GREENWOOD

STRATEGY

ACCESS TO LAND AND LAND USE POLICY FOR PLANTATION FOREST INVESTMENT

Report prepared for the North-northwest Tasmania Regional Forestry Hub

September 2020

esk mapping & GIS

FIFTH ESTATE

SFM forest products

GREENWOOD STRATEGY

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Final Report 11 September 2020

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Estimations of plantation land suitability, availability, higher and best use and economic viability that have been expressed in this document are indicative only, using data sources outside of the control of Greenwood Strategy Solutions Pty Ltd, Esk Mapping & GIS Pty Ltd, The Fifth Estate Consultancy Pty Ltd and SFM Environmental Solutions Pty Ltd (the Project Team), and based on very general assumptions.

Information supplied on the basis of stakeholder interviews reflect the views, knowledge and experience of those stakeholders and have been reflected and summarised as accurately as possible, while maintaining commercial confidence where required.

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EXECUTIVE SUMMARY

The North-northwest Tasmania Regional Forestry Hub (the Hub) was established in 2019 and is funded by the Commonwealth Government as part of the National Forest Industries Plan. The Hub, in consultation with industry, community and government stakeholders, has identified four priority themes aimed at delivering against the Commonwealth's objectives under the Plan.

Priority Themes

1. Access to land and land use policy for plantation forest investment
2. Supply chain and infrastructure
3. Climate change and carbon policy
4. Culture, skills and training

Greenwood Strategy has been engaged by the Hub to deliver this Assessment Report addressing the first of the four priority themes: *Access to land and land use policy for plantation forest investment*.

The Hub has advised that it will consider the opportunities and recommendations identified in this Assessment Report alongside any recommendations identified in relation to the remaining three priority themes. The Hub will then develop implementation plans commensurate with priority opportunities and funding.

Rationale for this Assessment Report

Objective of the Report

The objective for the Report is to undertake a strategic assessment of the factors affecting the forest growing and processing sectors in the context of land access and land use policy for north-northwest Tasmania. Figure 1 shows the Hub boundary. The broader context for the Report is consideration of ways in which the total available future plantation timber resources in the region can be maintained and augmented, underpinning the long term viability and sustainability of the region's forestry and forest products sectors. In particular, the Report has considered the following factors:

- Land type, suitability and availability.
- Integration of forestry with alternative crops and/or land uses.
- Incentives for private landowners to plant and grow trees.
- Investment cost of planting, harvesting and requisite approvals versus return on investment for private landowners.
- Private landowner confidence, time investment, skills and equipment.
- Regulatory framework and constraints.
- Social licence.

Project methodology

The methodology for delivering this Report comprises three elements:

1. Stakeholder consultation and analysis to develop an understanding of existing views about challenges and opportunities related to plantation expansion in the region.
2. Spatial and economic analysis to assess the practical availability of land to support plantation expansion.
3. Literature review, discussion and analysis to expand on the results of the stakeholder consultation and spatial and economic analysis.

The findings from each of the three project elements were consolidated to identify consistent themes, develop a comprehensive view of the challenges and opportunities for the sector related to the Report priorities and identify recommendations to provide the Hub with a basis for developing future priorities.

Summary of key findings

Overview

Plantation forestry currently comprises 18 per cent of Tasmania's agricultural land availability and 30 per cent within the Hub regional boundaries. This is several orders of magnitude higher than any other jurisdiction in Australia, with the average proportion at only 0.5 per cent.

The spatial analysis undertaken for this Assessment Report indicates that the area of current agricultural land which is (i) suitable and available, (ii) able to support plantations in competition with other land uses, and (iii) grow commercially viable plantations; is approximately 37,000 hectares. That suggests that plantation forestry is close to capacity for the region, at least on the basis of traditional industrial scale forestry.

The industrial and independent plantation estates in the Hub region have experienced a decline in area and will continue to do so over the next five to ten years. That future reduction is anecdotally estimated to be somewhere between 10,000 and 25,000 hectares. There is neither the commercial will or social license to support industrial scale expansion into higher productivity agricultural areas and, in any event, it is currently not possible under the Protection of Agricultural Land Policy.

The immediate priorities for the Hub, therefore, will need to be:

a) Maintaining and expanding the current plantation footprint to the extent that it is economically, commercially and socially feasible.
b) Identifying and driving smaller scale expansion opportunities in the context of both commercial and additional (environmental services and agricultural productivity) benefits.

The opportunities for maintaining and expanding plantation forestry in the Hub region will rely on the ability to develop models for integrating forestry into the farming landscape in ways which recognise that smaller, independent landowners have a range of motivations for considering tree plantation and the policy and commercial solutions will need to be both innovative and flexible. A key ingredient for success is likely to be improving the

forestry and forest products supply chain and market knowledge for smaller growers, to the extent that they feel confident and secure in making decisions about what to plant, how it will get to market and how the market will respond with respect to price. There is also a recognised need to improve knowledge about and acceptance of the integrated benefits of trees on farms – not simply commercial timber production but broader agricultural productivity benefits and environmental services.

The enabling policy environment, at both the Federal and State Government levels, is strongly supportive of integrating commercial plantations into the farming landscape and the industry increasingly recognises that fact. Recent changes to the Carbon Farming Initiative may, additionally, provide more direct incentive by providing early rotation cash generating opportunities – although there are acknowledged challenges with this.

Challenges

The immediate challenge with respect to the Hub's objectives is to identify mechanisms to maintain the existing plantation footprint. Currently the plantation estate in the region is contracting. It is anticipated that the current estate will decline by between 10,000 and 25,000 hectares over the next five to ten years. This decline includes industrial hardwood plantations, independent hardwood plantations and independent softwood plantations.

The secondary challenge is to identify opportunities to expand the plantation footprint and increase the overall potential availability of wood. This challenge is somewhat exacerbated by the fact that plantation forestry represents 30 per cent of agricultural land use within the Hub boundaries.

There is also a considerable community antipathy towards industrial expansion, and a considerable regulatory barrier in the form of the Tasmanian Government's Prime Agricultural Land Policy. Added to this is the institutional forestry investment model which favours mid-rotation acquisitions rather than greenfield establishment. In essence, therefore, industrial scale forestry expansion will not occur because none of the larger forest owners has a mandate for it and, regardless, it is recognised that community sentiment would not support it.

That means that opportunities for plantation expansion are dependent on effectively integrating smaller scale forestry plantations into the broader agricultural landscape. The agricultural community is at best agnostic towards plantation forestry and in many cases is firmly opposed to it. There are a number of reasons for this, including opinions about the best use of agricultural land, perceptions of commercial and technical challenges with plantation establishment, management, harvesting and marketing and cost barriers, including those imposed by the Forest Practices system.

In particular forestry supply chains and markets, including pricing, are viewed as complex and lacking in transparency by existing and potential agricultural participants in forestry plantations. Volatility in demand and pricing also creates a lack of certainty about future returns which is a challenge when a landowner is considering an expensive establishment exercise and loss of other land use alternatives for a fifteen to thirty year period. By contrast, when decisions are made about alternative land uses, commodity prices at either farm or factory gate are generally readily available, supply chains are understood and hence decisions are made on available, reliable market information.

There are also no existing, practical incentives to support expansion of either industrial or independent plantations. Traditional investment economics do not support green field establishment at any scale and in many cases do not justify re-establishment of harvested plantations. The non-wood productivity benefits of trees on farms are not recognised, either formally or informally and there is no enterprise level tool available to account for these. There is currently no market mechanism for environmental services. Changes to the Carbon Farming Initiative will change this in theory. However, the administrative and technical requirements for participating are a hurdle.

Opportunities

The analysis presented in this report indicates that there is approximately 37,000 hectares of land which is potentially suitable and available, competitive with other land uses and economically viable to support new forest plantations integrated into the broader agricultural landscape in the Hub region.

There is a significant opportunity to work on the development of tools and systems for measuring and accounting for non-wood values and to use this process to improve the acceptance among the agricultural community of the contribution that trees can make to augmenting on-farm productivity. Both the University of Tasmania and the University of Melbourne have progressed research and assessment of opportunities to apply natural capital accounting at the farm enterprise level in the context of forest plantations (small to medium scale).

The forest industry in the Hub region recognises the importance of working with smaller, independent landowners to develop commercial and land access arrangements which can benefit all parties and there is significant goodwill from the State and Federal Governments, as well as positive policy settings to support this approach.

There is an opportunity to further facilitate the development of effective and practical arrangements between industry and landowners, to deliver and communicate new models to improve landowner understanding of and familiarity with forest industry commercial and marketing structures, and to support improved technical capacity with respect to growing small scale commercial tree crops.

In general terms, Tasmania is better placed than most other jurisdictions to capitalise on emerging opportunities for solid wood processing of hardwood plantation products, as well as optimising the transition, where relevant, from short rotation hardwood to long rotation hardwood and softwood plantations to develop a fully mature and diverse plantation-based timber industry.

Recent Commonwealth Government changes to the legislation governing the Carbon Farming Initiative, and the way in which new plantations can participate in the Emissions Reduction Fund, also present an emerging opportunity for landowners to participate and generate real financial returns for new plantation investments.

Recommendations

Four high level recommendations have been developed, which reflect the findings from this Assessment Report and support an increase in future available wood resources in

the Hub region. Each of the recommendations includes a rationale and series of proposed actions.

Recommendation 1: Encouraging agroforestry and market accessibility

Rationale

This report has identified a desire within the sector to maintain the existing plantation footprint in the short term and expand it in the medium to long term.

There is broad recognition that the opportunity to achieve these outcomes from the industrial plantation estate is constrained by the nature of the existing industrial investment models and by social license and regulatory limitations on large scale plantation expansion.

There is a complementary recognition that the opportunity exists to better capitalise on potential plantation expansion integrated into the broader agricultural landscape through a range of farm forestry models. Aligned with this is a view that uptake of farm forestry could be improved if the indirect benefits of trees on farms is better understood by the farming community. Similarly, stakeholders recognise the need to better inform the farming community about the direct benefits of commercial farm forestry, with respect to both wood products revenue and potential environmental services income and benefits.

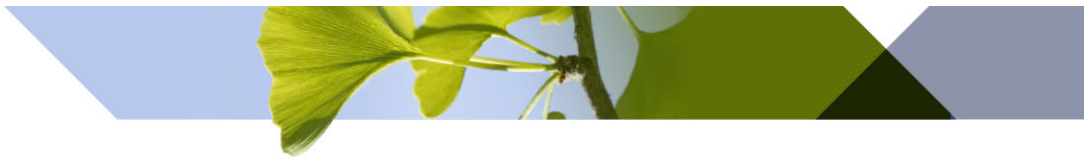
There are existing resources in place, particularly through Private Forests Tasmania, which address some of these issues. However, even for informed stakeholders, there was a low level of awareness of the existence of these resources.

Barriers to uptake extend beyond the technical practicalities of establishing and managing trees. There are five specific areas identified:

- A perceived antipathy within the broader agricultural community towards forestry generally and farm forestry specifically.
- Landowner understanding of how forestry supply chains, pricing and markets work, particularly in comparison to other agricultural commodities.
- Full appreciation of the range of commercial and non-commercial benefits of trees on farms, including with respect to agricultural productivity and environmental services.
- Lack of understanding and capacity to participate in the Carbon Farming Initiative and forest certification.
- Where to access reliable and professional services.

Recommendations

1. Inform and support landowners with respect to forest plantation establishment, management, harvesting and marketing, with a specific focus on the commercial aspects of integrated farm forestry:
    - Establish a framework to provide accessible market intelligence, specifically in relation to the costs and returns for commercial forestry. This should include log price indices and trends, plantation operations costs models and indices.



- Develop an administrative system for smaller landowners to be able to more easily participate in the Emissions Reduction Fund auctions through the Carbon Farming Initiative.
- Provide an enhanced and centralised service for landowners to access critical plantation management services, including technical advice, forest management certification and harvest and marketing services.

2. Leverage areas of shared interest with the agricultural sector, particularly with respect to:
    - Addressing social license issues in relation to trees on farms.
    - Maximising optimal land use.
    - Identifying carbon offset opportunities and promulgating the broader environmental and productivity advantages of trees on farms.
    - Addressing key regulatory issues, particularly in relation the Prime Agricultural Land policy.

Recommendation 2: Addressing regulatory barriers

Rationale

There are four specific issues with the existing regulatory regime:

- The forest practices system applies the same risk management framework to small scale plantations on agricultural land as to native forest operations.
- A significant component of regulatory costs are imposed at the planning and establishment phases rather than at the revenue generation phase.
- Plantations are excluded, at the landscape scale, from classes of agricultural productivity, as a measure to prevent industrial expansion into prime agricultural land, which is a real or perceived barrier to smaller scale, integrated plantation establishment.
- While the Carbon Farming Initiative requirements have been relaxed for the Hub region, there is still a view that the administrative process for participation is prohibitive, particularly for smaller growers.

Recommendations

1. Improve accessibility and simplify decision-making for potential growers – consider opportunities to introduce a risk-weighted approach streamlining the forest planning and approval processes for small-scale farm forestry on cleared agricultural land.
2. Quantify the regulatory costs profile for small-scale farm forestry and identify opportunities to reduce, remove or shift early rotation costs which are perceived to be a barrier to farm forestry investment.
3. Promote small-scale agroforestry opportunities in Prime Agricultural Land categories 1, 2 and 3, which is complementary to the Prime Agricultural Land policy intent. Additionally, consider proposed adjustments to the Protection of Agricultural Land Policy to recognise that small scale, integrated plantations pose no significant land use change risk for prime agricultural land, can provide

additional farm productivity and environmental services benefits and should be considered an *as of right* land use decision.

4. Develop a group approval framework for supporting small grower access to the Carbon Farming Initiative which enables landowners to more readily participate in the Emissions Reduction Fund. Consider adjustments of regulatory requirements for small-scale farm forestry plantations to participate in the CFI.

Recommendation 3: Improving the value proposition

Rationale

While maintaining and expanding the physical footprint of the plantation estate in the region is a primary focus of this Assessment Report, the opportunities to increase both wood flow and economic value are also important considerations. The Hub region is better placed than most forestry dependent economies with respect to regional scale, biological capability, infrastructure and emerging processing capacity to capitalise on opportunities related to transitioning to alternative forest management regimes which can deliver increased enterprise and regional benefits.

The two specific opportunities relate to:

- Transitioning from short to long rotation hardwood plantations to underpin a domestic plantation hardwood solid wood processing capacity.
- Transitioning from short rotation hardwood to long rotation softwood plantations where it is more suitable, to underpin expansion of the State's softwood solid wood processing capacity.

Recommendations

1. Expand and increase research into the forest management and timber processing requirements for solid wood processing from hardwood plantations.
2. Support the transition from short rotation hardwood to long rotation hardwood and softwood plantations with the aim of increasing domestic processing of high quality structural wood products; and consider opportunities for development of increased domestic solid wood processing capacity.

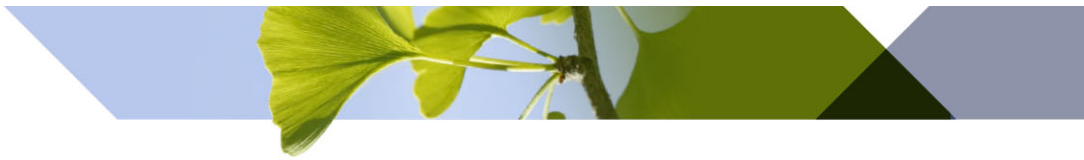
Recommendation 4: Facilitating commercial partnerships

Rationale

A key element for success in expanding and integrating commercial plantations into the broader agricultural landscape is the ability for the industry to identify and implement effective commercial partnership models with landowners which satisfy landowner expectations about how their land will be managed profitably and meet industry requirements with respect to investment fundamentals, resource accessibility and operational needs.

The need for effective commercial relationships relates both to the initial investment required to establish plantations, and arrangements for the sale of plantation products.

Collaborative investment models such as leases, joint ventures and outgrower frameworks as described in this report, have been successfully in the past to generate increases in



plantation area. However, the work undertaken by the University of Melbourne recognises that in order to improve the likelihood of take up by landowners, collaborative investment models should ideally be combined with a long-term commitment to wood purchase at competitive prices, income (where appropriate) for environmental services, specifically carbon and a commercial engagement which fosters transparency and mutual benefit for both parties.

This recommendation is necessarily linked with Recommendation 1. This is particularly in relation to improving transparency and landowner access to critical information to support and foster long-term investment decisions.

Through the development of this Report, there has been mention of the potential to develop a model for a third party aggregator to operate in the Region for the purposes of identifying and bringing farm forestry timber resources to market. While this would appear logical on the face of it, there are commercial and legal considerations in this suggestion, particularly as there are independent commercial operators that are currently engaged in this activity. Further, an aggregation model working at the harvest and marketing end of a plantation rotation is unlikely to increase investment confidence at the establishment phase.

Recommendations

Encourage industry co-investment in farm forestry plantations, considering:

- Preferred co-investment models.
- Investment funding commitment.
- Preferred species and silviculture regimes.
- Forward pricing models.
- Other commercial and contractual requirements.

BACKGROUND

National Forest Industries Plan

The Australian Government launched the *National Forest Industries Plan: Growing a Better Australia – A Billion Trees for Jobs and Growth* in September 2018. This important policy framework outlines the Commonwealth Government's strategy to drive growth in the renewable timber and wood fibre industry, focused on establishing nine Regional Forestry Hubs by 2020, in locations which already exhibit scale with respect to the extent of the regional plantation estate and timber processing and marketing infrastructure[1].

The Plan outlines an aim to establish a billion new trees over the next decade (including 400,000 hectares of new plantations nationally) in order to meet a projected four-fold increase in global and domestic wood fibre demand by 2050. A critical focus of the Plan is an intent of planting the right trees, at the right scale, in the right places.

The plan is supported by a 2018/19 budget commitment of $20 million over four years to support the implementation of the actions identified.

North-northwest Tasmania Regional Forestry Hub

About the Hub

The Hub (refer Figure 1) was established by the Tasmanian Forest and Forest Products Network (TFFPN) and is funded as part of the Commonwealth's commitment under the Plan.

The Hub works closely with industry, stakeholders, government and the community to drive the Commonwealth's objectives and supports the purpose of the TFFPN, which is to represent the shared views, aspirations and expectations of all those people who have a stake in the future of a sustainable Tasmanian forests, fine timber and wood fibre industry.

Development of Hub priorities

The Hub, in consultation with stakeholders, has identified four priority themes for the development of the Assessment Reports and associated recommendations to underpin its work over the funding period. The objective of each Assessment Report is to undertake a strategic assessment of the factors impacting the forest growing and forest processing sectors within the Hub's boundaries.

The focus of each of the Assessment Reports is to:

a) report on the current state of the forestry industries in the Hub area and factors limiting growth for the future;
b) determine the opportunities and barriers for the forestry and wood products sector in the Hub region; and
c) analyse and report on the constraints that affect the productivity and efficiency of the forestry sector in the Hub region.

[1] https://duniam.com.au/supporting-the-development-of-regional-forestry-hubs-in-gippsland-victoria-and-central-west-nsw/ and https://ausfpa.com.au/hubs/

The key considerations for this Assessment Report are:

- Land type, suitability and availability
- Integration of forestry with alternative crops and/or land uses
- Incentives for private landowners to plant and grow trees
- Investment cost of planting, harvesting and requisite approvals versus return on investment for private landowners
- Private landowner confidence, time investment, skills and equipment
- Regulatory framework and constraints
- Social licence

Figure 1: North-northwest Tasmania Regional Forestry Hub boundary

Overview of the plantation forestry sector in the Region

An understanding of the plantation forestry sector in north-northwest Tasmania provides important context for the analysis undertaken for this project and the findings and recommendations in the Assessment Report.

The plantation estate

Summary of plantation area in the region

The north-northwest Tasmania region comprises approximately 268,000 hectares (gross) of hardwood and softwood plantations. The net plantation area is some 211,000 hectares, representing approximately 11.5 % of the national plantation estate.

The plantation area is dominated by hardwood species (76%) which are comprised predominantly of *Eucalyptus nitens* and include a smaller area of *Eucalyptus globulus*. Softwood plantations are almost exclusively *Pinus radiata* with some very small specialist exceptions on small plantation holdings.

Table 1: Estimated net plantation area by ownership type and species in the Hub region ('000 hectares)[2]

Ownership type	*Hardwood*	*Softwood*	Total
Industrial private	100	47	148
Industrial public	25		25
Independent private	31[3]	7	39
Total	156	54	211

Changes in plantation area

As presented in Figure 2, ABARES has reported minimal changes in stocked plantation area for all of Tasmania[4] between 2008/09 and 2018/19. However, based on stakeholder consultation there is anecdotal evidence that the stocked plantation area is declining and will continue to decline. One institutional owner, for example, has identified that its existing small hardwood plantation estate in Tasmania will be harvested gradually and sold off over the next five years. Similarly, other stakeholders indicated that large areas of ex-managed investment scheme (MIS) hardwood plantations located on independently owned land are not expected to be replanted, along with a significant proportion of independently owned softwood plantations.

[2] *Source: EMG Analysis of Forest Groups, Private Timber Reserves & Tenure GIS layers sourced from LIST Map 2020*

[3] Includes approximately 5,500ha of fallow area expected to be replanted given it is currently under gazetted Private Timber Reserve.

[4] In the National Plantation Inventory program, which informs ABARES quarterly AFWP statistics summaries, Tasmania is considered a whole region. In some instances, therefore, it is not possible to present data at a resolution which can excise the Hub region for the purposes of this project. Where this is the case, the report explicitly refers to whole of state rather than regional data.

The spatial analysis undertaken for this project provides insight with respect to areas of declining plantation which do not appear to have been included yet in the national reporting.

Figure 3 shows the change in area categories for independently owned plantations between 2015 and 2019. Based on the consultation undertaken as part of this project, the strong indication is that, of the approximately 16,300 hectares of independently owned plantation harvested between 2015 and 2019, up to 64 per cent is not expected to be replanted (based on the fact that it does not have a Private Timber Reserve (PTR) present).

A number of those interviewed expressed the view that the absence of a PTR was a strong indication that a landowner did not intend to re-establish the plantation area. It is also anticipated by stakeholders that this same pattern will extend to other non-industrial areas of plantation as they are harvested.

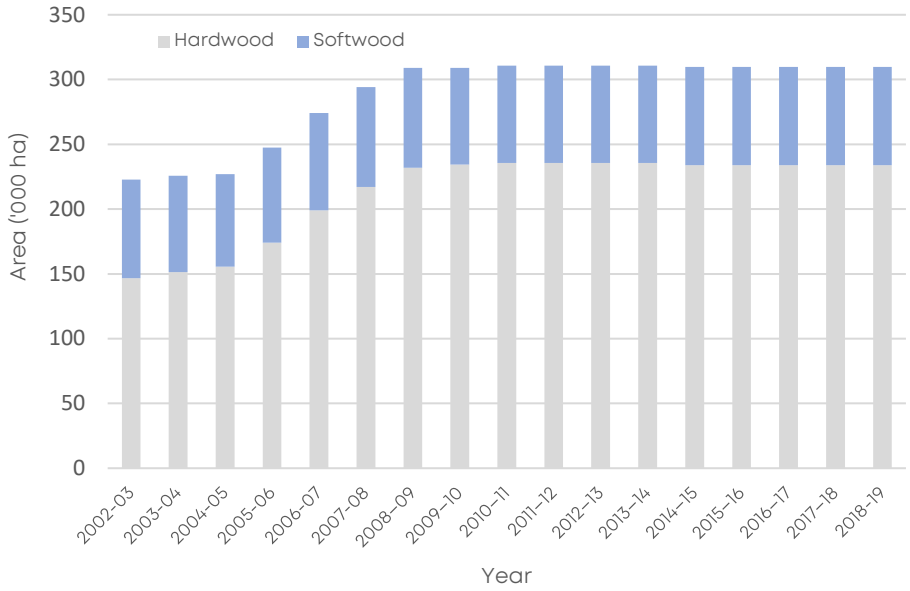


Figure 2: Tasmanian forest plantation area 2002/03 to 2018/19[5]

Historic drivers of plantation expansion

As with most Australian states, the introduction of forestry plantations in Tasmania began in the early parts of the twentieth century. Elliott (2011) notes that initial efforts in the early years of the twentieth century were driven by the State government's aim to minimise reliance on softwood imports for building construction and to provide employment opportunities.

A number of sources (for example, Freeman and Morton, 2014; de Fegely *et al*, 2011) have described how the expansion of Australia's (and Tasmania's) plantation estate occurred in two main tranches driven by specific Federal government policy initiatives.

[5] *Source: ABARES, Australian forest and wood products statistics, 2003 to 2020*

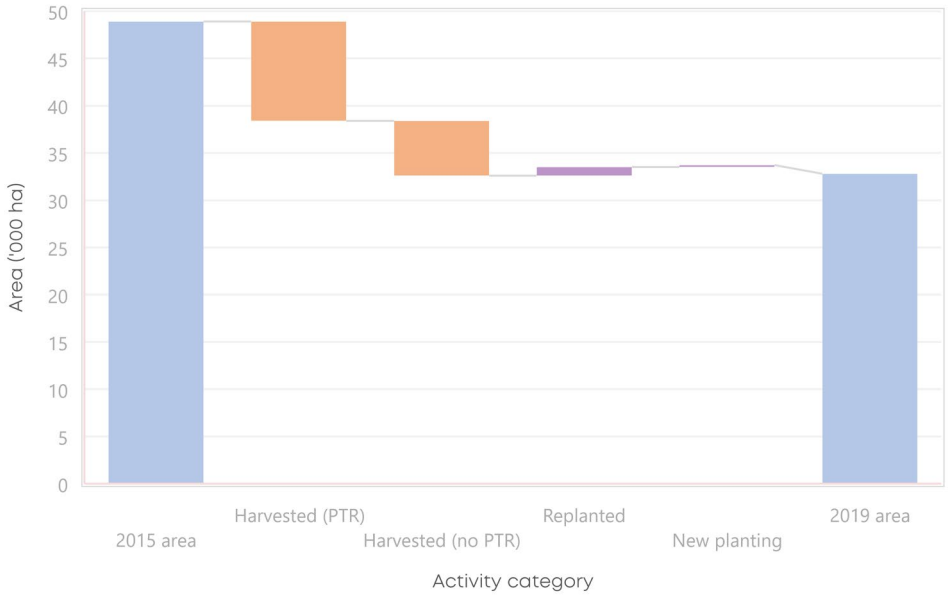


Figure 3: Changes in stocked area - independently owned plantations (2015-2019)[6]

The first tranche resulted in the establishment of Australia's one million hectare long-rotation softwood plantation estate. From the earliest part of the twentieth century, state and Commonwealth governments held concerns, first about the declining natural timber resources available and, second about Australia's emerging reliance on imported lumber to meet the needs of its growing population. From the late 1960s, this concern was addressed through the Commonwealth Softwoods Loans Scheme, under which the states were granted 35 year, low interest loans to establish a considerable softwood plantation estate. From the inception of the Softwood Forestry Agreements Act in 1967, through to the early 1990s, this policy resulted in the growth of the plantation estate from approximately 200,000 hectares to more than 1,000,000 hectares.

The second tranche resulted in the establishment of an equivalent area of privately held short rotation hardwood plantations. This was a consequence of Federal government endorsed tax incentives, delivered through retail Managed Investment Schemes (MIS). Indirectly, this was part of the 1994 National Forest Policy Statement, manifest through the Plantations 2020 policy position which sought to treble Australia's planted forest estate between 2003 and 2020, with the express aims of driving regional wealth creation and international competitiveness in relation to the balance of trade in wood products.

In Tasmania, there have been two other important and specific drivers for expansion of the hardwood plantation estate. The first was the State government's policy to expand the area of intensively managed hardwood plantations to supplement native forest timber supplies to the domestic solid wood market from the late 1990s[7]. The second was a drive by Gunns from the late 1990s to late-2000s to expand hardwood plantations for wood fibre production to support the proposed Bell Bay pulp mill facility, with the help of MIS regimes in place at the time.

[6] *Source: Esk Mapping & GIS, analysis of PTR & Forest Group information supplied by Private Forests Tasmania for periods 2015 and 2019*

[7] This was a requirement of the Tasmanian Regional Forest Agreement (1997) between the Commonwealth and Tasmanian State Governments

Plantation ownership and management trends

Australia has generally seen a significant shift in plantation ownership and management trends, particularly over the past twenty years. This is also the case for Tasmania generally, and for the Hub region more specifically.

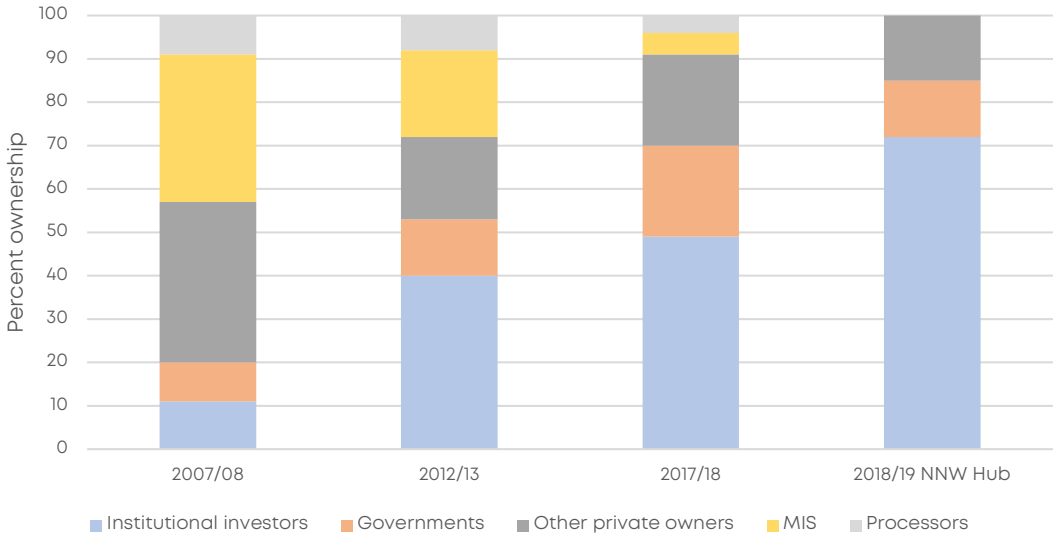


Figure 4: Plantation ownership trends in Australia, compared to the Hub

The Hub region has historically demonstrated a relatively higher level of private industrial ownership and vertical integration for hardwood plantations. However, since the MIS collapse and the parallel collapse of Gunns, institutional investors have dominated plantation ownership.

Figure 5: Comparison of private and public plantation ownership by Australian jurisdiction[8]

[8] *Source: Australian plantation statistics update 2020*

Note that joint ownership in the context of Figure 5 refers to joint ownership of the tree crop. Apart from Western Australia, where a significant tree crop share farming estate is still in place, these are relatively small legacy areas, including in Tasmania.

A concomitant trend has been the emergence third party professional management service providers. A considerable proportion of the region's institutionally owned plantations are managed by third party providers. These service providers also cover a large proportion of independent forests, particularly in relation to harvest management and marketing. Third party professional forest and harvest management in the Hub region accounts for a larger proportion of plantation forest related activity than any other Australian jurisdiction.

Plantation policy and regulatory environment

Plantation management in Tasmania is undertaken within a complex inter-jurisdictional system of legislation, policy and regulation which governs forest management at both the State and Commonwealth levels. Much of this framework is focused on achieving the correct balance between environmental, social and economic outcomes in the context of complex native forest management. For the purposes of this Assessment Report, there are two key areas of regulation with particular importance for any consideration of maintaining and expanding the plantation forest estate in the Hub region.

Tasmania's forest practices system

The regulation of commercial forest management in Tasmania stands apart from other jurisdictions in Australia, in that the State's forest practices system applies as a single regulatory framework across all tenures and all forms of forest management. The Department of State Growth (2017) provides a comprehensive overview of the system.

Tasmania's forest practices system is supported in legislation by the Forest Practices Act (1985), with the legislated objective (Schedule 7):

> *"…to achieve sustainable management of crown and private forests with due care for the environment, and taking account social, economic and environmental outcomes while delivering, in a way that is as far as possible self-funding-*
>
> *(a) an emphasis on self-regulation; and*
> *(b) planning before forest operations; and*
> *(c) delegated and decentralized approvals…; and*
> *(d) a forest practices code…; and*
> *(e) an emphasis on consultation and education; and*
> *…*
> *(h) through declaration of private timber reserves – a means by which private land holders are able to ensure the security of their forest resources."*

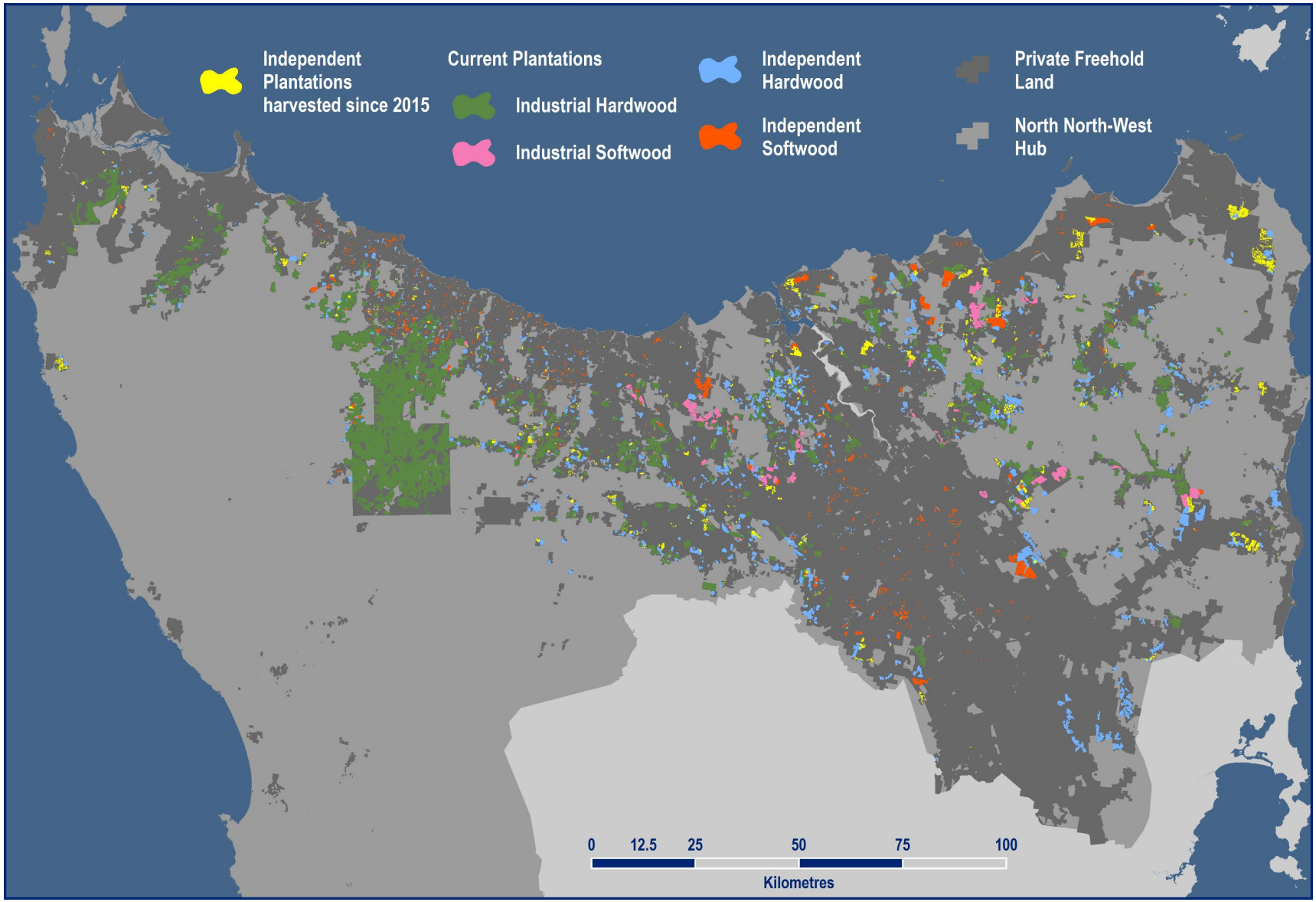
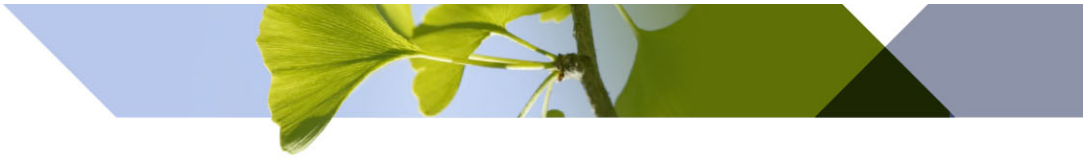


Figure 6: Distribution of privately owned plantations within the North-northwest Tasmania Regional Forestry Hub



The Act oversees a comprehensive regulatory and governance system for forest management in the State, for which the practical mechanism is the Forest Practices Code. The Code prescribes the way in which forest operations are planned for, approved, supervised and monitored to meet the objectives of the Act. It applies to all forest management activities which are covered by the forest practices system, regardless of the ownership of land or of forests, or the type of forestry (native or plantation) which is being undertaken.

In the context of this Assessment Report, a key element of the Act is the ability for privately owned forests to be covered by a Private Timber Reserve (PTR).

Where a PTR applies, the landowner is afforded a degree of regulatory security whereby planning, approval and supervision of forest management activities is governed by the forest practices system, allowing the landowner to bypass less consistent local government planning regulations. This is considered a real benefit in encouraging and securing the maintenance of private sector investment in the sustainable management of private forests in the state.

However, there is also some criticism that the forest practices system does not sufficiently recognise the wide disparity in risk profile between native and plantation forestry operations, particularly in respect of smaller scale, farm forestry plantings on cleared agricultural land. The planning requirements required by the Forest Practices Code are substantial and require a significant degree of technical knowledge, familiarity with the system and sign-off by an accredited Forest Practices Officer. There is, therefore, a view expressed by some stakeholders that the system represents a regulatory barrier for farm forestry expansion because it is too complex and expensive for most landowners to consider and provides less flexibility than is allowed under any other *as of right* agricultural land use.

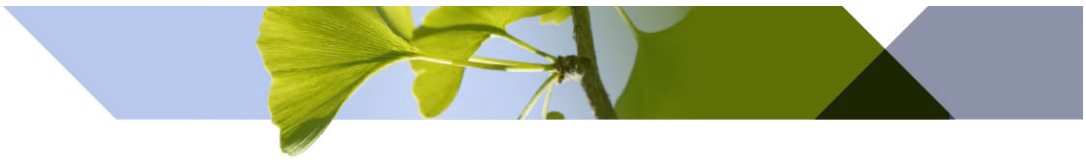
It is important to note that the Forest Practices Code has recently been reviewed and is currently in draft form awaiting approval. It is expected that the review will have gone some way to addressing the issues raised by stakeholders.

Protection of Agricultural Land Policy

The Protection of Agricultural Land (PAL) policy (the Policy) was implemented by the State government in order *"…to conserve and protect agricultural land so that it remains available for the sustainable use and development of agriculture, recognising the particular importance of prime agricultural land."* (Department of Premier and Cabinet, 2009).

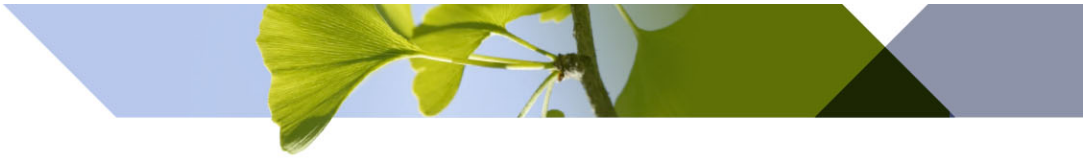
The Tasmanian Planning Scheme includes a Rural Zone and an Agricultural Zone for managing rural and agricultural areas, to which the Policy applies (Department of Justice, 2017). Within those zones, a Land Capability Classification system is used to assess, classify and map land according to its ability to support a range of crops. There are seven classifications, of which lands classified as Class 1, 2 and 3 are considered Prime Land and are subject to protections on conversion from agricultural to non-agricultural uses under the Policy (Department of Primary Industries, Parks, Water and Environment, undated).

In the context of the Policy, the term *Agricultural Use* covers activities including propagating, cultivating or harvesting plants or for keeping and breeding of animals, excluding domestic animals and pets. It includes the handling, packing or storing of agricultural produce for dispatch to processors or markets and controlled environment agriculture and plantation forestry.



The Policy restricts the establishment of new forestry plantations on Prime Land, unless a planning scheme reviewed in accordance with the Policy allows for it. Such a planning scheme is required to take account of *"…operational practicalities of plantation management, the size of the areas of prime agricultural land, their location in relation to areas of non-prime agricultural land and existing plantation forestry…"*.

