



REPORT: STAGE 2 ECONOMIC ANALYSIS PLANTATION LAND SUITABILITY ASSESSMENT

PFOLSEN 


16 January
2025

Forest Resource Security

This report was commissioned by the South & Central Queensland Regional Forestry Hub with funding from the Australian Government, Department of Agriculture, Fisheries and Forestry.




PLANTATION LAND SPATIAL SUITABILITY ASSESSMENT STAGE 2



Stage 2 Economic analysis

This report was commissioned by the South & Central Queensland Regional Forestry Hub with funding from the Australian Government - Department of Agriculture, Fisheries and Forestry

Author
Signature 

Author Name Erin Hodgson

Author Role Consulting Forester

Date 16 January 2025

Reviewed By

Name Phil Lacy

Role Consulting Manager

Name Tyron Venn

Role Economic Consultant

Date 16 January 2025

DISCLAIMER

This document has been prepared for you by PF Olsen for the purposes stated in the document. PF Olsen has used reasonable endeavours to ensure that the data and any other information in the document including any estimates, quotes, valuations and analyses is based on reliable sources and, where applicable, industry appropriate methodology and software. Although the information in this document is provided in good faith, PF Olsen does not make any express or implied representations or give any warranties or guarantees as to the accuracy or completeness of the information. PF Olsen does not accept liability for any claim, action, cost, loss or damage arising directly or indirectly from use or reliance on the information in this document.

PF Olsen (Aus.) Pty Limited
Suite 6, 50 Upper Heidelberg Road | Ivanhoe | Vic | 3079 | Australia
T: 1800 054 659 | ausinfo@pfolsen.com | au.pfolsen.com

TABLE OF CONTENTS

1.	Introduction	4
1.1	Aim.....	4
2.	Methodology.....	4
2.1	Silvicultural regimes.....	5
2.2	Assumptions.....	6
2.3	Heat maps.....	6
3.	Results.....	7
3.1	Linear relationships.....	8
3.2	Derived NPV.....	9
4.	Conclusion.....	10
	Appendix A – Heat maps, timber only.....	11
	Appendix B – Heat maps, timber and carbon.....	17

1. Introduction

In May 2024, PF Olsen completed a project for the South and Central Queensland Forestry Hub (the Hub) in which the Hub region was assessed for plantation suitability. In addition, an economic analysis was conducted on a representative point for each of the defined species and regimes. This report is available from the Hub website¹.

Upon completion of the plantation land spatial suitability assessment (Stage 1), it was determined that further economic analysis would enable greater understanding of the results in a spatial context.

The main outcome of this Stage 2 project is to provide a spatial heat map dataset which can be utilised by the public to help inform their decision making around potential future land use options.

1.1 Aim

The aim of the project is to develop spatial heat maps that represent an indicative net present value (NPV) from timber and carbon within the combined plantation suitability classes 2 & 3 for each of the key species.

2. Methodology

The following method was developed to retain the assumptions used in the Stage 1 project. The silvicultural regimes and key assumptions are outlined in Sections 4.2 and 4.6 of the Stage 1 report. Maintaining the same assumptions between Stage 1 and 2 will allow for comparison between the projects where appropriate.

To meet the aim of this project, the following methodology was used:

1. Using the gridded Australian Carbon Credit Unit (ACCU) estimates from the previous project, we identified all the point locations that were within suitability classes 2 and 3 for each of the species and regimes (six in total, four species plus two additional regimes for the softwood species).
2. The points from within the suitability classes 2 and 3 for each species and regime were analysed for their ACCU estimations. The ACCU estimates were arranged in ascending order and a representative mid-point was selected from the first to ninth deciles, equalling 9 points per species and regime.

¹ Plantation land spatial suitability assessment - <https://www.qldforestryhubs.com.au/south-central-our-projects>

3. The economic model from Stage 1 was applied to these nine points per species and regime. The FullCAM outputs for each point were analysed using the same economic model from Stage 1.
4. The outputs of the economic modelling were analysed to determine a linear relationship between ACCU estimations and NPV.
5. This linear relationship was applied to all of the points which fall into suitability categories 2 & 3 for all species and regimes, to generate two NPV values (timber only & timber and carbon).
6. Heat maps were generated is based on the two NPV values (timber only & timber and carbon) for each of the species and regimes. This resulted in twelve unique heat maps.

The heat maps generated through this analysis were provided as a PDF map and in digital format. The softcopy data can be uploaded to a web map for public use.

2.1 Silvicultural regimes

The following silvicultural regimes (Table 1) were maintained from Stage 1 for all the plantation species. This ensures that the ACCU and volume estimates are consistent between the two projects.

Table 1- Silvicultural regimes

Species	Initial stocking (per ha)	Weed control spray	Fertiliser	Thinning age (yrs.)	Thin stocking (per ha)	Clearfall age (yrs)
FullCAM 2016- Plantation Method						
Southern pine - Low Rainfall	833	Yes	Yes	17	450	28
Southern pine - High Rainfall	1200	Yes	Yes	15	600	27
Hoop Pine- Thin	925	Yes	Yes	20	500	45
Hoop Pine- No Thin	800	Yes	Yes	n/a	n/a	45
Spotted gum	1000	Yes	Yes	10	250	35
Gympie messmate	1000	Yes	Yes	17	500	30

2.2 Assumptions

Table 2 summarises the key assumptions of the financial model used to determine the net present value (NPV) for each of the model points. These are also the same assumptions that were used in the Stage 1 project.

Table 2- Key assumptions summary

Type	Assumption	Commentary
Model area	20 hectares	As per Stage 1
Distance to mill	100kms	As per Stage 1
Carbon price	\$30	Spot price from Stage 1
Timber value	Variable by species and log product	As per Stage 1
Timber volume	As per FullCAM	
Timber product mix	As per FullCAM	
Discount rate	5%	As per Stage 1
Establishment costs	\$2000 per ha	As per Stage 1
Annual management costs	Not included	
Council rates	0.03% of land value	As per Stage 1
Land value	Fixed at \$8,000	As per Stage 1
Notional land rental	0.02% land value	As per Stage 1
Establish Plantation Govt Grant	n/a	Not included in NPV modelling for Stage 2

2.3 Heat maps

All of the heat maps use the same value scale for NPV (timber only or timber and carbon). This will allow for different species and regime heat maps to be compared like for like.

The following NPV value scales were used:

- Timber only (-\$110,000 to \$70,000) in \$10,000 increments
- Timber and carbon (-\$100,000 to \$375,000) in \$25,000 increments

All heat maps are presented in Appendix A and B.

3. Results

Table 3 presents the statistics of ACCU estimates for each of the species and regimes.

Table 3 – ACCU (tCO₂-e/ha) statistics for each species and regime

Species/regime	Average	Standard deviation	Minimum	Maximum
Messmate	444	89	102	741
Hoop No thin	348	151	137	1048
Spotted Gum	333	145	131	1005
Hoop Thin	297	129	117	894
Sth Pine Low	273	119	108	821
Sth Pine High	265	115	104	797

The ACCU and volume estimates from FullCAM for each representative point location were used in the economic model to derive an indicative NPV for timber only, and timber plus carbon.

The relationship between estimated ACCUs and NPV were analysed, and it was clear that there was a linear relationship between these two variables. An example of the linear relationship is provided in Figure 1.

