Independent validation of land-use change from pastoral farming to large-scale forestry

November 2021

Orme & Associates Limited

Client Report

Update of land-use change from pastoral farming to large-scale forestry for 1st and 2nd quarter 2021

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Executive Summary

Orme & Associates has been commissioned by Beef + Lamb New Zealand to:

REVIEW AND UPDATE the Land Use change on Pastoral Farms report provided through BakerAg on a six-monthly basis.

This report covers the period **1/1/2021 to 30/6/2021** and also includes a limited number of properties allocated against 2020 that were not recorded in the original report, due to timing issues with settlement dates, and probable effect of COVID-19 restrictions during the latter part of 2020 affecting conditional clauses.

134 rural properties classified as Pastoral or Forestry were identified as changing hands during the first two quarters of 2021. Of these 19 (14%) met the criteria for inclusion in the report as potentially being converted from pastoral to afforestation.

Whole farms identified as purchased for potential afforestation

The first six months of 2021 ending 30/6/2021 are tabled below:

Expected Purpose by Entity	2021		2021 Total Area (Hectares)	% of Total Area
	Qtr1	Qtr2		
Honey	2634		2634	19%
Carbon Forestry	2300	1270	3570	25%
Forestry	2573	1326	3899	27%
Forestry OIO	1402	2714	4116	29%
Grand Total (Hectares)	8909	5310	14219	100%

The results of our review estimate:

1. The gross land area of whole farms purchased in the first six months of 2021 for planting is estimated at **14,219 ha**. (11,585 ha Exotic and 2634 ha Honey)
2. Approximately 2,634 ha gross land area is identified for Honey operations.
3. Approximately 3,570 ha gross land area is identified as purchased by a known Permanent Carbon Entity.
4. Approximately 4,116 ha gross land area is identified through the OIO decision summaries.
5. The balance of 3,899 ha gross land area is assumed to be for domestic purchasers interested in both forestry and carbon.

The data was based on sales that could be verified during the stated period.

In addition, further sales of 8,832 hectares have also been added for the 2020 year after the release of our initial report in August 2021. This increased the 2020 results in our previous report to 28,159 ha.

The areas identified in the updated 2020 year include sales that emerged confirmed, as a result of timing issues around the OIO approvals process and apparent conditional domestic sales in November/December 2020 that have since settled. Using the methodology summarised, the updated results for the period 1/1/2020 - 31/12/2020 are:

Expected Purpose by Entity	2020				**2020 Total (Hectares)**	% of Total Area
	Qtr1	Qtr2	Qtr3	Qtr4		
Honey	0	0	0	3295	**3295**	12%
Carbon Forestry	1748	1275	1610	7949	**12582**	45%
Forestry	1900	0	1304	3318	**6522**	23%
Forestry OIO	0	1933	1521	2306	**5760**	20%
Grand Total	**3648**	**3208**	**4435**	**16868**	**28159**	**100%**

If a rolling twelve-month average sales period is adopted, then for the period 1/7/2020 – 31/6/2021:

Expected Purpose by Entity	2020/2021				**Total (Hectares)**	% of Total Area
	Qtr3	Qtr4	Qtr1	Qtr2		
Honey	0	3295	2641	0	**5936**	17%
Carbon Forestry	1610	7949	2291	1278	**13128**	37%
Forestry	1304	3318	2599	1328	**8549**	24%
Forestry OIO	1521	2306	1400	2709	**7936**	22%
Grand Total	**4435**	**16868**	**8931**	**5315**	**35549**	**100%**

Emerging trends

LUCAS 2016 layer summary

Analysis of the 2016 LUCAS layers of the properties identified since the last report suggest:

80.7% (vs 65.7% in the 2017-20 period) of the whole farms sold into forestry were in clear pasture,

5.1% (6.7%) in potentially reverting country and

14.0% (27.5%) in either exotic or indigenous forest species.

This would appear to indicate a shift in the overall characteristics of the land changing hands from the initial reporting period (2017-2020) with 13.5% less vegetation overall, on those properties traded.

LUC classification summary

Further analysis of properties in this sample found that:

91.0% (90.4%) in our assessment of land being identified for conversion, since the initial report, is land of LUC 6 and above.

72.6% (52.0%) of the area is in LUC 6,

18.1% (36.7%) in LUC 7 and 0.2% (1.7%) in LUC 8.

