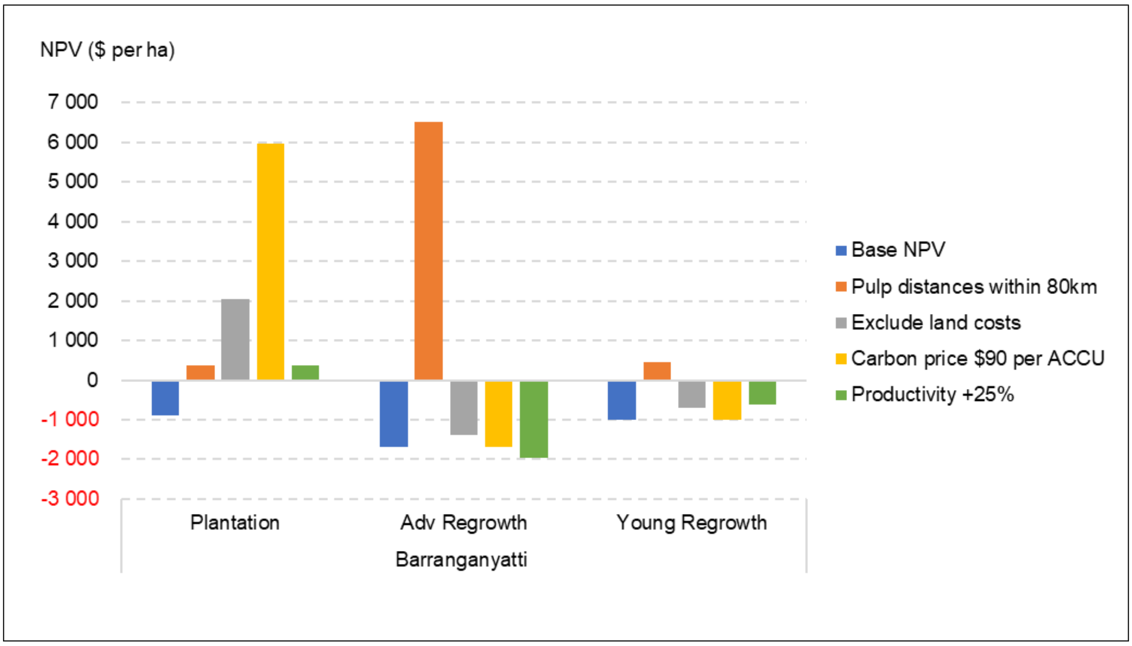
At **Ellangowan**, reducing the distance to a pulp market provides a significant uplift particularly for advanced regrowth as the reduction in transport costs is realised in the first year of the investment cashflow. This is illustrated in Figure 2-4 below.

Figure 2-4: Changes to NPV (@6% real) with modified assumptions (Ellangowan)



Whilst a highly productive site, returns at **Barranganyatti** are severely impacted by a lack of pulp markets. The very high yielding thinning in advanced regrowth in the first year of the investment means that it incurs a significant loss in thinning, impacting the overall NPV. When this haulage distance is assumed to be reduced to 80km, returns from managing advanced regrowth could exceed over $6000 per ha (refer to Figure 2-5).

Figure 2-5: Changes to NPV (@6% real) with modified assumptions (Barranganyatti)



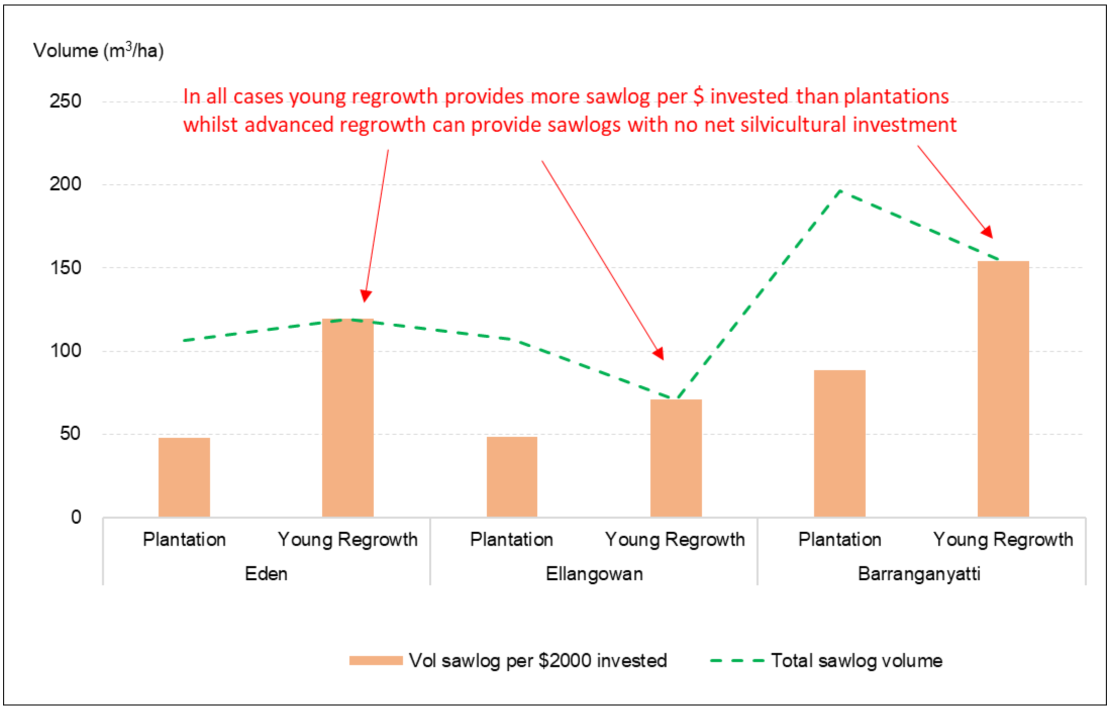
This sensitivity analysis demonstrates that access to markets within 80km is a key to ensuring thinnings can be undertaken profitably and hence provide positive cashflows early in the investment timeframe. Removing or reducing land costs, and offering a high carbon price only provides significant benefits to plantations when productivity is relatively high. Although there is considerable uncertainty in terms of productivity and thinning growth responses across all the scenarios, the analysis does not suggest altering productivity assumptions within +/- 25% will have a significant impact on returns overall. Other drivers are more profound.