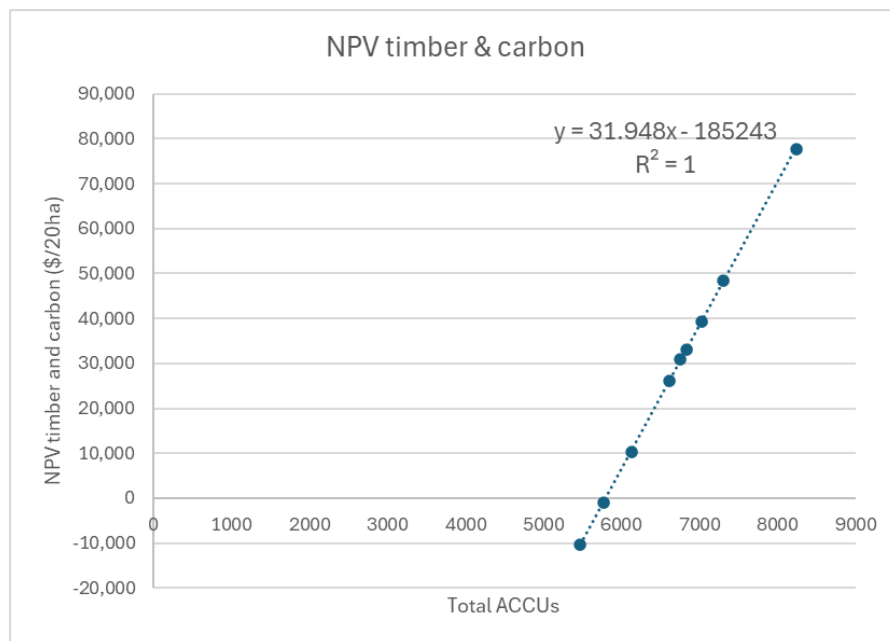


Figure 1- NPV vs ACCU for 20 ha of Gympie messmate (timber and carbon)

All of the species returned high R² values ranging from 0.95-1.00. From these relationships, linear equations were derived. These equations were applied to all model points for that species within the Hub region for suitability classes 2 & 3.

3.1 Linear relationships

The following linear equations were derived from the economic modelling results. These equations provide the NPV for a 20 hectare plantation.

$$NPV/20 \text{ ha} = (a \times B) - d$$

Where

B = Carbon ACCU estimate (tCO₂-e/ha)

Messmate	Timber only	Timber and carbon
a	11.652	31.948
d	129,831	185,243

Spotted gum	Timber only	Timber and carbon
a	10.746	28.625
d	144,947	186,238

Sth Pine High	Timber only	Timber and carbon
a	9.6323	27.813
d	136,768	178,383

Sth Pine Low	Timber only	Timber and carbon
a	7.9934	25.874
d	137,514	178,054

Hoop No thin	Timber only	Timber and carbon
a	8.3549	24.17
d	148,351	193,463

Hoop Thin	Timber only	Timber and carbon
a	10.352	27.642
d	145,947	191,894

Note: all linear relationships were derived from the NPV values outputted from the economic model **without** the government grant.

3.2 Derived NPV

Figure 2 and Figure 3 present a ‘box and whiskers’ plot of NPV by species and regime. Each box and whisker provide the following information:

- Mean - the ‘X’ within the box
- Median - the line within the box
- Bounds of the box - the bottom of the box is the median of the bottom half of the dataset (1st quartile) and the top of the box is the median of the top half of the dataset (3rd quartile)
- Whiskers - the minimum and maximum values of the dataset (ignoring outliers)
- Outliers - those values that are outside the interquartile range.