This effectively prevents the industrial expansion of plantation forestry in Prime Land categories. There is a view that it also negates the potential for farm forestry plantings within those zones, even where they can be demonstrated to provide additional on-farm benefits with no impact on the Policy intent. However, the policy does not entirely prevent the establishment of trees – it includes an area limit of 10 hectares which is certainly sufficient to facilitate smaller farm forestry and amenity or shelterbelt plantings. In reality, the situation is likely more complex. The Prime Land categories reflect areas where agricultural activity is significantly more intense on higher quality soils with less environmental risk related to factors such as weather or erodibility. These are also land use pursuits that are characterised by intensive capital development, including irrigation infrastructure. The presence of trees is considered both a logistical challenge and inconsistent with maximising returns from economic land use.



STAKEHOLDER CONSULTATION

Rationale

The purpose of the stakeholder consultation was to generate informed input from a wide range of sources in order to guide the development of a full picture of the *current state of play* regarding the region's plantation forest sector, and identify where the opportunities, incentives, barriers and threats lie with respect to expanding the availability of plantation grown timber into the future.

Methodology

A suite of formal questionnaires was developed for each stakeholder category, in consultation with the Hub. The questions are included in Appendix 1. The questionnaires were designed to elicit information in a consistent fashion within each stakeholder category. The intent was to generate comparable information which could be utilised to consolidate and present the findings of the consultations in a manner which could support the development of recommendations for the Hub. The consultation method also afforded stakeholders the opportunity to make additional commentary where appropriate.

A total of 30 stakeholders were interviewed as part of the project. As noted, these stakeholders covered a wide range of interests related to the sector, including:

- Industrial forest growers.
- Independent forest growers.
- Plantation timber processors and experts.
- Forest industry service providers (forest and harvest managers, technical service providers, harvest and haul and silvicultural service providers).
- State and federal government agencies.
- Academics.
- Representative (including peak) organisations in forestry and agriculture.

The intent was to generate information from a broad cross-section of relevant individuals and organisations in order to establish a reliable and defensible baseline of data and opinion regarding potential opportunities for the sector.

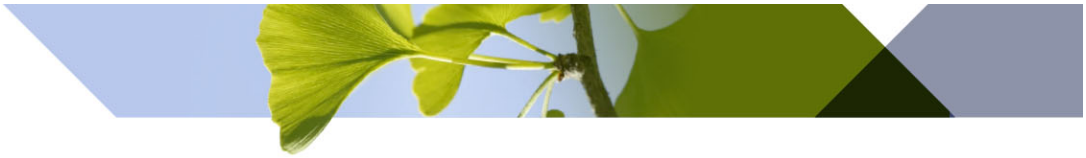
Summary of outcomes

Estate expansion

Based on our discussions with stakeholders, for industrial hardwood plantations, the region's estate is set to decline by somewhere between 10,000 hectares and 25,000 hectares over the next five years[9]. The driver for this is rationalisation and sell off of non-core plantation areas, plus anticipated reversion of significant areas (up to 80%) of leasehold/share farm/joint venture properties[10].

[9] As well as being identified through the stakeholder consultations, this contention is supported by independent sources. Freeman and Morton (2014) for example identified a likely reduction in hardwood plantations for Tasmania at between 5,000 and 20,000 by 2020.

[10] Note that this phenomenon is not unique to Tasmania. We are seeing the area of softwood and hardwood plantations across Australia diminish as some harvested areas are not being replanted where the landowner can not foresee appropriate risk adjusted returns from plantations and/or does not have the capital to tie up for another rotation. Other land use options are financially and practically more appealing.



This Report discusses opportunities to increase productivity of the existing estate through genetics (i.e. tree breeding), changes in silvicultural regimes and other opportunities. This can be considered a form of expansion, as it results in increasing the available wood, while not delivering an increased land footprint for plantations. A key consideration is how to maintain the existing plantation footprint to the greatest extent possible, and assist in increasing the productivity, in terms of volume and value per hectare.

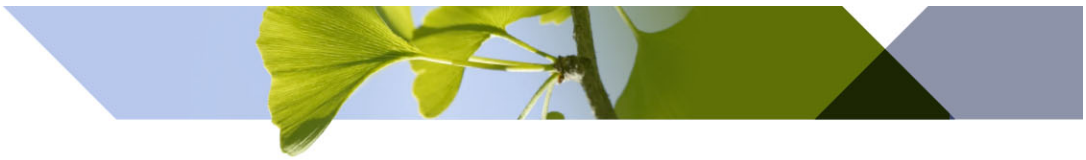
In relation to the softwood estate, the general view seems to be that the industrial plantation estate (essentially comprising the Taswood[11] estate), will be maintained as it is. The independently owned pine plantation estate appears to be slowly declining as it matures and is harvested.

There are few, if any, existing incentives to support expansion of the plantation estate, either for industrial growers or independent growers. Some stakeholders have pointed to the Forest Practices System as a pseudo incentive because it provides certainty to landowners regarding future ability to harvest. There is also positive sentiment towards the focus areas of Private Forests Tasmania in relation to programs and information supporting independent forest growers. However, these are better described as support programs than incentives or market drivers. Some industrial growers and processors point to leases, joint ventures and contractual arrangements as commercial incentives to plant. However, again, these are more properly classified as programs or simply part of the commercial landscape, rather than drivers or incentives. The ERF is a potential incentive, particularly if recent changes (including addressing the 600 mm rainfall barrier) deliver improved access through reduced administration.

The major barriers to expansion include:

- Timber Investment Management Organisation fund constraints and rules which are focused on existing assets and not geared towards green fields or brown fields expansion.
- Lack of availability of suitable land at scale and at affordable prices to support an acceptable return on investment when assessed against risks and fund hurdle rates – this is driven at least in part by competition for alternative land uses, particularly dairy and beef cattle.
- Community antipathy towards industrial expansion, combined with legacy concerns about the historic impacts of MIS expansion.
- A perception that the farming community in general does not consider tree plantations as a legitimate land use.
- Regulatory barriers, specifically the State Government's Protection of Agricultural Land (PAL) policy, introduced in 2009, as well as the costs associated with regulatory instruments including Private Timber Reserves, Forest Practices Plans and the Private Forest Service Levy.
- For smaller independent growers, additional barriers to establishment include a suite of factors which relate to limited knowledge about growing, harvesting and marketing trees, such as: lack of confidence in future markets for a long term investment; perceived lack of transparency in supply chains (including costs and prices); and, in some cases, negative experiences with the market and service providers in the market.

[11] The Taswood estate comprises approximately 46,000 hectares of softwood plantations which were originally established by the State government. In 1999, 50 per cent of this estate was sold down to GMO resources (an institutional investor) to create a joint venture which was called Taswood. In 2012 the entire estate was sold to New Forests. It is still referred to as the Taswood estate. The whole of the Taswood estate is located within the Hub region.



- Limited ability for smaller growers to access certification to guarantee future market access.
- As a result of recent fire history throughout the country, particularly last summer, the ability to insure plantations is emerging as a specific risk factor.

There does not seem to be much discrimination between preferred species for expansion. The general sentiment is that species selection is driven by site and market factors. There is some suggestion that, for independent growers, market competition is stronger for hardwood, which might drive decision-making. Further, there appears to be little or no appetite in expanding potential species beyond the three dominant species currently grown – *E. nitens*, *E. globulus* and *P. radiata.*

There is also active estate rationalisation occurring for industrial growers looking to replace some areas of hardwood plantation with softwood plantation, to better suit local site conditions and markets. In this context, one stakeholder (a third party forest manager) noted that in the north west a rational decision-maker would favour hardwoods and in the northeast softwoods, based on the combination of soil types, rainfall distribution and market availability.

In addition to financial returns, the main considerations for investment include land prices, land availability, land productivity, confidence in future markets and proximity to markets. Plantation scale is also a critical consideration, particularly in relation to plantation management costs.

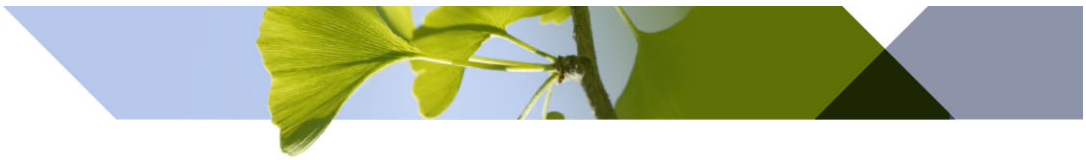
Supply forecasting and arrangements

The general outlook for supply is that it will decline over the next five years or so, for a number of reasons. Those reasons vary somewhat between hardwood and softwood plantations, and also between private and public plantations.

In relation to privately owned hardwood plantations, the main short term driver for supply decline relates to age class distribution of the ex-MIS estate. Plantation establishment peaked between 2002 and 2007. That estate has now largely matured and is being harvested. As harvest is completed, a net reduction in plantation area is occurring due to major industrial growers rationalising their estates and smaller independent growers choosing not to replant on leasehold, share farm and joint venture properties. Stakeholders consulted indicated` , based on their interactions with private small plantation owners at the point of plantation harvest and marketing, they have assessed the proportion of independent landowners looking to re-establish hardwood plantations at somewhere between 10 per cent and 20 per cent. The indicative reduction in hardwood plantation area over the next five years looks to be between 10,000 and 25,000 hectares.

This is a material concern with respect to future supply. For example, one large company involved in growing, processing and exporting woodchips indicated that third party market supply contributes between 8 and 17 per cent of total throughput for its wood chipping and export operations. Similarly, a major exporter noted that independent market wood comprises approximately 50 per cent of its current wood flow.

The situation with publicly owned hardwood plantations is slightly different. These are plantations which have been managed under specific, intensive silvicultural regimes with the objective of producing solid wood products at final harvest. Commercial thinning from these plantations is producing wood products for the wood chip and round log export markets and is expected to be completed within the next 18 months. Apart from small areas of harvest to



support solid wood processing trials, this estate is then targeted for final harvest from 2027. Whether or not these areas are re-established with the intent for solid wood or commodity wood production will depend on the extent to which the processing sector responds to the plantation solid wood opportunity. However, it is expected that this area will remain as plantation into the future.

The softwood plantation estate in the region is dominated by the Taswood estate with a small area of independently owned plantations. There is a predicted peak in production on the Taswood estate which will occur over the next decade as a consequence of uneven age class distribution. However, in the long term, the estate is expected to be managed towards a normalised timber production regime.

The independently owned softwood estate was largely established with State government funding support in the 1990s and is now at harvest age. It is difficult to determine clearly what landowner intent is post-harvest. However, service providers have indicated through the consultation process that they expect at least 50 per cent of this smaller estate will not be replanted. One stakeholder indicated that the major softwood timber processors have struggled to secure market access to third party softwood resource recently.

With respect to supply forecasting, the larger industrial estates are managed on the basis of modelled and forecasted harvest and supply, based on existing market conditions. Independent wood is not generally considered in the forecasting process and tends to be treated opportunistically as it becomes available.

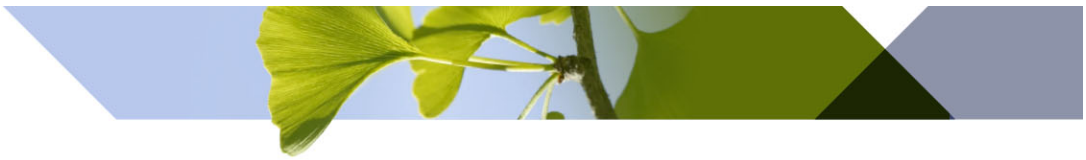
All of the stakeholders spoken to recognise the current importance of independently grown plantation wood to supplement industrial plantation supply. There is also general recognition of the importance of identifying means by which the corporate forest and wood products sector can work with landowners to maintain and improve future timber supplies.

Practically all independent wood is currently purchased from growers on the stump in a reasonably vibrant and competitive market. However, it is recognised that independent growers have little knowledge or insight about how the supply chains and markets work. Consequently, they are reliant on wood purchasers and third party service providers to manage and communicate these aspects of the harvest and marketing process.

It is recognised that, while there is strong market competition for independently grown wood, particularly for hardwood plantations, the balance of power in commercial relationships has rested with those parts of the supply chain beyond control of the grower. Further, it is acknowledged that if the sector is to encourage future establishment to maintain or augment supply, the nature of these commercial relationships needs to change to reflect greater levels of communication and equitability for smaller growers. Examples presented during the stakeholder consultation included introducing greater transparency and certainty around pricing and supply chain costs, as well as improved harvest scheduling in favour of smaller growers.

Silviculture, markets and products

The industrial growers consulted all expressed the view that a focus on improving plantation productivity (the amount of wood that can be grown per hectare) is critical in supporting future supply levels. This is reflected in a stated focus on silviculture, genetics and site productivity factors (such as fertility and impacts of animal and plant pests, for example).



With respect to hardwood plantations, opportunities may exist to move from shorter pulpwood only regimes to longer solid wood regimes. However, apart from the public plantation hardwood estate, there is little evidence of real intent to make this shift. The existing privately owned industrial hardwood estate was planted specifically with wood chip production in mind, either for export or for the proposed Bell Bay pulp mill. In recent years a small but significant round log export market has emerged for some of the better quality logs, indicatively about 10 per cent of total production[12].

A significant barrier to introducing silvicultural regimes targeted at the domestic solid wood market is the issue of export parity pricing – there is real scepticism about whether the domestic market can afford or is willing to pay for logs produced on longer rotations with more intensive silvicultural intervention, at a price point which would justify shifting from export markets. The experience gained from the harvest of the publicly owned long-rotation hardwood plantations will provide important market information but this will not be available until after 2027.

There was some discussion about the potential impacts on export demand and pricing resulting from the current global geopolitical instability, particularly in relation to the China market. However, there were no strong indications that industrial growers are looking to shift away from the current export market focus in any meaningful way. That said, all the growers expressed support for work being undertaken in the processing sector to look at the viability of domestic solid wood processing for hardwood plantation logs.

In relation to softwood plantations, there is a keen interest in alternative silvicultural regimes, such as a move to multiple thinning events and introduction of targeted fertilising regimes, which are aimed at improving productivity and generating a more normalised supply profile into the future. The current view is that the softwood sector supports production of a diverse range of target products from treated pine landscaping products through to structural timber.

One stakeholder noted that any material progress with carbon pricing for plantations is likely to have a strong influence on future silvicultural regimes, with a focus on longer rotation lengths and possibly alternative target products, specifically for hardwood plantations.

Supply chain challenges

The most significant supply chain challenge identified by practically all stakeholders is access, congestion, competition and management of the port facilities at both Burnie and Bell Bay. It is important to note that issues related to supply chains, logistics and markets are addressed in a separate Assessment Report. In this Report we have sought only to reflect the comments of stakeholders in relation to the impacts on potential access to land and land use policy.

Specific issues around access to port space and chip piles at Burnie were raised by most relevant stakeholders, although there is a sense that these issues, which have been long standing, are gradually being resolved. All stakeholders had a view about what the issues are and which parties were responsible, with all indicating that other parties were responsible for manipulating access to markets through the port. It was also noted that one perverse outcome from these challenges is that inconsistent pricing and access at Burnie is resulting in wood being transported from the north west to Bell Bay, when Burnie is the logical delivery point. This has a material impact on ability to competitively price wood for smaller independent growers.

[12]Prices and demand in this market have been notoriously volatile. Exported volume in log form can range from 0% to as much as 50% of harvest, depending on prices and log availability.

All stakeholders reported that access to, and cost of harvest and haul contractors is not a limiting logistics factor in the region. It was also generally reflected that the core road infrastructure in the region is of a reasonably high standard and can be effectively managed with respect to seasonality and year-round harvest and haul access.

An emerging supply chain issue relates to the production of solid wood for domestic markets, particularly from the public estate. The issue relates to where, and at what scale the processing sector should be encouraged to develop, in order to access this geographically widely distributed resource most effectively. If private industrial and independent growers also start to consider solid wood regimes for hardwood plantations this may provide clearer answers to the challenge.

Figure 7: Partially harvested Eucalyptus nitens plantation, Red Hills (Credit: P. Groenhout, 2017)

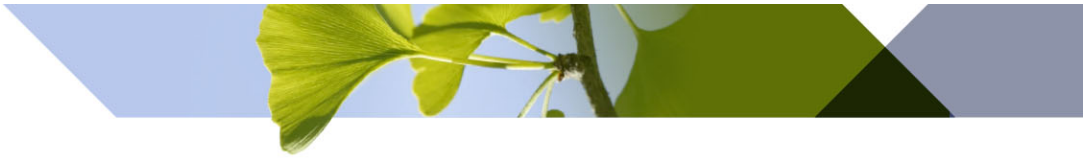
Social license

Operating the current estate

When considering operating the current plantation estate, the consistent view from all stakeholders is that, while some elements of the farming community don't view plantations as a valid economic land use, the current plantation estate is accepted as a routine part of the landscape.

There does seem to be slightly better acceptance of softwood plantations than hardwood plantations – the reasons provided for this view include that softwood plantations have been around for longer, integrate better with farming land uses and are better understood.

Most of the stakeholders interviewed identified that there are localised social license challenges associated with operating the current estate. Mostly these relate to neighbour and local community interactions on matters such as log truck use of roads, impacts on school bus routes,



and localised effects of operations such as chemical use, dust and noise. Stakeholders generally consider these issues to be readily manageable. Further, the Forest Practices System is seen to be a highly useful tool and structure for facilitating management of these issues.

There is a sense that the nature of centralised corporate ownership means that there isn't a local face to operation of the plantation estate and that this has an impact on the nature of local communities.

Expansion of the current estate

Practically all stakeholders consulted agreed that any further industrial scale expansion of the plantation estate would create significant social license issues for the sector. This reflects industry perceptions about the views of the regional farming community, issues of land use competition and community consideration of what the most appropriate land uses in the agricultural landscape are.

There appears to be somewhat of a geographic divide on this issue, with communities in the north west much more strongly opposed to plantation expansion generally and industrial expansion specifically. This divide also correlates strongly with the higher agricultural productivity in the north west which has seen over the past decade a significant increase in intensive dairy and beef cattle enterprises and also, to some extent, corporatisation of agricultural enterprises. Antipathy to plantation expansion is not considered as much of an issue in the central north and north east but it is still a factor.

One of the consistent reasons provided for these concerns is the extent to which landowners were burnt during the aggressive expansion of the managed investment schemes and Gunns during the period 2002 to 2007. There is a strong sense that the hardwood plantation sector, specifically, operated with little regard to community sentiment and that as those enterprises failed, they left landowners with practical and financial issues that are still being resolved.

The consistent view expressed was that the sector must find ways to better work with the broader farming community to integrate commercial tree production at smaller scale with other agricultural enterprises. This is seen as the most likely and reasonable way to maintain and augment the current plantation estate. Along with this is the recognition that the sector will need to find different ways to operate in order to ensure future access to independently grown plantation wood.

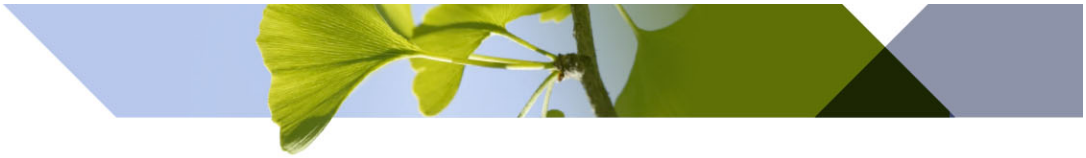
Some stakeholders stated that they thought some tactical expansion of the existing industrial estate would be acceptable, where it makes sense to rationalise around existing plantation locations.

Regardless, a dominant theme is the limited opportunity in the north west for the reasons already noted.

Additional social license issues

A number of stakeholders noted their view that the conservation movement generally is ambivalent towards plantation forestry in its current form, especially while the issue of native forest harvesting is still in play. However, several stakeholders reflected that:

- if native forest harvesting was to cease, conservation groups and the Greens would most likely develop a more actively negative position towards the plantation sector; and



- there would likely be resistance from conservation groups to industrial plantation expansion.

There was no specific evidence provided to support either of these concerns. However, it appears to reflect the general perceptions held by stakeholders towards the conservation movement and its attitudes to the forestry sector generally.

Another issue raised by several stakeholders was that the industrial plantation estate and processing facilities are significantly foreign owned and a large proportion of the wood harvested, particularly from hardwood plantations, is exported overseas. Consequently, forestry is seen to generate little economic value-add in Tasmania and few jobs beyond the harvest and haul sector. In the current economic and geopolitical environment there was a concern expressed that the absence of domestic processing for a largely foreign-owned resource[13] may present future social license issues for the sector.

Certification

Most stakeholders interviewed view forest management and chain-of-custody certification as a critical element for viable forestry and timber processing activities. There are two main drivers for certification that apply slightly differently for the hardwood and softwood sectors. Certification is also considered a critical consideration for independently grown plantation timber.

All industrial plantations in Tasmania are certified to one or both of the available certification schemes. In relation to hardwood plantations and products, certification is an absolute requirement to access international woodchip markets. By contrast, with the exception of chip exports, for the softwood sector there is not a strong market driver for certification. However, all major forest owners, whether institutional investors or the State government, have an expectation that their forests will be certified, regardless of the expectations of markets.

Certification for small forest growers is viewed as both important and challenging. There is a preference for independently sourced timber to be certified but also a recognition that it is not always practical or possible. In this context there are a number of third party service providers which can facilitate certification for smaller growers. This improves the marketability of wood from those plantations.

While there is scope under both certification schemes for a small amount of uncertified timber to enter the supply chain, there are critical percentage thresholds which, if reached, mean that no more uncertified wood can be used in any particular year. At least one industrial woodchip exporter noted that it has been in a situation where it has had to limit the amount of uncertified, independently grown timber that it can purchase because this threshold has been reached.

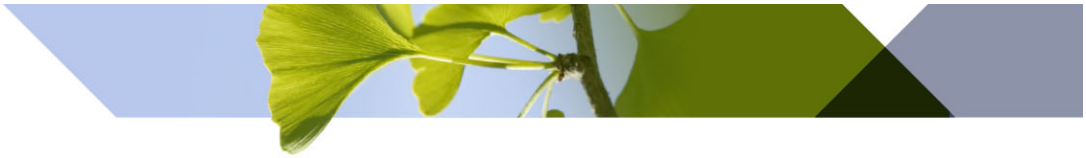
Certification for small forest growers is also challenging from the perspective of both cost (relative to scale) and ability to meet specific certification rules for one-off harvesting events.

Carbon pricing and other market and policy incentives

Carbon

There was a consistent view among most of the stakeholders consulted that the availability of a carbon price would be a critical driver for plantation expansion, based primarily on the fact

[13] This is more perception than reality as the relevant industrial owners are either Australian-based companies or have at least some Australian-based superannuation institutions as part of their investor mix.



that it is a mechanism for offsetting early rotation costs and therefore improving the investment economics for green field plantations. Some within the industry have already had success in Emissions Reduction Fund (ERF) auction bids (under the Carbon Farming Initiative (CFI)) for changing from short rotation hardwood to long rotation softwood plantations. Stakeholders also considered that a carbon price may play a decisive role in future for shifting from short pulpwood rotations to longer solid wood silvicultural regimes in hardwood plantations, although the view was expressed that this is contingent on proving up the solid wood processing capability for *E. nitens* and *E. globulus*, which is not certain at this point.

There is generally a positive view of the possible role of a carbon value in improving investment economics. However, there was also considerable scepticism about the ability to scale participation in the ERF and CFI to meet the challenges of maintaining or expanding the plantation estate and timber availability in the region. Issues identified include that:

- the administrative and technical process for evaluating and submitting a project to meet the requirements to participate in an ERF bid are complex and onerous, with no guarantee of success.
- the extent to which the carbon value generated from successful bids is capable of meaningfully offsetting early rotation costs is not certain.

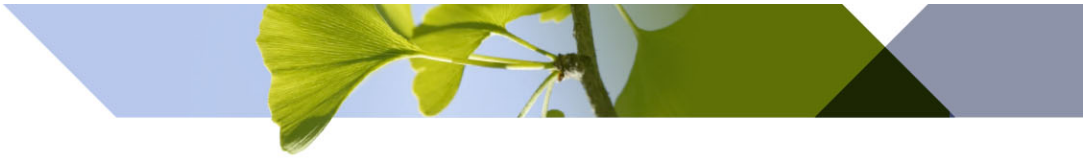
There was some discussion about the ability for the sector to participate in voluntary carbon markets. However, none of the stakeholders spoken to identified any examples of where this is happening or being actively considered and investigated.

The ERF and CFI aren't viewed as a meaningful incentive opportunity for establishing independent, small scale plantations at this stage, due primarily to the administrative and technical burden of developing and submitting a potential project for participation in auctions. There are additional concerns about how reporting and management of obligations would work for smaller independent growers. There is an opportunity for the Hub to investigate ways to assist smaller independent growers through a group or regional approach.

Other incentive opportunities

There were no specific opportunities identified by stakeholders. The general observation is that any encouragement for replanting or for establishing new plantations needs to focus on the early rotation costs. High level opportunities identified are focused on partnership models, such as leases, share farms and joint ventures. There is also an emerging view that one of the most effective means for achieving commercially viable tree establishment on farms needs to be based on the concept that trees offer considerably more commercial value to a whole farm enterprise than simply the end of rotation timber production and return. Some stakeholders are actively looking at mechanisms to account for these other values, such as natural capital accounting.

Private Forests Tasmania has a current project aimed at developing and implementing a program for matching potential investors with interested and viable commercial plantation development opportunities on privately held land in Tasmania. In the context of the Commonwealth Government's 2018 policy framework and work undertaken elsewhere, including by the University of Melbourne and through Forest and Wood products Australia, it appears that this program is a good fit with the emerging concept of effectively and practically integrating commercial timber plantations into the broader rural land use landscape. The primary



challenge will be how to integrate traditional *at-scale* forestry investment models with traditional agricultural small-holding land-use decision making approaches.

The concessional loan scheme announced at the last Federal election by the Coalition is generally considered to be of limited use in encouraging plantation expansion. The reasons for this include:

- Institutional investors are not interested in loans to supplement funds raised.
- The economy is already operating in a low interest environment.
- There is a perception that the administrative and reporting requirements for low interest concessional loans are a deterrent to any landowner, large or small, that might consider plantation expansion.

Examples from other jurisdictions

None of the stakeholders spoken to could identify any contemporary examples where greenfield establishment of plantations is working to support commercial timber production. There were a number of examples provided where it has been attempted more recently but unsuccessfully. Examples include Brazil and Chile, where recent plantation expansion efforts have met with considerable community resistance. Another example provided was expansion of environmental plantings in China (predominantly for watershed protection), although there are doubts about actual performance of these programs.

Small grower resource

Procuring small grower timber

It is clear that there is a very strong and competitive market for independently grown timber in the region, for both hardwood and softwood plantations. This resource is almost exclusively purchased on a stumpage basis with either the processor or exporter, or a service providing agent, procuring the timber and providing the harvest, haul and marketing arrangements.

Nearly all processors and exporters have some degree of reliance on third party timber resources and in most cases, there is a competitive process in place for purchase of the timber.

An issue which was consistently identified by stakeholders is that smaller growers generally have little insight into the functioning of supply chains and timber markets, and the nature of costs and prices beyond the stump. It appears that this contributes to a lack of confidence among many of these smaller growers about timber markets and supply chains, which some view as a genuine barrier to replanting or new establishment. Several stakeholders noted that farmers can readily access current farm-gate and delivered prices for a wide range of crop and livestock commodities but cannot get access to this information for commodity timber. Further, timber pricing, particularly for export products, can be quite volatile and subject to market forces which are obscure to these growers.

These factors contribute to a perception by industrial growers that a significant proportion of the value of timber is being captured by players along the supply chain that understand its functioning better than the landowner. Those supply chain actors argue that the risk profile, particularly in relation to harvest and haul costs, justifies this approach to stumpage pricing. Whether or not this the case, the perception is strong.

Compounding this issue is that, while timber procurers recognise it as a material issue, there is a reluctance to provide a greater degree of transparency about supply chain and production

costs, and demand drivers. Another compounding issue is that, for many smaller growers, their ability to market resource in a timely fashion is dictated by the broader considerations of processors, which means that at times small grower harvest is deferred in favour of industrial grower priorities. The obverse to this is that smaller growers sometimes make spot decisions about whether or not to proceed with harvest, based on current market conditions and sometimes have an expectation that their resource will be able to slot into the supply chain whenever pricing improves.

All the timber procuring stakeholders that were consulted identified that maintaining or expanding the private grower resource base is an important priority, and that the factors discussed above are a genuine barrier to that potential.

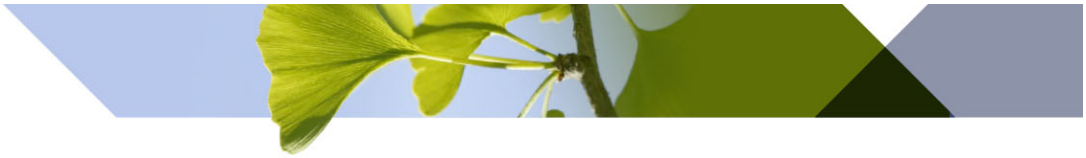
A number of processors identified that there is more that can be done to improve supply chain and market transparency and that there are opportunities to create greater certainty, and return more margin to the grower, in the form of tree crop equity or timber pricing. All timber procuring stakeholders identified that more needs to be done to help smaller growers better understand the way that timber is procured, harvested, transported and marketed and to build confidence in supply chains and pricing. There is a role for the Hub to facilitate the collection and dissemination of this information.

Figure 8: Harvested Eucalyptus nitens logs, Red Hills (Credit: P. Groenhout, 2017)

Regulatory framework and third party costs of establishment

A key challenge identified for smaller forest growers is that Tasmania has a strong regulatory system, in the form of the Forest Practices System, that imposes expectations that landholders do not experience with any other *as of right* land use.

The value of the Forest Practices System is well recognised, in terms of reducing the potential negative impacts of forest establishment and harvesting, providing a useful mechanism for



circumventing inconsistent local government planning rules and providing certainty with respect to right to harvest. However, it is also seen as overly complex and expensive for smaller forest growers and is perceived as a barrier to expansion. One stakeholder noted that the regulatory framework was established in the context of native forest harvesting on public land and is less suited to smaller plantation areas on previously agricultural land. There is some recognition of this, and the regulatory system (in particular the Forest Practices Code) has been subject to review with a focus on how better to facilitate and support smaller forest establishment on private land.

Another perceived challenge is that the regulatory and levy system applying to forested land imposes costs on the basis of area established, early in the rotation, rather than imposing costs at the point of harvest. A number of stakeholders felt that shifting the levy and planning fees from the cost end of the plantation cycle to the revenue end would be a significant improvement in terms of encouraging greater participation in plantation growing by smaller landowners. It should be noted that both the PFS levy and FPP fees already apply at the harvest end. Therefore, there are potentially two issues to address: first, shifting the remaining regulatory costs (or a good proportion of them) to the revenue end of the plantation production cycle; and second, addressing an apparent misperception about where costs lie.

Nature of smaller forest growers

In terms of the nature and motivation of independent forest growers, there were two broad categories identified:

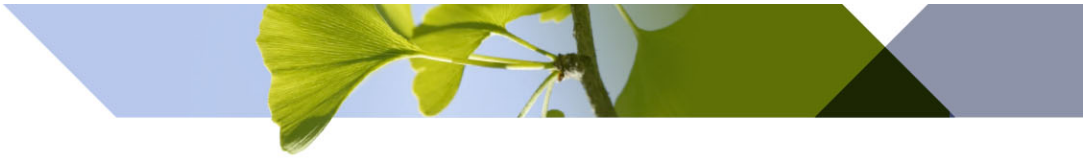
- Landowners who are motivated by environmental outcomes and planting trees for the sake of planting trees.
- Landowners who are commercially motivated to maximise potential returns from their properties through integrated land use.

The first group is considered smaller and is not necessarily motivated to replant with commercial tree species. For example, one landowner spoken to identified that while he had generated an income from thinning his softwood plantation, he didn't expect it to be harvested until it was about fifty years old, implying that the motivation was aesthetic as much as commercial. Further, he identified that he would not re-establish to pine, preferring to see the area move to native forest in the long term.

The second group is considered larger and, as indicated, motivated by rational economic decisions about highest and best land use. Often these landowners are targeting areas for plantation establishment which are not suited to any other productive land use because of topography or inherent site quality issues. In some cases, this means that harvesting the plantations is more difficult because of access and regulatory challenges, which has had the consequence that many of these areas are not being replanted after harvest and are not being reverted to any other agricultural use.

Access to services

Third party professional and technical services to support expert forest management are readily available within the Hub region. Technical forest services providers noted that smaller forest growers form a very small part of their revenue base. Forest management and harvesting and marketing management service providers noted they had a broad client base from smaller to industrial scale growers. However, for smaller growers the services are generally focused on either establishment or harvesting and marketing.



Smaller independent growers consulted as part of this Assessment Report expressed a variety of views as to their awareness of and use of third party service providers. For some, technical consulting advice with respect to the initial establishment of their plantations was all that had been utilised, for others, third party harvesting and marketing services were seen as important because they considered the management of their plantation as a distraction from other income generating land use activities which they knew more about.

Landowner views of forestry plantations

The perception of most stakeholders consulted is that the agricultural community generally has a negative view of the role of tree plantations in the physical and economic landscape, whether as discrete plantation areas, or as an integrated part of a farming enterprise. It is apparent from the interviews that this view is held most strongly in the north west, which corresponds with a greater intensity of agricultural activity and higher agricultural productivity. One stakeholder noted that landowners and farmers in that region have "*zero interest in trees*" and are actively removing all planted trees and shelterbelts in the area in order to make way for pasture and irrigation infrastructure.

There is a strong sentiment that the best means by which to address this issue is to invest strongly in developing programs to better inform landowners about the broader productivity and non-wood values of trees on farms.

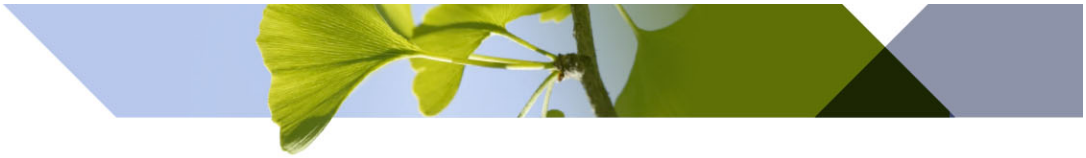
Regulatory barriers to expansion

A number of stakeholders identified that Tasmania's overall regulatory environment, for all activities, is a coarse barrier to development. Several stakeholders expressed the view that there was a history of knee-jerk policy reactions to vocal stakeholders at the margins. This is considered the case even when the proposed activities are broadly in line with general community and social license expectations.

A primary example provided to support his contention is the Protection of Agricultural Land (PAL) policy which stakeholders felt was introduced in a reactive response to the rapid expansion of MIS plantations in the period from 2002 to 2007, and is seen as a significant barrier to any form of plantation expansion. All stakeholders that identified this issue recognised and accepted the fact that there is a need to ensure that high quality land is secured for availability to produce high value crops and livestock. However, it was also identified that the policy is oversimplified and does not support establishment of trees as part of a whole farm planning approach to integrated production, and nor does it recognise the broader value of trees on farms in supporting general agricultural productivity.

More specifically, in relation to forestry regulation, stakeholders identified that the red and green tape associated with forestry developments is not in place for other agricultural land uses. Despite the recognised benefits of the Forest Practices System, the fact that this level of approval and regulatory cost is required to make an informed land use decision to establish commercial tree plantations, means that immediately it is perceived as more difficult than making a decision to change land use from grazing to cropping, for example.

Stakeholders generally felt that in looking at regulatory solutions which reduce costs, expedite planning and approvals processes and appropriately treat the lower risk profile of integrated farm plantations would significantly improve the perception of farm forestry as a viable and



valid land use alternative, and may help to drive the cultural change necessary to expand plantation establishment.

Forestry policy

There is a consistent sentiment among stakeholders that governments, at both the state and federal level, are supportive of the role of plantations in the region and that this support is bipartisan across the political spectrum. Stakeholders were generally of the view that the State government recognises the role of plantation forestry and would likely be supportive of any practical recommendations aimed at removing barriers for farm forestry.

Private Forests Tasmania is viewed as the most suitable and likely organisation to facilitate what is perceived to be the need for cultural change in the farming community, supported by extensive work to assist landowners to better understand the overall benefits of trees on farms as well as looking at improving landowner education about and understanding of commercial timber supply chains and markets.

The newly formed Tasmanian Forest Products Association (TFPA) is seen as having a significant role to play in informing, advocating and influencing policy direction in the state generally. TFPA is replacing the Forest Industries Association of Tasmania, and has expanded to include plantation grower and processor membership. Stakeholders also expressed that both the TFPA and PFT will be well placed to work more effectively and collaboratively with other agricultural advocacy organisations, such as the Tasmanian Farmers and Graziers Association, DairyTas and the Tasmanian Agricultural Productivity Group, with the aim of improving the outlook for farm forestry expansion in the region. There is a potential role for the Hub to work with these other bodies to help educate owners and managers about the wood and non-wood values of plantations on farms.

SPATIAL AND ECONOMIC ANALYSIS

This section presents a summary of the rationale, methodology and results from the spatial and economic analysis undertaken for this Assessment Report. Appendix 3 provides detailed coverage of the methodology data sources and rationale for the analysis.

Summary

Approach and results

The spatial and economic analysis undertaken for the project considered six steps in determining the potential for plantation expansion in the Hub region. These entailed modelling (for *Eucalyptus nitens* and *Pinus radiata*) of:

- Plantation land availability and suitability.
- Plantation availability based on Higher and Best Use (HBU) analysis.
- Plantation viability, based on economic analysis.
- Landowner intent analysis.
- Natural capital plantation potential.
- Validation of results.

A concept of Plantation Development Potential was used to provide an area basis for considering areas within properties potentially capable of supporting plantations. These classes are summarised in Table 2 below. The spatial analysis also considered the opportunity for *natural capital plantations*, or plantations which offer no real prospect of commercial timber returns but can provide alternative services in relation to on-farm benefits and improved agricultural productivity.

Table 2: Description of plantation development potential categories

Plantation development potential category	Description
No potential	Model criteria results in site not having any potential for plantation development
Natural Capital potential (Riparian)[14]	Model criteria results in site being available for Natural Capital Planting within a Modified Riparian Zone
Natural Capital potential (Wetland)	Model criteria results in site being available for Natural Capital Planting within Modified Wetland
Natural Capital potential (Slope)	Model criteria results in site being available for Natural Capital Planting in areas too steep for other land use
Small-Scale potential (Riparian)	Model criteria results in site being available for Small-Scale Planting within a Modified Riparian Zone
Commercial potential	Model criteria results in site being available for Commercial Planting

The summary of results of the spatial and economic analysis is presented in Table 3 below.

[14] Note that the Natural Capital planting category described below relates purely to plantings which have no realistic potential contribution to future timber production but may form part of an environmental services opportunity – these are tree plantings in riparian zones, steep and erodible areas and areas which are restricted from harvest activity. The key commercial species have been used here as a proxy for suitability to plant. However, it is more likely that alternative endemic species would be better suited to these sites. There will also be situations where economies of scale mean that these natural capital plantings can form an effective component of an integrated whole farm tree planting plan.

Table 3: Summary of spatial and economic analysis results – commercial plantations

Species	Rating	Suitable (ha)	Available (ha)	Viable (ha)
Softwood	High	51,069		36,698
	Low	300,014	61,976	21,438
	Nil	272,941		3,607
Hardwood	High	38,792		16,147
	Low	197,087	41,445	16,603
	Nil	382,923		8,511

Additionally, landowner intent with respect to plantation establishment or re-establishment was considered in the context of historic harvesting and re-establishment over the period 2015 to 2019, to provide a proxy for estimating likely activity into the future. Additional anecdotal evidence was considered with respect to the pattern of Private Timber Reserve additions and revocations.

In summary, the analysis indicates that there is approximately 37,000 hectares with high commercial viability for the establishment of softwood plantations and 21,000 hectares with moderate viability for establishment of softwood plantations in the Hub region, hardwood plantations only being viable on much smaller subset of these same areas (16,000 hectares of high viability and 17,000 hectares of moderate viability). These areas are in addition to the existing plantation estate of 211,000 hectares in the region.

This should be compared with the 49,000 hectares of independently owned plantation area within the region that was present in 2015, of which some 17,000 hectares has been harvested at 2019 and 9,500 hectares is not expected to be replanted. This suggests that, while there is considerable area which can be considered as the commercially viable catchment, the extent to which that can be converted to new plantation area is likely to be much more limited, and highly dependent on the success of the Hub's implementation plans.