2.4 Other observations

The major advantage managing existing native forest regrowth for hardwood sawlog production is the low input costs required and capacity to utilise an existing resource. Figure 2-6 demonstrates the returns measures in sawlog volume per ha for $2000 invested in silvicultural works. It highlights that:

- A $2000 investment in thinning young regrowth results in up to twice as much sawlog produced when compared to the same investment in plantations
- Both advanced regrowth and young regrowth could be expected to produce more sawlog per hectare than plantations on two of the three case study areas
- Advanced regrowth can produce significant quantities of sawlog without any upfront investment.

Figure 2-6: Comparison of total sawlog volume and investment impact



3. SOCIAL IMPACTS

Social impacts of establishing greenfield plantations have been the subject of numerous detailed studies and will vary by region and the context within which they are established. This contrasts with the management of existing native forests, where the proposed approach is not a land use change but more intensive management than may have been practiced in the past.

3.1 Land-use change

The most pronounced social implications from plantations arise from visible land-use change[12]. Establishing plantations on previously cleared farmland can fundamentally alter rural landscapes that communities identify as agricultural. Even where land is marginal or financially stressed, conversion to forestry may be perceived as a withdrawal from food production and a shift away from long-standing farming traditions.

In regions with strong pastoral identities, large-scale plantation establishment can generate resistance based on concerns about “locking up” land for long rotations, reduced flexibility for future land uses, and increased bushfire risk[13]. There may also be anxiety about external or corporate ownership, particularly if land consolidation accompanies plantation expansion. Community objections are often less about forestry per se and more about cumulative change, including fewer farm households, altered visual character, and perceived erosion of rural culture.

By contrast, more intensive native forest management does not involve a categorical land-use shift. The land remains forested and within an established production or conservation framework. As a result changes such as increased management intensity may be perceived as incremental rather than transformational.

3.2 Cultural and environmental values

Plantations on cleared farmland avoid impacts on remnant native ecosystems and may be viewed positively in terms of carbon sequestration, shelter, and landscape rehabilitation. However, monoculture plantations can be viewed negatively for their water consumption, potential fire risk, and lower visual diversity relative to more varied mixed farming landscapes.

In contrast, intensive native forest management can generate concern where native forests are valued for biodiversity and recreation, or other heritage values. However, on private land particularly where forests are already managed for timber, intensification of management, within existing regulatory frameworks may be less impactful. Selective harvesting, thinning, or improved silviculture may be socially acceptable when framed as stewardship that maintains forest cover and long-term productivity.

Importantly, native forest management often aligns with a narrative of continuity: forests remain forests. When practices are transparent and carefully managed, community concern may be moderated by recognition that active management can reduce fuel loads, enhance forest health, and sustain regional timber supply and associated economic development.[14]

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[12] Williams, K. J. H., & Schirmer, J. (2012). Understanding the relationship between social change and its impacts: The experience of rural land use change in south-eastern Australia. Journal of Rural Studies, 28(4), 538–548. https://doi.org/10.1016/j.jrurstud.2012.05.002

[13] Leys, Andrea & Vanclay, Jerome. (2010). Social learning study of plantation forestry in the Upper Clarence catchment of north-eastern NSW. 10.13140/RG.2.1.2986.8969.

[14] StollzNow Research. (2023). Forestry’s social licence to operate in North East NSW (Report prepared for North East NSW Forestry Hub). North East NSW Forestry Hub.

3.3 Social licence and governance

Plantations on cleared farmland generally face fewer regulatory hurdles but can encounter local opposition where development planning is insufficiently consultative. Social licence challenges are strongest when change is rapid or spatially concentrated. Effective engagement, staged development, and landscape-scale planning are therefore critical to minimising community angst.

Intensive native forest management, while often subject to greater scrutiny, benefits from established governance systems, and potentially a history of low impact management. Where landholders demonstrate sound compliance systems and are cognisant of local issues , social licence may be more stable than public debate suggests, particularly in regions accustomed to forestry activity.