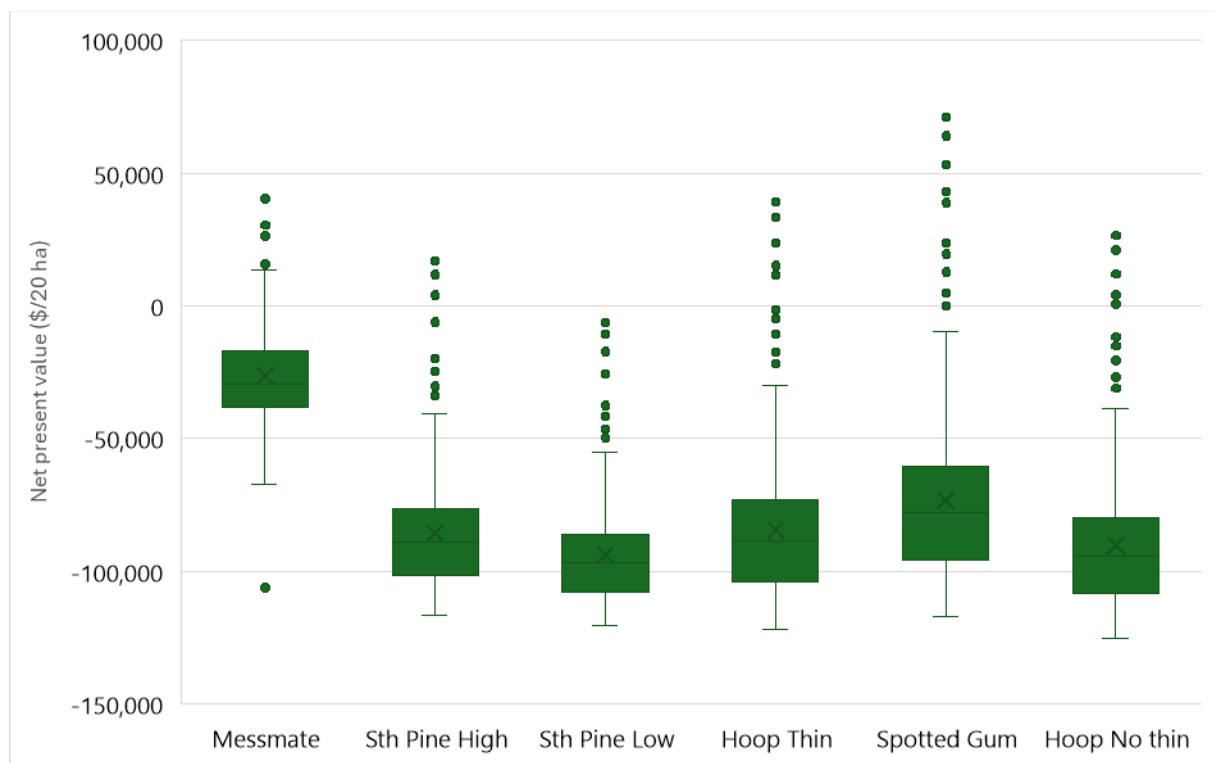


Figure 2 - Box and whisker plot of NPV per 20 ha for timber only

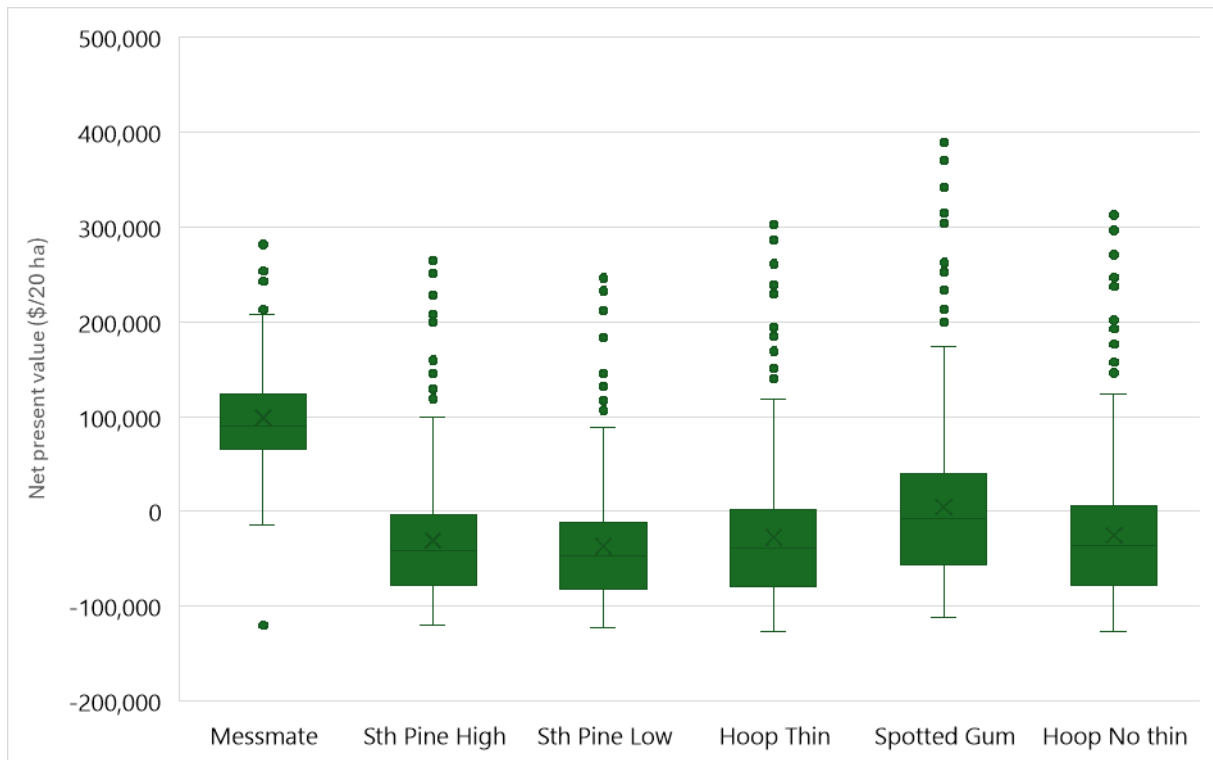


Figure 3 - Box and whisker plot of NPV per 20 ha for timber and carbon

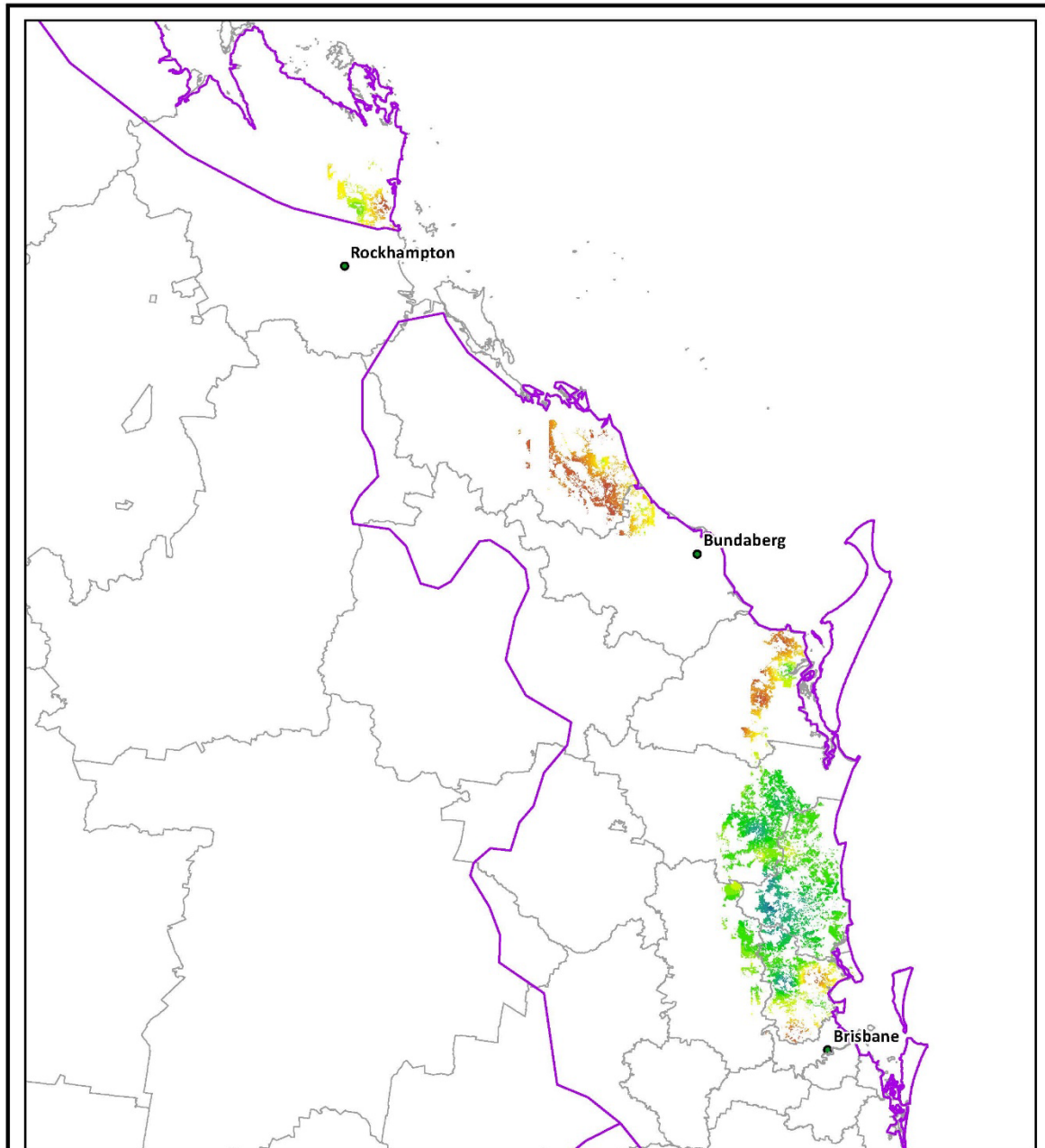
The figures above demonstrate that, even in the areas identified as most suitable for that species, there are many instances where the NPV is negative. However, there are also plenty of examples where the NPV is positive for all species and regime combinations when carbon values are included. This highlights the importance of site selection, detailed FullCAM analysis and thorough economic analysis on a case-by-case basis.

4. Conclusion



This Stage 2 project has demonstrated that, under fixed input cost and product value assumptions, there is a linear relationship between estimated ACCUs and estimated NPV. This outcome meant that a model could be developed for each of the species and regimes that converted ACCUs to NPV for any given location within the Hub region.

The main outcome of this project is the generation of heat maps showing estimated NPV within the most suitable areas for each of the species. These heat maps are available on the Hub’s online map viewer.

Appendix A – Heat maps, timber only



Messmate - NPV Timber Only (Site Classes 2&3)

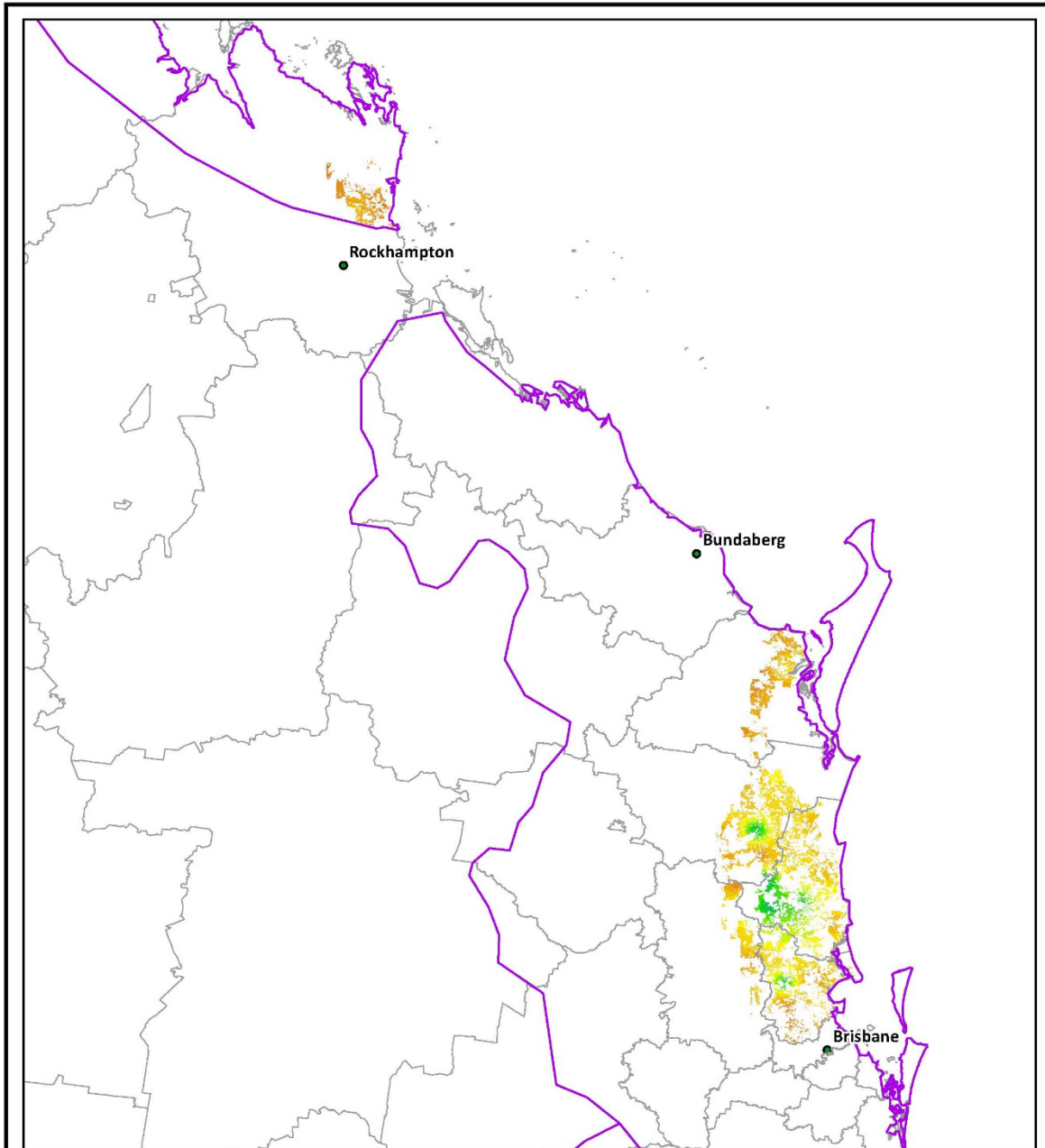
 Local Government Areas	 -70,000 - -60,000	 0 - 10,000
 NPI_Regions	 -60,000 - -50,000	 10,000 - 20,000
 -115,000 - -110,000	 -50,000 - -40,000	 20,000 - 30,000
 -110,000 - -100,000	 -40,000 - -30,000	 30,000 - 40,000
 -100,000 - -90,000	 -30,000 - -20,000	 40,000 - 50,000
 -90,000 - -80,000	 -20,000 - -10,000	 50,000 - 60,000
 -80,000 - -70,000	 -10,000 - 0	 60,000 - 70,000