Classes 2-5 have decreased from 9.5% to 9.0%.

Although a small shift in LUC from 7 to 6, when combined with the changes in the LUCAS classification, it appears to signal more productive land in the market being purchased for afforestation purposes.

Erosion Susceptibility Classification summary

In terms of Erosion Susceptibility Classification (ESC), the land falls into the four main ESC classes as follows:

ESC Class	1/1/2021 to 30/6/2021	1/1/2020 to 31/12/2020
Low	42.4%	28.2%
Medium	43.7%	35.8%
High	13.3%	26.0%
Very High	0.6%	9.9%

It is noted that there appears to have been a shift in the ESC classification of the land transacted in this 2021 period, compared to the initial report 2020, with a reduction in the Very High ESC and an increase in Low and Moderate class land.

Location

With the increased carbon (cash) flows available to forest plantings, forestry is cementing itself as an even more attractive option. This has increased since July 2021, with the movement of the spot price for carbon reaching ~$65.40 on 9/9/21, from ~$43.50 on 30/06/21.

The locational spread across the country of the properties, signals that more areas are being considered for conversion, with a lift in the area of properties being traded in the South Island, which is a notable shift in the previous trend as prices rise significantly in the North Island. Although outside of this reporting period an additional 8,015 ha has been approved through the OIO for the South Island and 982 ha for the North Island in the July and August decision summaries.

Land-use Change

Land prices in most regions have continued to climb. While this is positive for the landowners concerned, as it also lifts the equity value of other properties in the area, the increased carbon price is likely to see more pressure on land for conversion to forestry.

1. Introduction

Orme & Associates has been commissioned by Beef + Lamb New Zealand to:

"Update and track the amount of land that has been or will be planted into exotic plantation species in the near future that is likely to take land out of pastoral production".

The project initially involved a comprehensive review of available land-use-change data, to provide up-to-date statistics on the areas of land being from converted from pastoral farming into forestry under different ownership models, grant programmes and owner objectives for the period 1/1/2017 to 31/12/2020. This was tabled as the "*Land-use change from pastoral farming to large-scale forestry"* prepared through BakerAg.

To provide a benchmark for 'whole of farm' purchase we analysed all sales of 250 ha or more to be consistent with the process for the original report.

Plantable area (effective forest land) was calculated using the LUCAS layer classifications to identify pastural land available to change on each property, again consistent with the initial report methodology.

Land Use Capability (LUC) Classification was obtained by intersecting the property titles with the NES layer.

After the release of the report it was discovered that part of the area attributed to the Crown Forestry Joint Venture programme within the 1BT fund, included approximately 9,144 ha of cutover area and therefore not technically pastoral land being converted.

This did not affect the area sold into probable afforestation which formed the basis of the report, but is a material difference in what we thought had been planted within farm.

When combined with the updated sales information from this update, the table is represented as below:

Whole of Farm Purchase	Year				Q1 & 2	Grand Total (Hectares)	Percentage by Conversion
	2017	2018	2019	2020	2021		
Honey (Manuka)	3039	7340	1678	3295	2634	17986	15.6%
NZ Sales	2510	11245	26198	19104	7469	66526	57.6%
OIO	1455	8982	10626	5760	4116	30939	26.8%
Total Whole of Farm	7004	27567	38502	28159	14219	115451	100.0%
Partial farm plantings by Landowner through 1BT/JV							
1BT Landowner Grant		12,124 Indigenous + 13,434 Exotic				25560	66.8%
Crown Forestry JV		21,822 orginal-9,144 cutover				12678	33.2%
Total Partial farm funded		47382				38238	100.0%
Totals						153689	

Table 1: Updated data for whole farms and partial farm new planting areas, December 2020

2. Methodology

Once again, a review of land sales recorded through real-estate records was undertaken for the period 1/1/2020 to 30/6/21. This was then compared to properties previously recorded and also the OIO website to cross reference and identify any omissions or time delays and sales dates recorded.

The table below shows 14,219 hectares of sheep and beef farm sales were sold to forestry related companies in 2021 and additional 8,833 hectares in farm sales were recorded in 2020 following the release of our previous report in August 2021.