4. RISK ANALYSIS

This section presents a comparative risk assessment of the alternative scenarios. A comparative risk assessment provides a structured framework to identify, analyse, and weigh potential outcomes, for more informed decision-making based on the relative risks of scenarios.

4.1 Approach

A key consideration in this process is clearly defining the perspective from which risks are assessed. Different stakeholders such as policymakers, local communities, landowners, investors, and environmental organisations - will perceive and prioritise risks differently based on their values, responsibilities, and exposure to potential consequences. Identifying the risk perspective results in risk assessments that are focused, specific, clear and unbiased.

For this comparison, risks have been considered and assessed from two distinct perspectives, to align with the objectives of the scope. These are:

1. *Risks from an investor or landowner*: This includes landholders involved in the investment in various ways.
2. *Risks from a regional community perspective*: This comprises local communities including local towns as well as regional communities.

4.2 Key risks

The identification of key risks was informed by previous studies[15] and the literature review conducted for various aspects of this study. Based on these two primary sources, the most prominent risks identified, from an investor perspective and a regional community perspective, are set out below (Table 4-1).

Plantations require high upfront capital and long rotations before achieving returns, creating exposure to establishment risks such as drought, pests and fire. Viability depends on stable long-term markets and sufficient regional scale to achieve efficiencies in management, harvesting and processing. Once established and approved, regulatory settings are generally more stable, though long-term land management policy certainty remains a critical factor. Plantation carbon is easier to quantify and be monetised. There is no current pathway for crediting carbon in native regrowth forests.

Regrowth native forests can provide earlier income where stands are mature, but returns are less predictable due to mixed species, variable quality and operational constraints. They face higher regulatory and policy risk, including changing harvest rules and time-limited approvals, which can quickly affect supply and investment certainty. Socially, plantations may raise land-use competition concerns, while native forest management may attract greater political and community scrutiny but avoids displacement of agricultural land.

[15] Murray Region Forestry Hub & Central West Forestry Hub. (2025). Land use review and comparison: The relative contribution of potential environmental plantings and harvestable timber plantations to regional economies in NSW and northern Victoria (Final Report)

Table 4-1: Comparison of risks

Risk Category	New Hardwood Plantations	Regrowth Native Forest
Investor / landowner risk perspectives		
Economic Viability	Very high upfront capital investment with long period before returns. Dependent on stable long-term markets for specific plantation species. Financial exposure during establishment including drought, pests.	Potential for immediate returns for advanced regrowth. Uncertainty due to variable stand quality, irregular growth rates, and fluctuating yields. Market value affected by defects and mixed species. Operational constraints (e.g., harvest exclusions) can reduce harvest volumes.
	Economic viability is highly related to scale – increased areas planted or managed within a region enable economies of scale in management, silvicultural, protection, harvesting, transport and downstream processing. Where scale is small, risks to the economic viability of plantations and native regrowth remain.	
Market & Industry Stability	Plantation supply may be more predictable, but markets may shift in the 10–30 year establishment horizon. Requires stable long-term planning and investor confidence.	Native forest operations (including downstream processing) may face policy changes, public scrutiny, and conflict with conservation stakeholders - risk of supply uncertainty or operational restrictions.
Regulatory & Policy Risk	Lower regulatory volatility once land-use approvals are secured. Long-term certainty needed in water and land-use policy, but overall a more stable environment.	High risk of policy shifts (e.g., changes to harvest rules, increased protection), which can rapidly affect viability. Compliance burden is significant. Notably current PNF Plans can be granted for a maximum of up to 15 years.
Climate & Environmental Risk	Young plantations may have high mortality risk during drought and impacts from pests and disease. Fire risk concentrated due to uniform age. Tolerance will depend on species selected and age.	Fire tolerance increases after 5 to 10 years post thinning with increased tree height and, diameter. The potential for natural regeneration and management of a mixed age forest also help mitigate fire risk.
Community / social risks		
Land Use Competition	Plantations may compete with agriculture, affecting local land values and creating community resistance.	Regrowth occurs on existing forest land, so limited competition or displacement risks.
Social Licence & Public Perception	Plantations may have strong social acceptance (particularly once established and well managed), however there would be expected to be concerns in terms of water use, landuse change.	Social and political sensitivity around native forest management. Risk of legal challenges and community opposition.
Regional Employment & Community Impact	Creates initial short-term employment pulse, then long lag until harvest job creation. Long-term employment more stable once plantations mature.	Provides immediate employment given the potential for harvesting and silvicultural works, but can be cyclical and unpredictable, affecting local contractor certainty. Community conflict can impact social licence.
Carbon & Climate Policy Exposure	Plantation carbon is easy to quantify and monetise. Loss events (fire) create liability risk.	Carbon accounting is more complex with no current pathways available. Policy changes (e.g., native forest carbon recognition) could improve economic returns. More intensive management could improve resilience to changing climate.

Note - Red – significant, Yellow – moderate, Green - low

5. SUMMARY AND CONCLUSION

This analysis has primarily identified that managing native forest regrowth more intensively can offer immediate returns to the landowner, is far less capital intensive than plantations, and by maintaining existing land use is less disruptive to local communities.