Date: 23/12/2024
Author: hodge
Projection: GCS GDA 1994
Scale: 1: 3,000,000@A3



Map Disclaimer: This product is distributed as is, without warranties of any kind either expressed or implied, included but not limited to warranties of suitability to a particular purpose or use. This map is intended for use only at the published scale. This map was compiled using data believed to be correct at the time of printing. A degree of error is inherent in all maps.



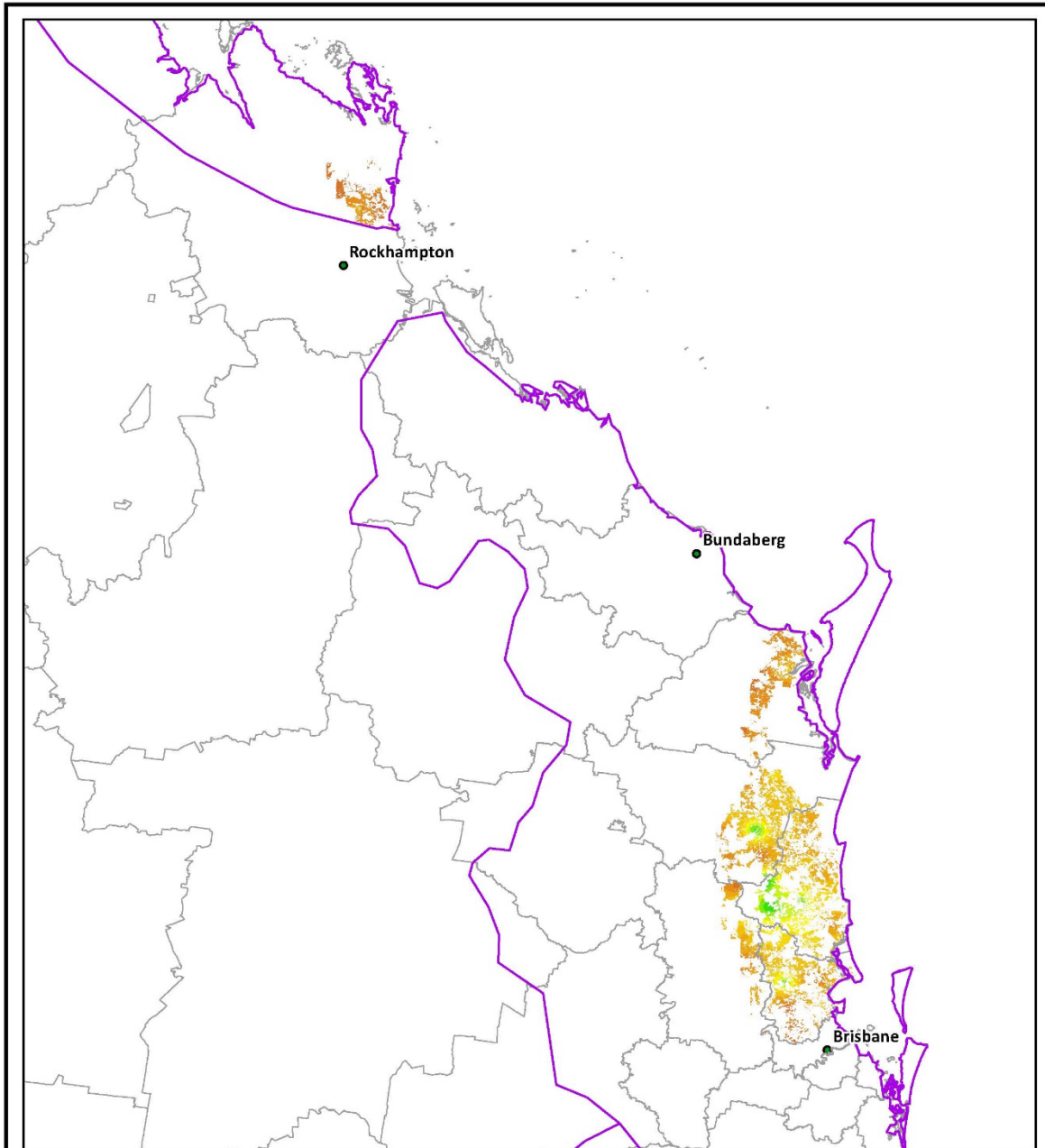
Southern Pine High rainfall - NPV Timber Only (Site Classes 2&3)



Date: 23/12/2024
Author: hodge
Projection: GCS GDA 1994
Scale: 1: 3,000,000@A3



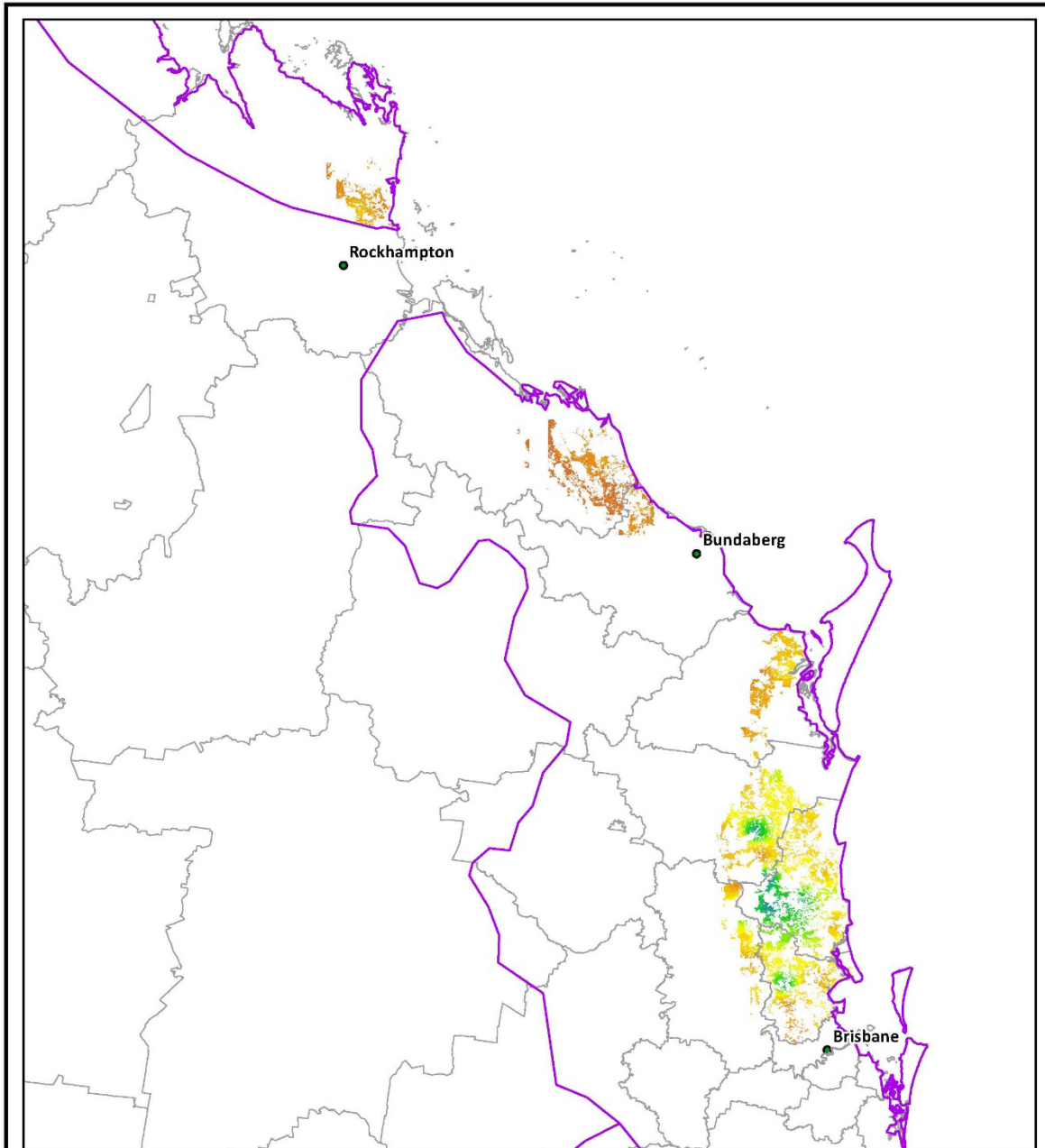
Map Disclaimer: This product is distributed as is, without warranties of any kind either expressed or implied, included but not limited to warranties of suitability to a particular purpose or use. This map is intended for use only at the published scale. This map was compiled using data believed to be correct at the time of printing. A degree of error is inherent in all maps.