Expected Purpose by Entity	Additional Properties by Quarter (Qtr)									2017-2020 Comparison
	2020			2020 Total (Hectares)	2021		2021 Total (Hectares)	**Grand Total (Hectares)**	% by Conversion	
	Qtr2	Qtr3	Qtr4		Qtr1	Qtr2				
Honey	0	0	0	0	2634	0	2634	**2634**	11.4%	15.6%
Carbon Forestry	0	0	4306	4306	2300	1270	3570	**7876**	34.2%	28.8%
Forestry	0	326	1349	1674	2573	1326	3899	**5574**	24.2%	27.5%
Forestry OIO	689	1020	1143	2852	1402	2714	4116	**6968**	30.2%	28.1%
Grand Total	689	1346	6798	8833	8909	5310	14219	**23052**	100.0%	100.0%

Table 2: Land sale data from 01/01/21 to 30/06/21

This results in an updated 2020 table as below:

Expected Purpose by Entity	2020				**2020 Total (Hectares)**	% of Total Area
	Qtr1	Qtr2	Qtr3	Qtr4		
Honey	0	0	0	3295	**3295**	12%
Carbon Forestry	1748	1275	1610	7949	**12582**	45%
Forestry	1900	0	1304	3318	**6522**	23%
Forestry OIO	0	1933	1521	2306	**5760**	20%
Grand Total	**3648**	**3208**	**4435**	**16868**	**28159**	**100%**

When combined with the sales identified for 2021 subtle changes in the purchase patterns emerge:

Expected Purpose by Entity	**2020**				**2020 Total (Hectares)**	**% of Total Area**	**Q1 & Q2 2021 Area**	**% of 2021 Area**
	Qtr1	**Qtr2**	**Qtr3**	**Qtr4**				
Honey				3295	**3295**	12%	**2634**	19%
Carbon Forestry	1748	1275	1610	7949	**12581**	45%	**3570**	25%
Forestry	1900		1304	3318	**6522**	23%	**3899**	27%
Forestry OIO		1933	1521	2306	**5760**	20%	**4116**	29%
Grand Total (Hectares)	**3648**	**3207**	**4435**	**16869**	**28159**	**100%**	**14219**	**100%**

Sales that showed up as having been completed within the 2020 year but were not included in the initial August report, have been included in this analysis.

An analysis of the detail behind these sales showed that several OIO sales were approved in 2021 decisions. OIO decisions from July and August 2021 also show an additional 3,498 ha and 5,499 ha respectfully approved, however, this is outside of this reporting period and not included in this analysis at this stage.

Domestic sales recorded for the last quarters of 2020 related to November/December agreement dates that appeared not to settle and be reported (most likely due to conditional clauses) until 2021. As mentioned in the initial report there was an expectation that delays due to COVID-19 restrictions, could have an impact on the reporting timeframes.

Maps of land acquisitions

Indicative Regional maps of all properties identified in this review are included in the Appendices.

The maps show that in the South Island, initial land acquisitions identified for forestry were generally widely scattered, however, as additional properties change hands there appear to be clusters and natural groupings starting to emerge in the Otago region (see maps 5 & 6). Additional sales reported in the July/August OIO summaries will add to this pattern.

In contrast, the North Island map, which had showed some major clusters of properties in the initial report (especially around existing afforestation areas) that were likely to be converted from sheep and beef farming to radiata pine, has seen a spreading of the sales pattern into other regions.

3. Land Type Affected

3.1 Areas of land being converted to forestry by LUC Class

We analysed the Land Use Capability (LUC) Classification data for properties identified in several ways, including by owner and by region.

The LUC system is an assessment of the land's capability for use, which '*takes into account its physical limitations and its versatility for sustained production*'.