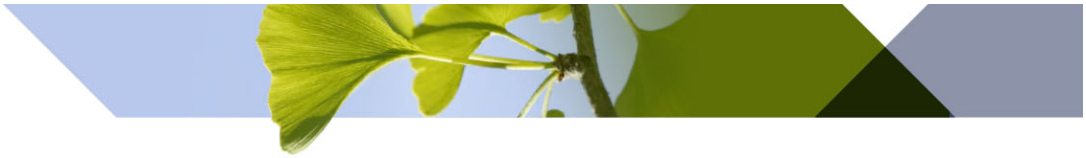
Assessment of current land use

Plantation land uses (i.e. gross land area, including supporting infrastructure, reserves, non-production areas and similar) comprise some 7% (268,000 hectares) of the total area of the Hub region, as shown in Table 4 below.

Of the gross plantation land use area in north-northwest Tasmania[15], 71% (192,000ha) is managed by private forest management companies within large industrial plantation estates on a mix of private and public land, 15% (42,000ha[16]) is owned by a large number of independent landowners on private land and the remainder (25,000 hectares) is publicly owned land managed by Sustainable Timbers Tasmania.

[15] Derived from the Draft DPIPWE 2019 Land Use layer, which reports plantation area data as at 31st December 2018

[16] As at 31st December 2019, approximately 32,000ha was identified as standing plantation forest, and another 10,000ha identified as harvested and, based on the PTR analysis described above, was assumed to be either: fallow awaiting replanting; in the process of being replanted; or recently replanted.



In terms of private freehold land, there is currently 129,000ha[17] net productive forested plantation area in the Hub region, of which 89% (116,000 hectares) is hardwood plantation and 11% (13,000 hectares) is softwood plantation.

Table 4: North-northwest Tasmania land use classification (2019)

Land use category	Area (hectares)	Percentage of land area
Nature conservation	1,409,469	35%
Other native forest	959,193	24%
Grazing and livestock	528,547	13%
Production native forest	498,136	12%
Plantations	267,944	7%
Infrastructure and built-up	116,382	3%
Cropping	97,670	2%
Waterways	97,626	2%
Land in transition	10,015	0%
Horticulture	3,924	0%
Mining	3,870	0%
Total	3,992,776	100%

Methodology and results

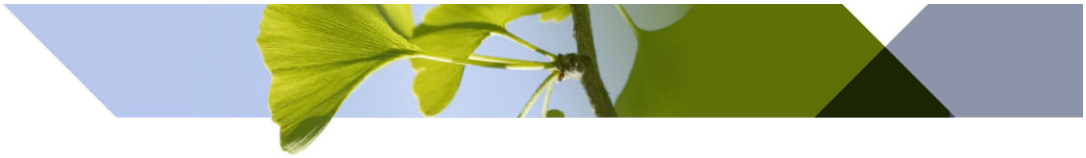
Overview

Land suitability, availability and viability for plantation use in north-northwest Tasmania was assessed using a desktop Geographic Information System (GIS) modelling approach.

The process involved six steps:

1. Plantation land suitability modelling: this process reviewed current land use in terms of capacity, legislation and social licence with respect to potential for conversion to plantation use, and married this with physical site environmental factors, to assess location and extent of areas likely available and suitable for plantation use.
2. Plantation availability (HBU) modelling: this process overlaid the physical plantation availability and suitability model outputs with competing agricultural land use site suitability to provide an indication where there may be conflicts or opportunities for plantation use.
3. Economic modelling: this process overlaid the higher and best use model outputs with key economic drivers that would influence the commercial viability of any plantation development such that commercial wood catchment zones could be identified. Each

[17] Derived from the Draft PFT 2019 PRIPIT layer, which reports plantation area data as at 31st December 2019



private property parcel within the model was analysed against these economic drivers to score their commercial potential.

4. Landowner intent analysis: to assist with understanding current landowner intent with respect to plantation use since the final collapse of plantation managed investment schemes in Tasmania in 2013, a GIS analysis of plantation status between 2015 and 2019 was undertaken.
5. Natural capital planting modelling: this process was run independently of the commercial modelling describes in steps 1 to 4 above, focusing on areas that could coexist within intensive cropping or grazing land uses to enhance natural services on the site so as to increase overall site productivity and sustainability. Areas modelled included riparian zones and wetlands with heavily modified vegetation cover, and very steep slopes.
6. Model review: a random sample of 66 modelled properties were chosen from across the Hub region and the model outputs were assessed against current imagery to ensure consistency with on-ground conditions and operational logic.

Plantation Suitability Model

The plantation suitability assessment was undertaken in order to determine which parts of the agricultural land base in the Hub region have the requisite physical characteristics to support the establishment of commercial hardwood or softwood plantations, and are available from a regulatory perspective (with reference to local planning schemes and forest practices limitations). The analysis demonstrates that of the approximately 630,000 hectares assessed, approximately 270,000 hectares has low suitability and 51,000 hectares has high suitability for potential plantation expansion (noting that softwood suitability is higher and hardwood suitability is a subset of softwood suitability). A total of 272,000 hectares was considered to be unsuitable for any plantations, and 393,000 unsuitable for eucalypt plantations.

Detailed outputs for both hardwood and softwood plantations are included in Tables 5 and 6, below. Figure 10 presents the results in map form for the Hub region.

The key inputs used to formulate the Plantation Land Suitability Model were:

Tenure	○ Parcels of private land tenure were extracted from the LIST Cadastral layer.
Legislation	○ Local Government Interim Planning Schemes which do not permit plantation use were excluded from the model, primarily relating to slope and riparian zone management. ○ Forest Practices Code 2015 legislation was reviewed and limitations on planting and harvesting were modelled.
Current Land Use	○ The DRAFT DPIPWE 2019 Land Use data was reviewed and existing land uses that would prevent plantation development were excluded ○ Areas under proposed irrigation schemes were included in the model to highlight areas that might reduce plantation access if irrigated due to competition with higher value cropping
Site Suitability	○ The NCH Enterprise Suitability layers for *Eucalyptus nitens* and *Pinus radiata* were overlaid with the above data to rank suitability of potentially available land, using the following site factors: ▪ rainfall ▪ soil characteristics ▪ frost/elevation
Commercial Cropping Slope Limits	○ Marginal and exclusion thresholds for commercial cropping were modelled and overlaid with the above.

Table 5: Plantation land suitability for Eucalyptus nitens in north-northwest Tasmania (hectares)

Suitable Land Uses	Total area assessed	Unsuitable	Small Scale Potential (Modified Riparian)	Commercial Potential (Slope suitable for Cropping)	Commercial Potential (Slope marginal for Cropping)	Commercial Potential (Slope unsuitable for Cropping)
3.2.0 Grazing modified pastures	305,185	133,754	5,274	148,406	12,002	5,748
3.2.0 Grazing modified pastures (with Irrigation Potential)	110,122	63,408	1,785	40,388	3,209	1,333
3.2.1 Native/exotic pasture mosaic	11,740	6,457	90	4,589	435	169
3.2.1 Native/exotic pasture mosaic (with Irrigation Potential)	3,715	2,806	20	774	75	40
3.3.0 Cropping	3,987	1,144	67	2,583	146	48
3.3.0 Cropping (with Irrigation Potential)	2,365	1,413	20	908	21	3
3.6.0 Land in transition	1,657	683	18	789	101	65
3.6.0 Land in transition (with Irrigation Potential)	173	28	5	102	24	14
3.6.1 Degraded land	4,401	2,553	146	1,417	208	77
3.6.1 Degraded land (with Irrigation Potential)	1,951	1,706	26	180	27	12
4.2.0 Grazing irrigated modified pastures	94,770	47,288	1,473	41,666	3,083	1,261
4.3.0 Irrigated cropping	88,736	45,597	827	40,038	1,710	564
No Suitability	392,923	306,837	0	86,085	0	0
Low Suitability	197,087	0	0	188,794	8,293	0
High Suitability	38,792	0	9,751	6,959	12,748	9,334
Grand Total	*628,802*	*306,837*	*9,751*	*281,839*	*21,040*	*9,334*

Table 6: Plantation land suitability for Pinus radiata in north-northwest Tasmania (hectares)

Suitable Land Uses	Total area assessed	Unsuitable	Small Scale Potential (Modified Riparian)	Commercial Potential (Slope suitable for Cropping)	Commercial Potential (Slope marginal for Cropping)	Commercial Potential (Slope unsuitable for Cropping)
3.2.0 Grazing modified pastures	302,995	42,798	7,240	232,385	13,960	6,612
3.2.0 Grazing modified pastures (with Irrigation Potential)	109,577	42,933	2,793	58,169	3,926	1,756
3.2.1 Native/exotic pasture mosaic	11,695	4,413	107	6,418	530	227
3.2.1 Native/exotic pasture mosaic (with Irrigation Potential)	3,690	2,411	25	1,040	128	87
3.3.0 Cropping	3,971	371	87	3,305	157	51
3.3.0 Cropping (with Irrigation Potential)	2,343	289	93	1,925	30	5
3.6.0 Land in transition	1,634	204	28	1,215	114	74
3.6.0 Land in transition (with Irrigation Potential)	172	11	6	112	26	18
3.6.1 Degraded land	4,315	634	325	2,974	279	103
3.6.1 Degraded land (with Irrigation Potential)	1,921	1,147	122	589	40	23
4.2.0 Grazing irrigated modified pastures	93,221	7,187	2,046	79,359	3,279	1,350
4.3.0 Irrigated cropping	88,489	22,522	1,309	62,103	1,928	626
No Suitability	272,941	124,922	0	148,019	0	0
Low Suitability	300,014	0	0	290,554	9,460	0
High Suitability	51,069	0	14,181	11,021	14,937	10,930
Grand Total	*624,024*	*124,922*	*14,181*	*449,593*	*24,398*	*10,930*

Note: Areas highlighted in red were deemed unlikely to be suitable based on current land use. Those in yellow highlight are of mix of areas: a) within proposed irrigation schemes such that a proportion will become irrigated and unlikely to be available in future; or b) have current land use of which only a portion of which would be suitable; or c) are likely marginal for current use due to steeper slopes and so a proportion is likely suitable.

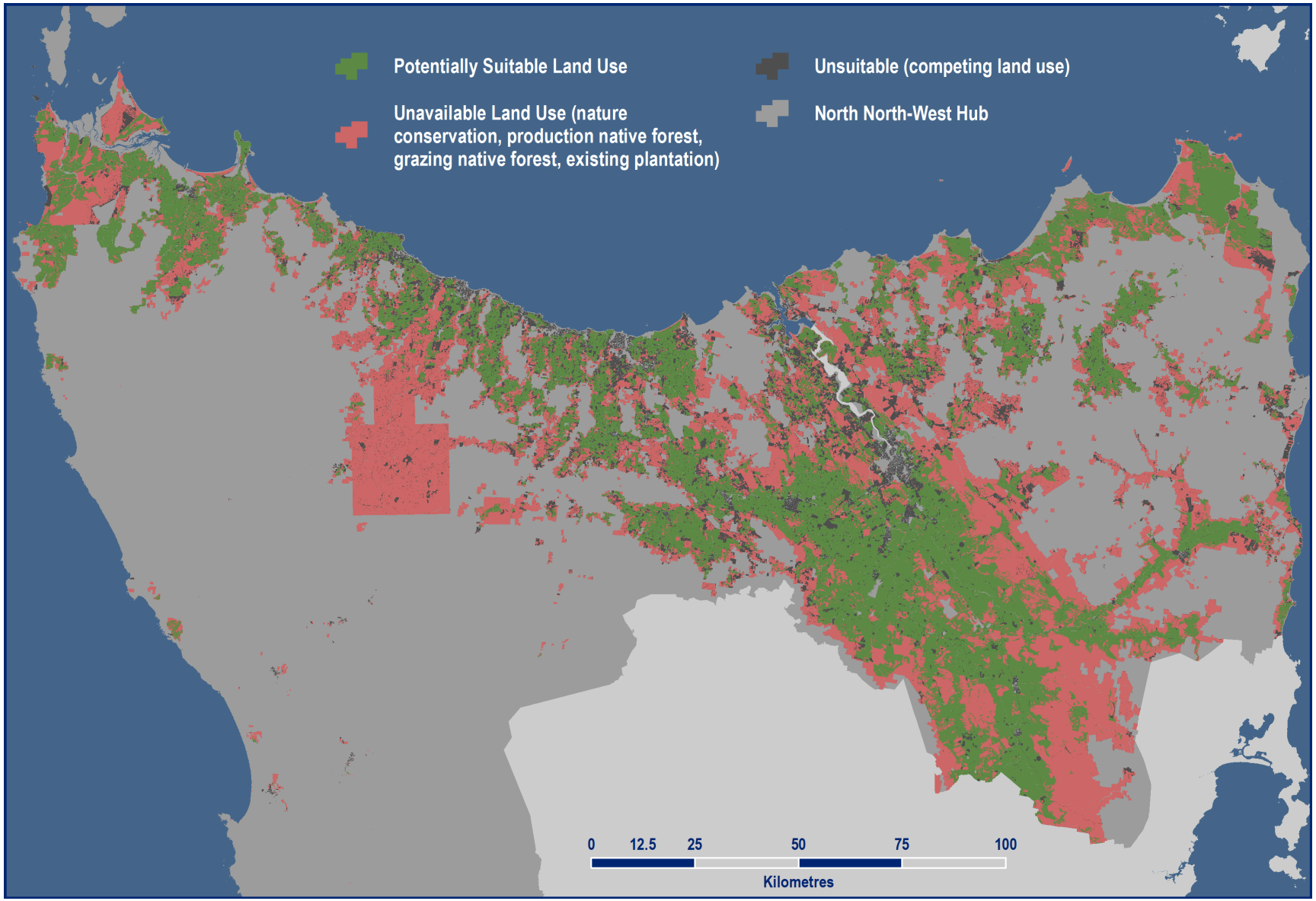


Figure 9: Plantation land suitability on private freehold land in north-north-west Tasmania

Land Availability (Higher and Best Use) Model

A land availability filter was applied to the suitability results, using analysis of optimal value to determine the Higher and Best Use (HBU) for each parcel assessed.

Optimal value is defined by the International Valuation Standards Council as:

…the most probable use of a property which is physically possible, appropriately justified, legally permissible, financially feasible, and which results in the highest value of the property being valued.

This optimal value makes part of the "Highest and Best Use" (HBU) approach to valuing a property, but in principal it is also applied operationally in commercial agricultural enterprises whereby private landowners will attempt to achieve optimal value for each of the site types across a farm, as this in theory provides the greatest return from the property as a whole.

Assuming current market trends for food and wood don't change significantly relative to one another, financially, the discounted cash flow returns from cropping rotations on highly suitable sites with good access to rainfall or irrigation when analysed over the lifetime of a single plantation rotation, will generally be higher than those from a plantation, and so are typically HBU. Where sites have lower suitability to cropping, these are still very likely to favour cropping over plantations if only the wood harvest component of the trees is factored in over the length of a plantation rotation. However, unlike most crops, trees have many natural capital values with a known benefit locally and to the wider economy and if they are valued correctly, and most importantly the value of their services can be returned directly to the landowner, this might push the landowner to give consideration for marginal sites to have plantation HBUs.

Currently, carbon sequestration is the only natural capital value of trees with a trading market that has the potential to provide financial return directly to the landowner. Shelter provided by trees for crops and livestock has been proven to increase productivity, providing indirect financial return, and soil erosion mitigation would also provide indirect on-site returns to the landowner in terms of overall property sustainability. Other natural capital values such as water quality maintenance and native habitat maintenance could also contribute to the land-use decision making process if properly quantified and valued.

To place a value of trees on farms in terms of complete financial and natural capital value is beyond the scope of this modelling exercise. Instead we provide an overview on the location and quantum of area across the range of suitability between intensive agricultural use and plantation use where land appears available for plantation, such that the more marginal cropping areas can be identified and the plantation land use case can be considered under a more wholistic approach to HBU.

The key inputs used to formulate the Higher and Best Use Model for potentially commercial sites were:

Crop Suitability	o	Site suitability for key crops likely to compete for land area suitable for plantation development were modelled against the plantation site suitability models to identify areas of likely conflict or opportunity
Grazing Suitability	o	Grazing and plantations can co-exist in dryland situations (i.e. shelter), but unlikely in irrigated scenarios (i.e. dairy). In those dryland situations, the suitability for key crops was used as a proxy for good grazing country, and similarly modelled against plantation suitability to identify areas of likely conflict or opportunity
Commercial Crop Slope Limits	o	Slope analysis was undertaken across areas potentially available for plantation use to determine which sites would be less suitable or unsuitable for cropping, but still suitable for plantation use.

Table 7: Plantation land availability (hectares) for Eucalyptus nitens after HBU deductions

Suitable Land Uses	Total area available	Small Scale Potential (Modified Riparian)	Commercial Potential (Slope suitable for Cropping)	Commercial Potential (Slope marginal for Cropping)	Commercial Potential (Slope unsuitable for Cropping)
3.2.0 Grazing modified pastures	25,027	5,274	2,002	12,002	5,748
3.2.0 Grazing modified pastures (with Irrigation Potential)	3,685	1,785	440	128	1,333
3.2.1 Native/exotic pasture mosaic	5,283	90	4,589	435	169
3.2.1 Native/exotic pasture mosaic (with Irrigation Potential)	910	20	774	75	40
3.3.0 Cropping	115	67	0	0	48
3.3.0 Cropping (with Irrigation Potential)	23	20	0	0	3
3.6.0 Land in transition	85	18	0	2	65
3.6.0 Land in transition (with Irrigation Potential)	23	5	0	3	14
3.6.1 Degraded land	1,848	146	1,417	208	77
3.6.1 Degraded land (with Irrigation Potential)	244	26	180	27	12
4.2.0 Grazing irrigated modified pastures	2,803	1,473	0	70	1,261
4.3.0 Irrigated cropping	1,398	827	0	7	564
Grand Total	*41,445*	*9,751*	*9,402*	*12,958*	*9,334*

Table 8: Plantation land availability (hectares) for Pinus radiata after HBU deductions

Suitable Land Uses	Total area available	Small Scale Potential (Modified Riparian)	Commercial Potential (Slope suitable for Cropping)	Commercial Potential (Slope marginal for Cropping)	Commercial Potential (Slope unsuitable for Cropping)
3.2.0 Grazing modified pastures	**36,064**	7,240	8,252	13,960	6,612
3.2.0 Grazing modified pastures (with Irrigation Potential)	**6,392**	2,793	1,325	518	1,756
3.2.1 Native/exotic pasture mosaic	**7,282**	107	6,418	530	227
3.2.1 Native/exotic pasture mosaic (with Irrigation Potential)	**1,279**	25	1,040	128	87
3.3.0 Cropping	**144**	87	0	6	51
3.3.0 Cropping (with Irrigation Potential)	**100**	93	0	1	5
3.6.0 Land in transition	**123**	28	0	22	74
3.6.0 Land in transition (with Irrigation Potential)	**33**	6	0	9	18
3.6.1 Degraded land	**3,681**	325	2,974	279	103
3.6.1 Degraded land (with Irrigation Potential)	**774**	122	589	40	23
4.2.0 Grazing irrigated modified pastures	**4,092**	2,046	0	695	1,350
4.3.0 Irrigated cropping	**2,013**	1,309	0	78	626
Grand Total	***61,976***	*14,181*	*20,598*	*16,267*	*10,930*

Note: The logic is that the 'Availability table' takes the 'Suitability table' for each species and makes the following deductions:

1. No change to areas flagged as high availability (white cells)
2. If flagged as low availability (i.e. yellow cells) then only area for sites which have a plantation Enterprise Suitability score greater than all other modelled crops will be included. Crop suitability was used as a proxy for grazing suitability in the dryland Grazing land use cases
3. If flagged as no availability (i.e. red cells), no area is transferred across.

Plantation Economic Model

Over and above growth rates, which will dictate how much and how quickly a return can be made on investment, and which are dealt with in terms of site suitability, other key drivers for ensuring Commercial Plantings are indeed financially viable include harvesting and roading costs, cartage costs, land (either purchase or lease) costs, and management and overhead costs.

Fixed costs, such as land, roading, management and overhead will have less impact on viability if there is sufficient scale and geographic consolidation of plantation area within the property. Harvesting costs typically relate to stem piece size and terrain, such that plantations with smaller diameter stems or on steeper slopes will be more expensive to harvest.

Small Scale and Natural Capital plantings will not have the same economic constraints given their end use might be local and/or not directly financial, although Small Scale plantings can be integrated with any commercial potential areas to boost scale.

Of these financial drivers, distance to market and scale could be modelled within this land assessment project, over and above the land slope classification included in the suitability modelling. The degree of consolidation of viable plantation areas was considered in the qualitative model review process undertaken to validate the overall success of the model to fit on-ground conditions.

The key inputs used to formulate the Plantation Economic Model were:

1. Distance to Market.

2. Plantation Enterprise Scale.

Table 9: Viable area for potential commercial hardwood plantation expansion in north-northwest Tasmania

Scale within Property (ha)	0 to 25 km from nearest Market	25 to 50 km from nearest Market	50 to 100 km from nearest Market	> 100 km from nearest Market	Total
> 100	1,190	2,798	2,442	554	*6,984*
50 to 100	522	1,042	935	237	*2,735*
25 to 50	799	1,623	2,101	1,025	*5,548*
10 to 25	2,121	3,611	3,912	972	*10,618*
1 to 10	4,513	4,587	4,454	915	*14,469*
0.1 to 1	275	339	239	55	*908*
High Viability	4,631	9,074	2,442	0	16,147
Moderate Viability	4,513	4,587	6,949	554	16,603
Low to No Viability	275	339	4,693	3,204	8,511
Grand Total	*9,419*	*14,000*	*14,085*	*3,759*	*41,262*

Table 10: Viable area for potential commercial softwood plantation expansion in north-northwest Tasmania

Scale within Property (ha)	0 to 25 km from nearest Market	25 to 50 km from nearest Market	50 to 100 km from nearest Market	> 100 km from nearest Market	Total
> 100	1,638	5,886	6,205	679	*14,408*
50 to 100	1,725	2,184	1,366	81	*5,357*
25 to 50	2,750	4,392	2,623	62	*9,827*
10 to 25	4,945	6,974	3,283	21	*15,223*
1 to 10	6,633	6,853	2,525	5	*16,016*
0.1 to 1	347	448	113	5	*913*
High Viability	11,057	19,436	6,205	0	36,698
Moderate Viability	6,633	6,853	7,273	679	21,438
Low to No Viability	347	448	2,638	174	3,607
Grand Total	*18,037*	*26,737*	*16,115*	*853*	*61,743*

Landowner Plantation Intent Model

To provide some indication of current landowner intent with respect to plantation enterprises, a change analysis was undertaken to compare the harvest and re-establishment status of the plantations under private independent landowner management at their peak extent in 2014, immediately following the collapse of the plantation managed investment schemes, to current.

To assist with understanding current private independent landowner intent with respect to plantation enterprises since the final collapse of plantation managed investment schemes in Tasmania in late 2013, a GIS analysis of plantation status between 31st

December 2015 and 31st December 2019 was undertaken, using plantation mapping data provided by Private Forests Tasmania.

The plantation mapping data did not provide any indication of future intent where plantations were identified as having being harvested within this period, so the presence or absence of a current private timber reserve (PTR)[18] on the site was used to indicate if the plantation was likely to be replanted or not.

Table 11: Land use change analysis - independent plantations

	Land use change (hectares)					
Land use category	Plantation area (2015)	New planting	Harvested, replanted	Harvested, PTR present	Harvested, PTR absent	Plantation area (2019)
Hardwood plantation	40,713		861	5,633	9,510	25,570
Softwood plantation	8,192		60	204	937	7,050
Undefined plantation		194				194
Total	48,905	194	921	5,837	10,448	32,814

In relation to the existing independently-owned plantation estate in the region, in 2015 there was a total of 48,905 hectares in the region, comprising 40,713 hectares of hardwood and 8,192 hectares of softwood. By the end of 2019, 16,285 hectares of this area had been harvested and not replanted, leaving 32,814 hectares of independently owned plantation (25,570 hectares of hardwood and 7,050 hectares of softwood). Of this harvested area, 10,448 hectares did not have a Private Timber Reserve (PTR) in place, suggesting that it is unlikely to be re-established to plantation. This represents a reduction of 61 per cent for the harvested area and 21 per cent of the overall area.

A number of sources indicated during the stakeholder consultation that PTR revocations are occurring at the rate of 1,000 to 2,000 hectares per month at present and are far exceeding the commencement of new PTRs. This indicates that there is a strong possibility that the 21 per cent reduction in existing independent plantation area over the past four years is probably a floor and that, for the remaining area, the area which will not be re-established is likely to be higher.

Natural capital plantings

In parallel to the commercial plantation modelling described above, the following areas were identified across all suitable land uses as potential areas for reforestation or revegetation to provide natural capital values to the property and community as a whole. Given these areas are unlikely to be harvested, thought should be given to establishment of non-commercial endemic tree or vegetation communities that would

[18] A private timber reserve (PTR) is an area of private land set aside for forestry purposes and registered on the title. Where a PTR is in place, areas harvested must be restocked with trees under the Forest Practices Act.

provide equivalent, if not higher, natural capital values to the property than would standard plantation species. The areas analysed for natural capital plantings.

1. Modified Riparian Zones
   Areas immediately adjacent watercourses which traverse intensive agricultural settings and which have had native vegetation removed were considered as potential areas for reforestation to provide remedial and local productivity benefits in the forms of erosion mitigation, water quality improvement and shelter. These modified riparian zones identified for natural capital potential would not be able to be harvested under current Forest Practices Code legislation, and on larger scale watercourses, form the geographic core around which the commercially available Small Scale plantings were identified.
2. Modified Wetlands
   Wetland areas converted from native vegetation to pasture or cropping land were considered as a potential area for reforestation as these low lying areas are typically prone to waterlogging and if not adequately drained are likely to be marginal for cropping.
3. Very Steep Slopes
   Areas which under current Forest Practices Code legislation are considered too steep for harvesting by ground-based methods are also areas likely to be erosion prone, so where no stabilising vegetation currently exists would make suitable areas for reforestation via natural capital plantings.
   The natural capital analysis was run under the same E. nitens and P. radiata suitability analysis as the Commercial and Small Scale plantation analyses, but it should be noted that endemic species might have even greater range in terms of suitability should such species be selected. Note also that some of these steep slopes might still be accessible for harvest under Forest Practices Code requirements using cable-based methods, which are typically more expensive than ground-based methods.

Table 12: Natural capital plantation potential for Eucalyptus nitens (hectares)

Suitable Land Uses	Total area	Natural Capital Potential (Modified Wetland)	Natural Capital Potential (Modified Riparian)	Natural Capital Potential (Slope > 19 degrees)
3.2.0 Grazing modified pastures	4,403	1,032	1,206	2,166
3.2.0 Grazing modified pastures (with Irrigation Potential)	1,050	187	424	439
3.2.1 Native/exotic pasture mosaic	75	2	20	53
3.2.1 Native/exotic pasture mosaic (with Irrigation Potential)	41	17	8	16
3.3.0 Cropping	35	5	16	13
3.3.0 Cropping (with Irrigation Potential)	8	0	7	0
3.6.0 Land in transition	43	1	3	39
3.6.0 Land in transition (with Irrigation Potential)	7	0	1	5
3.6.1 Degraded land	115	3	65	48
3.6.1 Degraded land (with Irrigation Potential)	15	1	10	3
4.2.0 Grazing irrigated modified pastures	1,111	343	380	388
4.3.0 Irrigated cropping	472	138	183	151
Total Availability	*7,373*	*1,728*	*2,325*	*3,320*

Table 13: Natural capital plantation potential for Pinus radiata (hectares)

Suitable Land Uses	Total area	Natural Capital Potential (Modified Wetland)	Natural Capital Potential (Modified Riparian)	Natural Capital Potential (Slope > 19 degrees)
3.2.0 Grazing modified pastures	6,593	2,500	1,650	2,443
3.2.0 Grazing modified pastures (with Irrigation Potential)	1,595	324	696	575
3.2.1 Native/exotic pasture mosaic	120	15	23	81
3.2.1 Native/exotic pasture mosaic (with Irrigation Potential)	66	20	9	36
3.3.0 Cropping	51	18	19	15
3.3.0 Cropping (with Irrigation Potential)	30	0	29	0
3.6.0 Land in transition	66	15	5	45
3.6.0 Land in transition (with Irrigation Potential)	8	0	1	6
3.6.1 Degraded land	201	10	125	66
3.6.1 Degraded land (with Irrigation Potential)	44	3	33	8
4.2.0 Grazing irrigated modified pastures	2,660	1,730	504	426
4.3.0 Irrigated cropping	718	270	276	172
Total Availability	*12,151*	*4,906*	*3,370*	*3,875*

Model Review

A random sample of 66 modelled properties was chosen from across the Hub region and across a range of primary agricultural uses and property sizes, and reviewed against current imagery to assess the on-ground accuracy of the modelling, and to support interpretation.

The following observations were made:

- On the whole the model appeared fit for purpose for the majority of properties reviewed.
- Of the 60 large properties (i.e. > 1,000ha) present in the region, many were classified as “high” or “moderate” viability. However, this was in many cases an artefact of property size where accumulation of small riparian areas pushed them into higher economic ratings. Review of several examples indicates that lack of aggregation of smaller areas is likely to render them of much lower economic viability from an operational harvesting perspective where they cannot be consolidated with more significant candidate areas. As such, the figures presented in the top row of Tables 9 and 10 should be considered optimistic, as these large properties contributed a significant area to the “> 100ha” economic scale class.
- The model identified several areas as highly viable for plantations which appear to have been recently converted from plantation back to grazing, so are likely to be unavailable from a landowner intent perspective, despite plantation suitability outranking cropping suitability.
- Modelling of shelterbelts along fence or road lines or between pivot circles was not attempted. However, many of the properties reviewed could likely accommodate such plantings, and several already did.

Examples of the viability model outputs for a specific Property can be seen in Figure 10 (Softwood) and Figure 11 (Hardwood).

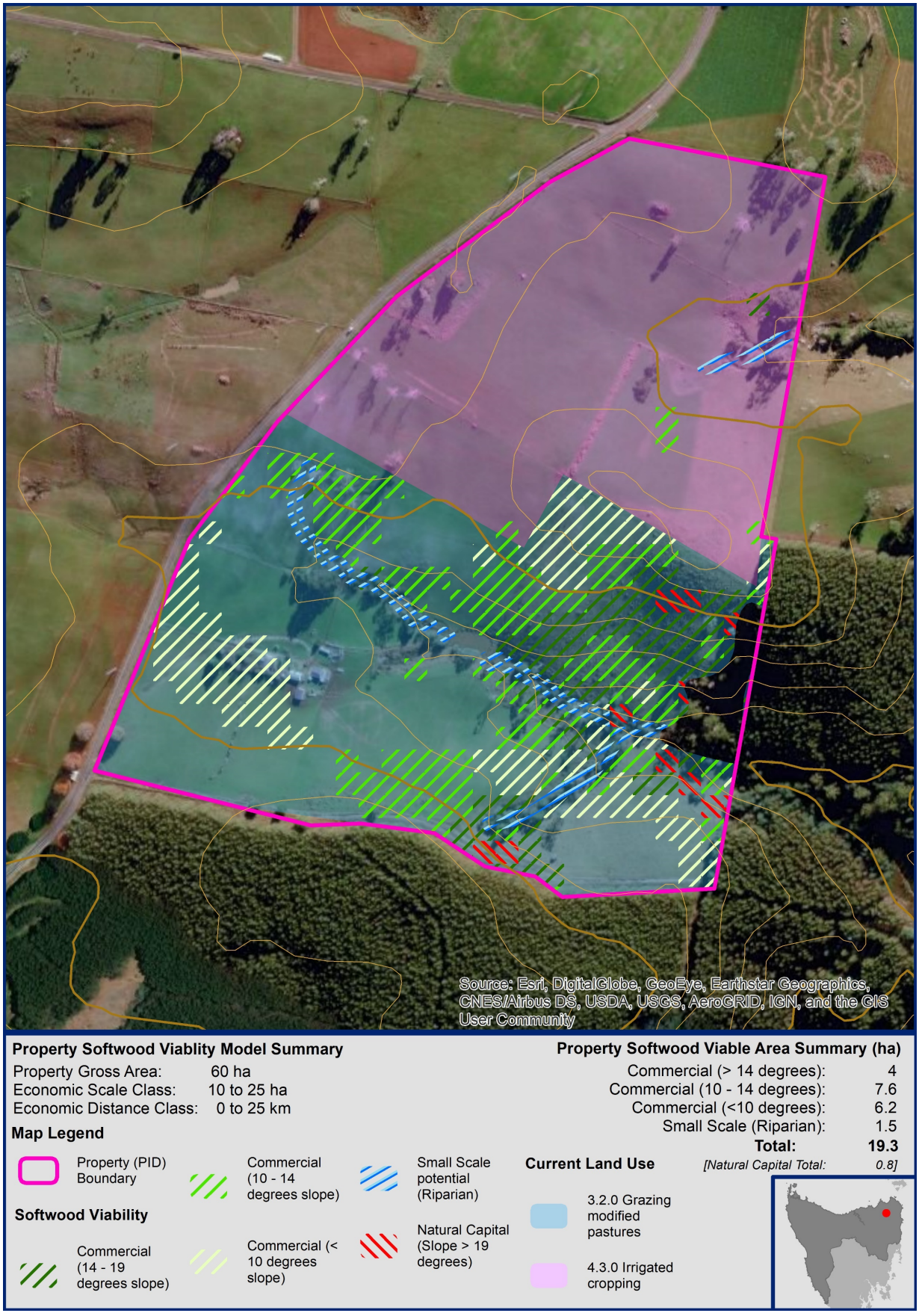


Figure 10: Example output of softwood viability model

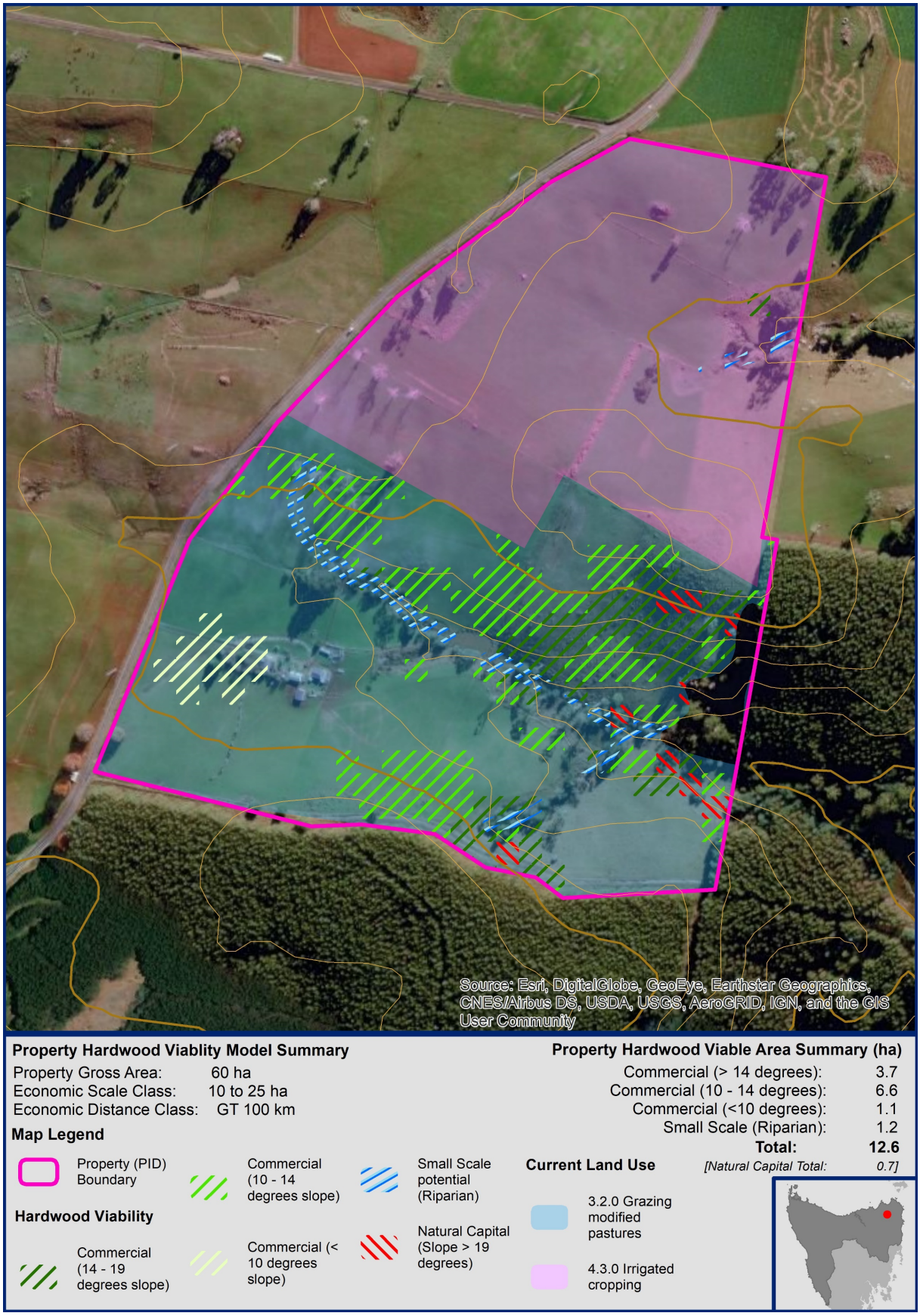


Figure 11: Example output of hardwood viability model

DISCUSSION AND ANALYSIS

This section of the report combines the results of the stakeholder consultation process and the spatial and economic analysis with detailed discussion and analysis, informed by references to contemporary academic, policy and technical literature.

Maintaining and expanding the plantation footprint

A primary objective for this Assessment Report is to consider opportunities to enhance the total future availability of plantation wood from the Hub region. Based on the stakeholder consultation and spatial analysis results, this appears to be a viable but challenging prospect. Stakeholders identified four primary mechanisms for achieving this objective:

1. Maintaining the current plantation footprint;
2. Identifying practical and achievable means of expanding the future plantation footprint;
3. Identifying and driving opportunities to improve productivity and product value from the plantation estate;
4. Improving the uptake of integrated commercial tree plantations in the broader agricultural landscape.

These four mechanisms are explored in more detail below. It should be noted that the four focus areas are, to some extent, inter-related, as are some of the factors which impact the ability to achieve them, which are discussed in more detail later in this section.

History and outlook for plantation expansion

The building of Australia's current planted forest estate was driven by two key federal government policy initiatives and supported by state government policy and operational action (Figure 9).

The first tranche resulted in the establishment of Australia's one million hectare long rotation softwood plantation estate. From the earliest part of the twentieth century, state and federal governments held concerns, first, about the declining natural timber resources available (or, in the case of South Australia, absence of natural forest resources) and, second about Australia's emerging reliance on imported lumber to meet the needs of its growing population. From the 1960s, this concern was addressed through the Commonwealth Softwoods Loans Scheme, under which the states were granted 35-year, low interest loans to establish a considerable softwood plantation estate. From the inception of the Softwood Forestry Agreements Act in 1967, through to the early 1990s, this policy resulted in the growth of the plantation estate from approximately 200,000 hectares to more than 1,000,000 hectares.

The second tranche resulted in the establishment of an equivalent area of privately held short rotation hardwood plantations. This was a consequence of Commonwealth government endorsed tax incentives, delivered through retail MIS. Indirectly, this was part of the 1994 National Forest Policy Statement, manifest through the Plantations 2020 policy position which sought to treble Australia's planted forest estate from 2003 to 2020, with

the express aims of driving regional wealth creation and international competitiveness in relation to the balance of trade in wood products.

The key observation is that Australia's 1.9 million hectare plantation estate was almost entirely delivered as a consequence direct federal government policy intervention. Both of these policies provided specific financial and tax incentives to directly address the real constraints to investing in plantation establishment.

The critical lesson is that material expansion of the plantation estate requires direct government policy intervention in order to be successful. This is due primarily to the considerable economic and commercial barriers to plantation expansion, as explained below.

Whittle *et al* (2019) undertook modelling to determine the economic potential for plantation expansion in Australia until 2050. They identified that approximately 4,800 hectares of new short rotation hardwood could be economically competitive with other agricultural land use nationally, and approximately 24,000 hectares of softwood plantations, considering current conditions. It should be noted that this modelling assumes an industrial approach to new plantation establishment, rather than an integrated land use solution. The report also draws the conclusion that Tasmania is not a major contributor to potential plantation expansion under the constraints of the modelling approach[19].

A brief history of and outlook for the industrial timberland asset class

Of the world's four billion hectares of forests, somewhere between two and four per cent (100 to 200 million hectares) is considered to comprise the potential timberland investment base, or "investible universe" (Brand. 2019). These are forests managed intensively for timber production, often in the form of plantations. Institutional investment in this asset class is predominantly focused in the United States (more than 50 per cent) with the rest distributed between South America (Brazil, Uruguay, Argentina and Chile), Oceania (predominantly Australia and New Zealand), south-east Asia, Africa and parts of Europe.