Southern Pine Low rainfall - NPV Timber Only (Site Classes 2&3)




Map Disclaimer: This product is distributed as is, without warranties of any kind either expressed or implied, included but not limited to warranties of suitability to a particular purpose or use. This map is intended for use only at the published scale. This map was compiled using data believed to be correct at the time of printing. A degree of error is inherent in all maps.



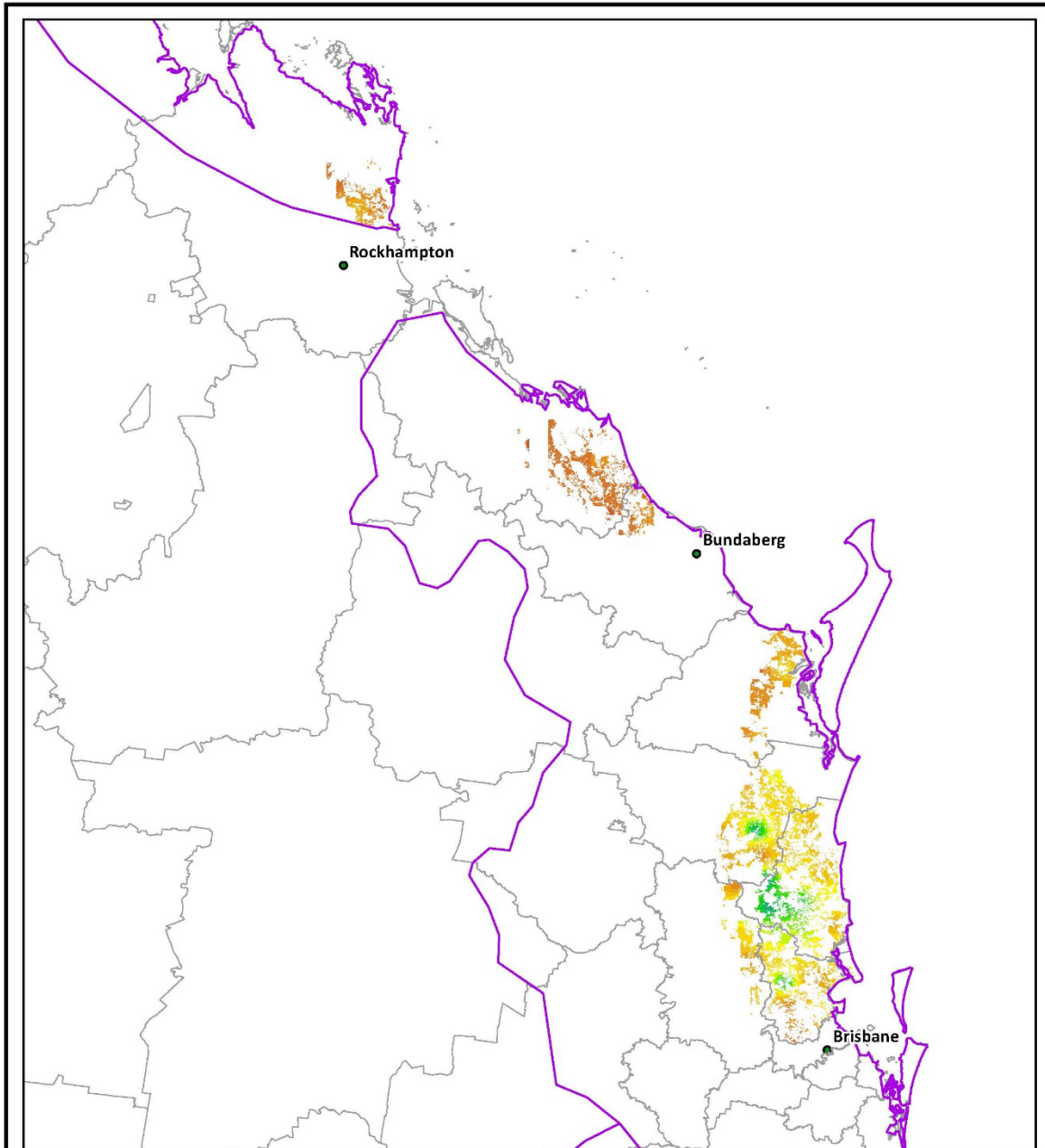
Hoop Pine Thin - NPV Timber Only (Site Classes 2&3)



Date: 23/12/2024
Author: hodge
Projection: GCS GDA 1994
Scale: 1: 3,000,000@A3




Map Disclaimer: This product is distributed as is, without warranties of any kind either expressed or implied, included but not limited to warranties of suitability to a particular purpose or use. This map is intended for use only at the published scale. This map was compiled using data believed to be correct at the time of printing. A degree of error is inherent in all maps.