Although highly sensitive to the assumptions applied in a cost-benefit analysis, across two out of the three case study areas both advanced and young regrowth scenarios offered significantly better returns than investing in new plantations.

Critically, access to markets, particularly for low grade logs such as pulp must be available within a reasonable economic distance. Despite favourable and productive forests, Lower North Coast returns are severely curtailed by the long distance to pulp markets, whereas the market at Eden provides an immediate positive cashflow for landowners with the potential to thin advanced regrowth.

The economic treatment of land is also important. For plantations, the change in land use will mean either land must be purchased or taken out of other agricultural production and therefore incurring an opportunity cost. In either case the cost of land remains a drag on economic returns, which is exacerbated by relatively low productivity across much of the available land base.

Table 5-1 provides a tabulated summary of the findings of this study.

Table 5-1: Comparative summary

Aspect	New Hardwood Plantation	Regrowth Native Forest
Investment summary	***Capital-intensive, long-duration investment with persistent negative cash flows***	***Low-carrying-cost investment with minimal interim exposure and value concentrated at maturity.***
Base case NPV ($ per ha)	***-$900 to -$6900***	***-$1 700 to $5 000***
Cost benefit ratio	***0.45 to 0.93***	***0.51 to 1.69***
Key drivers of Returns	Returns highly dependent on land cost and carbon price	Returns highly dependent on access to pulp / low grade markets for thinnings
Upfront Cost	High establishment and early-stage management costs.	Low upfront cost; forest already established, but improvement such as espacement may be needed.
Time to Returns	Predictable rotations but long delay before first harvest.	Potentially shorter if regrowth is mature; yields variable.
Silvicultural Control	Full control over species, genetics, spacing and management should provide higher productivity.	Limited control over genetics, spacing and uniformity; relies on stand improvement.
Timber Quality	Consistent, predictable wood quality and form.	Potential for high-value sawlogs but variable form and higher levels of defect.
Environmental & Biodiversity	Lower biodiversity at establishment; simpler but less diverse stand structure.	Maintains existing biodiversity and habitat structure; strong ecological value.
Risk Profile	High early-stage risks (mortality, drought), but more predictable long-term risk management.	No establishment risk, but higher exposure to natural disturbances and variable stand condition.
Regulatory Settings	Clearer regulatory pathway on cleared land; may involve land-use change approvals.	Often highly regulated with public scrutiny; current approvals (PNF Plans) max term of 15 years.
Carbon Profile	Current method, relatively low yields	High existing carbon stocks; no current pathway

ANNEX 1 - LITERATURE REVIEW SUMMARY

Theme 1.

Note: Numbering for each source reflects this review's referencing database identifier

1. Institute of Foresters of Australia, & New Zealand Institute of Forestry. (1997). Preparing for the 21st century: Proceedings of the 4th Joint Conference of the Institute of Foresters of Australia and the New Zealand Institute of Forestry (Supplementary volume).

Key points/summary: Not applicable – to be removed

2. Private Forests Tasmania. (2023, April). Financial analysis for private native forestry (Fact Sheet No. 7). Greenwood Strategy Solutions.

Key points/summary: Provides basic explanation of potential financial returns from managing and harvesting native forests. Sets out assumptions on costs, process and yields. Compares returns on a DCF basis from thinning versus clearfell strategy

3. DAFF (2005). Yield equations for regrowth forests regenerated from fire on the southeast coast of New South Wales. Canberra: Australian Government Department of Agriculture, Fisheries and Forestry

Key points/summary: Considered the development of growth and yield models for unthinned stands regenerated from fire in the coastal area of south-east NSW. *E. sieberi* is the predominant commercial species, is often found in association with *E. obliqua, E. cypellocarpa, E. fraxinoides, E. dalrympleana, E. muellerana, E. radiata, E. dives, E. longifolia, E. globoidea and E. viminalis*. High intensity fire can destroy all trees and induce dense even-aged regrowth stands. Stand densities of 85,000 trees/ha within six months after fire, of 30,000 trees/ha at age 9 and of 3,300 trees/ha at age 32 have been reported (Bridges 1983, Jurskis, unpublished report).

4. M. Cassidy, G. Palmer, K. Glencross, J.D. Nichols, R.G.B. Smith, Stocking and intensity of thinning affect log size and value in *Eucalyptus pilularis*, Forest Ecology and Management, Volume 264,2012,Pages 220-227,ISSN 0378-1127

Key points/summary: The financial attraction of delaying thinnings until trees reach commercial size may not deliver the best returns. Plantation thinning trial data was used to assess the relationship between tree age, size and value. The lowest final stocking of 125 sph achieved the highest returns at 36 years.

5. New England – North West Forestry Investment Group. (2002, April). Economic aspects of native regrowth forestry on farms in the New England region. Eco Resource Development for Regional Development Board.

Key points/summary: This considered the returns from managing native forest on farms in northern NSW. It found that whilst had hardwood forest growth rates vary significantly across the region, unmanaged forests range from 0.25 – 0.5m^3/ha/yr, this could be increased to 3 to 5 m^3/ha/yr on the best sites. Non-commercial thinning from 10,000+ sph to 300 to 600 sph could cost between $350 - $1700 per ha, however costs in the region were expected to be on the lower end of this range.