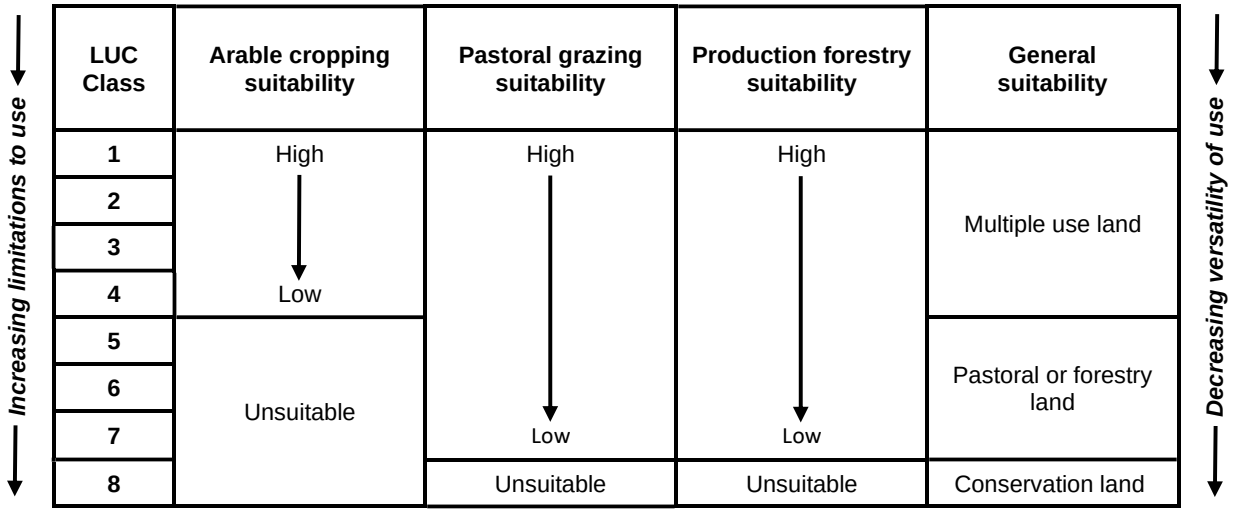


Figure 1: Increasing limitations to use and decreasing versatility of use from LUC Class 1 to LUC Class 8

Land Use Capability (LUC) Classification and **Erosion Susceptibility Classification (ESC)** layers were intersected on top of the property title layers. This again produced a data set with accurate estimates of the areas of land in different LUC and ESC classes on all the properties identified for the period concerned.

Region	Land Use Classification (LUC) Band								Grand Total
	2	3	4	5	6	7	8	Other	
North Auckland	0	0	55	0	171	109	0	0	**334**
South Auckland	32	44	125	0	2634	680	9	0	**3524**
Hawkes Bay	52	182	154	0	3529	856	0	0	**4774**
Wellington	0	187	236	0	3582	968	7	1	**4980**
Marlborough	0	16	31	0	1775	507	25	1	**2354**
Nelson	0	0	0	0	462	389	0	0	**852**
Canterbury	0	0	57	0	562	659	0	0	**1278**
Otago	0	53	622	0	3612	15	0	0	**4302**
Southland	23	126	89	0	417	0	0	0	**655**
Grand Total	**107**	**608**	**1368**	**0**	**16743**	**4182**	**41**	**3**	**23052**
% of Total	0.5%	2.6%	5.9%	0.0%	72.6%	18.1%	0.2%	0.0%	**100.0%**
% 2017-2020	0.1%	3.1%	5.4%	0.9%	52.0%	36.7%	1.7%	0.1%	**100.0%**

Table 3: Summary of all LUC areas due for conversion to forestry

When compared to the LUC percentages from the initial report, a subtle change in the classification is starting to emerge with more Class 6 land and less Class 7 land being involved.

3.2 Areas of land being converted to forestry by ESC

Table 4 shows the areas of land by region under the different ESC categories going into forestry. Here we see a more even split between land in the three main ESC classes – low, moderate, and high – with only a small percentage of 'Very high' (i.e. highly erodible land) being destined for planting. This represents a slight departure from the previous 4-year profile possibly reflecting a reduction in 'harder' farmland for sale due to an earlier transition.

Region	Erosion Susceptability Class (ESC)					Grand Total (Hectares)
	Low	Moderate	High	Very High	Other	
North Auckland	61	164	109	0	0	334
South Auckland	618	2478	428	0	0	3524
Hawkes Bay	1516	1524	1608	126	0	4774
Wellington	1072	3227	673	7	1	4980
Marlborough	1822	278	254	0	1	2354
Nelson	462	389	1	0	0	852
Canterbury	619	659	0	0	0	1277
Otago	2955	1346	0	0	0	4302
Southland	646	9	0	0	0	655
Grand Total	9771	10074	3071	133	2	23052
% of Total	**42.4%**	**43.7%**	**13.3%**	**0.6%**	**0.0%**	**100.0%**
% 2017-2020	28.2%	35.8%	26.0%	9.9%	0.0%	100.0%

Table 4: Areas of land (ha) being converted to plantation forestry by Erosion Susceptibility Classification

Historically, steeper land has been purchased by forestry interests due to its availability/lesser interest from farming and/or for environmental reasons. Carbon forestry (where radiata pine is planted but there is no intention to harvest the trees) and mānuka are two further options which are now attractive on some of this most challenging of ESC classes.