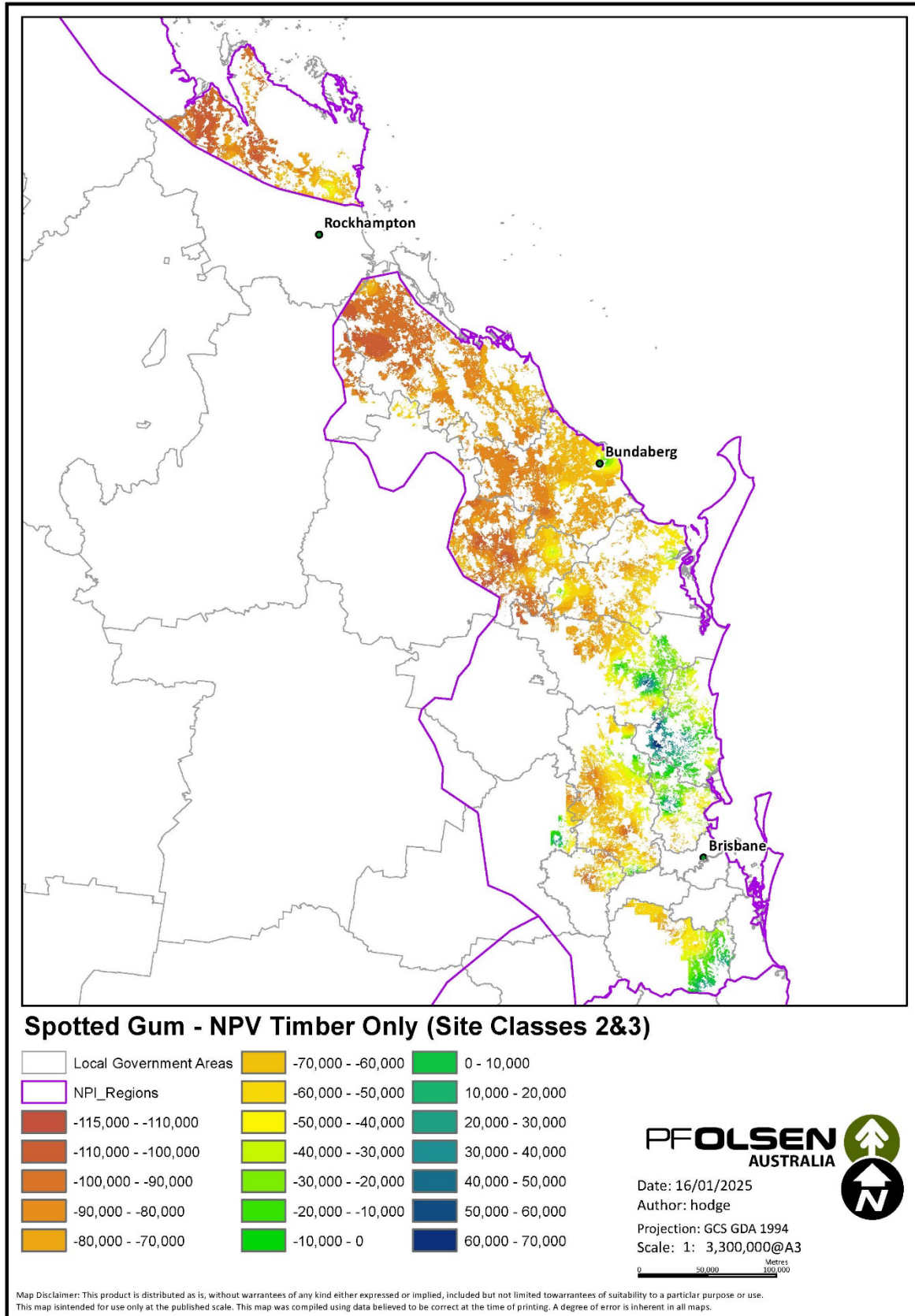


Hoop Pine No thin - NPV Timber Only (Site Classes 2&3)

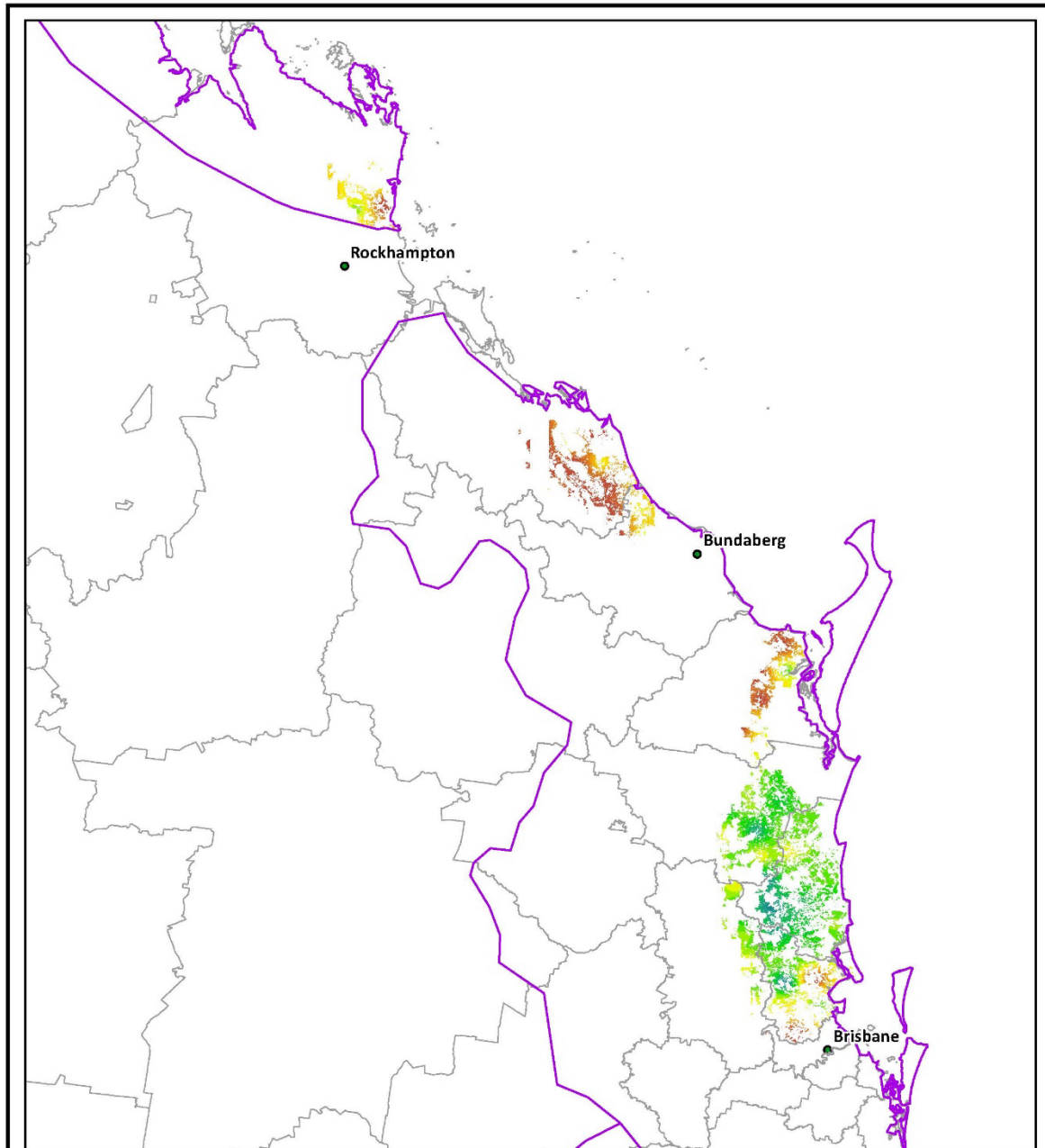
 Local Government Areas	 -70,000 - -60,000	 0 - 10,000
 NPI_Regions	 -60,000 - -50,000	 10,000 - 20,000
 -115,000 - -110,000	 -50,000 - -40,000	 20,000 - 30,000
 -110,000 - -100,000	 -40,000 - -30,000	 30,000 - 40,000
 -100,000 - -90,000	 -30,000 - -20,000	 40,000 - 50,000
 -90,000 - -80,000	 -20,000 - -10,000	 50,000 - 60,000
 -80,000 - -70,000	 -10,000 - 0	 60,000 - 70,000



Map Disclaimer: This product is distributed as is, without warranties of any kind either expressed or implied, included but not limited to warranties of suitability to a particular purpose or use. This map is intended for use only at the published scale. This map was compiled using data believed to be correct at the time of printing. A degree of error is inherent in all maps.



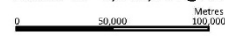
Appendix B – Heat maps, timber and carbon