6. Forrester, D., Bauhus, J., & Connell, M. (2003). Competition in thinned Silvertop Ash (*Eucalyptus sieberi* L. Johnson) stands from early coppice growth. Forest Ecology and Management, 174(1-3), 459–475.

Key points/summary: Examined the effects of thinning intensity and site quality on coppice growth in 18-23 year old regrowth stands of *E.sieberi.* Coppice contributed up to 33% of the BA 3 years after thinning. Results showed that control of coppice development would benefit trees on medium to low-quality sites.

7. Washusen, R., Morrow, A., Ngo, D., Northway, R., Bojadzic, M., Harwood, C., Volker, P., Wood, M., Valencia, J. C., & Innes, T. (2008, January). *Eucalyptus nitens* thinning trial: Solid wood quality and processing performance using conventional processing strategies (Project No. PN07.3019). Forest & Wood Products Australia.

Key points/summary: Determined the sawn product recovery of plantation grown *E.nitens* sawlogs. Trees were 21 years old, from sites at 100 – 400 sph, and unthinned (700 sph).
8. Y.Wang, P. Fagg, F.Hamilton (June, 2002) Growth response of mixed species eucalypt regrowth 7 years after early spacing treatments (unpubl.) **Key points/summary:** This paper reviewed the growth response 7 years after espacement trials were conducted in mixed species forests dominated by *E.sieberi*. 3 spacing treatments - corridor+stem injection, corridor plus chainsaw, just corridor - best was 1.2cm per year compared to 0.7cm per year control
9. Roxburgh, S. H., Wood, S. W., Mackey, B. G., Woldendorp, G., & Gibbons, P. (2006). Assessing the carbon sequestration potential of managed forests: A case study from temperate Australia. Journal of Applied Ecology, 43(6), 1149–1159 **Key points/summary:** Demonstrated that forests recovering from prior logging have the potential to store significant amounts of carbon, with current biomass stocks estimated to be approximately 60% of their predicted carrying capacity, a value similar to those reported for northern temperate forests. Although sequestration activities often focus on the afforestation and reforestation of previously cleared land, the results suggest that, native forest management should also be considered when developing terrestrial carbon management options.
10. Pigott, J.P., Palmer, G.P., Yen, A.L., Tolsma, A.D., Brown, G.W., Gibson, M.S. & Wright, J.R., 2010. Establishment of the Box-Ironbark Ecological Thinning Trial in north central Victoria. Proceedings of the Royal Society of Victoria 122(2): 111-122. **Key points/summary:** Focused on a trial to support the development of an ecological management strategy - to restore diversity of habitat in Box-Ironbark forests and woodlands.
11. Washusen, R., Morrow, A., Wardlaw, T., & Ngo, D. (2009). The effect of thinning on wood quality and solid wood product recovery of regrowth forests: *E. regnans* from Southern Tasmania (Project No. PN06.3015). Forest & Wood Products Australia. **Key points/summary:** Identified differences in solid wood quality, recovery and board defects between E. regnans logs obtained from thinned and unthinned native forest regrowth in Tasmania. Select grade and product recovery was higher in unthinned stands. Thinned stands had more kino veins and more spring.
12. Francis, B., Venn, T., Lewis, T., & Brawner, J. (2022). Case Studies of the Financial Performance of Silvopastoral Systems in Southern Queensland, Australia. Forests (MDPI), 13(2), 186 **Key points/summary:** Four case study properties in southern Queensland, Australia, with willing landholders, native forests dominated by spotted gum (*Corymbia citriodora ssp variegata*). Simulated different treatments including thinning - treatments increased the mean annual increment of merchantable timber over 20 years by an average of 1.3 m^3/ha/year relative to the scenario where no management was performed in year 0. (derived increase of 1.5 m^3/ha/yr to 2.7 m^3/ha/yr). Refer to extract below.

Table 4. Mean annual increment and product volumes in 2038.

Stand Characteristic by Scenario in 2038	Case Study Property			
	Glenbar	Gayndah	Doughboy	Rathdowney
Locked-up				
MAI (m^3/ha/year)	1.1	0.8	2.1	0.8
Harvested volume (m^3/ha)				
Sawlog	16.7 (69%)	6.8 (47%)	32.6 (80%)	17.2 (100%)
Pole	2.5 (10%)	2.4 (26%)		
Other	5.1 (21%)		8.2 (20%)	
Total harvested volume	24.3	9.2	40.8	17.2
Retained volume (m^3/ha)				
Sawlog	2.7 (12%)	7.9 (23%)	2.3 (16%)	6.3 (16%)
Pole	4.5 (20%)	1.7 (5%)	0.1 (1%)	2.0 (5%)
Other			0.1 (1%)	
Un-merchantable	15.1 (68%)	25.3 (72%)	11.3 (82%)	30.9 (79%)
Total retained volume	22.3	34.9	13.8	39.2
Silviculturally treated				
MAI (m^3/ha/year)	2.4	2.0	3.1	2.1
Harvested volume (m^3/ha)				
Sawlog	28.6 (64%)	15.2 (65%)	44.1 (79%)	27.5 (80%)
Pole	9.9 (22%)	8.1 (35%)		6.9 (20%)
Other	6.2 (14%)		11.9 (21%)	
Total harvested volume	44.7	23.3	56.0	34.4
Retained volume (m^3/ha)				
Sawlog	5.8 (43%)	20.3 (96%)	4.7 (68%)	16.8 (70%)
Pole	4.7 (35%)	0.8 (4%)	0.1 (1%)	1.7 (7%)
Other	0.3 (2%)		0.1 (1%)	
Non-merchantable	2.8 (20%)		2.0 (29%)	5.5 (23%)
Total retained volume	13.6	21.1	6.9	24