The total pool value of these assets is estimated at somewhere between USD200 and 400 billion, of which somewhere around between 25 and 50 per cent is already owned by timberland investors.

Timberland emerged as an asset class in the United States during the late-1980s to mid-1990s, driven by the tax treatment differential between industrial owners and north American pension funds which meant that industrial ownership of forest assets was clearly less commercially efficient. By the time Australia's MIS driven plantation establishment had peaked, the availability of new timberland assets in the US had dried up. However, the interest in the asset class was burgeoning and focus was turned to other potential investment locations.

[19] It should be noted that the findings of this report and analysis are strongly disputed and there has already been new plantations established in regions where it said there is no commercial opportunity. It is questionable whether it's analysis of the Hub area reflects existing and future opportunities.

Investment in Australian assets started with the sale of the Victorian government plantations in the late 1990s, at the same time that large transactions were occurring at pace in New Zealand. After a reasonable hiatus, this was followed by Tasmania's joint venture plantation estate, and then the South Australian and Queensland public plantation estates. During that period, the failure of the retail MIS sector also saw a significant influx of predominantly north American institutional capital, which acquired these stranded assets during the period from 2010 to 2015.

The significant appeal of Australia (and New Zealand) as a capital destination in the timberland investment space is driven largely by:

- The scale of the total asset base.
- The ease of doing business.
- Strong regulatory and environmental management credentials.
- The relatively high level of jurisdictional, legal and economic stability and lower risk levels with respect to indirect government intervention, fraud and corruption compared to South America, Africa and south-east Asia.

This has resulted in considerable competition for assets, reflected as discount rate competition, leading to substantial premiums for many assets over the past decade in particular. In fact, of the current deployed capital of around USD 100 million, Australia and New Zealand comprise the largest tranche (20%) behind the US (70%), and the rest of the world contributes 10%.

Importantly, institutional timberland investment has been focused primarily on established forest assets, with an existing cash flow from operations based on a harvestable age profile and existing product markets. New forest establishment, comprising land acquisition (purchase or lease) and planting of greenfield locations has not been considered a viable option due to the high upfront costs, time until harvest (cash flow) and the impacts of the time cost of money, even at relatively low discount rates and reducing expectations with respect to Internal Rate of Return. However, most of the key players currently operating in the Australia and New Zealand timberland investment space also have significant amounts of undeployed capital in existing funds.

Timberland investment performance in south-east Asia and Africa has proved a significant challenge because of biological performance (growth rates), markets, access to assets at scale, jurisdictional integrity and real costs. Added to that, the lack of available assets in the "safe" jurisdictions of Australia and New Zealand has resulted in considerable competition for even small-scale assets.

This suggests, and is supported anecdotally, that institutional investors are becoming increasingly comfortable with the concept of new forest establishment as a component of their investment thesis into the future. In the Australian context, it is reasonable to observe that some of the more progressive investors and fund managers may be waiting to determine where the Federal Government ultimately defines its policy position on trees and carbon before they consider more active investment in new plantation expansion. However, there is no evidence that this is imminent and, regardless, there are other material issues, including social license, which are likely to work against aggressive expansion.

Trends and drivers

The plantation estate is contracting

From the mid-1990s until the collapse of the MIS sector between 2009 and 2012, Australia's plantation sector expanded by about one million hectares. This expansion occurred almost entirely as a consequence of hardwood plantations funded under the MIS structure. Over the same timeframe, the softwood plantation area remained largely static.

Following the MIS collapse, the majority of that estate was acquired by institutional investors over a five to seven year period. Areas not acquired by institutions were either acquired by agricultural investors and gradually reverted to agriculture, or were taken over by a large cadre of individual farm lessees who also have largely reverted the land. Additionally, all of the large institutional investors have been engaged with the reversion and disposition of uneconomic hardwood plantation properties.

Ownership has rapidly shifted and consolidated

Since 2007 there has been a dramatic shift in ownership of Australia's plantations. MIS, processors and governments have all sold significant areas of plantations with institutional ownership increasing from 10 per cent to 49 per cent of the estate. This has been accompanied by a major consolidation of ownership and rationalisation of both forest management and timber processing.

In Tasmania private ownership by institutional investors accounts for about 90 per cent of the total plantation area.

Timberland transactions have slowed

With ownership of the ex-MIS plantations now fully transitioned to institutional ownership, and most of the public forest estates also now owned by TIMOs, timberland transactions have slowed considerably.

China's trade dominance

Since the global financial crisis, China has dominated growth in the global wood products trade, for both raw and processed products. For Australia, that has seen China replace Japan as the primary export destination for hardwood woodchip used in the manufacture of rayon and fine paper products. For Australian softwood, the impact has been more subdued, with an increase in low grade round log exports from regions with ready port access, albeit with greater volatility than from other economies such as New Zealand.

Exposure to China has proved both positive and challenging for the Australian forest products sector. With respect to hardwood plantation products, China's growth has resulted in a significant increase in demand and price which has coincided with the maturing of large parts of the hardwood plantation estate. China's hardwood cellulose industry has also matured quite rapidly over the same time frame, particularly with respect to its appetite for higher quality fibre. This is due at least in part to the larger scale and higher capital requirements for pulpwood processing as compared to sawlog processing.

However, as with other commodities, the Chinese market can be fickle and volatile, driven partly by sentiment and the influence of domestic China policy in the context of credit provision and economic expansion priorities. Although more robust and less volatile than the trade in round log products, there is also a degree of volatility in woodchip markets.

This issue of "fickleness" in the Chinese wood products market is currently being realised with respect to both hardwood woodchip and hardwood and softwood round log exports, an impact which is being felt in the Hub region. Demand has declined materially over the past 12 months in particular. While it is difficult to pinpoint exactly what factors have driven this reduced demand, at least some of it probably relates to the broader trade impacts of the COVID-19 pandemic and possibly to the broader geopolitical factors which are influencing Australia's trade status with China currently.

Supply is contracting

As a consequence of age class distribution, contracting estate size and significant fire impacts over the past fifteen years, Australia's overall plantation wood supply is predicted to contract, particularly for hardwood plantations. This is also the case for the Hub region.

The role of environmental services and integrated land management

There is a growing awareness within the commercial sector about the significant potential role that environmental services markets and integrated land management can play in supporting expansion of Australia's planted forest estate and to address predicted future supply contraction. Additionally, environmental services markets, particularly for carbon, have the potential to fundamentally change the economic case for plantation establishment, by providing additional, early rotation cashflow.

Constraints to plantation expansion

Plantation economics

Forestry plantations are generally considered to fall into the real asset class. As such, investment in established assets is based on a rational analysis of the time cost of money over what is generally a medium to long term investment horizon. Typically, this is assessed using forest modelling and a range of operational and market inputs to develop a discounted cash flow analysis, net present value and internal rate of return over a specified time frame. This will typically be the fund lifetime, or a single or multiple rotation, depending on the requirements of the fund manager and/or investors. Decision-makers will apply a discount rate to the analysis commensurate with their appetite for risk and certainty. As might be expected for a politically and economically stable operating environment, discount rates for Australian assets are generally low on a global comparative basis and, in fact, asset sales are often considered to be determined on the basis of a "discount rate shootout", particularly for assets at scale where there is a high degree of certainty about the inputs.

In simple terms, the main profit drivers for forestry investments are:

1. Cost of land (whether acquired or leased).
2. Costs of establishment.
3. Costs of ongoing management.

4. Plantation growth rates.
5. Rotation length.
6. Log product prices.

For harvest-ready, mature estates with a mix of age classes, existing markets and established management arrangements, there is considerable appeal for institutional investors in the immediate cashflow benefits, opportunities to generate operational efficiencies and the possibility to generate real capital appreciation on the asset – either land, or trees or both. Thompson (2010) notes that institutional investors are inclined to view plantation investments as capital acquisitions which rely on immediate or, at worst, early investment cashflow as part of the investment thesis, driving a preference for investment in mature plantation or plantations with a balanced mix of age classes.

However, establishment of a new plantation estate brings with it high upfront costs, a long timeframe until cash generation and, potentially, a higher degree of risk due to either environmental factors (particularly those that could contribute to plantation failure) or economic issues (both input costs and markets).

In this context, some of the major constraints to the expansion of Australia's plantation estate are outlined below.

Land

The availability of and price for land has consistently been recognised as a major constraint to new plantation forests in Australia. Among others, Matysek and Fisher (2016) note that industrial plantations are consistently uneconomic where land must be acquired at the average regional unit cost per hectare. This means, therefore, that the only land viable for plantation forestry will be the least expensive and therefore the least productive, or where land is available at no capital cost (that is, public land or farm forestry, which is a focus area for this Assessment Report).

Plantation forestry simply cannot compete with prime agriculture. In fact, the decline in Australia's net plantation area since the failure of the MIS sector, is based largely on the fact that a rational assessment of higher and best use for many of the hardwood plantations is, in fact, other agricultural pursuits.

A compounding issue is that the least productive land will result in the slowest potential growth rates which has the net impact of generating lower internal rates of return due to either lower marketable volume at rotation end, or longer rotations. Add to that the increased risk of biological damage as a consequence of growth stresses (for example, increased susceptibility to weed competition or attack by pests and diseases), and the risk profile is significantly enhanced.

An additional compounding factor is the impact of land location with respect to primary markets – either processing or export. Plantation profitability is increasingly sensitive to haulage distance, driven predominantly by rising fuel and labour costs. Limits to economic haulage distance are generally considered to be in the order of 90 to 100 kilometres. This is an absolute figure for isolated plantations and generally applies as a weighted average figure for larger estates, although even in the case of larger estates, absolute haulage distances beyond 150 kilometres are generally unviable.

Time cost of money

The use of discounted cashflow analysis to develop net present value and internal rate of return metrics to guide plantation investment is a significant constraint to institutional investment in new plantations. This is fundamentally due to the high early input costs (land and establishment) and long lead time to revenue generation. It is exceptionally difficult, particularly in a high input cost environment such as Australia, to make the investment thesis stack up in favour of profitable new plantation investment. The potential role of environmental services in providing early rotation revenue could positively impact this dynamic, particularly as institutional expectations about investment hurdle rates are also moderating.

Constraints specific to Tasmania and the Hub region

Forestry plantations already comprise a significant proportion (30 per cent) of the available agricultural land within north-northwest Tasmania, and much more so than in any other Australian jurisdiction, where the average proportion of agricultural land dedicated to plantation forestry is about 0.5 per cent. This provides strong support for the inference that industrial plantation presence in the region is probably close to capacity.

Freeman and Morton (2014), in a report for the Commonwealth Government about the likely expansion of forestry plantations in Australia, state that there is little likelihood of new plantation establishment occurring in Tasmania. The report considered both softwood and hardwood plantations on both short and long rotations. The summary findings were:

Table 14: Assessment of likelihood of plantation expansion in Tasmania[20]

Plantation type	Likelihood	Key factors
Softwood – long rotation	Unlikely	• Existing processing capacity adequately met by log availability, volume exported. • No substantive new establishment over past five or more years.
Softwood – short rotation	Unlikely	• No established investment model.
Hardwood – long rotation	Unlikely	• Influenced by native forest industry restructuring • Processing sector not configured to handle plantation sawlog • Misalignment between return on risks and investor expectations
Hardwood – short rotation	Unlikely	• No substantive new establishment over past five or more years. • Industry restructured from MIS to institutional investors. • Plantation estate maturing and being rationalised (area reductions).

[20] *Source: Freeman and Morton, 2014*

It is important to clarify that this assessment was made in 2014 and there have been some material developments, particularly in the policy environment, since the report was published. Particular considerations are the Commonwealth Government's 2018 policy commitment and more recently, changes to the ERF rules to allow fuller participation of plantations in the Carbon Farming Initiative. The report also did not consider the potential for silvicultural program change (short rotation hardwood to long rotation softwood or long rotation hardwood), or the emerging commercial and technical capacity to deal with such changes.

In that context, it is reasonable to observe that the findings were accurate at the time and, in some important respects, are still relevant. However, there are industrial developments occurring within the Hub region which look capable of substantially altering this predicted trajectory. In particular, there appears to be considerable scope for expanding domestic softwood processing capacity, as well as emerging capability for solid wood processing from long rotation hardwood plantations.

Improving productivity and product value

Much of the focus of this Assessment Report relates to opportunities to increase integrated farm forestry through the Hub region, as a means of maintaining or expanding the plantation footprint in the Region. Given the focus of the Assessment Report is Access to Land and Land Use Policy, that is appropriate. However, the supporting context for the Report is consideration of how the total available basket of wood can be maintained or increased for the Hub region. There is also merit in considering how the value of that wood can be improved.

ABARES (2016) forecasts that, aside from some production peaks (2030-39 for softwood and 2030-34 and 2040-44 for hardwood), future plantation log production will be relatively stable for Tasmania during the period until 2059 (refer figure 12).

With respect to hardwood plantations, the most significant proportion of production is currently destined for the export woodchip market. However, the saw log proportion is expected to increase from 100,000 m^3 per annum to about 500,000 m^3 per annum from 2030. By contrast, the product distribution for softwood logs is consistently at around a 50 per cent split between saw log and pulpwood, except for the period 2035-39, when saw log will increase considerably.

In terms of current markets, there may not be much opportunity to improve the product split and value for the softwood estate – as existing opportunities to improve lower log value are strongly liked with the round log export market. There is, though, real capacity to increase the total log throughput and, therefore, increase the total market for softwood logs.

In relation to the hardwood estate, there is an existing round log export market which consumes a variable annual volume destined for veneer production in China, depending on demand. However, most of the industrial hardwood estate has been established specifically with woodchip production in mind. There has been, therefore, little silvicultural or genetic focus on the solid wood characteristics of these plantations. The exception is Sustainable Timber Tasmania's hardwood plantation estate, which has been

intensively managed specifically with a future potential domestic solid wood market in mind.

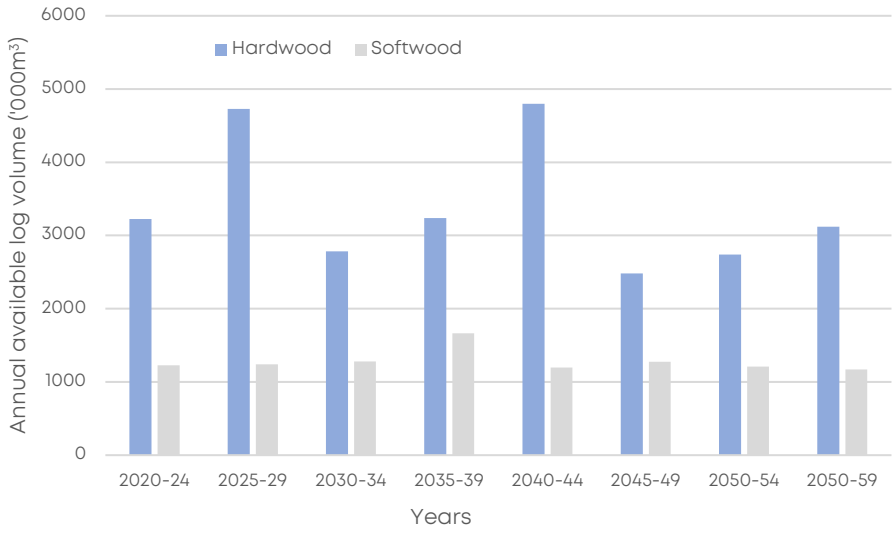


Figure 12: Average annual forecast log availability, Tasmania, 2020-24 to 2050-59[21]

A driver for this has been longer term substitution for reduced native forest harvest from the public estate. However, the current hardwood sawmilling sector is generally not set up for processing plantation hardwood logs and sawmill processing research around this resource is in its infancy.

There is a significant opportunity to increase focus on silvicultural regimes to support solid wood production from the hardwood plantation estate and augment current research efforts to explore the opportunities for plantation hardwood sawmilling as well as other solid wood products, such as cross-laminated timber and veneer/plywood.

The current trade status for log and wood products exports to China is significantly deflated with respect to both demand and pricing. The future trade implications of the COVID-19 pandemic and geopolitical conflict between China and Australia reinforces the high level of exposure this sector has to offshore markets and unpredictable volatility.

That suggests that where opportunities exist to increase domestic consumption of hardwood log products and to improve product value through solid wood processing, they should be actively considered and supported.

There is also likely to be an opportunity to consider transition from short rotation hardwood to long rotation softwood for significant parts of the estate where eucalypts are not the preferred species. It is likely that Tasmanian domestic softwood log processing capacity can respond to this transition, which could generate increased economic activity associated with domestic softwood lumber exports within Australia.

[21] *Source: ABARES, 2016*

Figure 13: Cross laminated timber (CLT) panels manufactured by CLTP Tasmania from E. nitens for use in residential construction (Credit CLTP Tasmania)

Community and landholder perceptions of plantation forestry

The likelihood of achieving material expansion of north-northwest Tasmania's commercial planted forest estate is linked closely with community and stakeholder perceptions of plantation forestry in the region. There are four important elements to this issue of social license:

1. General community attitudes to plantation forestry and forestry more broadly, including:
   - potential or perceived environmental and community health impacts; and
   - views about foreign ownership and the export of raw materials, versus creating economic activity domestically.
2. Regional and farming community attitudes about the implications of forestry expansion for competing land uses and regional infrastructure impacts.
3. Localised perceptions related to the proximity of plantation operations and implications for neighbourhood issues such as noise and air pollution, management of local traffic with log trucks and use of chemicals.
4. Property level landowner perspectives about the suitability or not of tree planting in the context of other on-farm activities.

There is a considerable body of research related to the issues of both broad social license for forestry (and specifically plantation forestry) as well as landowner perspectives on the adoption of agroforestry.

The stakeholder consultation undertaken for this Assessment Report demonstrates that industrial expansion of the plantation estate is highly unlikely and that future expansion efforts are best targeted at improving the uptake of plantation integration into farming systems within the region. To that extent, while it is useful to understand some of the broader social license issues attached to the plantation forestry sector, the focus of this section relates to those factors which influence landowner decision-making with respect to trees on farms.

Social license for forestry

Schirmer *et al* (2018) interviewed some 980 Tasmanian residents in the Cradle Coast, Northern and Southern regions to evaluate community perceptions of the social, economic, service and infrastructure effects of the forestry industry in communities where it operates.

Generally, the survey results indicated that survey respondents recognised forestry as an important regional activity but not as important as agriculture or tourism. However, in each of the regions, there was a considerable difference between residents of local government areas (LGAs) with a high economic dependence on forestry versus those where forestry was less important economically.

This difference was manifest for the Northern and Cradle Coast regions, which are most relevant to this Assessment Report. For residents in LGAs with high forestry dependence forestry and tourism were equally important. However, for those in LGAs with low forestry dependence, tourism was considerably more important than forestry. Similarly, residents in high forestry dependence LGAs rated wood or paper manufacturing as much more important than those in low forestry dependent LGAs (refer Figure 14).

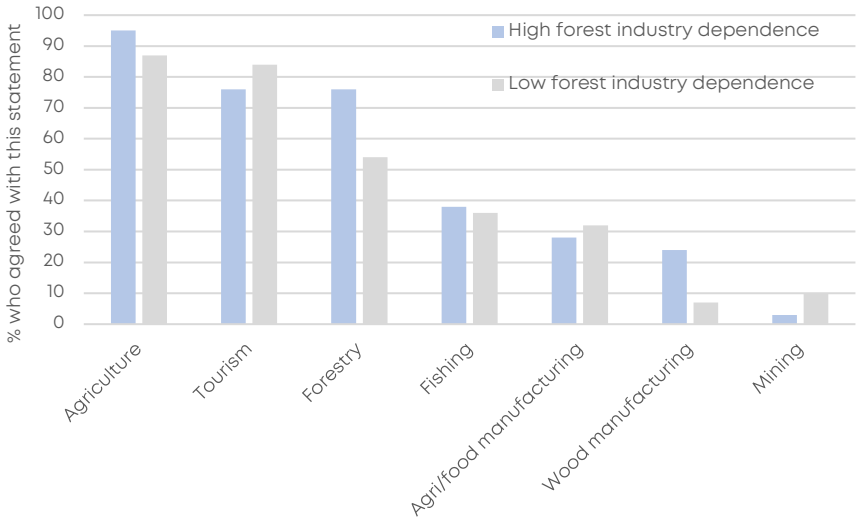


Figure 14: Proportion of residents (Northern region) who view forestry as an important industry[22]

[22] *Source: Adapted from Schirmer et al, 2018*

The survey also considered residents' views on the positive and negative impacts of forestry, compared with agriculture and tourism, against eleven "quality of life" factors, which were:

- Local employment.
- Cost of living.
- Friendliness of the local community.
- Health of local residents.
- Traffic on local roads.
- Quality of local roads.
- Attractiveness of the local landscape.
- Local water quality.
- Bushfire risk.
- Land prices.

With respect to positive impacts in the Northern and Cradle Coast regions, forestry scored considerably lower than agriculture and tourism, and markedly so for community friendliness, landscape attractiveness, local water quality, local environmental health and land prices. In relation to negative impacts of the three sectors, forestry scored markedly more poorly than tourism and agriculture for practically every category except for cost of living.

These findings suggest that Tasmanians generally perceive that the forest industries offer somewhat fewer positive outcomes than either farming or tourism, and create significantly more negative outcomes for the local community.

It is important to note that the survey did not discern between native and plantation forestry. However, it is also unlikely that there would be much perceived difference between the two types of forestry with respect to the categories considered.

Perceptions of industrial plantation expansion

Stakeholders consulted for this Assessment Report consistently identified that there was no social license in support of industrial plantation expansion in the Hub region. Stakeholders particularly noted that there remained a high degree of resentment towards the large scale MIS expansion, during the period 2000 to 2009 in particular. Stakeholders also expressed a broader view of historic resentment towards forest industry corporations (specifically Gunns, but other organisations by affiliation) and the plantation industry's perceived lack of alignment and complementarity with the general agricultural community in the region.

These anecdotal findings are supported by a considerable amount of research literature, particularly in relation to rural community attitudes towards forestry expansion during the MIS era throughout Australia. Miller and Buys (2014) note that these studies have consistently identified similar themes which have tended to revolve around the implications of plantation expansion for land-use change and subsequently on rural social constructs and socio-economic viability. It should be noted that these studies have rarely identified environmental concerns from plantation expansion, except where they

have a direct perceived impact on rural productivity, for example in relation to availability of water.

Common themes identified for all areas where rapid MIS plantation expansion took place focus on the issues which combine social and economic concerns about change in a complex matrix of cause and effect (Leys and Vanclay, 2010).

For example, demographic change is commonly identified as a consequence of corporate forestry interests purchasing farms at inflated land prices, which result in older people leaving family farms on the one hand, and at the same time making it difficult for young farmers to enter the land market. The replacement of people for trees results in changes to the local population mix and a reduction in the availability of rural services (for example schools, medical services and volunteers). This in turn, reduces the quality of lifestyle in the affected location and levels of employment and economic activity. Overall, these studies identify a resulting sense of loss of community and lifestyle which is compounded by a sense of powerlessness in dealing with larger, impersonal corporate neighbours that have fewer shared interests and less focus on the social and economic wellbeing of the area.

With respect to north-northwest Tasmania, the peak in MIS expansion occurred several years after other key plantation regions, particularly south-west Western Australia and the Green Triangle. It also occurred during a period of significant industry upheaval, during which the Gunns enterprise was under considerable public, political and legal scrutiny. It is possible that these factors have led to extended community concerns about the role of plantation expansion in the region, when compared with other jurisdictions.

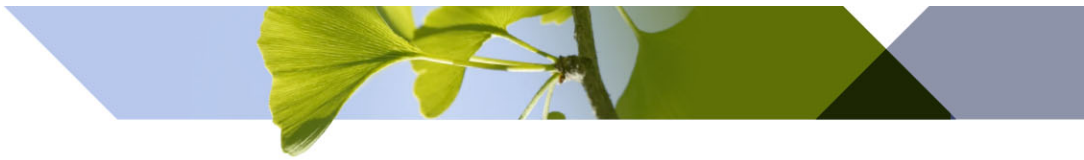
Williams (2013) addresses three issues concerning the acceptability of forestry plantations, in research undertaken in Tasmania and Western Australia:

- Community desires for rural land use and plantation forestry acceptability in this context.
- Community beliefs about the impacts of plantations.
- The kinds of plantations that are acceptable to communities.

The research identifies a number of important findings, that include:

- Softwood and hardwood plantations are perceived differently, with softwoods generally preferred. This may be because softwood plantations have existed at scale in the rural landscape for longer, leading to improved acceptance. It may also be because softwood plantations are associated with higher levels of domestic downstream processing and employment creation, compared to hardwood plantations for export pulpwood.
- Plantations owned by larger companies are considered less acceptable than smaller, integrated plantations owned by an individual as part of an overall agricultural enterprise. Aligned with this, plantations established as part of a rural property were considered more acceptable than plantations covering an entire property.

Williams also provides insight into the impacts of demographic change associated with plantation expansion. In particular, the research notes that, compared to other land uses, plantation forestry generates a higher level of full time employment in Tasmania.



However, and importantly, the jobs created are more likely to be in larger regional centres than rural areas.

Landowner attitudes to plantation forestry

A significant potential barrier to the integration of commercially viable forestry plantations into the agricultural landscape is the attitudes of individual landowners towards the value of trees on farms. This is a complex issue which is influenced by a wide range of social, economic and environmental factors.

The stakeholder consultation undertaken for this Assessment Report identified a number of specific barriers to landowner uptake of tree planting opportunities. These include:

Cost: the significant upfront costs for establishing plantations, including site preparation, tree stocks, planting, pest and weed management and fencing are seen as a potentially major barrier for independent landowners, particularly given the long lead times to revenue generation.

Opportunity cost: the opportunity cost of alternative land uses is considered to be one of the most significant barriers to agroforestry plantings. The extent to which this is an issue depends on the type of alternative land use (for example irrigated crop or livestock production versus dryland grazing); site specific environmental issues (for example soil erodibility and wind exposure) and the ability to fully utilise the property for agricultural production (for example, accessibility of steep or degraded areas for standard agriculture).

Decision-making flexibility: plantation establishment is seen as creating reduced decision-making flexibility when compared with other land uses. This is a function of both the length of time until revenue is generated and views about the requirements of regulation and/or requirements around funding to support establishment.

Knowledge and expertise: commercial tree planting, management, silvicultural treatment, harvest and marketing are considered by many landholders to be specialist activities requiring knowledge and expertise that many feel they do not possess.

Certainty and confidence: understanding of markets and pricing, and operational and supply chain costs, as well as confidence about future pricing at a much later point, were raised is important barriers to plantation establishment on farms. In particular, there is a view that landholders feel that they will be beholden to a number of supply chain actors without the benefit of full knowledge and whether or not they are likely to get a fair deal. By comparison, a number of stakeholders noted that for practically any other farming commodity these costs and prices, and the function of supply chains and markets, is quite transparent.

Schirmer and Bull (2011), in a Tasmanian study, assessed the willingness of landowners to undertake tree establishment (specifically for carbon sequestration purposes) and sought to align willingness with landholder values about the appropriate use of agricultural land. They identified five important elements which influence a landowner's willingness to plant trees. Their findings align with what the stakeholder consultation identified:

Plantation design: covering issues such as scale and location within the property, species, planting layout and the presence or not of non-wood benefits.

Social acceptability: relating to the extent that tree planting aligns with the landowner's own beliefs and values with respect to trees in the rural landscape, and broader social norms within their rural community.

Socio-demographic attributes of farmers and their properties: for example, age, education, income, goals and motivations, combined with property size, length of ownership and enterprise type.

Landowner skills, knowledge and experience: confidence in existing skills, as well as ability to access new skills and knowledge, are important in influencing the adoption of agroforestry as a new land management option.

Perceptions of plantation attributes: perceptions about the economic, environmental and land management attributes of plantations are important. In particular these cover: economic costs and benefits; impacts on land management complexity; impacts on land management flexibility; on-property environmental costs and benefits; perceptions about externalised costs and benefits; risk of failure; and the ease with which forestry can be trialled as a new practice.

A number of stakeholders identified that the motivations of individual landowners in relation to their willingness to establish trees on farms fit into some readily observable categories: those who recognise the value of trees, regardless of any economic return; those who recognise the value of trees as an integral and important part of the commercial matrix for the property; and those who see no value in planting trees in the agricultural landscape.

These observations are directly supported by Fleming *et al* (2019), who identify the same three categories of landowners. In their paper, the authors identify that farmers who see trees as an economic proposition tend towards a narrow conception of agroforestry as a purely economic alternative to other land uses, represented by commercially viable monoculture plantations. However, this group was more likely to consider the non-wood productivity benefits of agroforestry, including amenity, shelter, water quality and erosion control. Many of the survey respondents in this category already had trusted sources of information to support decision-making about tree planting and were likely to be actively engaged in extension and outreach programs. The research identified this group as the largest among the respondents, which suggests that there is significant opportunity to target this group with the right programs, in order to facilitate meaningful agroforestry developments.

Facilitating integrated farm forestry

The work undertaken for this Assessment Report has clearly identifies that any effective strategy for expanding the planted forest estate in north-northwest Tasmania will necessarily rely on the ability to influence land-use decision-making in the broader agricultural landscape and will need to focus on small scale on-farm plantings rather than larger, industrial scale expansion.

As noted previously in this report, limitations on industrial expansion are driven by three factors: plantation investment economics and the willingness of institutional investors to embark on greenfield expansion; lack of social and community support for industrial scale expansion in the region; and limitations imposed by regulation, specifically Tasmania's Protection of Agricultural Land policy.

The Hub region has a relatively high level of independent plantation ownership – at 42,000 hectares it is approximately half the area of privately owned non-industrial plantations in all of Victoria (c. 88,000). Combined with the fact that 30 per cent of the region's agricultural land base already is covered by plantations, this does suggest that the opportunities for timber plantations are approaching capacity.

However, the spatial and economic analysis undertaken for this Assessment Report demonstrates that there may be as much as 37,000 hectares distributed across the region's agricultural land base which is viable for integrated forestry under a non-industrial model.

Emerging focus on integrating tree plantations with agriculture

Historical context

There is a long history of enabling policy mechanisms to support expansion of small scale plantation forestry into the broader agricultural landscape in Australia.

One specific mechanism was the Joint Venture Agroforestry Program (JVAP), which was a co-operative program between Forest & Wood Products Australia, the Rural Industries Research and Development Corporation and the former Commonwealth agency, Land and Water Australia. The JVAP invested significant research funding over nearly two decades, from 1993 until it was wound up around 2011, aimed primarily at improving the perception, uptake and role of agroforestry as a meaningful economic and environmental component of sustainable rural landscapes (Powell, 2009). Another specific element was the establishment of Private Forest Development Corporations in key locations throughout Australia, as a direct outcome of the Plantations 2020 Vision policy framework.

Powell (2009) notes *that "…the benefits of agroforestry proved more difficult to demonstrate than first envisaged. There were few obvious win-win situations that favoured integrated farm forestry over industrial plantation forestry. [Excluding MIS]..the area of farm forestry plantations…increased by about 33,000 ha…[and]…it is highly likely that JVAP …had a large bearing on this result."* In summary, therefore, the leading enabling policy mechanism for encouraging integrated farm forestry contributed to the establishment of around 30,000 hectares of agroforestry plantings for a wide range of purposes, from environmental management and land remediation, through to commercial production, over a two decade timeframe.

This suggests that the right policy settings, combined with appropriate focus and availability of information, can productively contribute to integrated plantation expansion in the rural landscape, recognising that it is challenging to achieve. Nevertheless, it is important to note that, while the JVAP and its associated programs may have been considered successful, the main outcome was non-commercial tree establishment in areas that were generally not well located with respect to existing forest

industries. Further, over the same period of time, the program generated only about three per cent the amount of plantation establishment that was established through the more direct policy intervention of the taxation driven MIS program. Similarly, the Private Forestry Development Corporations, while achieving considerable positive profile for forestry in the relevant regions, did not contribute directly to any meaningful increase in commercial plantation area.

Current situation

In the decade long period between the JVAP and Private Forest Development Corporations being wound up, and the announcement of the National Forest Industries Plan, there has been practically no Commonwealth Government focus on agroforestry and very little state-level focus, with the exception of Tasmania.

During that same period, however, Powell's stated premise that investment conditions favour industrial plantations over integrated agroforestry has changed materially. As has been noted throughout this Assessment Report, there is very little appetite or scope for industrial scale plantation expansion in Australia. There is, though, increasing recognition of the role that integrated farm plantings can play in maintaining and augmenting the plantation estate in key forestry regions.

This emerging awareness is reflected in national policy settings, academic and research priorities and, importantly, in the industrial forest and forest products sector. Consequently, a number of recent developments have occurred, including:

- the National Forest Industries Plan focuses directly on supporting opportunities for farm forestry to develop greater capacity to contribute to regional wood flows.
- Forest & Wood Products Australia has recognised, in its 2019/20 Annual Operating Plan, the importance of mechanisms that value of non-wood plantation services to assist the expansion of Australia's commercial plantation estate.
- The University of Melbourne recently completed a significant program of research, partly funded by individual industrial forestry and processing companies, called the Next Generation Plantation Investment project, specifically focused on opportunities to develop and implement partnership models for integrating commercial plantation forestry into the broader agricultural landscape and supplement future wood flows.
- Private Forest Tasmania's investment strategy, articulated in its Corporate Plan 2020-2023, focusses on projects and programs that will contribute to expanding the extent and value of the private forest estate in Tasmania.

Challenges for farm forestry growers

Plantation investment economics

The primary challenge to non-industrial private forestry is fundamentally the same as the challenge to forestry investment generally – does it stack up economically? However, there are important nuances. These include:

- Private landholders are usually presented with alternative land-use opportunities which will generate immediate and annual cash flows.

- Establishment costs are a significant impediment to small enterprises with constrained cashflows and limited access to capital.
- While many individual landholders recognise both the internal and external benefits of agroforestry, internal benefits are often sacrificed on the basis of alternative short-term revenue streams and external benefits extract no financial benefit in the absence of effective environmental services markets.
- The lead time between plantation establishment and commercial returns is considered a significant impediment.

Powell's (2009) JVAP review identified that, in the absence of environmental services markets, agroforestry in high rainfall areas is at best marginal, depending on proximity to markets, and in low rainfall areas it is uneconomic.

Despite these barriers, it is also the case that traditional investment economics do not necessarily apply in relation to smaller scale forestry. In particular, individual landowners are less likely to take a traditional investment economics approach to the inclusion of land as capital in the investment. They are also more likely to take a whole of property view, with forestry treated as a part of an integrated farm management approach, and are unlikely to value their own labour

However, it would seem that these factors do not outweigh the barriers in most instances. There is also a strong indication that subjective negative sentiment towards plantations is an enhancing factor with respect to these barriers.

The role of environmental services

A consistent theme in the agroforestry and farm forestry literature is the extent to which a lack of markets for the environmental services from small scale forestry limits its uptake. There is considerable contemporary research about the internal integration benefits of trees on farms (for example, England *et al*, 2020; O'Grady and Mitchell, 2018), although little solid economic assessment. However, the external benefits are not currently recognised.

While there are encouraging signs and commitments, the fact remains that there are no effective policy mechanisms in place for recognising, valuing and affording payments for environmental services from tree plantations in Australia. There are opportunities in voluntary markets, specifically for carbon. However, these are difficult to access, strongly risk-adjusted with respect to price and require a coordinated approach to attract international interest through financial intermediaries.

Supply chain challenges

Even with some scale, private forest growers are seriously challenged across the supply chain when compared to their industrial peers. This includes in relation to:

- Access to plantation establishment, forest management and harvesting services.
- Access to quality, genetically improved seed and tree stocks.
- Access to research and up to date information to support management.
- Access to markets.
- Access to timely market information, similar to other agricultural products
- Capacity and capability to negotiate competitive rates for services and products sales.

- Capacity and capability to manage, monitor and ensure acceptable on-ground outcomes.

This is not fundamentally different to the way in which farmers are exposed to the supply chain in other agribusiness sectors. However, in other sectors this is often dealt with through co-operative arrangements in relation to procurement and marketing which, while not necessarily ideal, is at least understood.

In regions closer to markets, third-party forest managers are present, there are increased opportunities for small forest owners. This is the case for the Hub region, as it is in the Green Triangle and north-east Victoria, the Murray Valley in New South Wales and in south-west Western Australia (Albany region). However, there are also many examples in these regions where small forest owners have engaged log traders, harvesting contractors or processors to manage harvest, for example, and have been left with below market returns and significant clean-up costs as a consequence of poorly conducted harvesting. There are also examples where forest owners have been left with significant regulatory compliance issues because the appropriate planning and approvals have not been sought or adhered too by unscrupulous providers.

Regulatory environment

Issues around Tasmania's regulatory environment are covered in more detail in the following section.

Practical opportunities for integrated farm forestry

The nature of and motivations for farm forestry

By its nature, small-scale non-industrial farm forestry plantings are motivated by a range of factors. Stewart (2010) suggests farm forestry can be broadly categorised as small to medium sized plantations for the purposes of either (or a combination of): marketable wood production; firewood and fencing on-farm; or non-timber benefits (e.g. erosion control or amenity and aesthetics).

As noted earlier in the research by Fleming *et al* (2014), it appears that farm forestry practitioners tend to be focused on either the commercial or the non-commercial motivations for establishing trees.

During the consultation process for this Report, a number of stakeholders identified that there is a need to improve landowner understanding of the full range of integrated commercial, productivity and environmental services benefits of trees on farms.

Investment models

Keenan *et al* (2019) consider that alternative models are required to facilitate forest industry engagement with landowners that have different scales of suitable land, varied motivations for growing trees, a range of needs with respect to cash flow and income and different levels of risk appetite. In their wide ranging review of potential plantation investment models, they recognise that any commercially viable models must allow for these very real differences in private landowner motivations and requirements, while also being cognisant of practical industry constraints.

They note five key preconditions for a successful program of co-investing in plantation establishment in the rural landscape:

1. *Regional planning to ensure that the right tree species are planted in the right places to generate the desired benefits.*
2. *A commitment to purchase wood, with prices high enough to generate required rates of return for investors.*
3. *Income through carbon or other payments for environmental services as the trees are growing.*
4. *An investment vehicle to generate sufficient scale for investors and underwrite investment risks.*
5. *Mutual understanding, trust and long-term commitment among landowners, the timber industry and other stakeholders.*

A number of stakeholders consulted for this Report recognised that the forestry and forest products sectors – that is purchasers of timber from smaller, independent landowners - need to reconsider the models for commercial partnerships. In particular, there is a recognition by some commercial players that there is a commercial power and knowledge imbalance which, if addressed, could be a significant contributor to improving attitudes towards integrated forestry plantations.

Essentially, this suggests (logically) that the actions of actors in the commercial and industrial sectors is equally as important as the potential enabling policy and incentives that might flow from state and Commonwealth government programs.

Keenan *et al* identified a spectrum of business models for commercial tree growing. They recommended three of these models as suitable for application in the context of collaborative plantation business models that could effectively align landowner and industry interests (refer Figure 15).

The outgrower, joint venture and land lease options are all further assessed as collaborative models for commercial tree plantations on private land, with each operating against variations of a matrix of key business model inputs comprising land, capital, labour, technical and markets. They also represent variations with respect to risk profile for each of the key parties involved (that is, the landowner and the investing partner).

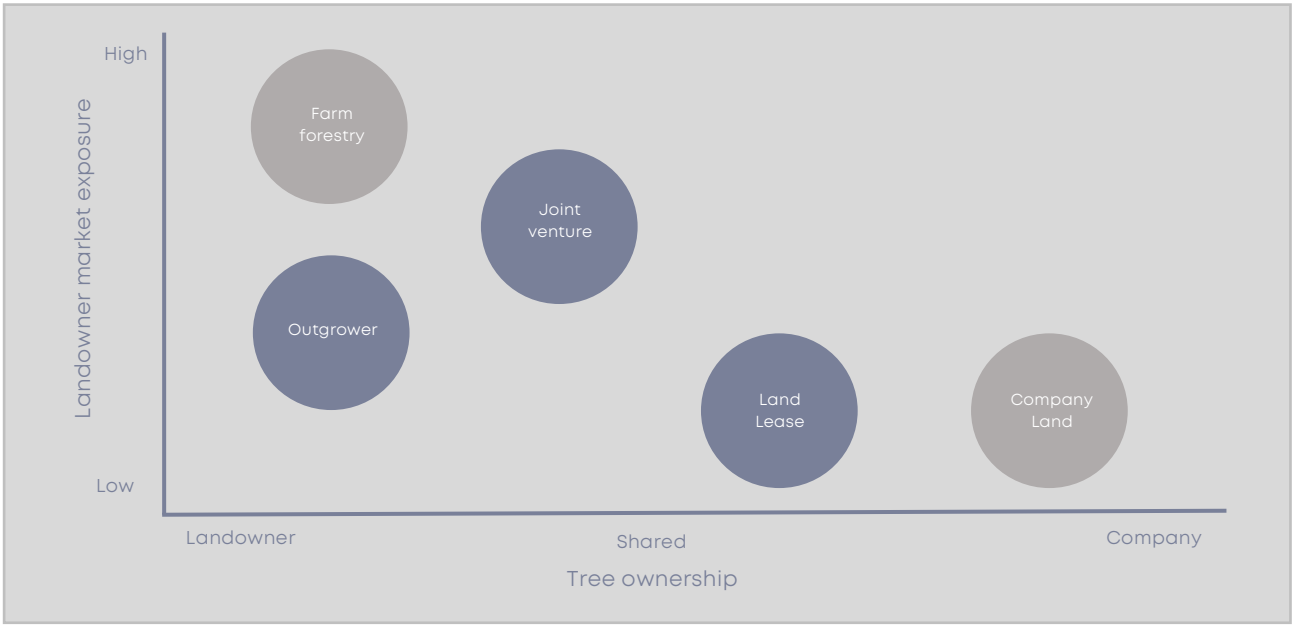


Figure 15: The spectrum of business models for commercial tree-growing

The details of each approach are summarised below. Overall, the Land Lease model presents the least risk to the landowner apart from the opportunity cost of alternative land use, the Joint Venture model reflects a more even share of risk and cost and the Outgrower model represents a greater degree of risk and outlay for the landowner.