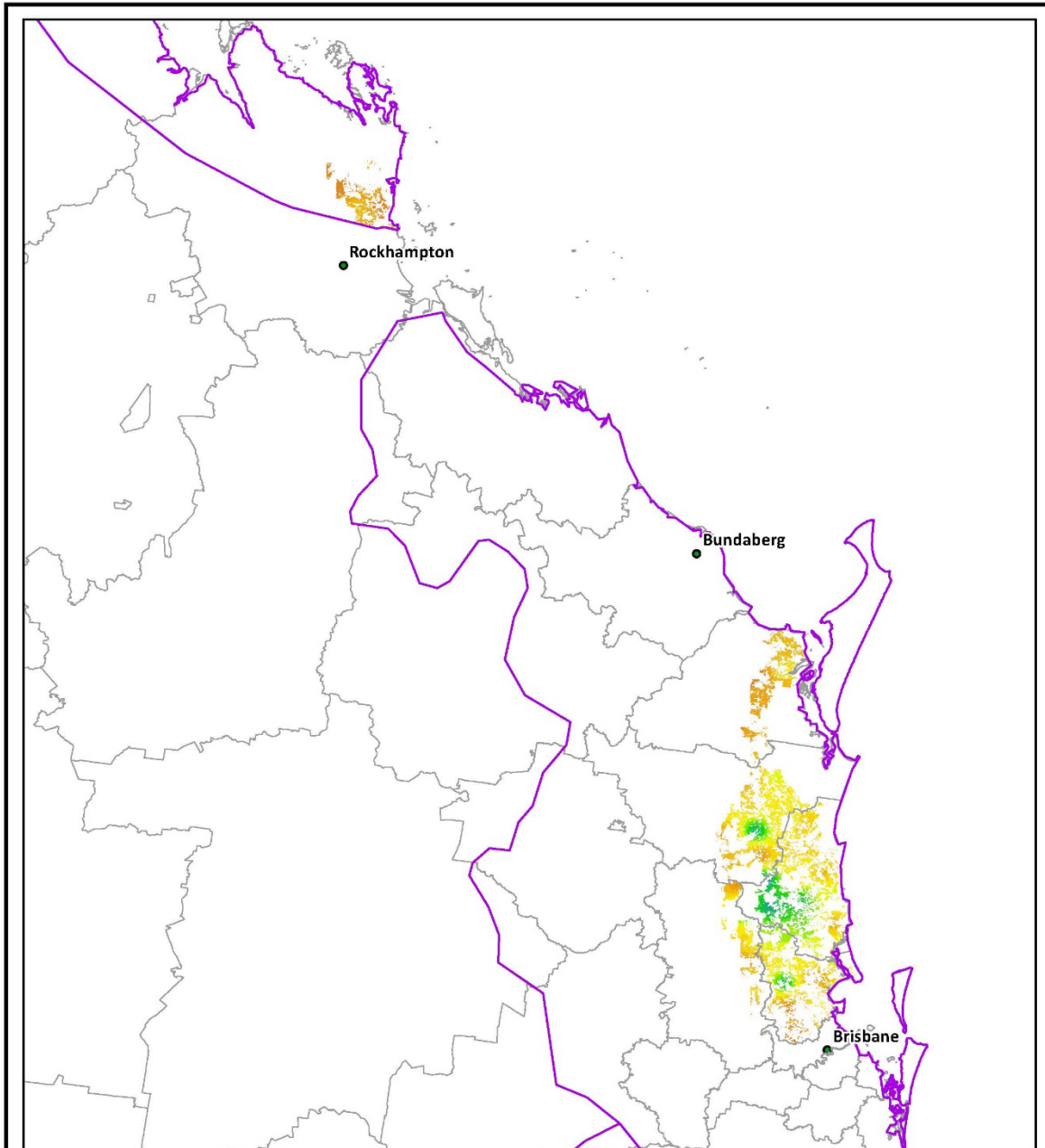
Messmate - NPV Timber & Carbon (Site Classes 2&3)



Date: 23/12/2024
Author: hodge
Projection: GCS GDA 1994
Scale: 1: 3,000,000@A3






Map Disclaimer: This product is distributed as is, without warranties of any kind either expressed or implied, included but not limited to warranties of suitability to a particular purpose or use. This map is intended for use only at the published scale. This map was compiled using data believed to be correct at the time of printing. A degree of error is inherent in all maps.



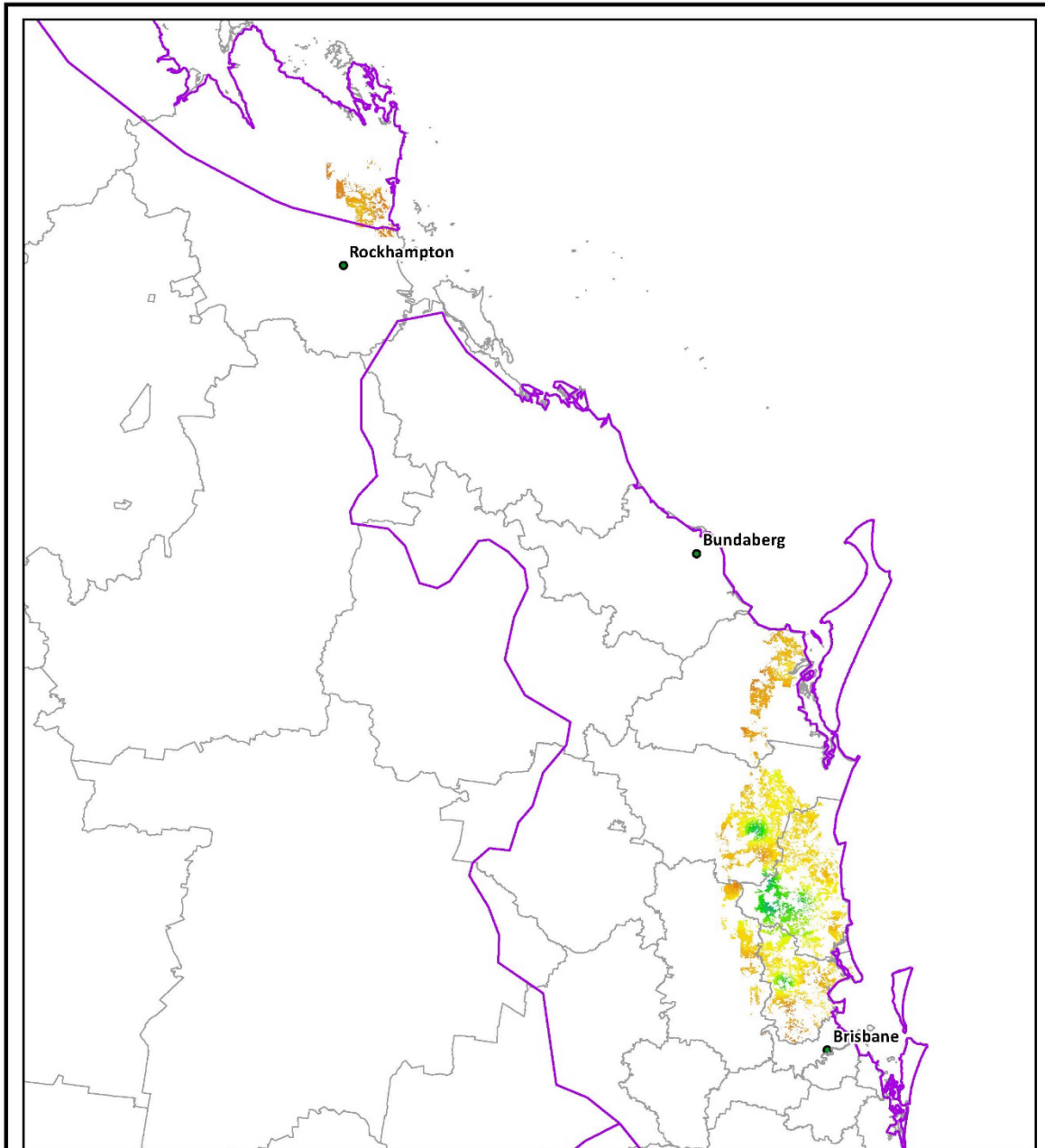
Southern Pine High rainfall - NPV Timber & Carbon (Site Classes 2&3)



PFOLSEN AUSTRALIA 



Date: 23/12/2024
 Author: hodge
 Projection: GCS GDA 1994
 Scale: 1: 3,000,000@A3


Map Disclaimer: This product is distributed as is, without warranties of any kind either expressed or implied, included but not limited to warranties of suitability to a particular purpose or use. This map is intended for use only at the published scale. This map was compiled using data believed to be correct at the time of printing. A degree of error is inherent in all maps.