13. Connell, M. J., Raison, R. J., & Jenkins, P. (2004). Effects of thinning and coppice control on stand productivity and structure in a silvertop ash (*Eucalyptus sieberi* L. Johnson) forest. Australian Forestry, 67(1), 30–38.

Key points/summary: 28-y-old stand of silvertop ash near Orbost Vic. BA to 50%, stocking 250sph. BA in thinned 47-67% higher than unthinned, treated coppice - 60% - 89% higher over 6 years. Quotes previous study that 80-100 year old *E.sieberi* stand will have a stocking of 150 sph, however only 20 might contain HQ sawlog under natural conditions. GENERAL OBSERVATION - BA reduction of 50% provides an increased BA increment of the largest trees by 30-90%, NSW 35% after 5 years.

14. Department of Sustainability and Environment Victoria. (2006). NATIVE FOREST SILVICULTURE GUIDELINE No. 13.

Key points/summary: Commercial thinning is the harvesting of the unwanted merchantable trees in the stand. In ash stands this almost invariably means harvesting of the smaller trees that would later die through suppression - described as 'thinning from below'. Pre-commercial thinning is thinning where none of the removed trees are utilised, the operation being carried out to promote the growth of the young trees with the expectation that the stand will be commercially thinned 10-20 years later. NCT (age 8 to 750sph) has been shown to have a +ve impact on growth, and final product yield. In Ash need to reduce BA by at least 50% to get a response. - Also looks at environmental issues, and , and operational implications - HBT retention, understorey disturbance, soil compaction, weeds. Ash - T5 + T20 CF50 = MAI18, T25, CF65 - MAI14, UT80 MAI12

15. Forestry Tasmania. (2001). Thinning Regrowth Eucalypts (Native Forest Silviculture Technical Bulletin No. 13). Hobart: Forestry Tasmania.

Key points/summary: The Young Regrowth Thinning Series (YRTS) was established by the Forestry Commission in the early 1980s, and consists of five thinning experiments in 15 to 25-year-old eucalypt regrowth around Tasmania - E.regnans, delegatensis and lowland MS. Thinned at 24 years. Model developed to predict volume and sawlog recovery - 20% more sawlog at age 65. Sawlog yield at 65 equivalent to that of 80 years in the unthinned stand

16. Connell, M (unpub). Report on growth and yield for use in developing the VicForests Thinning Strategy (VicForests, 2005)

Key points/summary: Foothill and coastal mixed-species forests are dominated by Silvertop Ash–Stringybark associations, with regrowth mostly 45 years old or younger, originating from harvesting or past wildfires.

Thinning responses vary with age, genotype, climate, soils, understorey competition and thinning intensity. Mechanism driving growth include increased water availability, improved access to light and nutrients. Thinning generally increases diameter growth of retained trees with little loss of total volume, particularly when carried out soon after crown closure in fast-growing species like Silvertop Ash. Early spacing and thinning can accelerate stand development, shorten rotations, increase sawlog size and quality, and reduce harvesting costs, improve tree health, increase resilience to fire, and improve the genetic pool over time through selection. Benefits depend on adequate but not excessive basal-area reduction.

Timing – by 30 years many stands may have lost significant growth potential. Early spacing ensures site potential is directed at the sawlog crop, but can be capital intensive, and assumes future economic gains.

Trials across Victoria and NSW show 20–60% diameter increases, strong basal-area increments and improved sawlog yields, especially where coppice is removed. Commercial thinning can provide immediate returns and set up future high-value sawlog crops, but long-term economic data remains limited, making intensive management difficult to justify without confidence in sustained growth and value gains. This contrasts with commercial thinning that can produce immediate returns and covers treatment costs (to varying degrees).

Productivity benchmarks – STA – current merchantable MAI – 1.3 to 2.0, Mountain mixed species 3.0 to 5.0.

STA East Gippsland trials – age 26-28 years, BA reduced by 40-50%, 1200sph reduced to 250 sph. Potential for second thinning to 150sph. Growth responses Sawlog BA increment increased from 1.2 to 1.7m3. Stand BA increment increased to 3m2/ha/yr. Removal of coppice can improve sawlog yield by ~20% (relative terms) - Thinned + coppice removal: Additional 15–20% growth increase in all years.

Harvesting costs - trees of ~0.1 m^3 is 2–3 times more expensive than trees of ~0.5 m^3. Other influencing factors include distance to markets, market type, machine costs, overheads (fire protection, roading, administration).