Collaborative Model 1: Land lease or crop share

	Inputs				
Contributor	Land	Labour	Capital	Technology	Market
Landowner	✓				
Company/investor		✓	✓?[23]	✓	✓

Tree ownership:	Company/investor
Landowner risk profile:	Low
Landowner control:	Low
Relevant to:	Larger commercial-scale landowners looking for regular and secure annual income, with no appetite for managing trees.
Required scale:	Minimum 20 hectares, location dependent

[23] Note: Question mark denotes potential/possible application of the methodology

Collaborative Model 2: Joint Venture

	Inputs				
Contributor	Land	Labour	Capital	Technology	Market
Landowner	✓	✓	✓?		
Company/investor			✓?	✓	✓

Tree ownership:	Agreed share between parties, depending on inputs
Landowner risk profile:	Moderate
Landowner control:	Shared control (moderate)
Relevant to:	Larger commercial-scale landowners prepared to commit resources and funds to tree growing, or those prepared to take a higher risk/return profile.
Required scale:	Minimum 50 hectares, to justify transaction costs (location and growth dependent).

Collaborative Model 3: Outgrower

	Inputs				
Contributor	Land	Labour	Capital	Technology	Market
Landowner	✓	✓	✓		
Company/investor			?	✓	✓

Tree ownership:	Agreed share between parties, depending on inputs
Landowner risk profile:	Moderate-High
Landowner control:	Moderate-High
Relevant to:	Landowners that require a higher degree of control and greater interest in managing and marketing trees.
Required scale:	Minimum 5 hectares, depending on location, growth and impacts on economies of scale.

It is reasonable to observe that each of these models has been used at various times in the context of independent private plantations across Australia, and certainly within the Hub region. Nevertheless, the framework in which they are presented by Keenan *et al* is a useful way both to think about models for application in the Hub region and to communicate with landowners.

Policy and regulatory settings

Positive policy settings and direct incentives to support the establishment of plantations have played a significant role in the expansion of Australia's, and Tasmania's, plantation estate. Typically, these have been delivered through state and Commonwealth funded

programs. However, there is also a strong history of the commercial sector playing a role in directly supporting efforts for future plantation expansion, particularly through leases, joint venture and share farming arrangements.

The role of policy settings and incentives

Historic role of policy settings and incentives

As has been discussed elsewhere in this report, policy settings and incentives have played an essential role in the establishment of Australia's nearly two million hectare industrial forest plantation estate. A fundamental causal factor for this has been the need to address the significant investment barriers to successful plantation estate expansion. These relate primarily to the high initial costs of plantation establishment (related both to the cost of land and the costs of planting) combined with strong competition from alternative land uses, long investment timeframes (between 15 and 40 years depending on species, management intent and location), and relative lack of certainty about future markets and pricing.

Historically, favourable policy interventions have focused on the need to address private or public investment barriers by actively recognising the additional social, economic and environmental benefits of plantations. Predominantly these have been around issues such as security of domestic wood supply and generation of regional employment and wealth creation opportunities (de Fegely *et al*, 2011).

Unanticipated consequences

A critical challenge for any incentives or less direct policy interventions is the avoidance of perverse economic outcomes as a consequence of policy implementation, while achieving promotion of the identified benefits. Well documented examples of the distortionary impacts of previous policy for encouraging plantation expansion have included:

- Poorly located plantations with respect to site quality, site suitability and practical proximity to market.
- Consequently, stranded assets and poorly managed plantations in some situations and locations.
- Localised impacts on agricultural land prices, undermining market principles with respect to highest and best land use.

In this context, de Fegely *et al* (2011) note that the important criteria should be considered as part of any policy intervention related to supporting plantation expansion:

- *low cost to the taxpayer;*
- *minimal distortion to related markets and sectors;*
- *commercially driven market based outcomes;*
- *well defined 'exit' strategy for government to facilitate long term commercial sustainability;*
- *ability to leverage sustained private sector investment;*
- *capture of other benefits of plantations (e.g. carbon).*

It is important to note that the essential role of policy interventions in generating plantation expansion is not unique to Australia and is reflected in many other jurisdictions globally.

Catton *et al* (2004) provide a useful summary of the historic impact of incentives for plantation expansion in Australia. They identify four development phases for the Australian plantations sector. It can be argued that Australia's plantation development has entered a fifth phase since then, as described in Table 15 below.

Table 15: Australia's plantation development phases

Phase	Time period	Incentives	Impacts
1: Softwood import replacement	1900-1960	• State government investment in experimental plantings and initial estate expansion	• Slow expansion of softwood plantation estate, heavily weighted to South Australia
2: Self-sufficiency	1960-1980	• Softwood Forestry Agreement Act. • Deferred and low interest loans from Commonwealth to states	• Rapid expansion of softwood plantation estate • Large scale conversion of public native forests and private land to softwood plantations • Initial hardwood plantations at scale
3: Transition from public softwood to private hardwood	1980-1990	• National Afforestation Program • Conservation and agroforestry focused programs, including Landcare; Save the Bush; Our Country Our Future; Bushcare. • Significant funding support • State-based schemes aimed at joint ventures with industry and private landowners	• Strong focus on addressing rising environmental awareness around issues caused by agricultural land clearing (e.g. erosion, salination, biodiversity loss) • Increase on plantations on former farmlands • Increase in hardwood plantation area
4: Rapid expansion	1990-2010	• National Forest Policy and Plantations 2020 Vision Statement • Tax incentives for retail Managed Investment Schemes • Joint Venture Agroforestry Program • Regional Plantation Development Committees • Wide range of other direct and indirect incentives, mostly tax based and largely linked to MIS expansion or general primary production tax easing measures.	• Plantation estate almost doubled nationally, comprising predominantly short rotation hardwood plantations for pulpwood production. • First privatisations of State government owned plantations (Victoria and Tasmania) • Rise and collapse of MIS
5: Rationalisation	2010-2020	• Carbon Farming Initiative • Introduction of National Forest Industries Plan focused on "the right trees in the right places at the right scale". • Funding and establishment of regional forestry hubs	• Stability in area of softwood plantation. • Reduction in hardwood plantation area. • Massive injection of institutional capital into ownership of plantations and downstream processing • Continued privatisation of State-owned softwood plantations. • Institutional ownership of collapsed MIS plantations.

Figure 16, below, presents the five plantation development phases in graph form, demonstrating the impact of each set of incentives and policy measures in relation to the expansion of the national plantation estate.

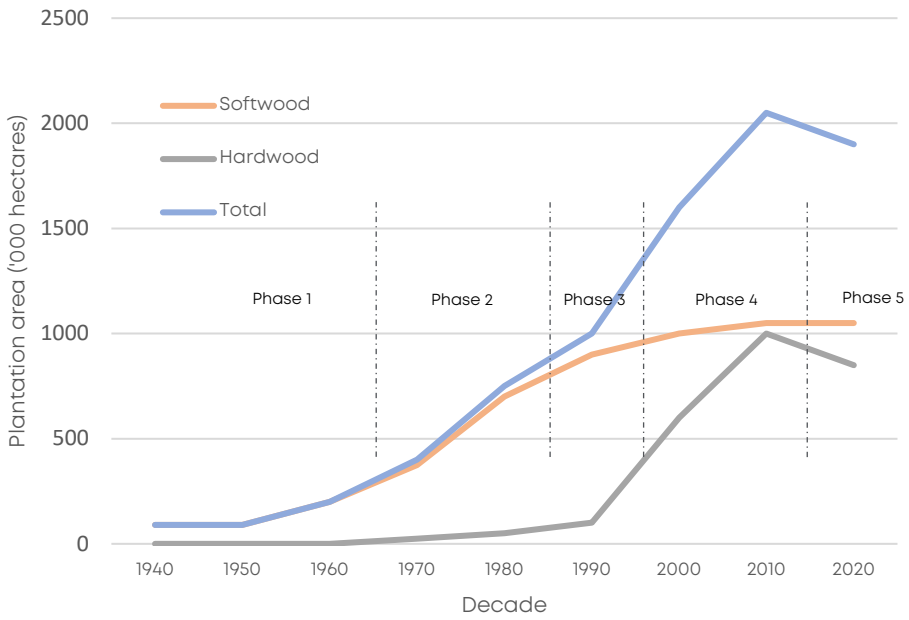


Figure 16: Growth of Australia's plantation estate[24]

Current policy and incentives

Policy

The current policy environment should be considered positive with respect to support for plantation expansion, both within the region and more broadly in Australia. The Commonwealth Government's *National Forest Industries Plan* is unambiguously focused on increasing Australia's plantation timber production capacity through establishing a targeted 400,000 hectare increase in plantation area nationally, in areas where the plantation sector and its dependent industries are already well established.

There is reportedly strong state government level support for the forest and forest products sector in Tasmania. While it is not reflected in a stated policy position on forest plantations, stakeholders generally consider that there is strong bipartisan state-level political support for exploring opportunities to expand the plantation estate in a way which complements other important agricultural land uses and augments the future viability of the forestry sector.

Incentives

In contrast to the broad policy support for plantation forest expansion, there are currently no effective incentive programs in place that reflect those higher level policy position(s).

For some time there has been an expectation across the sector that some form of carbon pricing mechanism, operating at industrial scale, will be available to recognise the

[24] *Source: Catton et al, 2004; ABARES; Stephens and Grist, 2014*

carbon sequestration benefits of forestry plantations, and structured in a way that encourages the establishment of trees at a variety of geographic scales.

The Commonwealth Government's Carbon Farming Initiative (CFI), which is the mechanism by which agricultural production industries can participate in the Emissions Reduction Fund (ERF), has until recently been limiting for plantation forestry. Changes to the CFI rules, aligned with the National Forest Industries Plan, promise to improve the accessibility to ERF auctions for forestry projects based on addressing the previously limiting rules, including by reducing the administrative burden. However, stakeholders have reflected that the challenges with defining, designing, documenting and submitting forestry projects such that they are at least eligible to participate in ERF auctions, without any guarantee of success, are a barrier to participation, even for larger corporate players.

At the state level, there are important programs in place, particularly through Private Forests Tasmania (PFT), to facilitate and expand development of private forestry. Specifically, PFT has recently undertaken a process to identify projects to be funded as demonstration sites for commercial scale agroforestry and PFT is also looking at opportunities to match interested private landowners with potential investors through its *Matching Project*.

Future policy and incentives

Types of policy mechanisms

A number of authors have commented on the range of policy settings and incentive structures that have been applied in the context of forestry in Australia (e.g., de Fegely *et al*, 2011). Thompson (2010) provides a useful summary of the typical investment mechanisms and their implications and challenges, which are summarised in Table 16.

There is a clear trend towards enabling mechanisms rather than direct incentives. This is typical of an advanced economy, such as Australia, where there is a high degree of sensitivity towards any mechanism which could, or could be perceived to, create market and economic distortions.

While it is a fact that direct mechanisms (the Commonwealth's softwood loans and MIS arrangements) have contributed materially to the creation of Australia's existing plantation estate, they both created distortions and perverse outcomes, ranging from conversion of native forest to plantation, through to inflationary pressure on rural land prices in key hardwood plantation regions. In this context, Enters & Durst (2004) note that direct mechanisms are typically used in the initiation and acceleration phases of investment with indirect mechanisms applying as the investment environment matures and the core objectives have been met, as shown in figure 15 below.

Reflecting these principles, the policy environment for plantation expansion in Australia currently is heavily weighted towards enabling, indirect mechanisms.

Examples of policy settings and incentives from other jurisdictions

Stakeholders consulted for this Assessment Report were not able to identify any significant direct policy mechanisms in support of forestry plantation expansion which are currently operating successfully around the world, apart from the forestry-friendly

emissions trading scheme in New Zealand which has had some impact on supporting maintenance of the existing plantation commercial plantation estate and a material impact in expanding the planting of trees for non-wood benefits (specifically carbon sequestration). With respect to indirect mechanisms, a number of stakeholders identified New Zealand's One Billion Trees policy. However, it is important to note that these two mechanisms have also generated a significant backlash from the broader agricultural sector, with claims of distortionary impacts with respect to alternative land uses. The backlash has been substantial enough that the New Zealand Government has sought to respond with supply chain and market interventions to favour domestic processing of plantation logs.

Catton *et al* (2004), Enters & Durst (2004) and de Fegely *et al* (2011) all provide comparative examples of historic policy and incentive mechanisms from various parts of the world. However, these do not offer any new principles that have not already been considered or applied in the Australian context.

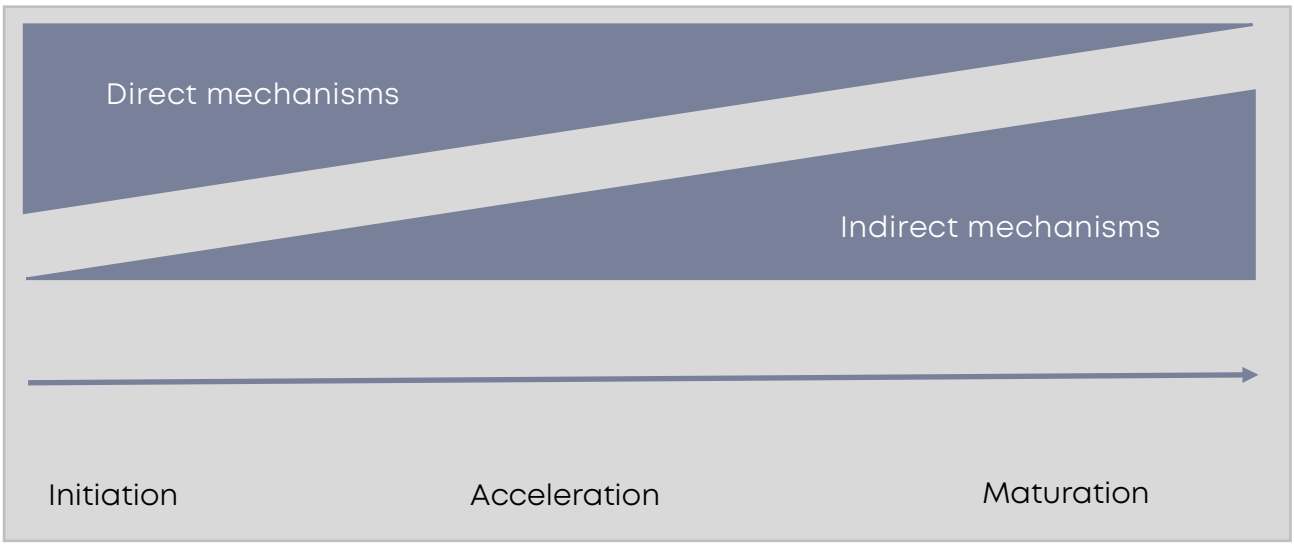


Figure 17: Continuum of plantation incentives over time[25]

[25] *Source: Enters and Durst, 2004*

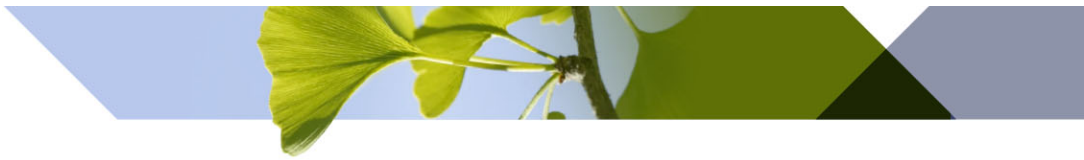
Table 16: Investment mechanisms typically used in Australian forestry[26]

Mechanism description	Implications, perceptions and challenges
Land grants, subsidies for inputs (e.g. seedlings), financial and monetary grants	• Likely to be perceived as favouring forestry over other land uses and creating a distortionary investment effect. • The Federal Government included in its 2018 election platform, funding of $250 million for plantation discretionary loans. These are yet to be enabled through parliament and have been subject to considerable negative scrutiny from the sector in Australia.
Taxation arrangements (e.g. capital deductions, accelerated depreciation, tax concessions at harvest, removal of stamp duty from plantation sales)	• Likely to be perceived as favouring forestry over other land uses and creating a distortionary investment effect. • Likely to be considered in a similar negative light as MIS taxation arrangements. • Removal of stamp duty could be a stimulus for longer rotations.
Private mechanisms (TIMOs, unit trusts, flow through investments, REITs)	• TIMO investment has now matured in Australia. • All these mechanisms involve concessionary taxation arrangements which may be considered in a similar negative vein to MIS. • This could be expanded to include privately driven joint venture and share farming arrangements in the context of farm forestry expansion.
Competition policy	• This has been a key driver in the sale of state-owned plantation assets and has effectively matured, with the exception of the West Australian and New South Wales assets, neither of which are likely to be sold in the short term.
Enabling policy (research, extension, moderation or removal of policy constraints) and market information	• For farm forestry, mostly reduced in application in Australia since the cessation of the Joint Venture Agroforestry Program almost a decade ago. • For forestry more broadly, mechanisms include product levies (supporting FWPA's research arm), the National Forest Industries Plan, National Forest Products Innovation program and funding and the Regional Forestry Hubs funding. • Tasmania is more advanced and active than other Australian state and territory jurisdictions, through Private Forests Tasmania. • Does not solve the issue of early rotation cash flows for non-wood products (carbon and other environmental services). • Would generally be considered as a benign approach and not creating market distortions.
Markets for non-wood products and benefits	• Opportunity for recognition of additional internal and external benefits of plantations, at either the enterprise or jurisdictional level. • Carbon pricing is looking more promising with recent legislative changes. Other services not recognised in markets.

The role of carbon pricing

The absence of an effective carbon pricing mechanism for plantation forests has long been considered a policy failure with respect to utilising available tools and mechanisms to support early rotation cash flows and, therefore, improve the appeal and economic viability of new plantations.

[26] *Source: adapted and updated from Thompson, 2010; note that Thompson's work references mechanisms to MIS which are no longer relevant to the contemporary investment environment*



Tree planting has nominally been eligible for participation in Australia's Carbon Farming Initiative, through the Emissions Reduction Fund auctions. However, recognition for new plantation establishment has been limited to areas which receive less than 600 millimetres per annum of rainfall, and has also been limited by total area within a property which is eligible.

The Commonwealth Government has recognised the limiting nature of these rules and has undertaken legislative change that allows new plantation establishment in specifically identified areas (aligned with the Regional Forestry Hubs).

CONSOLIDATED FINDINGS

Challenges and opportunities

This Assessment Report has identified a suite of challenges and opportunities in relation to Access to Land and Land Use Policy for the Hub Region which are summarised below.

Challenges

The immediate challenge with respect to the Hub's objectives is to identify mechanisms to maintain the existing plantation footprint. Currently the plantation estate in the region is contracting. It is anticipated that the current estate will decline by between 10,000 and 25,000 hectares over the next five to ten years. This decline includes industrial hardwood plantations, independent hardwood plantations and independent softwood plantations.

The secondary challenge is to identify opportunities to expand the plantation footprint and increase the overall potential availability of wood. This challenge is somewhat exacerbated by the fact that plantation forestry represents 30 per cent of agricultural land use within the Hub boundaries. This is several orders of magnitude higher than any other Australian jurisdiction, with the national average at about 0.5 per cent, suggesting that, at least for industrial scale plantations, the region has probably reached its capacity.

There is also a considerable community antipathy towards industrial expansion, and a considerable regulatory barrier in the form of the Tasmanian Government's Prime Agricultural Land Policy. Added to this is the institutional forestry investment model which favours mid-rotation acquisitions rather than greenfield establishment. In essence, therefore, industrial scale forestry expansion will not occur because none of the larger forest owners has a mandate for it and, regardless, it is recognised that community sentiment would not support it.

That means that opportunities for plantation expansion are dependent on effectively integrating smaller scale forestry plantations into the broader agricultural landscape. The agricultural community is at best agnostic towards plantation forestry and in many cases is firmly opposed to it. There are a number of reasons for this, including opinions about the best use of agricultural land, perceptions of commercial and technical challenges with plantation establishment, management, harvesting and marketing and cost barriers, including those imposed by the Forest Practices system.

In particular forestry supply chains and markets, including pricing, are viewed as complex and lacking in transparency by existing and potential agricultural participants in forestry plantations. Volatility in demand and pricing also creates a lack of certainty about future returns which is a challenge when a landowner is considering an expensive establishment exercise and loss of other land use alternatives for a fifteen to thirty year period. By contrast, when decisions are made about alternative land uses, commodity prices at either farm or factory gate are generally readily available, supply chains are understood and hence decisions are made on available, reliable market information.

There are also no existing, practical incentives to support expansion of either industrial or independent plantations. Traditional investment economics do not support green field establishment at any scale and in many cases do not justify re-establishment of harvested plantations. The non-wood productivity benefits of trees on farms are not recognised, either formally or informally and there is no enterprise level tool available to account for these. There is currently no market mechanism for environmental services. Changes to the Carbon Farming Initiative will change this in theory. However, the administrative and technical requirements for participating are a hurdle.

Opportunities

The analysis presented in this report indicates that there is approximately 37,000 hectares of land which is potentially suitable and available, competitive with other land uses and economically viable to support new forest plantations integrated into the broader agricultural landscape in the Hub region.

There is a significant opportunity to work on the development of tools and systems for measuring and accounting for non-wood values and to use this process to improve the acceptance among the agricultural community of the contribution that trees can make to augmenting on-farm productivity. Both the University of Tasmania and the University of Melbourne have progressed research and assessment of opportunities to apply natural capital accounting at the farm enterprise level in the context of forest plantations (small to medium scale).

The forest industry in the Hub region recognises the importance of working with smaller, independent landowners to develop commercial and land access arrangements which can benefit all parties and there is significant goodwill from the State and Federal Governments, as well as positive policy settings to support this approach.

Private Forests Tasmania is uniquely placed to facilitate the development of effective and practical arrangements between industry and landowners, to deliver and communicate new models to improve landowner understanding of and familiarity with forest industry commercial and marketing structures, and to support improved technical capacity with respect to growing small scale commercial tree crops.

In general terms, Tasmania is better placed than most other jurisdictions to capitalise on emerging opportunities for solid wood processing of hardwood plantation products, as well as optimising the transition, where relevant, from short rotation hardwood to long rotation hardwood and softwood plantations to develop a fully mature and diverse plantation-based timber industry.

The newly established Tasmanian Forest products Association is also uniquely well placed to generate improved dialogue with other agribusiness peak bodies and the State and Commonwealth Governments, in order to support the work of industry, individual landowners and the North-northwest Tasmania Regional Forestry Hub in developing and implementing appropriate policy settings to fully capitalise on these opportunities.

Recent Commonwealth Government changes to the legislation governing the Carbon Farming Initiative, and the way in which new plantations can participate in the Emissions

Reduction Fund, also present an emerging opportunity for landowners to participate and generate real financial returns for new plantation investments.

Recommendations

Overall context

Four specific recommendations have been developed which reflect the findings from this Assessment Report and support an increase in future available wood resources in the Hub region. Each of the recommendations includes a rationale and series of proposed actions.

Recommendation 1: Encouraging agroforestry and market accessibility

Rationale

This report has identified a desire within the sector to maintain the existing plantation footprint in the short term and expand it in the medium to long term.

There is broad recognition that the opportunity to achieve these outcomes from the industrial plantation estate is constrained by the nature of the existing industrial investment models and by social license and regulatory limitations on large scale plantation expansion.

There is a complementary recognition that the opportunity exists to better capitalise on potential plantation expansion integrated into the broader agricultural landscape through a range of farm forestry models. Aligned with this is a view that uptake of farm forestry could be improved if the indirect benefits of trees on farms is better understood by the farming community. Similarly, stakeholders recognise the need to better inform the farming community about the direct benefits of commercial farm forestry, with respect to both wood products revenue and potential environmental services income and benefits.

Private Forests Tasmania is already actively involved in two projects with the direct aim to improve the accessibility of agroforestry and landowner knowledge and understanding of how forestry plantations can contribute to on farm productivity, and to match potential investors with interested landowners.

There are existing resources in place, particularly through Private Forests Tasmania, which address some of these issues. However, even for informed stakeholders, there was a low level of awareness of the existence of these resources.

The recent establishment of the Tasmanian Forest Products Association is also seen as an opportunity to readjust the way the broader forest and forest products sector engages with both government and the agricultural sector.

Barriers to uptake extend beyond the technical practicalities of establishing and managing trees. There are five specific areas identified:

- A perceived antipathy within the broader agricultural community towards forestry generally and farm forestry specifically.

- Landowner understanding of how forestry supply chains, pricing and markets work, particularly in comparison to other agricultural commodities.
- Full appreciation of the range of commercial and non-commercial benefits of trees on farms, including with respect to agricultural productivity and environmental services.
- Lack of understanding and capacity to participate in the Carbon Farming Initiative and forest certification.
- Where to access reliable and professional services.

Recommendations

1. Inform and support landowners with respect to forest plantation establishment, management, harvesting and marketing, with a specific focus on the commercial aspects of integrated farm forestry:
    - Establish a framework to provide accessible market intelligence, specifically in relation to the costs and returns for commercial forestry. This should include log price indices and trends, plantation operations costs models and indices.
    - Develop an administrative system for smaller landowners to be able to more easily participate in the Emissions Reduction Fund auctions through the Carbon Farming Initiative.
    - Provide an enhanced and centralised service for landowners to access critical plantation management services, including technical advice, forest management certification and harvest and marketing services.
2. Leverage areas of shared interest with the agricultural sector, particularly with respect to:
    - Addressing social license issues in relation to trees on farms.
    - Maximising optimal land use.
    - Identifying carbon offset opportunities and promulgating the broader environmental and productivity advantages of trees on farms.
    - Addressing key regulatory issues, particularly in relation the Prime Agricultural Land policy.

Recommendation 2: Addressing regulatory barriers

Rationale

There are four specific issues with the existing regulatory regime:

- The forest practices system applies the same risk management framework to small scale plantations on agricultural land as to native forest operations.
- A significant component of regulatory costs are imposed at the planning and establishment phases rather than at the revenue generation phase.
- Plantations are excluded, at the landscape scale, from classes of agricultural productivity, as a measure to prevent industrial expansion into prime agricultural land, which is a real or perceived barrier to smaller scale, integrated plantation establishment.

- While the Carbon Farming Initiative requirements have been relaxed for the Hub region, there is still a view that the administrative process for participation is prohibitive, particularly for smaller growers.

Recommendations

1. Improve accessibility and simplify decision-making for potential growers – consider opportunities to introduce a risk-weighted approach streamlining the forest planning and approval processes for small-scale farm forestry on cleared agricultural land.
2. Quantify the regulatory costs profile for small-scale farm forestry and identify opportunities to reduce, remove or shift early rotation costs which are perceived to be a barrier to farm forestry investment.
3. Promote small-scale agroforestry opportunities in Prime Agricultural Land categories 1, 2 and 3, which is complementary to the Prime Agricultural Land policy intent. Additionally, consider proposed adjustments to the Protection of Agricultural Land Policy to recognise that small scale, integrated plantations pose no significant land use change risk for prime agricultural land, can provide additional farm productivity and environmental services benefits and should be considered an *as of right* land use decision.
4. Develop a group approval framework for supporting small grower access to the Carbon Farming Initiative which enables landowners to more readily participate in the Emissions Reduction Fund. Consider adjustments of regulatory requirements for small-scale farm forestry plantations to participate in the CFI.

Recommendation 3: Improving the value proposition

Rationale

While maintaining and expanding the physical footprint of the plantation estate in the region is a primary focus of this Assessment Report, the opportunities to increase both wood flow and economic value are also important considerations. The Hub region is better placed than most forestry dependent economies with respect to regional scale, biological capability, infrastructure and emerging processing capacity to capitalise on opportunities related to transitioning to alternative forest management regimes which can deliver increased enterprise and regional benefits.

The two specific opportunities relate to:

- Transitioning from short to long rotation hardwood plantations to underpin a domestic plantation hardwood solid wood processing capacity.
- Transitioning from short rotation hardwood to long rotation softwood plantations where it is more suitable, to underpin expansion of the State's softwood solid wood processing capacity.

Recommended actions

1. Expand and increase research into the forest management and timber processing requirements for solid wood processing from hardwood plantations.

2. Support the transition from short rotation hardwood to long rotation hardwood and softwood plantations with the aim of increasing domestic processing of high quality structural wood products; and consider opportunities for development of increased domestic solid wood processing capacity.

Recommendation 4: Facilitating commercial partnerships

Rationale

A key element for success in expanding and integrating commercial plantations into the broader agricultural landscape is the ability for the industry to identify and implement effective commercial partnership models with landowners which satisfy landowner expectations about how their land will be managed profitably and meet industry requirements with respect to investment fundamentals, resource accessibility and operational needs.

The need for effective commercial relationships relates both to the initial investment required to establish plantations, and arrangements for the sale of plantation products.

Collaborative investment models such as leases, joint ventures and outgrower frameworks as described in this report, have been successfully in the past to generate increases in plantation area. However, the work undertaken by the University of Melbourne recognises that in order to improve the likelihood of take up by landowners, collaborative investment models should ideally be combined with a long-term commitment to wood purchase at competitive prices, income (where appropriate) for environmental services, specifically carbon and a commercial engagement which fosters transparency and mutual benefit for both parties.

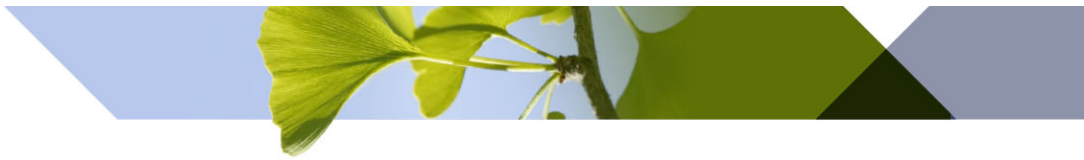
This recommendation is necessarily linked with Recommendation 1. This is particularly in relation to improving transparency and landowner access to critical information to support and foster long-term investment decisions.

Through the development of this Report, there has been mention of the potential to develop a model for a third party aggregator to operate in the Region for the purposes of identifying and bringing farm forestry timber resources to market. While this would appear logical on the face of it, there are commercial and legal considerations in this suggestion, particularly as there are independent commercial operators that are currently engaged in this activity. Further, an aggregation model working at the harvest and marketing end of a plantation rotation is unlikely to increase investment confidence at the establishment phase.

Recommendations

Encourage industry co-investment in farm forestry plantations, considering:

- Preferred co-investment models.
- Investment funding commitment.
- Preferred species and silviculture regimes.
- Forward pricing models.
- Other commercial and contractual requirements.



GLOSSARY

Commercial Plantation – areas of tree plantings greater than or equal to 10 hectares in size that can be harvested for financial return.

Industrial Plantation Estate – large aggregations of land holdings managed by a single entity, typically a forest management company, for plantation cropping. These estates were excluded from this analysis given plantation development within these land holdings has already been maximised.

Managed Investment Schemes (MIS) – MIS is a tax-effective plantation investment structure which was a key policy mechanism supporting the Federal Government's Plantations 2020 Vision and 1995 National Forest Policy Statement, which aimed to triple Australia's plantation footprint by 2020.

Natural Capital Plantation – small-scale tree plantings that could potentially achieve soil erosion mitigation, native habitat, shelter, carbon sequestration and other indirect values, for example, but could not be harvested for financial return.

Plantation Development Potential (PDP) – classification of a site (i.e. smallest unit of area modelled) in terms of potential availability for plantation use based on model assumptions.

Private Timber Reserve (PTR) - a mechanism under the Private Forests Act (1985) which allows for privately owned forests to be subject to regulation under the centralised forest practices system.

Small-Scale Plantation – areas of tree plantings less than 10 hectares in size that can be harvested for financial return.

Timber Investment Management Organisation (TIMO) – TIMOs are fund management specialists utilised to channel institutional investment into timberland assets. The term originated in the United States in the late 1980s, where investment is recognised as a specialist real estate investment.

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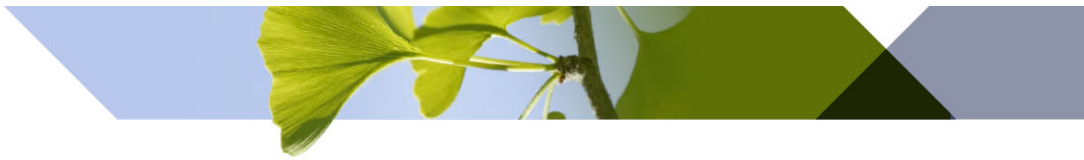


APPENDICES

Appendix 1: Questions for stakeholder consultation

Questions for grower consultations

1. What plans do you have in place to expand your existing plantation investment base in northern Tasmania?
    a. What incentives or market drivers are in place to support expansion?
    b. What barriers are in place that prevent expansion?
    c. What are the three most significant impediments for you regarding investment in greenfield plantations now and over the next five years?
    d. If you were to consider greenfield plantation investment would it be in softwood (*P. radiata*), traditional hardwood (*E. nitens* or *E. globulus*) or alternative species? Why?
2. What issues do you consider when assessing an expansion investment opportunity?
    a. What issues are specific to Tasmania?
3. What do the short, medium and long term supply profiles look like for your business (for example, are there any forecast gaps in supply)?
4. When considering investment, to what extent do you
    a. Actively forecast timber supply, demand and product distribution?
    b. Factor in potential major disruptions?
5. [For corporate growers] Does your business work with smaller growers to supplement estate size and supply levels?
    a. If so, what arrangements are in place to support that?
    b. What proportion of smaller growers are looking to replant?
6. Do you have any future plans to change:
    a. Silviculture?
    b. Target products?
    c. Target markets?
7. What, if any, are the supply chain challenges for your business (e.g. infrastructure, cost, availability of contractors, access)?
8. What is your perception of the social license for plantation forestry in northern Tasmania with respect to:
    a. Operating the current estate?
    b. Expanding the current estate?
    c. [What do you believe can be done to improve the social license for plantation forestry?]
9. What role does forest management and chain of custody certification play for your business?
    a. Is there a preference for one or other of the certification schemes (PEFC/FSC)?
    b. How critical is certification to your business's viability?
10. How important would a carbon value be in your decision to undertake greenfield investment?
    a. Are there other policy mechanisms or incentives that would influence your decision to invest in greenfield plantations?

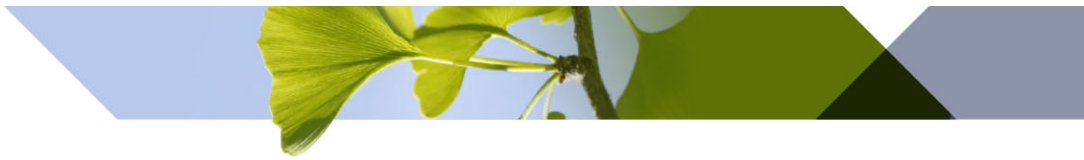
11. Are there any other issues that would influence your decision to invest or not invest in greenfield plantations (risks, issues, markets, incentives, etc)?
12. Where in Australia or in other parts of the world is investment in greenfield plantations being undertaken successfully?
    a. Why are they successful?
    b. What lessons are in those examples that can be applied to the northern Tasmania context?

Questions specifically for small forest growers

1. What was your motivation/reason for the current plantation investment?
2. Do you intend to replant following harvest of your current plantation?
    a. If yes, which species and why?
    b. If not, why not?
3. How do commercial tree plantings fit with overall management of your property?
4. What other benefits are generated from tree plantings on your property?
5. What arrangements do you have in place for accessing plantation management, harvesting and marketing services?
6. What factors have influenced your current plantings with respect to:
    a. Species planted?
    b. Plantation design?
    c. Proportion of property planted?
7. What support or incentives would reinforce or change your decision to establish commercial tree species as part of your land management mix?

Questions for timber processor/exporter consultations

1. What are the major products you are producing/exporting?
    a. Plantation wood type
    b. Products
    c. Volumes
2. What is your proportionate distribution of supply between major and smaller growers?
    a. How is smaller grower supply accessed?
3. To what extent do you engage with major and smaller growers to forecast future log supply?
4. What is the prognosis for short, medium and long term supply from:
    a. Major growers?
    b. Smaller growers?
5. What are the typical purchasing arrangements from smaller growers? (e.g. stumpage purchase, delivered purchase, purchase of third parties?
6. What, if anything, needs to be done to ensure there are markets for all log grades?
7. What regulatory barriers affect access to smaller private grower resource?
8. What proportion of smaller plantation growers do you think are looking to replant?
    a. Are you actively involved in assisting smaller growers to re-establish plantations after harvest?



   b. If yes, how? If not, why not?
9. What is your perception of the social license for plantation forestry in northern Tasmania with respect to:
   a. Operating the current estate?
   b. Expanding the current estate?
   c. [What do you believe can be done to improve the social license for plantation forestry?]
10. What, if any, are the impediments to you:
   a. Expanding your business?
   b. Investing in more capacity?
   c. Investing in improved technology?
   d. Employing more people?

Questions for service provider consultations

1. What proportion of your services are provided to smaller versus major plantation growers?
2. How are smaller growers aware of your services?
3. What business models do you apply to engagement by smaller growers versus larger growers?
4. What is your perception of the social license for plantation forestry in northern Tasmania with respect to:
   a. Operating the current estate?
   b. Expanding the current estate?
   c. [What do you believe can be done to improve the social license for plantation forestry?]

Questions for other stakeholder consultations

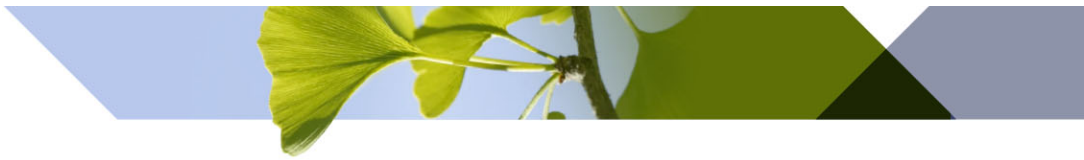
1. How does the regulatory framework support/hinder expansion of private forestry plantations?
2. What can be done from a regulatory perspective to enhance opportunities for private plantation estate expansion?
3. How does your organisation support the maintenance or expansion of commercial tree establishment on private land in Tasmania?
4. What additional support or incentives would your organization consider to facilitate expanded private plantation establishment in Tasmania?

[LGAs only]

1. How important is plantation forestry to the LGA economy?
2. What is the general feeling towards plantation forestry in the LGA?
3. How does council support/hinder plantation forest management and expansion?
4. How would council feel about active expansion of plantation forestry in the LGA?
5. What are the planning, infrastructure, logistics and regulatory issues facing the LGA with respect to plantation forestry?