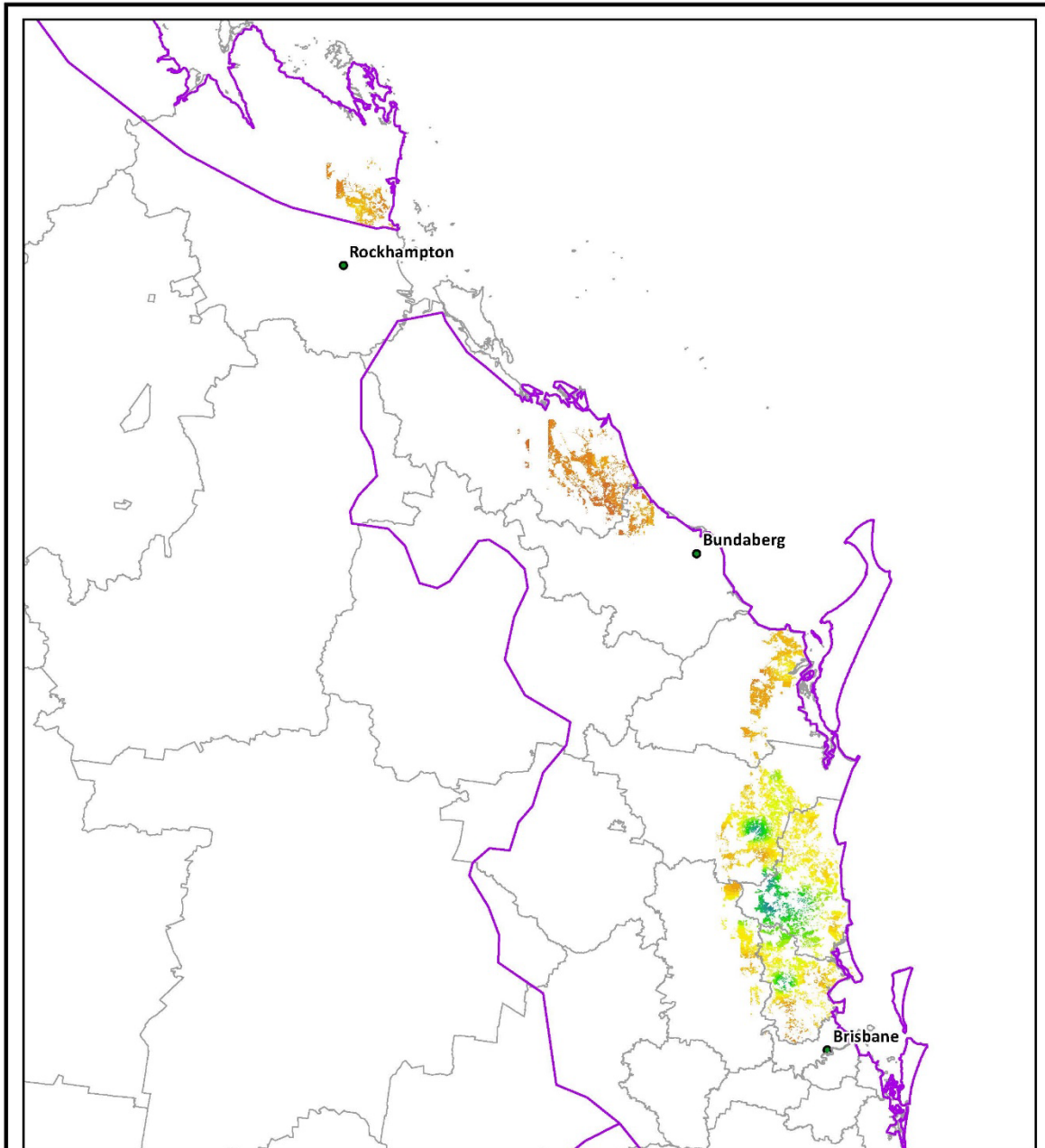


Southern Pine Low rainfall - NPV Timber & Carbon (Site Classes 2&3)



Date: 23/12/2024
Author: hodge
Projection: GCS GDA 1994
Scale: 1: 3,000,000@A3


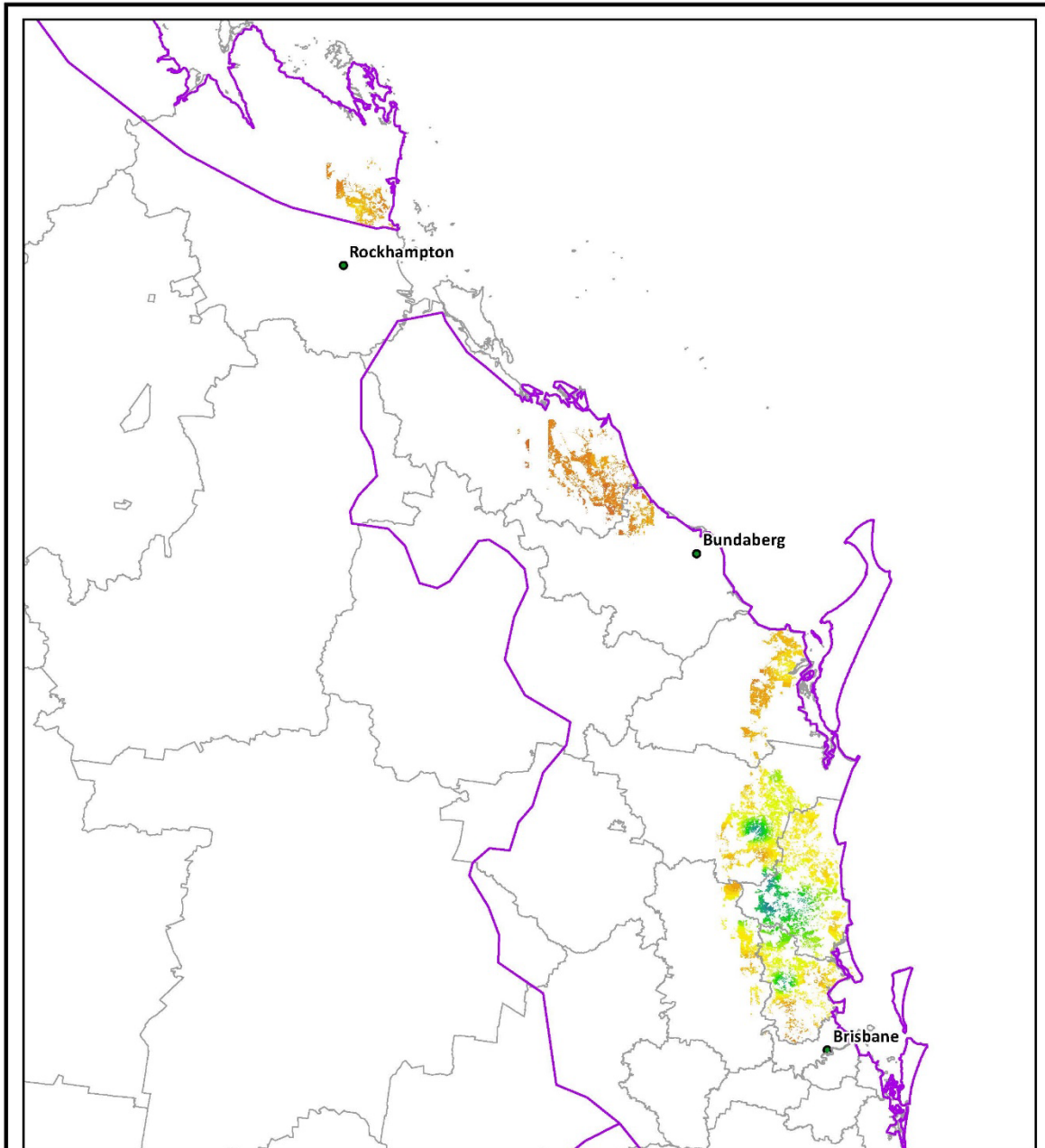
Map Disclaimer: This product is distributed as is, without warranties of any kind either expressed or implied, included but not limited to warranties of suitability to a particular purpose or use. This map is intended for use only at the published scale. This map was compiled using data believed to be correct at the time of printing. A degree of error is inherent in all maps.



Hoop Pine Thin - NPV Timber & Carbon (Site Classes 2&3)






Map Disclaimer: This product is distributed as is, without warranties of any kind either expressed or implied, included but not limited to warranties of suitability to a particular purpose or use. This map is intended for use only at the published scale. This map was compiled using data believed to be correct at the time of printing. A degree of error is inherent in all maps.



Hoop Pine No thin - NPV Timber & Carbon (Site Classes 2&3)



PFOLSEN AUSTRALIA 


Date: 23/12/2024
 Author: hodge
 Projection: GCS GDA 1994
 Scale: 1: 3,000,000@A3


Map Disclaimer: This product is distributed as is, without warranties of any kind either expressed or implied, included but not limited to warranties of suitability to a particular purpose or use. This map is intended for use only at the published scale. This map was compiled using data believed to be correct at the time of printing. A degree of error is inherent in all maps.