Modelling indicated in east Gippsland STA there could be a 48% increase in total yield from a non-commercial treatment at age 5, a commercial thinning ate age 16, and a clearfall at 100. Furthermore, if high quality SRA was thinned at age 28, final harvest could be brought forward from 100 years to 60 years.

17. R. Washusen, A. Morrow, M. Ryan and D. Ngo (December 2007). The effect of thinning on wood quality and solid wood product recovery of regrowth forests - E.sieberi from eastern Victoria (FWPRDC)

Key points/summary: This paper compared samples of thinned (1965, thinned 1991) and unthinned (1957) E. sieberi butt logs of similar grade and length but with different log diameter ranges. Unthinned logs had significantly greater ($p<0.05$) log end splitting and surface checking, greater volume docked from green boards from the unthinned log, however there was no significant difference in the recovery of boards after docking end splits (29 – 31%). Thinned stands produced more standard grade, unthinned more feature grade.

19. Paterson, S, Duver, A, Tasker, J, Black ,S, & Gavran, M 2025, An analysis of plantation productivity, ABARES research report, Australian Bureau of Agricultural and Resource Economics and Sciences, Canberra

Key points/summary: Developed new productivity estimates and yield tables for pulp and sawlog plantations across all NPI regions. North Coast euc. sawlog MAIs of 5-15m^3/ha/yr. 35 year rotation, 300m3/ha at CF with 50% sawlog, after a thinning age 22 of 75m^3/ha with 30% sawlog.

20. Glencross, K, Palmer, G, Pelletier, M, Nichols, JD, Smith, G 2014, Basal area increment is unaffected by thinning intensity in young Eucalyptus dunnii and Corymbia variegata plantations across different quality sites, Forest Ecology and Management (318, pp 326-333)

Key points/summary: Showed that regardless of thinning intensity, BA increment was unaffected but had a significant impact on DBH increment.

22. P. W. West & D. A. Ratkowsky (2023) A state-space growth model for Eucalyptus pilularis in subtropical Australia, fitted with and without seemingly unrelated regression, Australian Forestry, 86:3-4, 134-142

Key points/summary: The state-space model developed here for blackbutt forests in subtropical eastern Australia appeared to provide a virtually unbiased estimator of future growth of a stand in these forests from a

measurement made at any particular age. However, the precision of the estimates declined rapidly as the length of predictions exceeded about 10 years.
22. P. W. West (2021) Effects of site productive capacity and stand density management on the maximum density line for *Eucalyptus pilularis* (blackbutt), Australian Forestry, 84:4, 200-205, **Key points/summary:** Researchers collected data from two measurements taken in each of several native regrowth and plantation *Eucalyptus pilularis* (blackbutt) stands in subtropical NSW and Queensland. These measurements were taken after the trees had begun to die naturally from competition. Most of the regrowth stands had been thinned some time earlier. Using the Reineke model, which links how many trees a stand can carry to the average tree diameter, the team calculated a “maximum density line” for each stand following methods from Vanclay and Sands. They found that this maximum density increased in two situations: in more productive sites, and in the thinned regrowth stands. The increase in thinned stands has not been previously reported. The authors suggest it may occur because competition between trees takes time to build up again after thinning greatly reduces tree numbers. These findings affect how density-management diagrams are constructed and used in practical forest management.
24. North East NSW Forestry Hub (July 2024) Evaluation of the financial performance of existing hardwood plantations in north east New South Wales (Mia Cassidy and Graeme Palmer, SCU) **Key points/summary:** This study assessed whether existing hardwood plantations in north-east NSW are financially viable, using current log size and form to estimate timber value. It also examined which biophysical and management factors influence species performance, including product volume and quality. Data was collected from 26 plantations spread across different species, management and climate. Tree height and diameter were extrapolated to age 40, and taper equations were applied to determine the standing volume in each log class. FCNSW stumpage prices were applied to calculate standing volume per ha. The most limiting impact on value was log quality. Cost of thinning and pruning was estimated to be 0.387% or IRR, whereas the cost of poor form was 4%. Thinning improved IRR by between 4.1% and 11.3%. Doubling assumed log prices could increase IRR from 1.7% to 5.0%, reducing rotation lengths from 40 to 30 would increase IRR from 1.7% to 2.7%. MAI varied from 2.2 (SPG) to 13.9 (*E.nitens*), with an average across all species of 7.3. Concluded that successful plantation management requires further research with a focus on high value species and optimum silviculture, however the keys remain log size and quality. Assumptions: Costs - Year 0 $6100, Year 1 and 2$100, NCT $1000, Prune ages 3 and 7 $1000, annual maintenance $200. Price schedule (Coastal North) – Select hardwoods - $26 (2029cm), $42 (30-34cm), $67 (35-37cm), $94 (38-39cm), $129 (40-49cm), $156 (50-69cm), $189 (70+cm).
25. Venn, T., Lewis, T., Timperley, M., Baynes, J., Covey Associates Pty Ltd, Ryan, S., & Kathuria, A. (2024). Recognising the carbon sequestration potential in native regrowth forests: A report for the North East NSW, South East NSW, South & Central QLD and North QLD Regional Forestry Hubs. North East NSW Forestry Hub & partner forestry hubs. **Key points/summary:** assesses native forest regrowth productivity and carbon potential. It finds that published estimates of mean annual increment (MAI) in poorly managed private native forests in NSW and QLD generally range from about 0.15 to 1.7 m^3 per hectare per year, depending on forest type. This low productivity reflects poor silvicultural condition, often due to past high-grading and high density.. The report also notes that silvicultural management could increase MAI by three to five times, indicating significant potential productivity gains with active management. Provides MAI estimates by forest type in NSW.
26. Environment Protection Authority. (2010). *Silvicultural guidelines* (DECCW 2010/177) [PDF]. NSW Government. https://www.epa.nsw.gov.au/sites/default/files/10177silviculture.pdf **Key points/summary:** Provides operational requirements for native forest harvesting in New South Wales under the Private Native Forestry framework. The document outlines standards for regeneration, thinning, and