Appendix 2: Stakeholders consulted

Name	Organisation	Stakeholder category		Date
Tim Bates	Esk Mapping & GIS	Service Provider		18/06/2020
Andy Bell	PFP	Processor/Exporter		18/06/2020
Jason Bolch	SFM Products	Processor/Exporter	Service Provider	19/06/2020
Terry Brient	Tasmanian Agricultural Productivity Association	Other (Association)		18/06/2020
Shawn Britton	Britton Timbers	Processor/Exporter		17/06/2020
Steven Brown	Timberlands Pacific	Major Grower	Service Provider	25/06/2020
Richard Crabtree	Private	Independent Grower		23/06/2020
David Hamilton	Dorset Renewable	Independent Grower	Processor/Exporter	6/07/2020
Bryan Hayes	Tasmanian Forest Products Association	Other (Association)		19/06/2020
Natalie Heazlewood	Australian Forest Products Association	Other (Association)		24/06/2020
Luke Jones	Jones Forest Management	Service Provider		18/06/2020
John Lord	Private	Independent Grower		30/06/2020
Phil Lloyd	Timberlink	Processor/Exporter		26/06/2020
Zara Marais	University of Tasmania	Other (Academic)		22/06/2020
Phil Mason	New Forests Asset Management - ANZFF1	Major Grower	Processor/Exporter	16/06/2020
David Monckton	Private Forests Tasmania	Other (Government(		22/07/2020
Alastair Morton	State Growth Tasmania	Other (Government)		19/06/2020
Tony Price	Midway	Processor/Exporter	Grower	19/06/2020
Stephen Rymer	PF Olsen Australia	Major Grower	Service Provider	17/06/2020
Rob Smith	Private Forests Tasmania	Other (Government)		17/07/2020
Tony Stonjek	AKS Forest Solutions	Major Grower	Service Provider	25/06/2020
Rob Tole	Private	Independent Grower		1/07/2020
Peter Volker	Forest Practices Authority	Other (Government)		16/06/2020
Clint Webb	Midway Tasmania	Processor/Exporter	Grower	19/06/2020
Suzette Weeding	Sustainable Timbers Tasmania	Major Grower		23/06/2020
Penny Wells	Private Forests Tasmania	Other (Government)		22/06/2020
Steve Whiteley	Sustainable Timbers Tasmania	Major Grower		23/06/2020
Andrew Wilson	Department of Agriculture (Federal)	Other (Government)		23/06/2020
Jim Wilson	Forico	Major Grower	Processor/Exporter	17/06/2020
Clive Woolridge	Technical Forest Services	Service Provider		16/06/2020



Appendix 3: Spatial and economic analysis technical report

SPATIAL AND ECONOMIC ANALYSIS TECHNICAL REPORT

Appendix 3 of the ACCESS TO LAND AND LAND USE POLICY FOR PLANTATION FOREST INVESTMENT report prepared for the North-northwest Tasmania Regional Forestry Hub

Prepared by
Esk Mapping & GIS
27th August 2020

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Figures and Tables

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1 Glossary

Natural Capital Plantation – small-scale tree plantings that could provide water quality maintenance, soil erosion mitigation, shelter or carbon sequestration services within a property, for example, but could not be harvested for financial return due to current Forest Practices legislation.

Small-Scale Plantation – areas of tree plantings less than 10ha in size that can be harvested for on-site use or financial return.

Commercial Plantation – areas of tree plantings greater than or equal to 10ha in size that can be harvested for financial return.

Industrial Plantation Estate – large aggregations of land holdings managed by a single entity for plantation cropping. These estates were excluded from this analysis given plantation development within these land holdings has already been maximised.

Plantation Development Potential (PDP) – classification of a site (i.e. smallest unit of area modelled) in terms of potential availability for plantation use based on model assumptions. PDP classes used in this model are described in Table 1 below.

Table 1 – Description of Plantation Development Potential (PDP) Classes

Plantation Development Potential	Description
No potential	Model criteria results in site not having any potential for plantation development
Natural Capital potential (Riparian)	Model criteria results in site being available for Natural Capital Planting within a Modified Riparian Zone
Natural Capital potential (Wetland)	Model criteria results in site being available for Natural Capital Planting within Modified Wetland
Natural Capital potential (Slope)	Model criteria results in site being available for Natural Capital Planting in areas too steep for other land use
Small-Scale potential (Riparian)	Model criteria results in site being available for Small-Scale Planting within a Modified Riparian Zone
Commercial potential	Model criteria results in site being available for Commercial Planting

2 Overview

This technical document is provided to accompany the *Access to Land and Land Use Policy for Plantation Forest Investment* report prepared by Greenwood Strategy for the North-Northwest Tasmanian Regional forestry Hub, August 2020. This document describes the data sources, outputs and technical steps in preparing the spatial model supporting the main report.

The land availability for plantation use in NNW Tasmania was assessed using a desktop GIS modelling approach. The availability model build process involved four steps:

1. Physical Plantation Land Suitability Modelling: this process reviewed current land use in terms of capacity, legislation and social licence with respect to potential for conversion to plantation use, and married this with site environmental factors, to assess location and extent of areas likely suitable and available for plantation use.

2. Higher and Best Use modelling: this process overlaid the physical plantation availability and suitability model outputs with competing agricultural land use site suitability to provide an indication where there may be conflicts or opportunities for plantation use.

3. Economic modelling: this process overlaid the higher and best use model outputs with key economic drivers that would influence the commercial viability of any plantation development such that commercial wood catchment zones could be identified.

4. Model review: a random sample of modelled properties were chosen from across the NNW Hub area and across a range of primary agricultural uses and property sizes, and reviewed against current aerial imagery to confirm operation consistency.

To assist with understanding current landowner intent with respect to plantation use since the final collapse of plantation managed investment schemes in Tasmania in 2013, a GIS analysis of plantation status between 2015 and 2019 was also undertaken.

The following sections of this document provide more detail on the above.

3 2020 Plantation Land Suitability Model

The 2020 Plantation Land Suitability Model is a GIS/mapping model built to account for current land use, land use legislation, and environmental site suitability across North and North-West (NNW) Tasmania such that potential areas for plantation development can be identified. It was assumed that the land available is typically within existing agricultural settings, all other land uses not having capacity, social licence, or relevance for conversion to plantations.

This initial model does not attempt to compare plantation suitability against suitability for other potential agricultural uses, such as cropping, this is dealt with in the 2020 Plantation Highest & Best Use Model (refer Section 4). As such the areas presented in this initial component of the larger model should only be taken as indicative 'gross' availability.

The key inputs used to formulate the 2020 Plantation Land Suitability Model were:

1. NNW Hub
    - All spatial inputs to the model were limited to the NNW Hub Boundary
2. Tenure
    - Parcels of private land tenure within the NNW Hub were extracted from the LIST Cadastral layer to form the base land area for the model
3. Legislation
    - Local Government Interim Planning Schemes which do not permit plantation use were excluded from the model
    - Forest Practices Code 2015 legislation was reviewed and limitations or exclusions for planting and harvesting were modelled
4. Current Land Use
    - The DRAFT DPIPWE 2019 Land Use data was reviewed and existing landuses that would prevent plantation development were excluded
    - Areas under proposed irrigation schemes were also included to highlight areas that might reduce plantation access if irrigated due to competition with higher value cropping
5. Site Suitability
    - The NCH Enterprise Suitability layers for *Eucalyptus nitens* and *Pinus radiata* were overlaid with the above data to rank suitability of potentially available land, using the following site factors:
        - rainfall
        - soil characteristics
        - frost/elevation
6. Commercial Slope Limits
    - Marginal and exclusion slope thresholds for commercial cropping were modelled and overlaid with the above

The following sub-sections provide detail on the source, technical and analysis of the above.

3.1 NNW Hub Area of Interest

3.1.1 Model assumptions

All modelling was confined to the NNW Hub Area of Interest (AOI) as defined by an aggregation of local government area boundaries (refer Figure 1).

Figure 1 - North North-West Hub Boundary

3.1.2 Model parameters

The following table describes which local government area boundaries were merged to form the NNW Hub AOI layer.

Table 2 – Local Government Areas comprising the NNW Hub Area of Interest

Local Government Area	Hub
Break O'Day	NNW
Burnie	NNW
Central Coast	NNW
Circular Head	NNW
Devonport	NNW
Dorset	NNW
George Town	NNW
Kentish	NNW
Latrobe	NNW
Launceston	NNW
Meander Valley	NNW
Northern Midlands	NNW
Waratah-Wynyard	NNW
West Coast	NNW
West Tamar	NNW

3.1.3 Source

LIST Local Government Area layer (refer Section 10.6)

3.2 NNW Private Property Tenure Model

3.2.1 Model assumptions

The 2020 Plantation Land Suitability Model was confined to private tenure within the NNW Hub boundary as identified using the LIST Cadastral Parcels layer current at time of model preparation.

The Property Identifier (PID) was used to represent individual 'Private Property' or 'Farm' management units such that land use and availability could be analysed at the individual property-level (i.e. distance to market, economies of scale, etc).

The Industrial Plantation Estates were assumed to have been maximised in terms of plantation development and as such were identified within the NNW Private Property Layer and excluded from this analysis.

3.2.2 Model process

Once-off pre-processing steps to attribute which Properties are inside or outside the Industrial Plantation Estates:

1. Select statewide parcels from the LIST Cadastral Parcels layer with private tenure and valid PID (ie. CAD_TYPE1 = 'Private Parcel' AND PID <> '0')
2. Dissolve selected parcels by the Property Identifier (PID) attribute to create the TFFPN Private PID layer

3. Attribute PID's in the TFFPN Private PID layer as to whether they are inside (i.e. 'Industrial') or outside (i.e. 'Independent') of the Industrial Plantation Estates as indicated by the Draft PFT 2019 PRIPIT layer. **Note:** this pre-processing to assign Industrial Estate status was a partially-manual process given that the TFFPN Private PID layer and Draft PFT 2019 PRIPIT layer were not coincident – do not automate this step or manual entries will be lost.
4. Add a "Pltn_Ownership" column to the LIST Cadastral Parcels layer and joining this with the TFFPN Private PID layer using PID, record those PID's which comprise the Industrial Plantation Estate.

Model Steps:

1. Select all parcels from TFFPN Private PID layer which are recorded as private tenure, and which are recorded as outside the Industrial Plantation Estates.
2. Clip the above selection to the NNW Hub AOI to create the NNW Private Property layer
3. Add a "PltnOwn_PDPotential" column to the NNW Private Property layer and assign availability using the table in section 3.2.3 below.

3.2.3 Model parameters

The following table describes the specific parameters applied to the GIS layer to achieve the assumptions described above.

Table 3 – Modelled Plantation Development Potential by Plantation Ownership Class

Plantation Ownership Attribute	Description	Plantation Development Potential	Comment
Industrial	Property is within an Industrial Plantation Estate	No potential	
Independent	Property is outside an Industrial Plantation Estate	Commercial Potential	

3.2.4 Source

LIST Cadastral Parcels layer (refer Section 10.2).

Draft PFT 2019 PRIPIT layer (for identification of industrial plantation estate boundaries, refer Section 0).

3.3 NNW Planning Scheme Model

3.3.1 Model assumptions

Plantation development was constrained to planning zones under which it is a permitted activity using the Interim Planning Scheme layer current at time of model preparation. The Draft Planning Schemes which are planned to eventually replace the Interim Planning Schemes were available but are known to be undergoing significant review and so were deemed to be inappropriate for use in this modelling exercise.

3.3.2 Model process

Model Steps:

1. Clip the LIST Planning Scheme layer to the NNW AOI to generate the NNW Planning Scheme layer
2. Add a "Scheme_PDPotential" column to the NNW Planning Scheme layer and assign Plantation Development Potential based on the Planning Scheme Zone Code using the table in Section 3.3.3 below

3.3.3 Model parameters

The following table describes the specific parameters applied to the GIS layer to achieve the assumptions described above.

Table 4 – Modelled Plantation Development Potential by Interim Planning Scheme Zoning

Zone Code	Zone Description	Plantation Development Potential	Comments
10	10.0 General Residential	No potential	
11	11.0 Inner Residential	No potential	
12	12.0 Low Density Residential	No potential	
13	13.0 Rural Living	No potential	
14	14.0 Environmental Living	No potential	
15	15.0 Urban Mixed Use	No potential	
16	16.0 Village	No potential	
17	17.0 Community Purpose	No potential	
18	18.0 Recreation	No potential	
19	19.0 Open Space	No potential	
20	20.0 Local Business	No potential	
21	21.0 General Business	No potential	
22	22.0 Central Business	No potential	
23	23.0 Commercial	No potential	
24	24.0 Light Industrial	No potential	
25	25.0 General Industrial	No potential	
26	26.0 Rural Resource	Commercial Potential	Interim planning scheme only, zoning may change when final scheme released
27	27.0 Significant Agricultural	No potential	
28	28.0 Utilities	No potential	
29	29.0 Environmental Management	No potential	

30	30.0 Major Tourism	No potential
31	31.0 Port and Marine	No potential
32	32.0 Particular Purpose	No potential
33	33.0 Particular Purpose	No potential
34	34.0 Particular Purpose	No potential
35	35.0 Particular Purpose	No potential
36	36.0 Particular Purpose	No potential
37	37.0 Particular Purpose	No potential
38	38.0 Particular Purpose	No potential
39	39.0 Particular Purpose	No potential
40	40.0 Particular Purpose	No potential
41	41.0 Particular Purpose	No potential

3.3.4 Source

LIST Interim Planning Scheme layer (refer Section 10.5)

3.4 NNW Current Non-Industrial Plantation Model

3.4.1 Model assumptions

The Draft DPIPWE 2019 Land Use layer sourced plantation data as at 31st December 2018, which should be superseded by the plantation areas available within Draft 2019 PRIPIT layer (i.e. 31st December 2019).

Plantation land availability outside the industrial plantation estates are the focus of this assessment project, as such, only the plantations outside the industrial estates were refreshed, and a Non-Industrial Plantations layer was created to update the Draft DPIPWE 2019 Land Use layer. Fallow plantations areas under current PTR were also included given that the Forest Practices Act requires such areas be replanted.

3.4.2 Model process

Model Steps:

1. Select from the Draft 2019 PRIPIT layer all plantations (i.e. Forest Groups 'PHW' & 'PSW') with Ownership not equal to "Industrial"
2. Dissolve the above selection based on Ownership and Forest Group to create the Non-Industrial Stocked Plantations layer
3. Select from the Draft 2019 PRIPIT layer all fallow plantations (i.e. PITYPE = 'U/X.') which intersect a current PTR with Ownership not equal to "Industrial" to create the Non-Industrial Awaiting Replanting Layer
4. Merge the Non-Industrial Stocked Plantations layer and Non-Industrial Fallow Plantation Awaiting Replanting Layer to create the Non-Industrial Plantation Layer
5. Clip this to the NNW Hub AOI to generate the NNW Non-Industrial Plantations layer

3.4.3 Source

Draft PFT 2019 Private PI-Types layer (refer Section 0)

3.5 NNW Current Native Vegetation Community Model

3.5.1 Model assumptions

It was assumed that there was little to no social licence, and tight legislation limitations in some cases, on conversion of native forest or vegetation communities to plantation use, and as such all native vegetation communities were excluded from potential for plantation development. Only modified land with exotic non-forest vegetation was made available within this modelling exercise.

The Draft DPIPWE TASVEG 4.0 layer was classified into current native or exotic vegetation cover groupings to assist with current land use analysis.

3.5.2 Model process

Model Steps:

1. Clip the Draft TASVEG 4.0 layer to the NNW Hub AOI to generate the NNW Native Vegetation layer
2. Add a "NativeVeg_PDPotential" column to the NNW Native Vegetation layer and assign Plantation Development Potential to this column based on the TASVEG Code using the table in Section 3.8.3 below, all other TASVEG Codes not listed below being assigned "No potential" with the exception of the QAQ code which should be assigned as "Water".

3.5.3 Model parameters

The following table describes the specific parameters applied to the GIS layer to achieve the assumptions described above.

Note that only TASVEG 4.0 mapped features within the Forest Group Code 10 ("Modified land") are listed below, all other groups contain native vegetation communities (or other non-forest classification such as water) which were excluded from potential for plantation development.

Table 5 – Modelled Plantation Development Potential by 'Modified Land' Vegetation Class

TASVEG Code	Description	Plantation Development Potential	Comment
FAC	(FAC) Improved pasture with native tree canopy	No potential	
FAG	(FAG) Agricultural land	Commercial Potential	
FMG	(FMG) Marram grassland	Commercial Potential	
FPE	(FPE) Permanent easements	No potential	
FPF	(FPF) Pteridium esculentum fernland	Commercial Potential	
FPH	(FPH) Plantations for silviculture - hardwood	No potential	
FPS	(FPS) Plantations for silviculture - softwood	No potential	
FPU	(FPU) Unverified plantations for silviculture	No potential	
FRG	(FRG) Regenerating cleared land	No potential	
FSM	(FSM) Spartina marshland	Commercial Potential	
FUM	(FUM) Extra-urban miscellaneous	No potential	
FUR	(FUR) Urban areas	No potential	
FWU	(FWU) Weed infestation	Commercial Potential	
FAC	(FAC) Improved pasture with native tree canopy	No potential	

3.5.4 Data Source

Draft DPIPWE TASVEG 4.0 layer (refer Section 10.10)

3.6 NNW Modified Wetland Model

3.6.1 Model assumptions

'Modified Wetlands' were classed as wetlands, swamps and other water-logged areas identified without existing cover by native vegetation communities. To remediate these sites such that they can once again provide native habitat provision, erosion mitigation and water quality maintenance services into the future, it was assumed they may have potential as Natural Capital plantings.

Species selection for such sites might target those tolerant to water-logged soils, such as Blackwood (*Acacia melanoxylon*), as opposed to the predominant commercial plantation species, though establishment of non-forest endemic species may also be viable options to achieve the same outcome.

3.6.2 Model process

Model Steps:

1. Select all wetland areas from the LIST Hydrographic Area layer (i.e. HYDARTY1 = 'Wetland')
2. Intersect the above selection with the NNW Native Vegetation layer and where they are **not** currently covered by any native vegetation (i.e. NativeVeg_PDPotential = 'Commercial Potential'), export this to the NNW Modified Wetlands layer
3. Add a 'ModWetlands_PDPotential' column to the NNW Modified Wetlands layer and set the value for all features to 'Natural Capital potential (Wetland)'

3.6.3 Sources

LIST Hydrographic Area layer (refer Section 10.3)

Draft DPIPWE TASVEG 4.0 layer (refer Section 10.10)

3.7 NNW Modified Riparian Zone Model

3.7.1 Model assumptions

'Modified Riparian Zones' were classed as the areas immediately adjacent natural watercourses identified without existing cover by native vegetation communities. To remediate these sites such that they can once again provide native habitat provision, erosion mitigation and water quality maintenance services into the future, it was assumed they may have potential as Natural Capital and Small-Scale plantings.

Assuming water quality maintenance could be a key driver for riparian plantings within intensive agricultural settings, it was assumed that the Forest Practices Code 2015 prescriptions for minimum streamside reserve buffer widths would be appropriate minimums to apply to achieve this outcome.

Current legislation does allow the planting of plantation trees within 10m of all watercourses and harvesting is permitted within 10m of Class 4 watercourse, but it is not permitted within 10m of the more significant Class 1, 2 or 3 watercourses (Forest Practices Authority, 2015). However, legislation does not allow plantations to be established within 2m of any watercourse (Forest Practices Authority, 2015) and so such areas are assumed to be not available.

Within this model, those areas identified as available but within the 10m of significant watercourses (Classes 1, 2, or 3) were classified as “Natural Capital” plantings, the remainder as “Small-Scale” to flag that they may be planted in areas where sufficient area for Commercial plantings is not available.

Species selection for such sites might target those tolerant to water-logged soils, such as Blackwood (*Acacia melanoxylon*), as opposed to the predominant commercial plantation species, though establishment of non-forest endemic species may also be viable options to achieve the same outcome.

3.7.2 Model process

1. Clip all the natural water course line features (i.e. HYDLNTY1 = 'Watercourse') from the LIST Hydrographic Line layer to the NNW Hub AOI to create the NNW Watercourse Line layer
2. Buffer all features in the NNW Watercourse Line layer the using the Hydrology Class Buffer table in Section 1 below to generate the NNW Watercourse Line Buffer layer
3. Add a “ModRiparian_PDPotential” column to the NNW Watercourse Line Buffer layer and based on the buffer width and Hydrology Class, assign the Plantation Development Potential from the table in Section 1 below
4. Clip all the natural water course area features (i.e. HYDARTY1 = 'Watercourse') from the LIST Hydrographic Area layer to the NNW Hub AOI to create the NNW Watercourse Area layer
5. Assume all features in the NNW Watercourse Area layer are ‘Major Rivers’, and generate buffers as per the Hydrology Class Buffer table in Section 1 below to generate the NNW Watercourse Area Buffer layer
6. Add a “ModRiparian_PDPotential” column to the NNW Watercourse Area Buffer layer and based on the buffer width and Hydrology Class, assign the Plantation Development Potential from the table in Section 1 below
7. Union the NNW Watercourse Line Buffer layer with the NNW Watercourse Area Buffer layer to generate the NNW Watercourse Buffer layer
8. For polygons where the NNW Watercourse Line Buffer layer with the NNW Watercourse Area Buffer layer overlapped, assign the Plantation Development Potential based on the following priorities:

Table 6 – Priority for Plantation Development Potential Assignment for Overlapping Riparian Buffers

Priority	Plantation Development Potential
1	No potential
2	Natural Capital potential (Riparian)
3	Small-Scale potential (Riparian)

9. Intersect the NNW Watercourse Buffer layer with the NNW Native Vegetation layer and where the buffered riparian zones are not currently covered by any native vegetation (i.e. NativeVeg_PDPotential = “Commercial potential”), export these features to the NNW Modified Riparian Zone layer

3.7.3 Model parameters

The following tables describes the specific parameters applied to the GIS layer to achieve the assumptions described above.

Table 7 – Riparian Zone Buffer Widths and Modelled Plantation Development Potential

Hydrology Class Attribute	Assumed FPC Class	Buffer distance (m)	Plantation Development Potential
Major River	FPC Class 1	0-2m	No potential
Major River	FPC Class 1	2-10m	Natural Capital potential (Riparian)
Major River	FPC Class 1	10-40m	Small-Scale potential (Riparian)
River	FPC Class 1	0-2m	No potential
River	FPC Class 1	2-10m	Natural Capital potential (Riparian)
River	FPC Class 1	10-40m	Small-Scale potential (Riparian)
Minor River	FPC Class 1	0-2m	No potential
Minor River	FPC Class 1	2-10m	Natural Capital potential (Riparian)
Minor River	FPC Class 1	10-40m	Small-Scale potential (Riparian)
Major Stream	FPC Class 2	0-2m	No potential
Major Stream	FPC Class 2	2-10m	Natural Capital potential (Riparian)
Major Stream	FPC Class 2	10-30m	Small-Scale potential (Riparian)
Stream	FPC Class 2	0-2m	No potential
Stream	FPC Class 2	2-10m	Natural Capital potential (Riparian)
Stream	FPC Class 2	10-30m	Small-Scale potential (Riparian)
Minor Stream	FPC Class 3	0-2m	No potential
Minor Stream	FPC Class 3	2-10m	Natural Capital potential (Riparian)
Minor Stream	FPC Class 3	10-20m	Small-Scale potential (Riparian)
Tributary	FPC Class 4	0-2m	No potential
Tributary	FPC Class 4	2-10m	Small-Scale potential (Riparian)
Minor Tributary	FPC Class 4	0-2m	No potential
Minor Tributary	FPC Class 4	2-10m	Small-Scale potential (Riparian)

3.7.4 Sources

LIST Hydrographic Line layer (refer Section 10.4)

Draft DPIPWE TASVEG 4.0 layer (refer Section 10.10)

3.8 NNW Current Land Use Model

3.8.1 Model assumptions

Compared with a visual review of current satellite imagery across a random set of NNW sites, the majority of features mapped within the Draft DPIPWE 2019 Land Use layer appeared relatively current and accurate, so were included without modification into the 2020 Plantation Land Suitability Model.

Only a small subset of the available land use classes was identified as having any potential suitability for plantation development, generally those associated with cropping & grazing, as described in Section 3.8.3.

It was assumed that all private reserves available in the Tasmanian Reserve Estate were incorporated into the Draft DPIPWE 2019 Land Use layer, and so were not modelled separately during this project. Such areas were obviously not suitable for plantation development.

Mapped plantation features in the Draft DPIPWE 2019 Land Use layer were identified as one year out of date and so those plantations outside the industrial plantation estates were refreshed from the Draft PFT 2019 Private PI-Types layer (refer Section 3.9).

The Draft DPIPWE 2019 Land Use layer class of "3.2.1 Native/exotic pasture mosaic" represents sites with a mix of native vegetation and exotic vegetation, the latter being identified as potential for plantation development. To split out this potential area, the Draft TASVEG 4.0 layer was used to identify the native vegetation components within this land use.

Similarly, wetland and riparian zones were compared with the Draft DPIPWE TASVEG 4.0 layer to determine those zones currently not covered by native vegetation.

3.8.2 Model process

Steps:

1. Clip the Draft 2019 DPIWE Land Use layer to the NNW Hub AOI to create NNW Land Use Working 1 layer
2. Add the "LU_Code_Final" column to the NNW Land Use Working 1 layer and copy all existing "LU_Code" values across
3. Within "LU_Code_Final", for all land use features outside the Industrial Plantation Estates, replace the values 310, 311 & 312 (i.e. Plantations) with 320 ('3.2.0 Grazing modified pasture')
4. Union the NNW Non-Industrial Plantations layer with the NNW Land Use Working 1 layer to create the final NNW Land Use layer
5. Within the NNW Land Use layer assign to the column "LU_Code_Final" all plantations with Forest Group values equal to 'PHW' land to the code '311' (3.1.1 Hardwood plantation forestry) and those with 'PSW' to the code '312' (3.1.2 Softwood plantation forestry)
6. Add a "LU_PDPotential" column to the NNW Land Availability layer and assign Plantation Development Potential to this column based on the Land Use Code using the table in Section 3.8.3 below, referencing the "LU_Code_Final" column

3.8.3 Model parameters

The following table describes the suitability rating, in the form of the Plantation Development Potential, applied to the current land use.

Table 8 – Modelled Plantation Development Potential by Land Use Class

Land Use Code	Land Use Description	Area within NNW Hub (ha)	Plantation Development Potential	Comment
111	1.1.1 Strict nature reserves	1,594	No potential	
112	1.1.2 Wilderness area	604	No potential	
113	1.1.3 National park	669,355	No potential	
114	1.1.4 Natural feature protection	22,488	No potential	
115	1.1.5 Habitat/species management area	204,728	No potential	
116	1.1.6 Protected landscape	68,469	No potential	
117	1.1.7 Other conserved area	442,231	No potential	
120	1.2.0 Managed resource protection	596,750	No potential	
121	1.2.1 Biodiversity	2,334	No potential	
122	1.2.2 Surface water supply	307	No potential	
124	1.2.4 Landscape	13	No potential	
125	1.2.5 Traditional indigenous uses	691	No potential	
130	1.3.0 Other minimal use	4,507	No potential	
131	1.3.1 Defence land - natural areas	2,188	No potential	
133	1.3.3 Residual native cover	240,757	No potential	
210	2.1.0 Grazing native vegetation	111,645	No potential	Typically, native forest, to be excluded
220	2.2.0 Production native forests	498,136	No potential	
310	3.1.0 Plantation forests	31,441	No potential	Converted to '3.2.0 Grazing modified pasture' ready for replacement by plantation boundaries from the Draft PFT 2019 Private PI-Types layer
311	3.1.1 Hardwood plantation forestry	176,737	No potential	Converted to '3.2.0 Grazing modified pasture' ready for replacement by plantation boundaries from the Draft PFT 2019 Private PI-Types layer
312	3.1.2 Softwood plantation forestry	59,733	No potential	Converted to '3.2.0 Grazing modified pasture' ready for replacement by plantation boundaries from the Draft PFT 2019 Private PI-Types layer
320	3.2.0 Grazing modified pastures	411,656	Commercial potential	Contains areas likely to be suitable for plantations (i.e. stand-alone commercial and mixed grazing/commercial plantations for shelter), Enterprise Suitability ranking permitting. Notable exception to be excluded is the Temma Farm on the NW Coast, recently converted from a mix of failed (nearer coast) & commercial plantation back to pasture. Lots of unmapped shelterbelts (very narrow) exist throughout this land use class.

321	3.2.1 Native/exotic pasture mosaic	16,106	Commercial potential	High percentage is rough grazing and would be available, Enterprise Suitability ranking permitting. Visual review of TASVEG 4.0 confirms that this layer can be used to source mapping for the native veg component of this landuse which then needs to be excluded.
324	3.2.4 Pasture legume/grass mixtures	17	No potential	
325	3.2.5 Sown grasses	120	No potential	
330	3.3.0 Cropping	6,598	Commercial potential	Unused slivers, steep slopes & riparian zones are likely to be the only area available in this land use class. Need to confirm areas likely to become irrigated as this will likely reduce availability.
333	3.3.3 Hay and silage	130	No potential	
340	3.4.0 Perennial horticulture	12	No potential	
342	3.4.2 Olives	20	No potential	
347	3.4.7 Perennial vegetables and herbs	1	No potential	
353	3.5.3 Seasonal vegetables and herbs	45	No potential	
360	3.6.0 Land in transition	3,146	Commercial potential	Scattered mix of harvested plantations, cleared scrub and overgrown agricultural land
361	3.6.1 Degraded land	6,868	Commercial potential	Typically riparian erosion focused along the South Esk, Macquarie and Meander Rivers South and West of Launceston, but also includes 1,300ha of weed infestation (TASVEG 4) to the SE of Nile
410	4.1.0 Irrigated plantation forests	33	No potential	
420	4.2.0 Grazing irrigated modified pastures	97,353	Commercial potential	Unused slivers, steep slopes & riparian zones only area available in this land use class
421	4.2.1 Irrigated woody fodder plants	51	No potential	
422	4.2.2 Irrigated pasture legumes	21	No potential	
424	4.2.4 Irrigated sown grasses	670	No potential	
430	4.3.0 Irrigated cropping	89,868	Commercial potential	Very little opportunity for plantation development in this land use class, with the exception of linear plantings along roads/tracks or between paddocks. Majority of this land use mapping excluded riparian zones and was generally flat, so unlikely to yield any available land (but worth doing analysis to confirm). Some areas of FRG – "regenerating cleared land" (TASVEG 4) in this land use class appeared to still lack vegetation cover, so might be opportunity. Many unmapped shelterbelts existed in this land use suggesting little opportunity for additional shelterbelts development.
431	4.3.1 Irrigated cereals	113	No potential	
432	4.3.2 Irrigated beverage and spice crops	3	No potential	

437	4.3.7 Irrigated alkaloid poppies	958	No potential
440	4.4.0 Irrigated perennial horticulture	1,603	No potential
441	4.4.1 Irrigated tree fruits	39	No potential
442	4.4.2 Irrigated olives	30	No potential
443	4.4.3 Irrigated tree nuts	21	No potential
445	4.4.5 Irrigated shrub berries and fruits	351	No potential
446	4.4.6 Irrigated perennial flowers and bulbs	114	No potential
447	4.4.7 Irrigated perennial vegetables and herbs	2	No potential
449	4.4.9 Irrigated grapes	1,275	No potential
450	4.5.0 Irrigated seasonal horticulture	3	No potential
453	4.5.3 Irrigated seasonal vegetables and herbs	159	No potential
462	4.6.2 Abandoned irrigated land	1	No potential
510	5.1.0 Intensive horticulture	59	No potential
511	5.1.1 Production nurseries	160	No potential
513	5.1.3 Glasshouses	31	No potential
520	5.2.0 Intensive animal production	16	No potential
521	5.2.1 Dairy sheds and yards	252	No potential
522	5.2.2 Feedlots	150	No potential
523	5.2.3 Poultry farms	160	No potential
524	5.2.4 Piggeries	109	No potential
525	5.2.5 Aquaculture	141	No potential
526	5.2.6 Horse studs	1,636	No potential
527	5.2.7 Saleyards/stockyards	87	No potential
530	5.3.0 Manufacturing and industrial	1,451	No potential
532	5.3.2 Food processing factory	69	No potential
533	5.3.3 Major industrial complex	48	No potential
535	5.3.5 Abattoirs	42	No potential
537	5.3.7 Sawmill	218	No potential
540	5.4.0 Residential and farm infrastructure	13	No potential
541	5.4.1 Urban residential	11,860	No potential
542	5.4.2 Rural residential with agriculture	357	No potential
543	5.4.3 Rural residential without agriculture	67,840	No potential
544	5.4.4 Remote communities	309	No potential
545	5.4.5 Farm buildings/infrastructure	303	No potential
550	5.5.0 Services	11	No potential
551	5.5.1 Commercial services	748	No potential
552	5.5.2 Public services	1,014	No potential
553	5.5.3 Recreation and culture	4,450	No potential

554	5.5.4 Defence facilities - urban	2	No potential
555	5.5.5 Research facilities	494	No potential
560	5.6.0 Utilities	10	No potential
561	5.6.1 Fuel powered electricity generation	18	No potential
562	5.6.2 Hydro electricity generation	87	No potential
563	5.6.3 Wind electricity generation	98	No potential
565	5.6.5 Electricity substations and transmission	123	No potential
566	5.6.6 Gas treatment, storage and transmission	3	No potential
567	5.6.7 Water extraction and transmission	56	No potential
570	5.7.0 Transport and communication	13	No potential
571	5.7.1 Airports/aerodromes	779	No potential
572	5.7.2 Roads	23,733	No potential
573	5.7.3 Railways	1,639	No potential
574	5.7.4 Ports and water transport	119	No potential
575	5.7.5 Navigation and communication	3	No potential
580	5.8.0 Mining	1,112	No potential
581	5.8.1 Mines	1,558	No potential
582	5.8.2 Quarries	959	No potential
583	5.8.3 Tailings	241	No potential
590	5.9.0 Waste treatment and disposal	242	No potential
591	5.9.1 Effluent pond	1	No potential
593	5.9.3 Solid garbage	3	No potential
595	5.9.5 Sewage/sewerage	225	No potential
610	6.1.0 Lake	12,628	No potential
611	6.1.1 Lake - conservation	6,617	No potential
612	6.1.2 Lake - production	8,567	No potential
620	6.2.0 Reservoir/dam	1,619	No potential
621	6.2.1 Reservoir	384	No potential
622	6.2.2 Water storage - intensive use/farm dams	1,613	No potential
630	6.3.0 River	3,705	No potential
631	6.3.1 River - conservation	4,751	No potential
640	6.4.0 Channel/aqueduct	20	No potential
650	6.5.0 Marsh/wetland	3,609	No potential
651	6.5.1 Marsh/wetland - conservation	5	No potential
654	6.5.4 Marsh/wetland - saline	1,667	No potential
660	6.6.0 Estuary/coastal waters	21,940	No potential
661	6.6.1 Estuary/coastal waters - conservation	30,502	No potential

Figure 2 shows the distribution of the key land uses relevant for this project within freehold land in the NNW Hub.

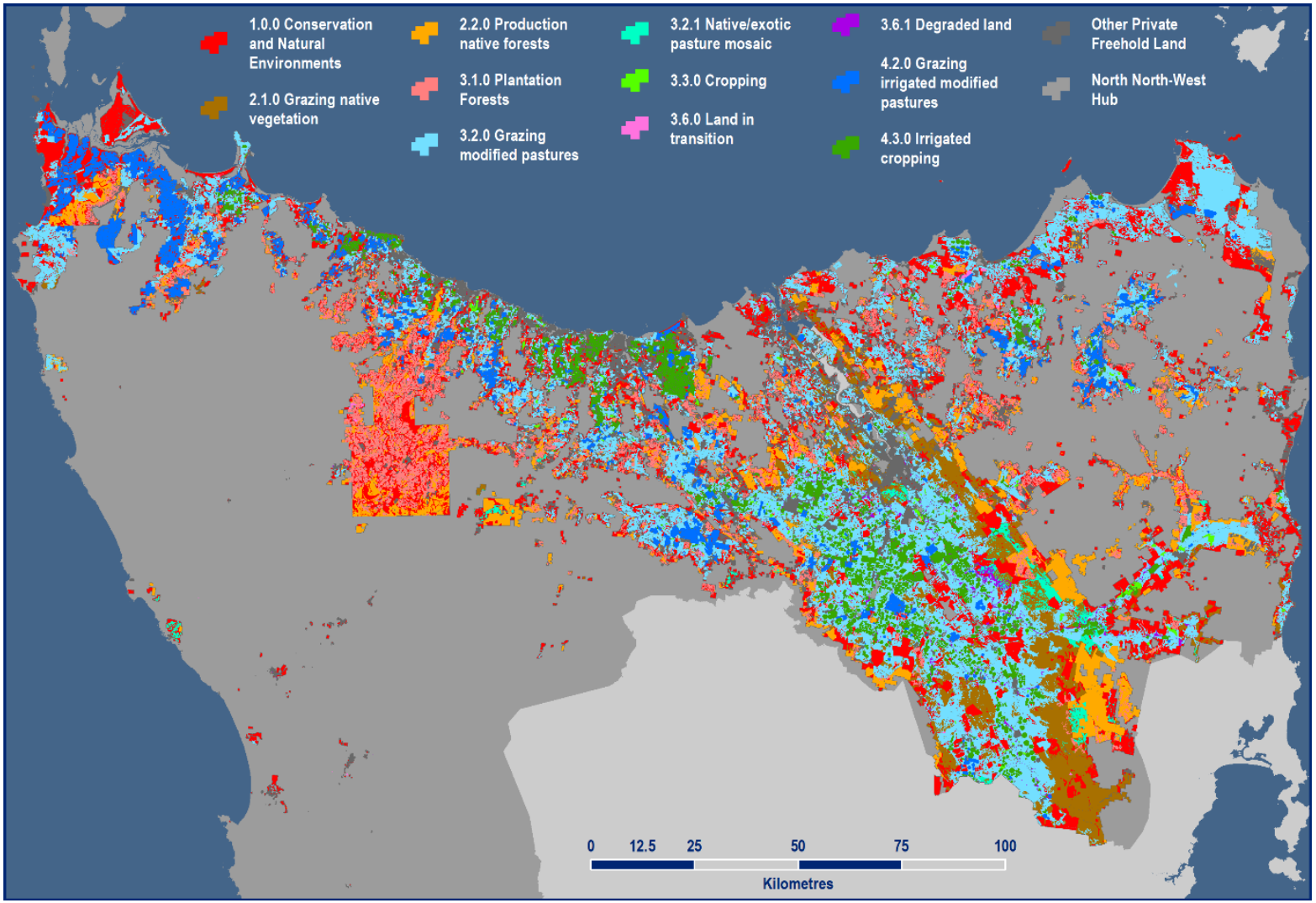

Figure 2 – Key relevant Land Uses on Freehold Land in the NNW Hub

3.8.4 Sources

Draft 2019 DPIPWE Land Use layer (refer Section 10.8).

Draft 2019 PFT PRIPIT layer (refer Section 0).

3.9 NNW Future Land Use Model

3.9.1 Model assumptions

Based on analysis of the data at hand, and anecdotal experience of land use in NNW Tasmania, it was assumed that in general irrigated cropping and grazing land uses will have less area available for potential plantation development than dryland equivalents.

Current dryland cropping & grazing areas identified as existing within the Proposed Tasmanian Irrigation Schemes were classified and reported separately to provide indication where plantation land availability may change as these irrigation schemes become active.

3.9.2 Model process

Model Steps:

1. Add an 'Irrigation_Scheme_Status' column to the Tasmanian Irrigation Potential Schemes layer and attribute all as 'Potential Irrigation'.
2. Add an 'Irrigation_Scheme_Status' column to the Tasmanian Irrigation Schemes Under Construction layer and attribute all as 'Potential Irrigation'.
3. Merge the two above datasets to create the Tasmanian Irrigation Potential layer.

3.9.3 Sources

Tasmanian Irrigation Proposed Scheme layer, Tasmanian Irrigation Schemes Under Construction layer.

3.10 NNW Commercial Slope Limits Model

3.10.1 Model assumptions

Areas of flat to moderate slopes (<= 10 degrees) allow for the mechanical establishment and harvesting of crops on a commercial scale, improving overall financial return from cropping enterprise on suitable sites. On these flatter sites suitable for cropping, without some early partial commercial harvest or ongoing financial return, such as in the form of carbon credit sales, it is unlikely that plantation enterprises would compete financially against them.

On steeper slopes this preference for cropping was assumed to be diminished, and it was assumed that above 14 degrees slope, plantation would be preferred over cropping. Note that the Enterprise Suitability layers also account for slope for relevant crops where it was a limiting factor (i.e. ES layers modelled sites unsuitable for potatoes over 14 degrees in slope and pyrethrum over 11 degrees).

Assuming that ground-based logging is the likely method of harvest for any plantation development within the agricultural landscape, 26 degrees slope is the upper limit allowed for harvesting on low to moderate erodibility soils, and 19 degrees for moderate-high to high erodibility soils (Forest Practices Authority, 2015). Given the lack of soil erodibility classes available for this project a limit of 19 degrees was chosen to represent the limit for potential Commercial plantings within this

modelling exercise. Areas identified with slopes greater than or equal to 19 degrees were identified for potential Natural Capital plantings.

3.10.2 Model process

Model Steps:

1. Clip the TFFPN Statewide Slope Class layer to the NNW Hub AOI to create NNW Slope Class layer.
2. Dissolve the NNW Slope Class layer based on the classification described in table XXX below.

3.10.3 Model parameters

The following table describes the specific parameters applied to the GIS layer to achieve the assumptions described above.