single-tree selection to ensure forest sustainability and ecological protection. It specifies rules for retaining habitat trees, protecting soil and water values, and maintaining biodiversity. The guidelines aim to balance timber production with long-term forest health by setting limits on harvesting intensity and mandating post-harvest regeneration benchmarks.
27. StollzNow Research. (2023). Forestry's social licence to operate in North East NSW (Report prepared for North East NSW Forestry Hub). North East NSW Forestry Hub. **Key points/summary:** investigates forestry's social licence to operate in North East NSW, assessing community attitudes, trust, and perceived benefits and impacts. Using survey and qualitative research, it identifies varying levels of support linked to employment, environmental concerns, and confidence in regulation. While forestry is recognised for regional economic contributions, environmental protection and transparency remain central to community acceptance. The report concludes that maintaining social licence requires improved communication, demonstrated environmental performance, and stronger local engagement
28. Williams, K. J. H., & Schirmer, J. (2012). Understanding the relationship between social change and its impacts: The experience of rural land use change in south-eastern Australia. *Journal of Rural Studies, 28*(4), 538–548. https://doi.org/10.1016/j.jrurstud.2012.05.002 **Key points/summary: E**xamines how rural land-use change in south-eastern Australia reshapes social structures, identities, and community wellbeing. Focusing on forestry and agricultural transitions, the authors analyse how demographic shifts, lifestyle migration, and changing economic bases alter social cohesion and local expectations. They argue that impacts are mediated by community perceptions, values, and adaptive capacity rather than land-use change alone. The study highlights the importance of governance, engagement, and social context in managing conflict and supporting resilient rural communities.
29. Leys, Andrea & Vanclay, Jerome. (2010). Social learning study of plantation forestry in the Upper Clarence catchment of north-eastern NSW. 10.13140/RG.2.1.2986.8969. **Key points/summary:** Documents an action research social learning process applied in the Upper Clarence catchment of north-eastern NSW to address community conflict around expanding hardwood plantation forestry. A diverse group of local stakeholders participated in deliberative activities to share knowledge, model landscape dynamics, and collaboratively develop adaptive co-management recommendations. The study found shifts towards more positive social and environmental attitudes among participants and highlighted the potential of facilitated social learning to build capacity, reduce conflict, and support more sustainable land-use practices.

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ANNEX 2 – MODELLING ASSUMPTIONS

Table A1: Base assumptions by forest type

Assumptions	Yr	Plantation	Regrowth	Units
Discount Rate:		6.0%	6.0%	Real pre-tax
Development costs (Direct):				
All productivity classes				
Site clearing/soil cultivation	0	-1 800	0	$/ha
Seedlings	0	-500	0	$/ha
Planting	0	-720	0	$/ha
Fertiliser	0	-200	0	$/ha
Weed control	0	-250	0	$/ha
Browsing	0	-100	0	$/ha
Establishment Sub-total (Year 0)	*0*	*-3 570*	*0*	
Weed control	1	-250	0	$/ha
Blanking/infill / Fertiliser	1	-250	0	$/ha
Browsing	1	-150	0	$/ha
Other (monitoring)	1	-60	0	$/ha
Establishment Sub-total (Year 1)	*1*	*-710*	*0*	
Weed control	2	-50	0	$/ha
Browsing	2	-100	0	$/ha
Establishment Sub-total (Year 2)	*2*	*-150*	*0*	
Non-commercial thin (where applicable)	5	0	-2 000	$/ha
Annual costs (Indirect):				
Area-based overheads	All	-75	-15	$/ha/yr
Land value	All	5 000	0	$/ha
Land rent %	All	3.5%	3.5%	%
Land rent	All	-175	-18	$/ha/yr
Land cost other (rates etc)	All	-20	-2	$/ha/yr
Land cost sub-total	All	-195	-20	$/ha/yr
Production costs:				
Thin 1		-60.00	-70.00	$/gmt
Thin 2		-50.00	-60.00	$/gmt
Roading cost		-35.00	-45.00	$/gmt
Clearfell		-5.00	-7.00	$/gmt
Transport cost rate		-0.20	-0.22	$/gmt/km

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