Table 9 – Modelled Plantation Development Potential by Slope Class

Slope Range (degrees)	Description	Plantation Development Potential
0 to 10	Suitable for commercial cropping and plantation	Commercial potential (Cropping preferred slope)
11 to 14	Suitable for commercial plantation	Commercial potential (Cropping possible slope)
15 to 19	Suitable for commercial plantation	Commercial potential (Cropping unsuitable)
>= 20	Suitable for non-commercial plantation	Natural Capital potential (Steep Slope)

3.10.4 Sources

TFFPN Statewide Slope Class layer (refer Section 11.3).

3.11 NNW Plantation Species Suitability Model

3.11.1 Model assumptions

Enterprise Suitability models were used to classify the land available for plantation development as generated in the preceding models into suitability classes for the key commercial species currently used in Tasmania.

Given the extensive overlap in site suitability between *Eucalyptus globulus* and *Eucalyptus nitens*, *E. nitens* suitability was chosen to represent both Eucalypt species in terms of hardwood plantation potential. *E. globulus* is typically less frost tolerant than *E. nitens* so would be limited to *E. nitens* sites of lower elevation and/or lower frost frequency. *Pinus radiata* was chosen to represent softwood plantation potential.

3.11.2 Sources

Enterprise Suitability layers for *Eucalyptus nitens* and *Pinus radiata* (refer Section 10.11).

3.12 2020 NNW Plantation Land Suitability Model Build

3.12.1 Model assumptions

Each of the models described in the previous sections was combined to form the final 2020 NNW Plantation Land Suitability Model such that each individual site could be assessed against all modelled availability and suitability criteria.

Each input model included a proposed Plantation Development Potential (PDP) value describing our assessment of potential availability for plantation use, based on the assumptions specific to each model for each site. To amalgamate these into a final value, all PDP values across all models for each sites was compared and the final value for a site assigned based on the priority described in Table 10 below, the input with the most limited potential for plantation development chosen to be the final representation for the site.

3.12.2 Model process

Model Steps:

1. Union all above input models to generate the 2020 NNW Plantation Land Availability layer.
2. Build process to analyse each record for all "*_PDPotential" columns derived from the input models, whereby the minimum Plantation Development Potential recorded for any column is recorded in the "Final_PDPotential" column, based on the following priority:

Table 10 – Priority for Final Plantation Development Potential Assignment derived from Individual Model Inputs

Priority	Final Plantation Development Potential	Description
1	No potential	No potential
2	Natural Capital potential (Modified Wetland)	Natural Capital potential (Modified Wetland)
3	Natural Capital potential (Modified Riparian)	Natural Capital potential (Modified Riparian)
4	Natural Capital potential (Steep Slope)	Natural Capital potential (Steep Slope)
5	Small-Scale potential (Modified Riparian)	Small-Scale potential (Modified Riparian)
6	Commercial potential (Cropping preferred slope)	Commercial potential (Slope suitable for cropping)
7	Commercial potential (Cropping possible slope)	Commercial potential (Slope marginal for cropping)
8	Commercial potential (Slope)	Commercial potential (Slope unsuitable for cropping)

3.13 Reporting

Export the resultant attribute table including areas in hectares, for report generation based on:

1. Current Land Use (Landuse_Description column).
2. Future Irrigation Areas (Irrigation_Scheme_Status column).
3. Plantation Development Potential (Final_PDPotential column).
4. Enterprise Suitability rating for *Eucalyptus nitens.*
5. Enterprise Suitability rating for *Pinus radiata.*

4 2020 NNW Highest and Best Use Model (Availability)

Optimal value is defined by the International Valuation Standards Council as:

> *…the most probable use of a property which is physically possible, appropriately justified, legally permissible, financially feasible, and which results in the highest value of the property being valued.*

This optimal value makes part of the "Highest and Best Use" (HBU) approach to valuing a property, but in principal it is also applied operationally in commercial agricultural enterprises whereby private landowners will attempt to achieve optimal value for each of the site types across a farm, as this in theory provides the greatest return from the property as a whole.

Assuming current market trends for food and wood don't change significantly relative to one another, financially, the discounted cash flow returns from cropping rotations on highly suitable sites with good access to rainfall or irrigation when analysed over the lifetime of a single plantation rotation, will generally be higher than those from a plantation, and so cropping uses are typically HBU In these highly productive sites.

Where sites have lower suitability to cropping, these sites are still very likely to be favoured for cropping over plantations in terms of financial return if only the return from final harvest of the trees is factored into the decision making process, the long wait for a return on investment from trees not being able to match frequent returns from short rotation cropping under a discounted cash flow analysis. However, unlike many crops, trees have many natural capital values with a known benefit to the wider economy and if they are valued correctly, and most importantly the value of their services can be returned directly to the landowner, this could push the landowner to give consideration for marginal cropping sites to have plantation HBU's.

Currently, carbon sequestration is the only natural capital value of trees with a trading market that has the potential to provide financial return directly to the landowner. Shelter provided by trees for crops and livestock has been proven to increase productivity, providing indirect financial return, and soil erosion mitigation would also provide indirect on-site returns to the landowner in terms of overall property sustainability. Other natural capital values such as erosion control, water quality maintenance and native habitat maintenance could also contribute to the land-use decision making process if properly quantified and valued.

To place a value of trees on farms in terms of complete financial and natural capital value is beyond the scope of this modelling exercise. Instead we provide an overview on the location and quantum of area across the range of suitability between cropping and plantations where land appears available for plantation, such that the more marginal cropping areas can be identified and the plantation land use case can be considered under a more wholistic approach to HBU.

The key inputs used to formulate the Higher and Best Use Model were:

- **Cropping Enterprise Suitability**
  - Site suitability for key crops likely to compete for land area suitable for plantation development were modelled against the plantation site suitability models to identify areas of likely conflict or opportunity.
- **Grazing Enterprise Suitability**
  - Grazing and plantations can co-exist in dryland situations (i.e. shelter), but unlikely in irrigated scenarios (i.e. dairy). In those dryland situations, the suitability for key crops was used as a proxy for good grazing country, and similarly modelled against plantation suitability to identify areas of likely conflict or opportunity.
- **Commercial Cropping Slope Limits**
  - Slope analysis was undertaken across areas potentially available for plantation use to determine which sites would be less suitable or unsuitable for cropping, but still suitable for plantation use.

4.1 NNW Cropping Enterprise Suitability Model

4.1.1 Model assumptions

A key set of 11 crops from the 20 available cropping Enterprise Suitability layers were chosen to represent the main broadacre agricultural competition to plantation development within Tasmania. Key areas well suited to higher economic return from agricultural uses could then be identified within the 2020 NNW Plantation Land Suitability Model to support decisions on Higher and Better Land Use between plantations and cropping species.

The available Enterprise Suitability layers were grouped into like 'functional' types and those broadacre crops likely to directly compete for land available for plantation.

4.1.2 Model process

Enterprise Suitability layers for the 11 target crops were unioned into a single layer to form the with the NNW Cropping Enterprise Suitability Model.

4.1.3 Model parameters

Enterprise suitability models were available for the crops outlined in Table 11, and those highlighted in green were used to compare with plantation suitability for the HBU analysis.

Table 11 – Enterprise Suitability Crops Available for Modelling

ES Crop	Model Status	Comments
Barley	Included	
Wheat	Included	
Blueberries	Excluded	
Cherries	Excluded	
Hazelnuts	Excluded	
Olives	Excluded	
Raspberries	Excluded	
Strawberries	Excluded	
Wine Grapes (Pino & Chard	Excluded	

Carrot	Included
Lucerne	Included
Potatoes	Included
Pyrethrum	Included
Ryegrass for Dairy	Included
Onions	Included
Industrial Hemp	Included
Linseed	Included
Poppies	Included

4.1.4 Sources

NCH_Enterprise_Suitability_Index

4.2 NNW Grazing Enterprise Suitability Model

4.2.1 Model assumptions

The cropping suitability was used as a proxy for grazing suitability.

4.3 NNW Commercial Cropping Slope Limits Model

4.3.1 Model assumptions

The NNW Commercial Slope Limits Model (refer Section 3.10) incorporated limits and exclusions for cropping in conjunction with forest planting and harvesting limitations and these were analysed to differentiate HBU for plantation development.

4.3.2 Source

NNW Commercial Slope Limits Model.

4.4 2020 NNW Highest & Best Land Use Model Build

4.4.1 Model assumptions

Of the areas interpreted as suitable for plantation development in the 2020 NNW Plantation Suitability Model, the following criteria were applied to determine those with higher and better use for plantation over other agricultural crops:

- **High Availability**: Site where the current land use or landform indicated agricultural crops or grazing were already marginal were all included as having a plantation HBU, for example:
    - Exotic/pasture mosaics, degraded land;
    - Steeper slopes; and
    - Riparian sites which were lacking sufficient vegetation to ensure long term stabilisation or mitigate erosion.
- **Low Availability**: Sites currently under intensive agricultural land use, or which had potential to become intensive agricultural use (i.e. current dryland grazing under proposed irrigation schemes). Within these lower suitability areas, only sites in which the suitability ranking of plantations outranked all other crops were included as having plantation HBU.

4.4.2 Model process

Model Steps:

1. The NNW Cropping Enterprise Suitability Model was unioned with the 2020 NNW Plantation Suitability Model and the attributes export to a table in CSV format.
2. An R script was built which loaded the attributes from the above step and classified each site into High, Low or No Availability, based on the criteria described in Section 4.4.1 above.
3. These classifications were joined back to the 2020 NNW Plantation Suitability Model to form the 2020 NNW Highest and Best Landuse Model.

5 2020 NNW Plantation Economics Model

Over and above growth rates, which will dictate how much and how quickly a return can be made on investment, and which are dealt with in terms of site suitability, other key drivers for ensuring Commercial Plantings are indeed financially viable include harvesting and roading costs, cartage costs, land (either purchase or lease) costs, and management and overhead costs.

Fixed costs, such as land, roading, management and overhead will have less impact on viability if there is sufficient scale and geographic consolidation of plantation area within the property. Harvesting costs typically relate to stem piece size and terrain, such that plantations with smaller diameter stems or on steeper slopes will be more expensive to harvest.

Small Scale and Natural Capital plantings will not have the same economic constraints given their end use might be local and/or not directly financial, although Small Scale plantings can be integrated with any commercial potential areas to boost scale.

Of these financial drivers, distance to market and scale could be modelled within this land assessment project, over and above the land slope classification included in the suitability modelling. The degree of consolidation of viable plantation areas was considered in the qualitative model review process undertaken to validate the overall success of the model to fit on-ground conditions.

The key inputs used to formulate the Plantation Economic Model were:

1. Distance to Market.

2. Plantation Enterprise Scale.

5.1 NNW Distance to Market Model

5.1.1 Model assumptions

Large (> 100,000 tonnes/annum) and medium (15,000 to 100,000 tonnes/annum) sized plantation hardwood and softwood processing and export facilities relevant to the NNW were used to represent market locations for any potential plantation development, from which travel distance to each Property (PID) could be modelled.

Cartage distance to large market locations was used as the primary input for this component of the economic analysis, distance to medium markets used as a secondary input where distance to the primary markets was outside nominated limits.

5.1.2 Model process

Model steps:

1. Extract from the TFFPN Plantation Market Locations layer the large to medium hardwood and softwood market locations.
2. Model cartage distance along the LIST Transport Layer from each Property (PID) within the NNW Rural Resource planning zone to the closest Large scale market.
3. Model cartage distance along the LIST Transport Layer from each Property (PID) within the NNW Rural Resource planning zone to the closest Medium scale market.

5.1.3 Model parameters

The large to medium markets available to NNW properties by plantation type are summarised in the tables below:

Table 12 – Plantation Softwood Large to Medium Market Locations

Location Name	Scale	Material Taken	Comment
BELL BAY	Large	Sawlog and Pulplog	Processing and Export facilities
BRANXHOLM	Medium	Sawlog	
BURNIE	Large	Sawlog and Pulplog	Processing and Export facilities
LONGFORD	Medium	Sawlog	
MACQUARIE WHARF	Large	Sawlog and Pulplog	Processing and Export facilities
NEW NORFOLK	Large	Pulplog	
PENGUIN	Medium	Pulplog	
SMITHTON	Medium	Sawlog	

Table 13 – Plantation Hardwood Large to Medium Market Locations

Location Name	Scale	Material Taken	Comment
BELL BAY	Large	Sawlog and Pulplog	Processing and Export facilities
BURNIE	Large	Sawlog and Pulplog	Processing and Export facilities
HAMPSHIRE	Large	Pulplog	
LONG REACH	Large	Pulplog	
LONGFORD	Medium	Sawlog	
MACQUARIE WHARF	Large	Sawlog and Pulplog	Processing and Export facilities
PENGUIN	Medium	Pulplog	

Properties were classified into the distance classes listed in Table 14 for analysis of economic viability.

Table 14 – Classification of Distance to Market

Distance to market (km)
< 25
25 – 50
50 – 75
75 - 100
> 100

5.1.4 Sources

LIST Transport Layer (refer Section 10.7).

TFFPN Private PID layer (refer Section 11.1).

TFFPN Plantation Market Locations layer (refer Section 11.2).

5.2 NNW Plantation Enterprise Scale Model

5.2.1 Model assumptions

The decision-making processing for plantation development potential will typically be undertaken by individual landowners at the enterprise scale, which are represented by Property (PID) boundaries in this modelling. Some landowners will own multiple Property (PID)s, some of which will be treated as a single enterprise where adjoining, but this is beyond the scope of the data available for this model.

It was assumed that to achieve a commercial plantation enterprise within a Property (PID), the size of any plantation needed to be at least 10 hectares. Contiguous areas suitable and potentially available for plantation area under 10ha in size were considered “Small-Scale”.

It was assumed that larger scale enterprises in general have more flexibility to optimise agricultural productivity avoiding the need to push into marginal land typically suited to trees, so are likely to have higher potential for plantation development.

The total property area, area of current agricultural operations, total area suitable and available for plantation development, and largest contiguous area suitable and available for plantation development was calculated for each Property (PID), extracted from the 2020 NNW Highest & Best Land Use Model to provide information against which these assumptions could be analysed.

5.2.2 Model process

Model Steps

1. Sum area identified in the NNW HBU model as potentially available for small scale and commercial plantation development for each PID and classify into plantation enterprise scale classes.

5.2.3 Model parameters

The sum of total commercial or small-scale area of softwood or hardwood plantation available in each Property was classified into 'economic scale' classes as per the ranges specified in Table 15 below.

Table 15 – Classification of Plantation Enterprise Scale

Total available commercial area within a Property (PID)
0.1 – 1 ha
1 – 10 ha
10 – 25 ha
25 – 50 ha
50 – 100 ha
>= 100 ha

5.2.4 Sources

2020 NNW Highest and Best Landuse Model (refer Section 4).

NNW Private Property Model (refer Section 3.2).

6 Current Plantation Land Use Summary

Plantation land uses (i.e. gross land estate area, including infrastructure, non-production areas, etc) comprise some 7% (268,000ha) of the total area of NNW Tasmania as indicated in the table below.

Table 16 – NNW Tasmanian 2019 Land Use Classification

Land Use Class	Area (ha)	% Land Use
1.1.0 Nature conservation	1,409,469	35.3%
1.2.0 Managed resource protection	600,095	15.0%
1.3.0 Other minimal use	247,453	6.2%
2.1.0 Grazing native vegetation	111,645	2.8%
2.2.0 Production native forests	498,136	12.5%
3.1.0 Plantation forests	267,911	6.7%
3.2.0 Grazing modified pastures	427,899	10.7%
3.3.0 Cropping	6,728	0.2%
3.4.0 Perennial horticulture	33	0.0%
3.5.0 Seasonal horticulture	45	0.0%
3.6.0 Land in transition	10,014	0.3%
4.1.0 Irrigated plantation forests	33	0.0%
4.2.0 Grazing irrigated modified pastures	98,094	2.5%
4.3.0 Irrigated cropping	90,942	2.3%
4.4.0 Irrigated perennial horticulture	3,434	0.1%
4.5.0 Irrigated seasonal horticulture	162	0.0%
4.6.0 Irrigated land in transition	1	0.0%
5.1.0 Intensive horticulture	250	0.0%
5.2.0 Intensive animal production	2,554	0.1%
5.3.0 Manufacturing and industrial	1,828	0.0%
5.4.0 Residential and farm infrastructure	80,682	2.0%
5.5.0 Services	6,719	0.2%
5.6.0 Utilities	395	0.0%
5.7.0 Transport and communication	26,287	0.7%
5.8.0 Mining	3,870	0.1%
5.9.0 Waste treatment and disposal	471	0.0%
6.1.0 Lake	27,812	0.7%
6.2.0 Reservoir/dam	3,615	0.1%
6.3.0 River	8,455	0.2%
6.5.0 Marsh/wetland	5,281	0.1%
6.6.0 Estuary/coastal waters	52,442	1.3%
Unclassified	20	0.0%
Grand Total	**3,992,776**	**100.0%**

Of the gross plantation land use area in NNW Tasmania[1], 71% (192,000ha) is managed by private forest management companies within large industrial plantation estates on a mix of private and public land, 15% (42,000ha[2]) is owned by a large number of independent landowners on private land, the remainder is publicly owned land managed by Sustainable Timbers Tasmania.

In terms of private freehold land, there is currently 129,000ha[3] net productive forested plantation area in the NNW, of which 89% (116,000ha) is hardwood plantation and 11% (13,000ha) is softwood plantation.

7 Landowner Plantation Intent Analysis

To assist with understanding current private independent landowner intent with respect to plantation enterprises since the final collapse of plantation managed investment schemes in Tasmania in 2013, a GIS analysis of plantation status between 31st December 2015 and 31st December 2019 was undertaken, using plantation mapping data provided by Private Forests Tasmania.

The plantation mapping data did not provide any indication of future intent where plantations were identified as having being harvested within this period, so the presence or absence of a current private timber reserve (PTR)[4] on the site was used to indicate if the plantation was likely to be replanted or not.

Table 17 – 2015 to 2019 Plantation Land Use Change Summary

Land Use as at 31st December 2015	Status as at 31DEC2019 (Area in hectares)					
	No change	New planting	Harvested, replanted	Harvested, PTR present	Harvested, PTR absent	Grand Total
Hardwood Plantation	25,570		861	5,633	9,510	40,713
Softwood Plantation	7,050		60	204	937	8,192
Not Plantation	194	194				
Grand Total	32,814	**194**	921	5,837	10,448	48,905

Of the 17,000ha harvested to date (35% of total area), more than half (54%) do not have a PTR present and so are likely to have been converted to other land uses. Figure 3 below provides an overview of the current plantation estate, including areas of plantation harvested since 2015.

[1] Derived from the Draft DPIPWE 2019 Land Use layer, which reports plantation area data as at 31st December 2018

[2] As at 31st December 2019, approximately 32,000ha was identified as standing plantation forest, and another 10,000ha identified as harvested and, based on the PTR analysis described above, was assumed to be either: fallow awaiting replanting; in the process of being replanted; or recently replanted.

[3] Derived from the Draft PFT 2019 PRIPIT layer, which reports plantation area data as at 31st December 2019

[4] A private timber reserve (PTR) is an area of private land set aside for forestry purposes and registered on the title, and where a PTR is in place, forested areas harvested must be restocked with forest.

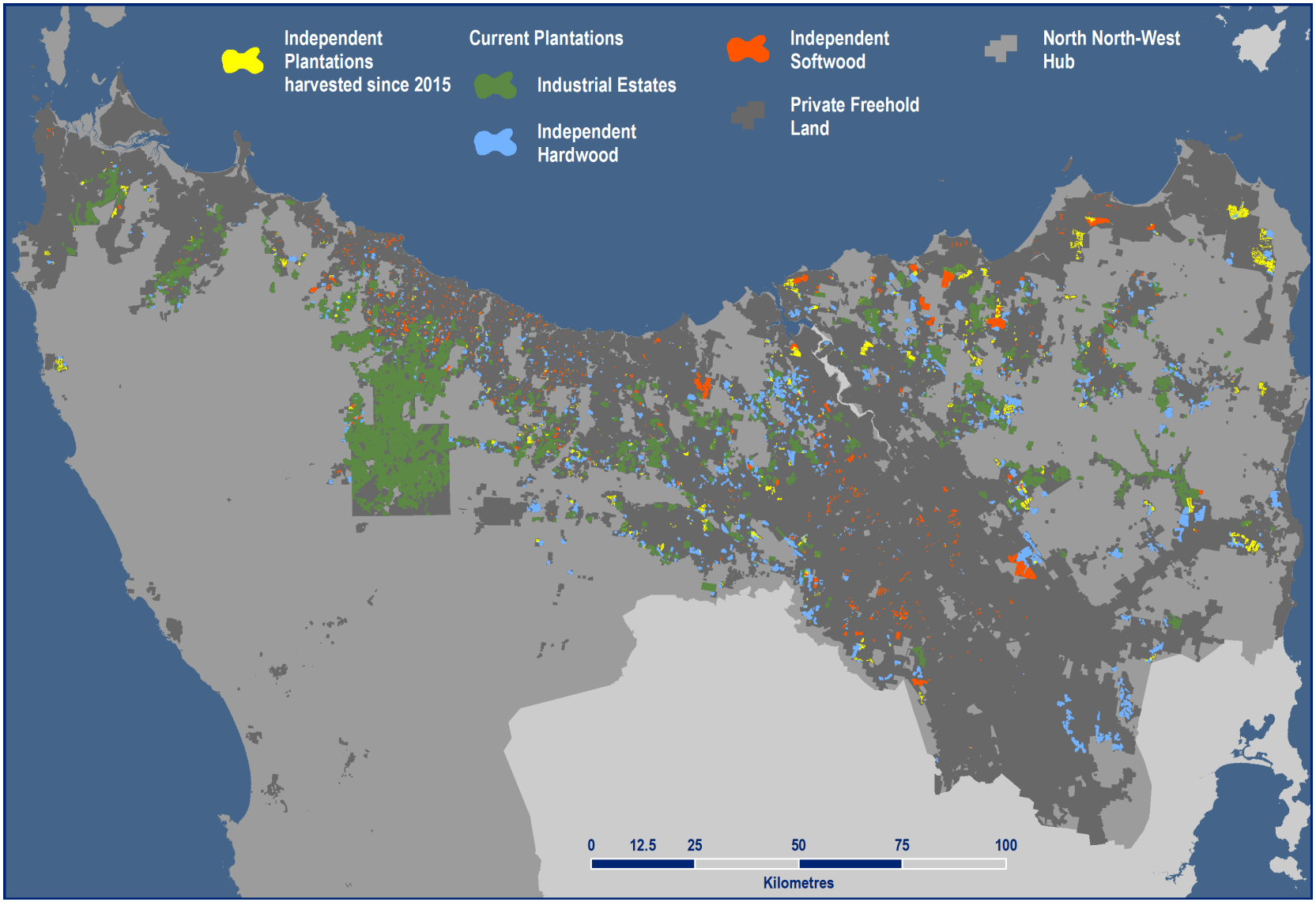

Figure 3 – Distribution of plantations, current and historic, in the NNW Hub

8 Results

8.1 NNW Plantation Land Suitability Model Results

Table 18 – Current Land Use Area (hectares) with Commercial Potential for Eucalyptus nitens Plantation by Suitability and Availability

Suitable Land Uses	Total Area Analysed	Unsuitable/ Unavailable	Small Scale Potential (Modified Riparian)	Commercial Potential (Slope <10 degrees, suitable for Cropping)	Commercial Potential (Slope 10-14 degrees, marginal for Cropping)	Commercial Potential (Slope 14-19 degrees, unsuitable for Cropping)
3.2.0 Grazing modified pastures	305,185	133,754	5,274	148,406	12,002	5,748
3.2.0 Grazing modified pastures (with Irrigation Potential)	110,122	63,408	1,785	40,388	3,209	1,333
3.2.1 Native/exotic pasture mosaic	11,740	6,457	90	4,589	435	169
3.2.1 Native/exotic pasture mosaic (with Irrigation Potential)	3,715	2,806	20	774	75	40
3.3.0 Cropping	3,987	1,144	67	2,583	146	48
3.3.0 Cropping (with Irrigation Potential)	2,365	1,413	20	908	21	3
3.6.0 Land in transition	1,657	683	18	789	101	65
3.6.0 Land in transition (with Irrigation Potential)	173	28	5	102	24	14
3.6.1 Degraded land	4,401	2,553	146	1,417	208	77
3.6.1 Degraded land (with Irrigation Potential)	1,951	1,706	26	180	27	12
4.2.0 Grazing irrigated modified pastures	94,770	47,288	1,473	41,666	3,083	1,261
4.3.0 Irrigated cropping	88,736	45,597	827	40,038	1,710	564
No Availability	392,923	306,837	0	86,085	0	0
Low Availability	197,087	0	0	188,794	8,293	0
High Availability	**38,792**	**0**	**9,751**	**6,959**	**12,748**	**9,334**
Grand Total	*628,802*	*306,837*	*9,751*	*281,839*	*21,040*	*9,334*

Areas highlighted in red were deemed unlikely to be suitable or available based on current land use. Those in yellow highlight were deemed of lower availability due to the following scenarios:

a) situated within proposed irrigation schemes of which a proportion will become irrigated and unlikely to be available in future;
b) have current uses of which only a portion of which would currently be suitable; or
c) are likely marginal for current use due to steeper slopes and so a proportion is likely suitable.

Table 19 below summarises areas modelled as suitable for hardwood plantings but with little to no non-commercial potential.

Table 19 – Current Land Use Area with Non-commercial Potential for Eucalyptus nitens Plantation by Suitability & Availability

Suitable Land Uses	Total Natural Capital	Natural Capital Potential (Modified Wetland)	Natural Capital Potential (Modified Riparian)	Natural Capital Potential (Slope > 19 degrees)
3.2.0 Grazing modified pastures	4,403	1,032	1,206	2,166
3.2.0 Grazing modified pastures (with Irrigation Potential)	1,050	187	424	439
3.2.1 Native/exotic pasture mosaic	75	2	20	53
3.2.1 Native/exotic pasture mosaic (with Irrigation Potential)	41	17	8	16
3.3.0 Cropping	35	5	16	13
3.3.0 Cropping (with Irrigation Potential)	8	0	7	0
3.6.0 Land in transition	43	1	3	39
3.6.0 Land in transition (with Irrigation Potential)	7	0	1	5
3.6.1 Degraded land	115	3	65	48
3.6.1 Degraded land (with Irrigation Potential)	15	1	10	3
4.2.0 Grazing irrigated modified pastures	1,111	343	380	388
4.3.0 Irrigated cropping	472	138	183	151
Grand Total	*7,373*	*1,728*	*2,325*	*3,320*

Table 20 – Current Land Use Area (hectares) with Commercial Potential for Pinus radiata Plantation by Suitability & Availability

Suitable Land Uses	Total Area Analysed	Unsuitable/ Unavailable	Small Scale Potential (Modified Riparian)	Commercial Potential (Slope <10 degrees, suitable for Cropping)	Commercial Potential (Slope 10-14 degrees, marginal for Cropping)	Commercial Potential (Slope 14-19 degrees, unsuitable for Cropping)
3.2.0 Grazing modified pastures	302,995	42,798	7,240	232,385	13,960	6,612
3.2.0 Grazing modified pastures (with Irrigation Potential)	109,577	42,933	2,793	58,169	3,926	1,756
3.2.1 Native/exotic pasture mosaic	11,695	4,413	107	6,418	530	227
3.2.1 Native/exotic pasture mosaic (with Irrigation Potential)	3,690	2,411	25	1,040	128	87
3.3.0 Cropping	3,971	371	87	3,305	157	51
3.3.0 Cropping (with Irrigation Potential)	2,343	289	93	1,925	30	5
3.6.0 Land in transition	1,634	204	28	1,215	114	74
3.6.0 Land in transition (with Irrigation Potential)	172	11	6	112	26	18
3.6.1 Degraded land	4,315	634	325	2,974	279	103
3.6.1 Degraded land (with Irrigation Potential)	1,921	1,147	122	589	40	23
4.2.0 Grazing irrigated modified pastures	93,221	7,187	2,046	79,359	3,279	1,350
4.3.0 Irrigated cropping	88,489	22,522	1,309	62,103	1,928	626
No Suitability	272,941	124,922	0	148,019	0	0
Low Suitability	300,014	0	0	290,554	9,460	0
High Suitability	**51,069**	**0**	**14,181**	**11,021**	**14,937**	**10,930**
Grand Total	*624,024*	*124,922*	*14,181*	*449,593*	*24,398*	*10,930*

Areas highlighted in red were deemed unlikely to be suitable or available based on current land use. Those in yellow highlight were deemed of lower availability due to the following scenarios:

a) situated within proposed irrigation schemes of which a proportion will become irrigated and unlikely to be available in future;
b) have current uses of which only a portion of which would currently be suitable; or
c) are likely marginal for current use due to steeper slopes and so a proportion is likely suitable.

Table 21 below summarises areas modelled as suitable for softwood plantings but with little to no non-commercial potential.

Table 21 – Current Land Use Area (hectares) with Non-commercial Potential for Pinus radiata Plantation by Suitability & Availability

Suitable Land Uses	Total Natural Capital	Natural Capital Potential (Modified Wetland)	Natural Capital Potential (Modified Riparian)	Natural Capital Potential (Slope > 19 degrees)
3.2.0 Grazing modified pastures	6,593	2,500	1,650	2,443
3.2.0 Grazing modified pastures (with Irrigation Potential)	1,595	324	696	575
3.2.1 Native/exotic pasture mosaic	120	15	23	81
3.2.1 Native/exotic pasture mosaic (with Irrigation Potential)	66	20	9	36
3.3.0 Cropping	51	18	19	15
3.3.0 Cropping (with Irrigation Potential)	30	0	29	0
3.6.0 Land in transition	66	15	5	45
3.6.0 Land in transition (with Irrigation Potential)	8	0	1	6
3.6.1 Degraded land	201	10	125	66
3.6.1 Degraded land (with Irrigation Potential)	44	3	33	8
4.2.0 Grazing irrigated modified pastures	2,660	1,730	504	426
4.3.0 Irrigated cropping	718	270	276	172
Grand Total	*12,151*	*4,906*	*3,370*	*3,875*

8.2 NNW Highest and Best Use Model Results

Table 22 below summarises the areas suitable and available for hardwood plantation development based on Higher and Best Use analysis. This table was generated from Table 18 on the following basis:

1. Areas flagged as High Availability (no fill) in Table 18 were transferred to Table 22 without discount.
2. Areas flagged as Low Availability (yellow fill) in Table 18 were analysed such that only the areas in which *E. nitens* enterprise suitability ranking outranked all other agricultural crop enterprise suitability rankings were transferred to Table 22 (i.e. highest and best use discount).
3. Areas flagged as No Availability (red fill) in Table 18 were excluded from Table 18.

Table 22 – Area (hectares) by Current Land Use of land Suitable and Available for Commercial Eucalyptus nitens Plantation after Higher and Better Use Considerations Applied

Suitable Land Uses	Total Available Area	Small Scale Potential (Modified Riparian)	Commercial Potential (Slope <10 degrees, suitable for Cropping)	Commercial Potential (Slope 10-14 degrees, marginal for Cropping)	Commercial Potential (Slope 14-19 degrees, unsuitable for Cropping)
3.2.0 Grazing modified pastures	**25,027**	5,274	2,002	12,002	5,748
3.2.0 Grazing modified pastures (with Irrigation Potential)	**3,685**	1,785	440	128	1,333
3.2.1 Native/exotic pasture mosaic	**5,283**	90	4,589	435	169
3.2.1 Native/exotic pasture mosaic (with Irrigation Potential)	**910**	20	774	75	40
3.3.0 Cropping	**115**	67	0	0	48
3.3.0 Cropping (with Irrigation Potential)	**23**	20	0	0	3
3.6.0 Land in transition	**85**	18	0	2	65
3.6.0 Land in transition (with Irrigation Potential)	**23**	5	0	3	14
3.6.1 Degraded land	**1,848**	146	1,417	208	77
3.6.1 Degraded land (with Irrigation Potential)	**244**	26	180	27	12
4.2.0 Grazing irrigated modified pastures	**2,803**	1,473	0	70	1,261
4.3.0 Irrigated cropping	**1,398**	827	0	7	564
Grand Total	***41,445***	*9,751*	*9,402*	*12,958*	*9,334*

Table 23 below summarises the areas suitable and available for hardwood plantation development based on Higher and Best Use analysis. This table was generated from Table 20 on the following basis:

1. Areas flagged as High Availability (no fill) in Table 20 were transferred to Table 23 without discount.
2. Areas flagged as Low Availability (yellow fill) in Table 20 were analysed such that only the areas in which *P. radiata* enterprise suitability ranking outranked all other agricultural crop enterprise suitability rankings were transferred to Table 23 (i.e. highest and best use discount).
3. Areas flagged as No Availability (red fill) in Table 20 were excluded from Table 23.

Table 23 – Area (hectares) by Current Land Use of land Suitable and Available for Commercial Pinus radiata Plantation after Higher and Better Use Considerations Applied

Suitable Land Uses	Total Available Area	Small Scale Potential (Modified Riparian)	Commercial Potential (Slope <10 degrees, suitable for Cropping)	Commercial Potential (Slope 10-14 degrees, marginal for Cropping)	Commercial Potential (Slope 14-19 degrees, unsuitable for Cropping)
3.2.0 Grazing modified pastures	**36,064**	7,240	8,252	13,960	6,612
3.2.0 Grazing modified pastures (with Irrigation Potential)	**6,392**	2,793	1,325	518	1,756
3.2.1 Native/exotic pasture mosaic	**7,282**	107	6,418	530	227
3.2.1 Native/exotic pasture mosaic (with Irrigation Potential)	**1,279**	25	1,040	128	87
3.3.0 Cropping	**144**	87	0	6	51
3.3.0 Cropping (with Irrigation Potential)	**100**	93	0	1	5
3.6.0 Land in transition	**123**	28	0	22	74
3.6.0 Land in transition (with Irrigation Potential)	**33**	6	0	9	18
3.6.1 Degraded land	**3,681**	325	2,974	279	103
3.6.1 Degraded land (with Irrigation Potential)	**774**	122	589	40	23
4.2.0 Grazing irrigated modified pastures	**4,092**	2,046	0	695	1,350
4.3.0 Irrigated cropping	**2,013**	1,309	0	78	626
Grand Total	***61,976***	*14,181*	*20,598*	*16,267*	*10,930*

8.3 NNW Plantation Economics Model

The resultant area available for hardwood plantation development as described in Table 22 were analysed at the Property level for economic scale and distance to market, and the results classified into 'viability' from an economic perspective as per Table 24 below.

Table 24- Viable area for potential commercial hardwood plantation expansion in the NNW Tasmania Hub

Scale within Property (ha)	0 to 25 km from nearest Market	25 to 50 km from nearest Market	50 to 100 km from nearest Market	> 100 km from nearest Market	Total
> 100	1,190	2,798	2,442	554	*6,984*
50 to 100	522	1,042	935	237	*2,735*
25 to 50	799	1,623	2,101	1,025	*5,548*
10 to 25	2,121	3,611	3,912	972	*10,618*
1 to 10	4,513	4,587	4,454	915	*14,469*
0.1 to 1	275	339	239	55	*908*
High Viability	**4,631**	**9,074**	**2,442**	**0**	**16,147**
Moderate Viability	4,513	4,587	6,949	554	16,603
Low to No Viability	275	339	4,693	3,204	8,511
Grand Total	*9,419*	*14,000*	*14,085*	*3,759*	*41,262*

The viability for hardwood plantation development is represented spatially in Figure 4 below, based on colour coding of property boundaries to align with high, moderate and low viability ratings as identified in Table 24Table 25 above.

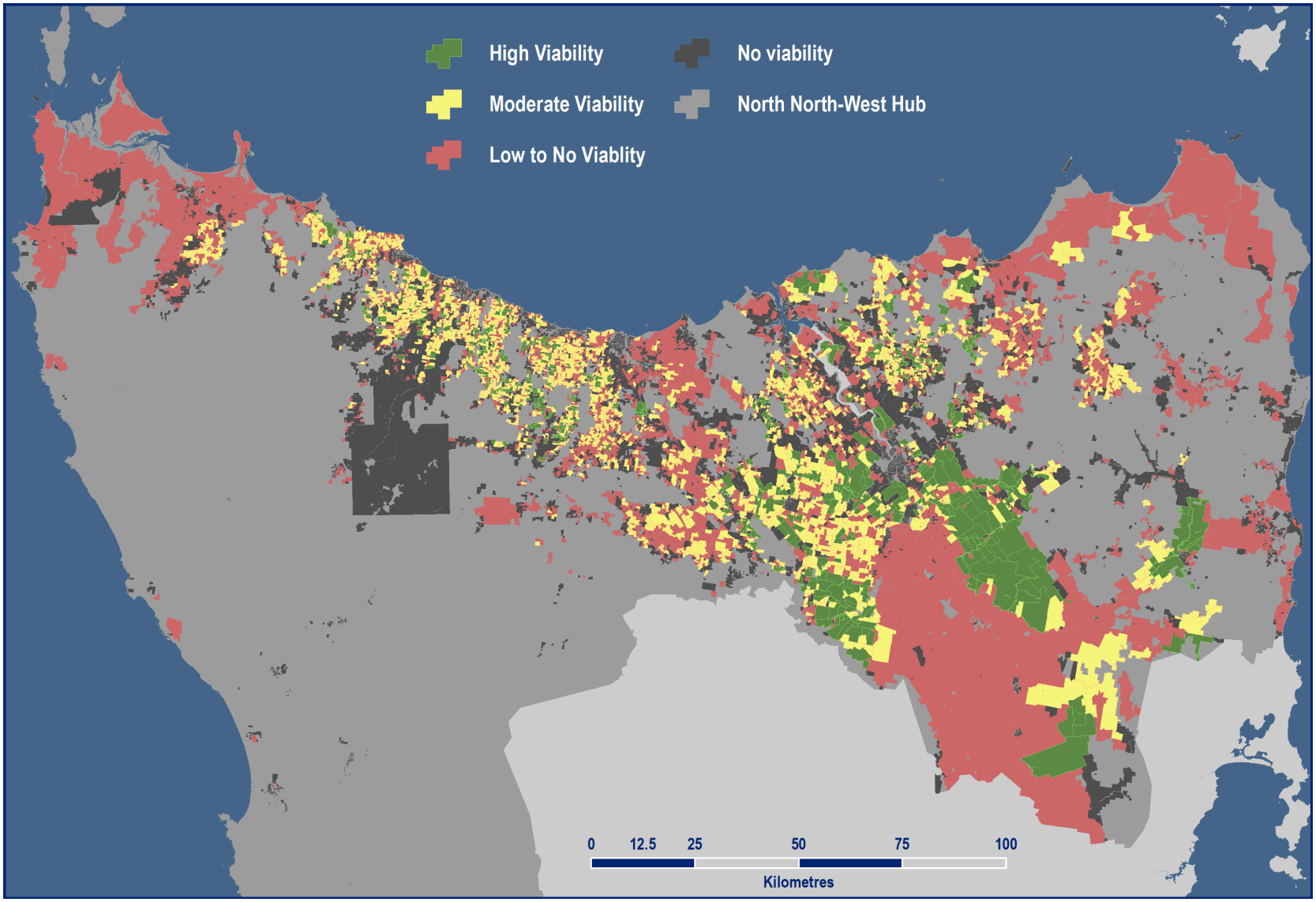

Figure 4 – Property-level viability of hardwood plantation development across the NNW Tasmania Hub

The resultant area available for softwood plantation development as described in Table 23 were analysed at the Property level for economic scale and distance to market, and the results classified into 'viability' from an economic perspective as per Table 25 below.

Table 25- Viable area for potential commercial softwood plantation expansion in the NNW Tasmania Hub

Scale within Property (ha)	0 to 25 km from nearest Market	25 to 50 km from nearest Market	50 to 100 km from nearest Market	> 100 km from nearest Market	Total
> 100	1,638	5,886	6,205	679	*14,408*
50 to 100	1,725	2,184	1,366	81	*5,357*
25 to 50	2,750	4,392	2,623	62	*9,827*
10 to 25	4,945	6,974	3,283	21	*15,223*
1 to 10	6,633	6,853	2,525	5	*16,016*
0.1 to 1	347	448	113	5	*913*
High Viability	**11,057**	**19,436**	**6,205**	**0**	**36,698**
Moderate Viability	6,633	6,853	7,273	679	21,438
Low to No Viability	347	448	2,638	174	3,607
Grand Total	*18,037*	*26,737*	*16,115*	*853*	*61,743*

The viability for softwood plantation development is represented spatially in Figure 5 below, based on colour coding of property boundaries to align with high, moderate and low viability ratings as identified in Table 25 above.

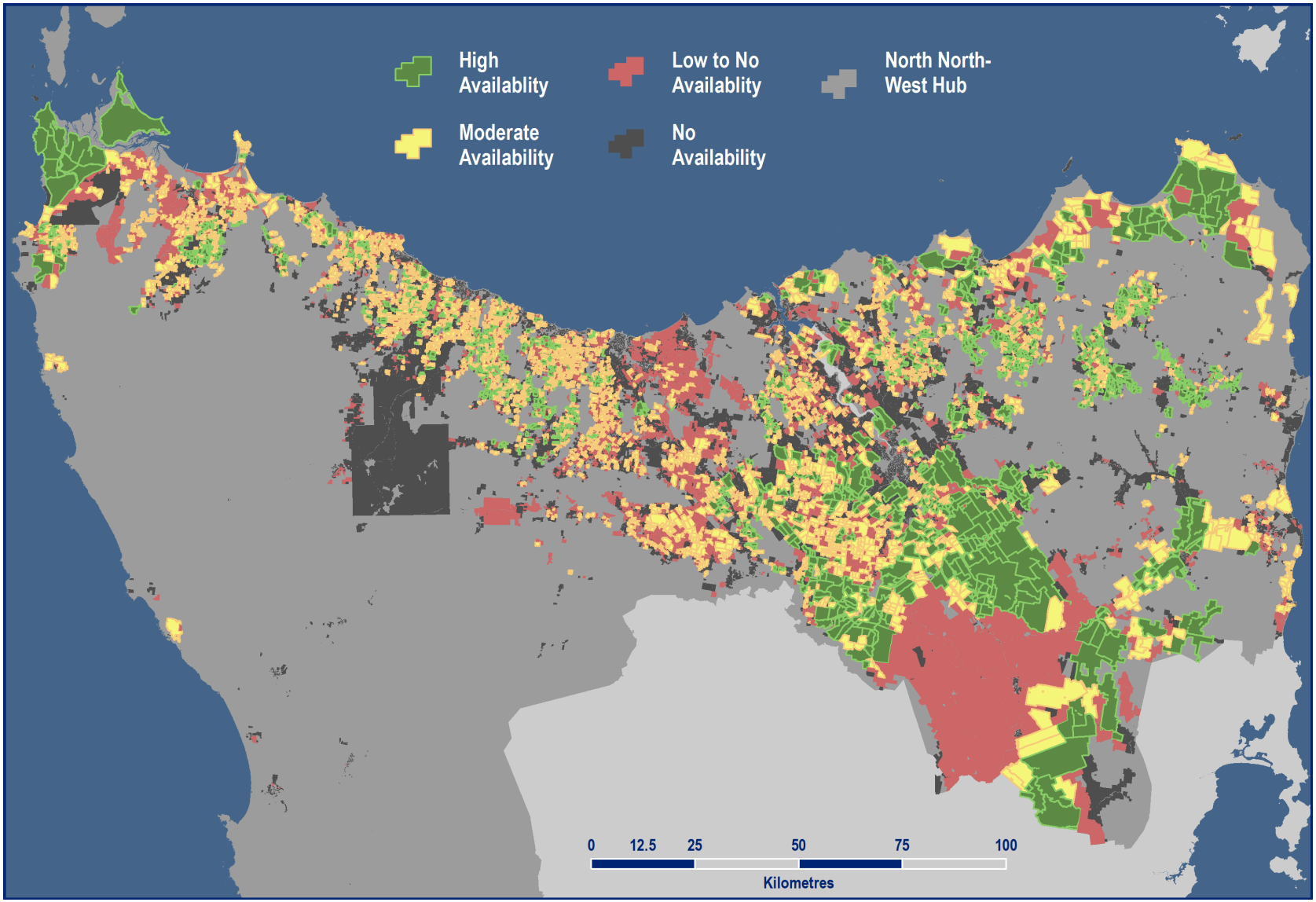

Figure 5 – Property-level viability of softwood plantation development across the NNW Tasmanian Hub

Figure 6 displays the combined viability of both softwood (SWD) and hardwood (HWD) plantation development across the NNW Tasmanian Hub.

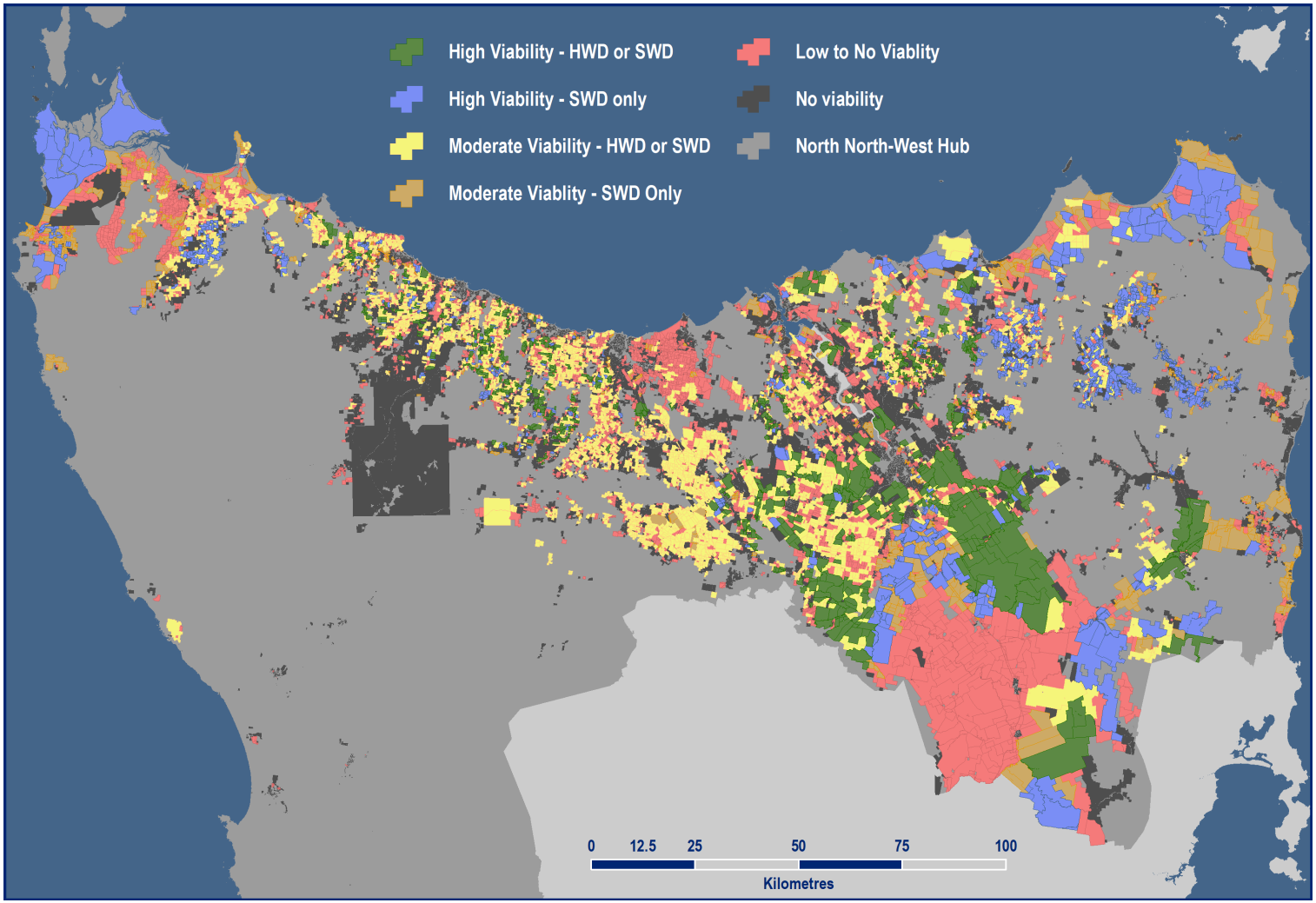

Figure 6 - Combined viability of softwood and hardwood plantation development across the NNW Tasmanian Hub

9 Model Review

A random sample of 66 modelled properties was chosen from across the Hub region and across a range of primary agricultural uses and property sizes, and reviewed against current imagery to assess the on-ground accuracy of the modelling, and to support interpretation.

Examples of the viability model outputs for a specific Property can be seen in Figure 10 (Softwood) and Figure 11 (Hardwood).

The following observations were made:

- On the whole the model appeared fit for purpose for the majority of properties reviewed
- Of the 60 large properties (i.e. > 1,000ha) present in the NNW Hub, many were classified as "high" or "moderate" viability, however this was in many cases an artefact of their sheer size accumulating large numbers of potential small scale (riparian) planting areas which then pushed them into higher ratings of economic scale. Review of several examples of these large properties identified the disparate and widespread nature of the small scale (riparian) planting areas and this lack of aggregation is likely to render them of much lower economic viability from an operational harvesting perspective where they cannot be consolidated with more significant candidate areas. As such, the figures presented in the top row of Tables 9 and 10 should be considered optimistic, as these large properties contributed a significant area to the "> 100ha" economic scale class. Refer Figure 9, Figure 10 & Figure 11 for examples.
- The model identified several areas as highly viable for plantations which appear to have been recently converted from plantation back to grazing, so are likely to be unavailable from a landowner intent perspective, despite plantation suitability outranking cropping suitability.
- Modelling of shelterbelts along fence or road lines or between pivot circles was not attempted in this modelling exercise yet many of the properties reviewed could likely accommodate such plantings, and several already did.

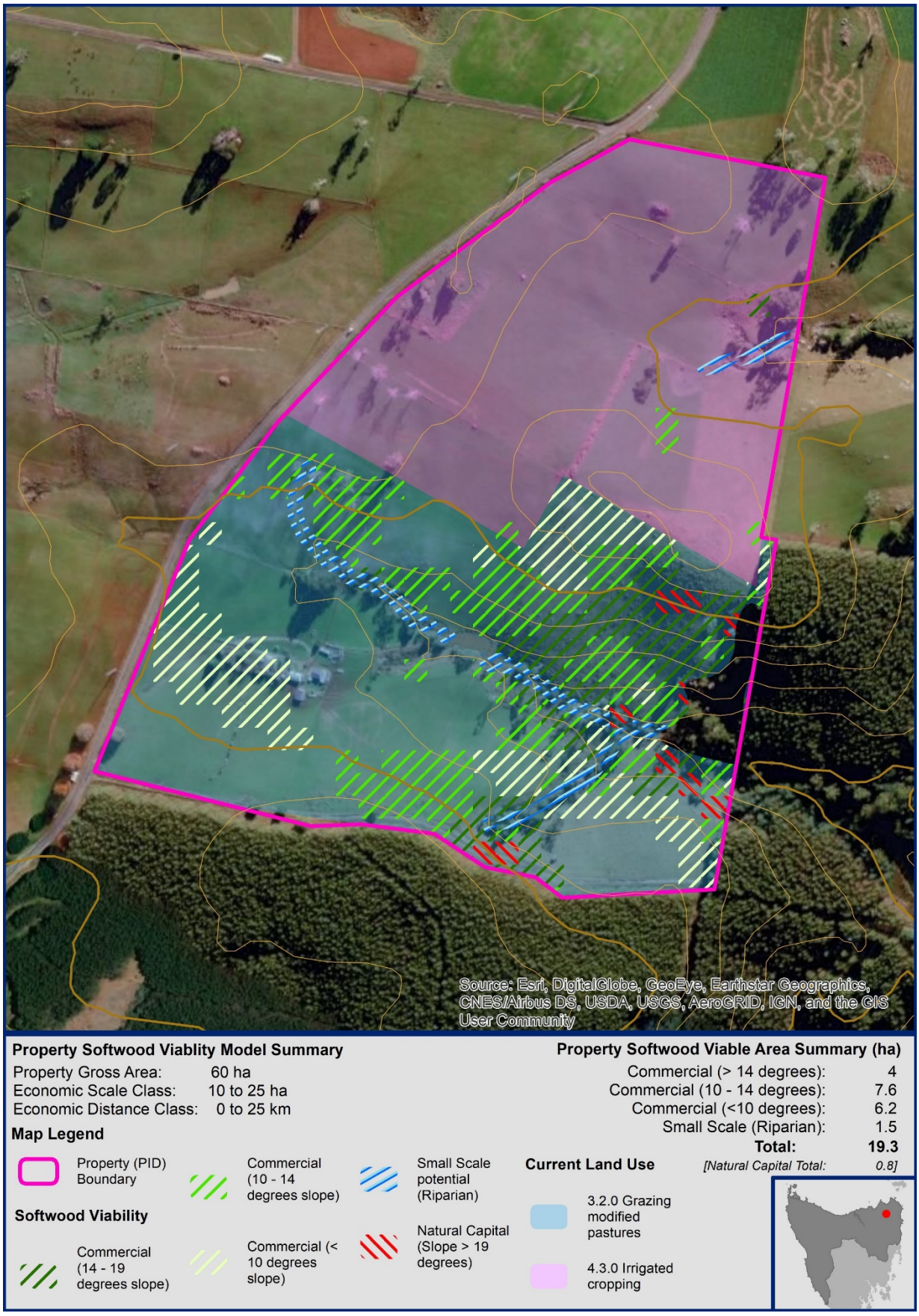

Figure 7- Example output of Softwood Viability Model

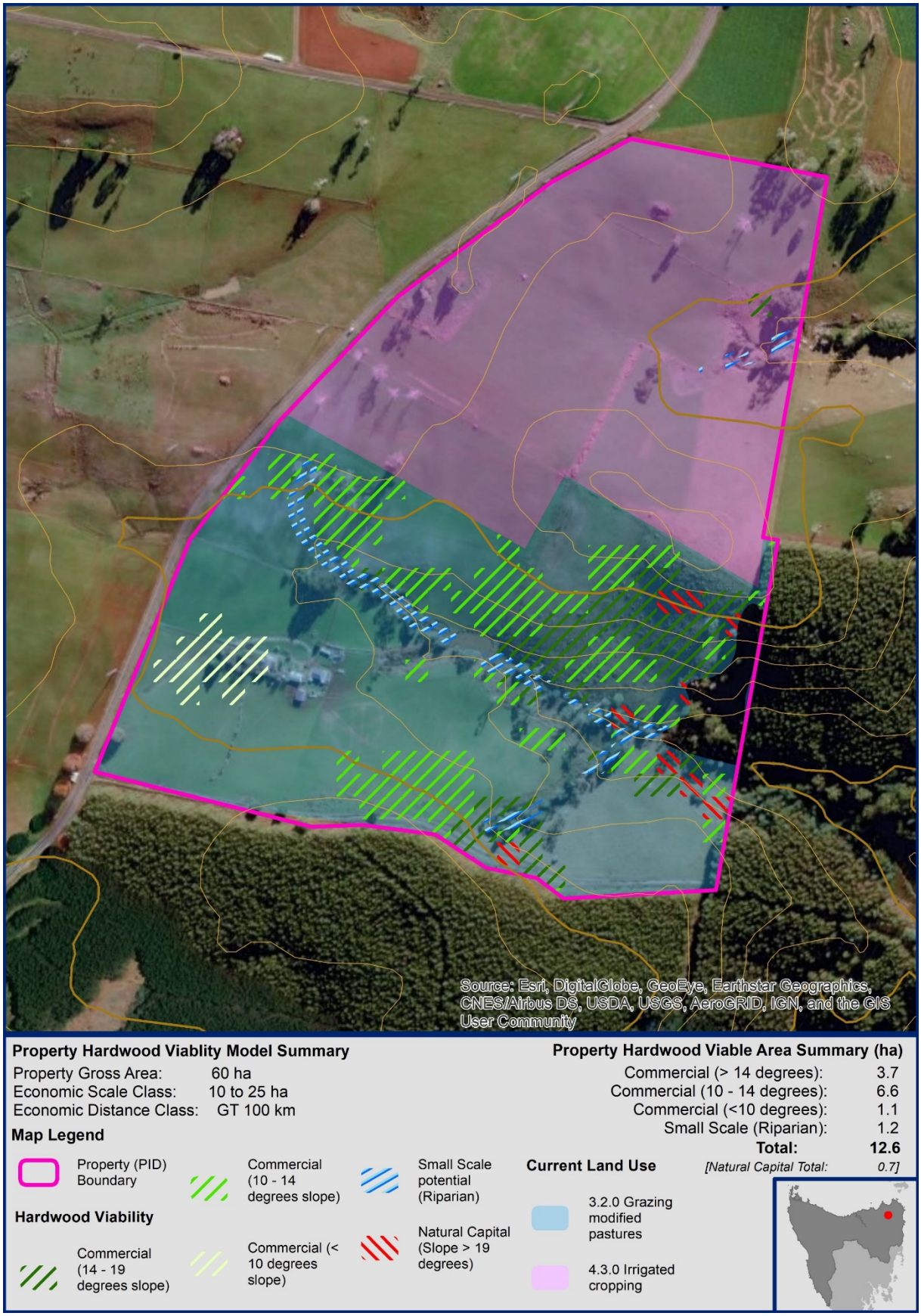

Figure 8- Example output of Hardwood Viability Model

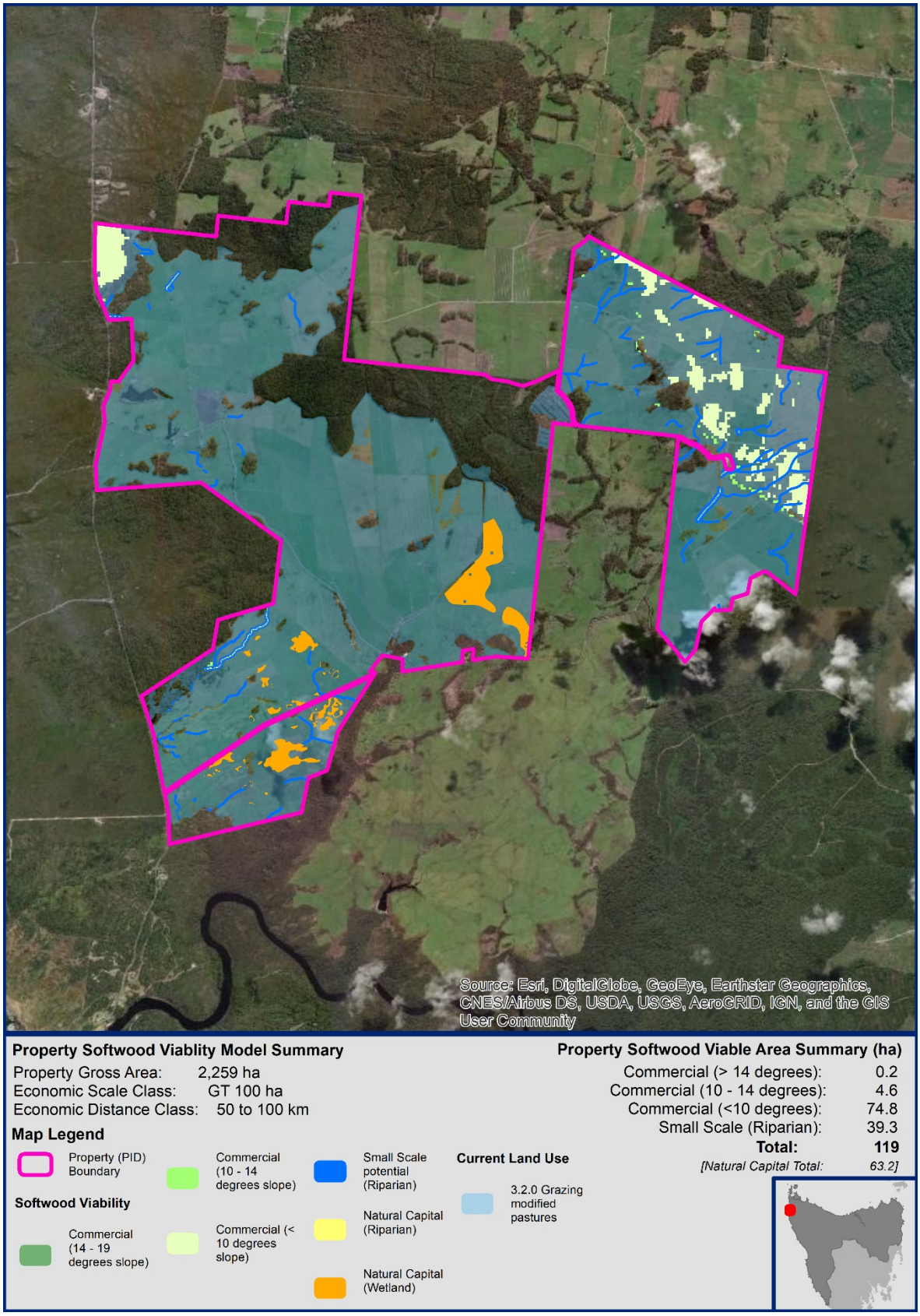

Figure 9 - Example 1 of Large Property with high proportion of small scale (riparian) areas contributing to total commercial potential

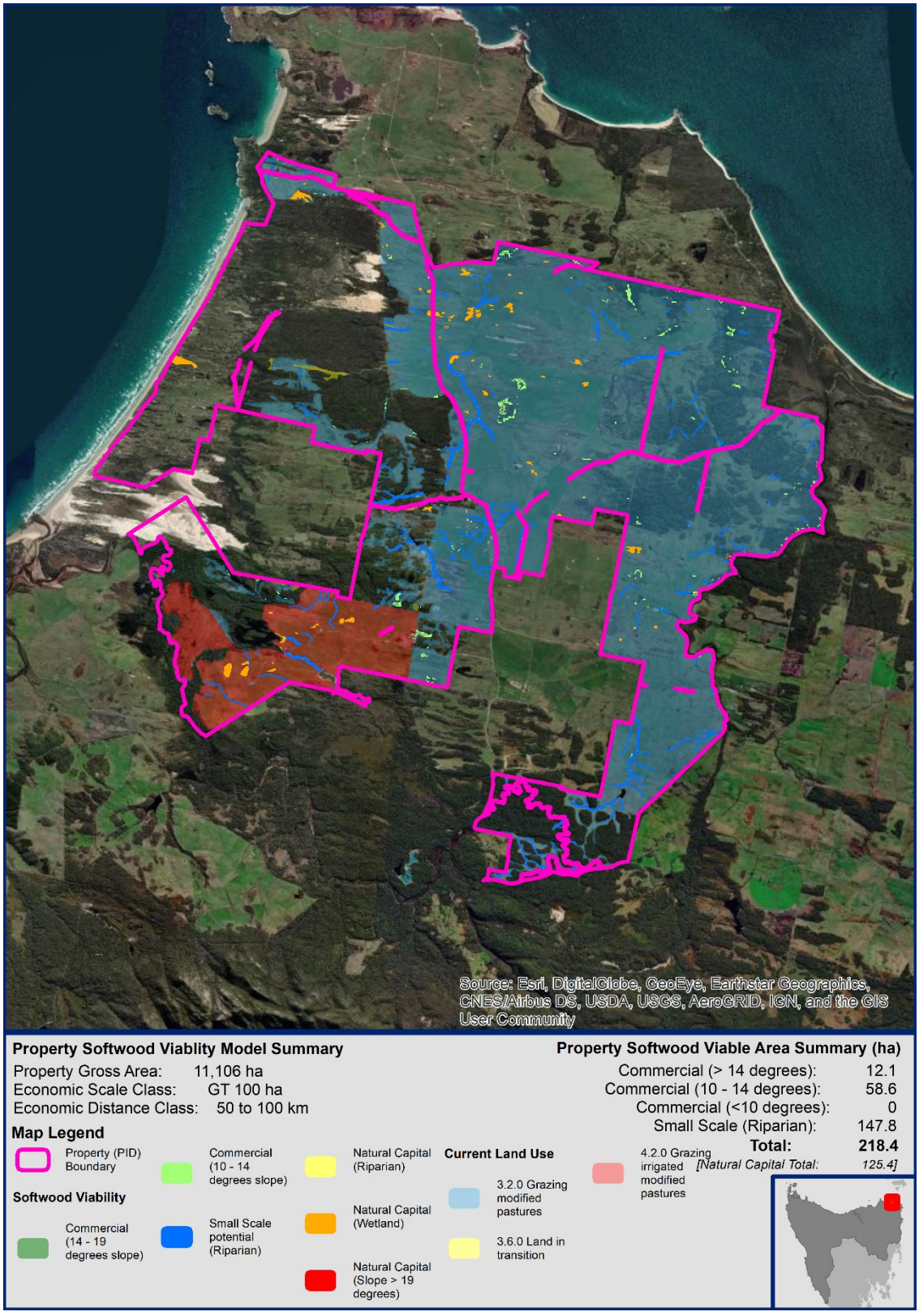

Figure 10 – Example 2 of Large Property with high proportion of small scale (riparian) areas contributing to total commercial potential

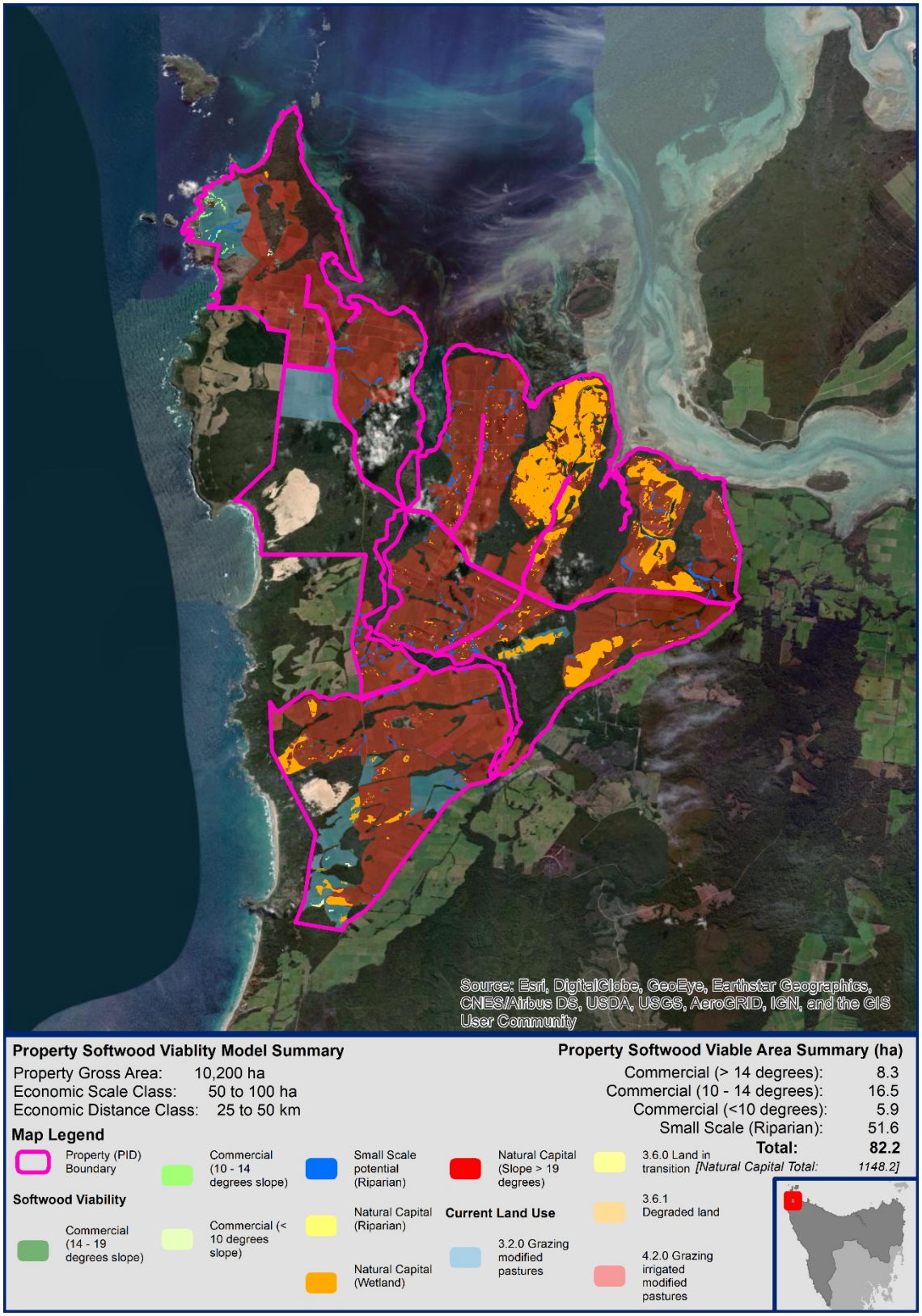

Figure 11- Example 3 of Large Property with high proportion of small scale (riparian) areas contributing to total commercial potential Data Sources

10 Data Sources

10.1 Draft Tasmania 2020 10m-Digital Elevation Model

10.1.1 Description

A statewide raster layer describing 10m elevation intervals across Tasmania.

10.1.2 Data Layer Name

DEM_30m_June2020_NHC_align.tif

10.1.3 Source

Mineral Resources Tasmania, State Growth (June 2020)

10.1.4 Data Licence/Disclaimer

The Draft Tasmania 2020 10m-Digital Elevation Model was provided to EMG by Mineral Resource Tasmania for use in this project under the following provisos:

- *it is used under the creative commons principle,*
- *accept that it is a draft,*
- *that it will change into the future.*
- *They would also need to note they will need to seek any updates from us*

10.2 LIST Cadastral Parcels layer

10.2.1 Description

A statewide vector layer describing cadastral parcels across Tasmania.

10.2.2 Data layer name

list_cadastral_parcels_statewide

10.2.3 Source

LIST Open Data, June 2020

10.2.4 Data Licence

Copyright © State of Tasmania. Data is supplied under Creative Commons Attribution 3.0 Australia (CC BY 3.0 AU)

http://creativecommons.org/licenses/by/3.0/au/

For appropriate attribution see the Land Tasmania Attribution Guidelines at:

http://listdata.thelist.tas.gov.au/public/LandTasmaniaDataAttributionGuidelines.pdf

10.2.5 Data Disclaimer

The Crown in the Right of Tasmania and its employees and agents: give no warranty regarding the Data's accuracy, completeness, currency or suitability for any particular purpose and those using it for whatever purpose are advised to verify it with the relevant Commonwealth or State government department, local government body or other source and to obtain any appropriate professional advice; and do not accept liability however arising including, but not limited to negligence for any loss resulting from the use of or reliance upon the Data or reliance on its availability at any time; give

no warranty that the Data is free of infection by computer viruses or other contamination, nor that access to http://listdata.thelist.tas.gov.au/opendata or any part of it will not suffer interruption from time to time, without notice. Data structures may vary between format types and delivery period.

10.3 LIST Hydrographic Area layer

10.3.1 Description

A statewide vector layer describing hydrological areas (i.e. waterbodies, dams, etc) across Tasmania.

10.3.2 Data layer name

list_hydrographic_area_statewide

10.3.3 Source

LIST Open Data, June 2020

10.3.4 Data Licence

10.3.5 Data Disclaimer

The Crown in the Right of Tasmania and its employees and agents: give no warranty regarding the Data's accuracy, completeness, currency or suitability for any particular purpose and those using it for whatever purpose are advised to verify it with the relevant Commonwealth or State government department, local government body or other source and to obtain any appropriate professional advice; and do not accept liability however arising including, but not limited to negligence for any loss resulting from the use of or reliance upon the Data or reliance on its availability at any time; give no warranty that the Data is free of infection by computer viruses or other contamination, nor that access to http://listdata.thelist.tas.gov.au/opendata or any part of it will not suffer interruption from time to time, without notice. Data structures may vary between format types and delivery period.

10.4 LIST Hydrographic Line layer

10.4.1 Description

A statewide vector layer describing hydrological lines (i.e. watercourses, drains, etc) across Tasmania.

10.4.2 Data layer name

list_hydrographic_line_statewide

10.4.3 Source

LIST Open Data, June 2020

10.4.4 Data Licence

10.4.5 Data Disclaimer

The Crown in the Right of Tasmania and its employees and agents: give no warranty regarding the Data's accuracy, completeness, currency or suitability for any particular purpose and those using it for whatever purpose are advised to verify it with the relevant Commonwealth or State government department, local government body or other source and to obtain any appropriate professional advice; and do not accept liability however arising including, but not limited to negligence for any loss resulting from the use of or reliance upon the Data or reliance on its availability at any time; give no warranty that the Data is free of infection by computer viruses or other contamination, nor that access to http://listdata.thelist.tas.gov.au/opendata or any part of it will not suffer interruption from time to time, without notice. Data structures may vary between format types and delivery period.

10.5 LIST Interim Planning Scheme layer

10.5.1 Description

A statewide vector layer describing the interim planning schemes across Tasmania.

10.5.2 Data layer name

list_interim_planning_scheme_overlay_statewide

10.5.3 Source

LIST Open Data, June 2020

10.5.4 Data Licence

10.5.5 Data Disclaimer

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access to http://listdata.thelist.tas.gov.au/opendata or any part of it will not suffer interruption from time to time, without notice. Data structures may vary between format types and delivery period.

10.6 LIST Local Government Area layer

10.6.1 Description

A statewide vector layer describing municipality boundaries across Tasmania.

10.6.2 Data layer name

list_local_govt_areas_statewide

10.6.3 Data Source

LIST Open Data, June 2020

10.6.4 Data Licence

10.6.5 Data Disclaimer

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10.7 LIST Transport layer

10.7.1 Description

10.7.2 Data layer name

list_transport_segments

10.7.3 Data Source

LIST Open Data, June 2020

10.7.4 Data Licence

For appropriate attribution see the Land Tasmania Attribution Guidelines at:

http://listdata.thelist.tas.gov.au/public/LandTasmaniaDataAttributionGuidelines.pdf

10.7.5 Data Disclaimer

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10.8 Draft DPIPWE 2019 Land Use layer

10.8.1 Description

A statewide vector layer describing land use as at 2019 across Tasmania.

10.8.2 Data layer name

DPIPWE_LU_2019_DRAFT_NNWhub

10.8.3 Data Source

Natural Conservation Branch, DPIPWE, June 2020

10.8.4 Data Licence

Email from Rhys Stickler:

"For this project, DPIPWE will make an exception to supply an uncontrolled draft version of the 2019 Land Use map of Tasmania to Esk GIS & Mapping. Due to the draft nature of the data, we request that the data be kept within your organisation and is not to be supplied externally to anybody else. Please reference the data as ***"Draft DPIPWE 2019 Land Use"*** *in any report, mapping or printed materials. Should you discover any errors in the data, we would appreciate your advice so that we can update data for the next release."*

Citation:

"Draft DPIPWE 2019 Land Use data sourced from Natural Conservation Branch, DPIPWE, © State of Tasmania"

10.8.5 Data Disclaimer

Data is draft as at 2019 (final release planned July 2020), and has not been validated or vetted for errors or inconsistencies.

10.9 Draft PFT 2019 PRIPIT layer

10.9.1 Description

A statewide vector layer describing pi-typing (i.e. forest description) across private land in Tasmania.

10.9.2 Data layer name

PFT_PRIPIT_2019

10.9.3 Data Source

The Draft PFT 2019 Private PI-Types layer was sourced from Private Forests Tasmania, as at 31st December 2019.

10.9.4 Data Licence

Data Licence Agreement "2020-01" between Esk Mapping & GIS and Private Forests Tasmania. Statewide base data prepared for the modelling to be provided back to PFT at the end of the project, all other source data to be destroyed on completion of the project.

Citation:

"Forest Groups data sourced from Private Forests Tasmania, www.privateforests.tas.gov.au , © State of Tasmania"

10.9.5 Data Disclaimer

Data is draft as at 31st December 2019 (final release planned August 2020), and has not been validated or vetted for errors or inconsistencies.

10.10 Draft TASVEG 4.0 layer

10.10.1 Description

A statewide vector layer describing vegetation communities across Tasmania.

10.10.2 Data layer name

TVMMP_TASVEG_4_0

10.10.3 Data Source

The Draft DPIPWE TASVEG 4.0 was sourced from the Tasmanian Vegetation Monitoring and Mapping Program, June 2020.

10.10.4 Data Licence

Creative Commons Attribution 3.0 Australia Licence

Citation:

"*Department of Primary Industries, Parks, Water and Environment. TASVEG 4.0, Released June 2020. Tasmanian Vegetation Monitoring and Mapping Program, Natural and Cultural Heritage Division."*

10.10.5 Data Disclaimer

Data is draft version of TASVEG 4.0 as at 31st December 2019 (final release planned July 2020), and has not been validated or vetted for errors or inconsistencies.

10.11 Enterprise Suitability Tree Species layers

10.11.1 Description

30mx30m resolution Enterprise Suitability layers for *Eucalyptus globulus*, *Eucalyptus nitens* and *Pinus radiata.*

10.11.2 Data layer names

NCH_Eucalyptus_globulus_suitability

NCH_Eucalyptus_nitens_suitability

NCH_Pradiata_suitability

10.11.3 Source

Natural and Cultural Heritage Values (NCH) Division of the Department of Primary Industries, Parks, Water and Environment (DPIPWE).

10.11.4 Data Licence

Required attribution:

Eucalyptus globulus suitability, 2018, © State of Tasmania
Eucalyptus nitens suitability, 2018, © State of Tasmania
Pinus radiata suitability, 2018, © State of Tasmania

10.11.5 Data Disclaimer

The Crown in the Right of Tasmania and its employees and agents: give no warranty regarding the Data's accuracy, completeness, currency or suitability for any particular purpose and those using it for whatever purpose are advised to verify it with the relevant Commonwealth or State government department, local government body or other source and to obtain any appropriate professional advice; and do not accept liability however arising including, but not limited to negligence for any loss resulting from the use of or reliance upon the Data or reliance on its availability at any time; give no warranty that the Data is free of infection by computer viruses or other contamination, nor that access to http://listdata.thelist.tas.gov.au/opendata or any part of it will not suffer interruption from time to time, without notice. Data structures may vary between format types and delivery period.

10.12 Enterprise Versatility Index layers

10.12.1 Description

A statewide aggregation of all enterprise suitability layers with a rating as to how many crops are suitable for a given site (i.e. versatility).

10.12.2 Data layer name

NCH_Enterprise_Suitability_Index

10.12.3 Source

Natural and Cultural Heritage Values (NCH) Division of the Department of Primary Industries, Parks, Water and Environment (DPIPWE).

10.12.4 Data Licence

Required attribution:

Enterprise Versatility Index, 2020, © State of Tasmania

10.12.5 Data Disclaimer

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10.13 Tasmanian Irrigation Proposed Schemes layer

10.13.1 Description

Areas proposed for irrigation scheme development.

10.13.2 Data layer name

TI_Proposed_Irrigation_Schemes

10.13.3 Data Source

Sourced from Tasmanian Irrigation, June 2020

10.13.4 Data Licence

TBC

10.13.5 Data Disclaimer

Boundaries may not be accurate, schemes may not proceed, provisional only.

11 Appendix – Layers generated in this project

11.1 TFFPN Private PID layer

11.1.1 Description

Layer of Property Identifiers (PIDs) for all private parcels within Tasmania. Generated during this modelling exercise to store property-level information such as presence/absence within the Industrial Plantation Estates, cartage distance to known markets, and results from property-level analysis for representation within maps.

11.1.2 Data layer name

TFFPN_Property_PID

11.1.3 Source

Generated by Esk Mapping & GIS, June 2020, spatial attributes & PID values sourced from the LIST Cadastral Parcels layer, other tabular attributes generated by Esk Mapping & GIS from various sources for specific use in this project.

11.1.4 Data Licence

Licensed by Esk Mapping & GIS for use by the Tasmanian Forests and Forest Products Network.

11.1.5 Data Disclaimer

Generated from sources of data outside of Esk Mapping & GIS control for specific use in this TFFPN Land Access Assessment Report. Not to be used for other projects. Use at own risk.

11.2 TFFPN Plantation Market Locations layer

11.2.1 Description

Layer of large, medium and small scale plantation hardwood and softwood processing and export facilities within Tasmania. Generated during this modelling exercise to analyse cartage distance from Properties to current markets.

11.2.2 Data layer name

TFFPN_Plantation_Market_Locations

11.2.3 Source

Generated by Esk Mapping & GIS, June 2020. Tabular descriptions of know primary processors were extracted from Private Forests Tasmania's "Directory of Tasmanian Forest Services 2020", aggregated where within reasonable vicinity of other processors, and geocoded to either specific locations or known transport hubs feeding into aggregated locations.

11.2.4 Data Licence

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11.2.5 Data Disclaimer

Generated from sources of data outside of Esk Mapping & GIS control for specific use in this TFFPN Land Access Assessment Report. Not to be used for other projects. Use at own risk.

11.3 TFFPN Statewide Slope Class layer

11.3.1 Description

30m x 30m resolution statewide layer of slope in 1 degree classes, aligned to the NCH Versatility Index layer.

11.3.2 Data layer name

TFFPN_Slope_30m_NCH_align_byte

11.3.3 Source

30mx30m resolution slope classes were generated by Esk Mapping & GIS from the Draft Tasmania 2020 10m-Digital Elevation Model supplied by Mineral Resources Tasmania, State Growth.

11.3.4 Data Licence

Licensed by Esk Mapping & GIS for use by the Tasmanian Forests and Forest Products Network

11.3.5 Data Disclaimer

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