Under the National Environmental Standard for Plantation Forestry (NES-PF) assessment, some of this land in Very High (red) and High (orange) zones cannot be planted for production forestry without resource consent – which would likely be given once roading and harvest plans were affirmed as being adequate to avoid the consequences of questionable steep land forestry practice seen in recent years in, for example, the Tolaga Bay and Nelson areas.

3.3 Comment: the value of LUC, ESC and LUCAS information

The LUC and ESC systems are both now well-established as descriptors of topography and erosion susceptibility and are used extensively to regulate and guide land use. They also inevitably influence the perceived and actual value of land on the open market.

Hill country farms in New Zealand are traditionally made up of a large percentage of LUC Classes 5, 6 and 7 land and some of these are very profitable. It is fair to say however, that the steeper the land (i.e. higher LUC and ESC classes), the higher the production costs to generate the same farming output per hectare compared with land in lower LUC/ESC classes. The same can be said of forestry, where, within reason, while land productivity is less sensitive to topography and erosion potential, costs of production are sensitive to these site

factors. Some of the country's best forest growth rates are seen on steep to very steep land in areas of moderate to high erodibility in the eastern North Island.

Equally, there are farms on lower LUC land that due to climatic conditions, choice of farming approach and other factors, are not as profitable as might be expected. However, the data suggests that forestry investors understand and remain confident of the potential of land in high LUC/ESC classes in the price range at which the land is currently available.

A shortage of properties and a continued rise in the value of carbon is seeing demand and price points trend steadily upwards with requests from Real estate agents looking for land in some districts, starting at $14,000 to $16,000/ha.

3.4 LUCAS Layer Analysis

As well as the ESC and LUC analysis undertaken, property shapefiles were intersected with the 2016 LUCAS Layer.

LUCAS 2016 Layer	Auckland	Hawkes Bay	Wellington	South Island	**Grand Total**	% of Total 1st & 2nd Qtr 2021	% 2017-2020
Cropland - Annual	0	0	0	0	**0**	0.0%	0.1%
Grassland - High producing	2018	2950	2189	1657	**8814**	38.2%	24.2%
Grassland - Low producing	1170	1550	1495	5583	**9798**	42.5%	41.4%
Grassland - With woody biomass	101	94	314	673	**1181**	5.1%	6.7%
Natural Forest	514	85	364	770	**1733**	7.5%	16.1%
Planted Forest - Pre 1990	29	51	77	277	**435**	1.9%	2.5%
Post 1989 Forest	10	38	535	472	**1054**	4.6%	8.9%
Other	0	0	0	5	**5**	0.0%	0.0%
Settlements or built-up area	0	1	0	0	**1**	0.0%	0.0%
Wetland - Open water	2	4	6	3	**15**	0.1%	0.1%
Wetland - Vegetated non forest	14	0	0	0	**14**	0.1%	0.0%
Grand Total	3858	4774	4980	9440	**23052**	100.0%	100.0%

Table 5: LUCAS 2016 layer

3.5 Distance to the nearest port

Historically, beyond a certain distance and depending on a range of variable factors including the log price, harvesting costs, transport costs and shipping costs, it becomes less economic to transport logs to the port for export.

This influences the value of traditional forestry land, however, with the increasing price of carbon, the economics of the entire cycle has greatly improved the returns from the first crop and provided increased confidence in pricing decisions.

In the initial report, properties were identified between 150 km and 200 km from the nearest port. Forests closer than 150 km to a port are those expected to be most likely managed for both timber and carbon revenues (based on current industry log revenues and costs), unless purchased by entities that have a carbon-only focus from the outset.

With the rise in the price of carbon since 31/12/2020, to a large degree, distance to market has impacted the decisions less, however, this may lead to possibly longer rotations and/or carbon only management regimes,

which will affect log supply going forward, so is potentially an issue for the traditional production forest industry in New Zealand.

Areas registered as permanent forestry within the post-1989 Emissions Trading Scheme (ETS), with a progressive production thinning regime, while maintaining the ‘forest land’ definition of 30% canopy cover, are expected to become attractive options.

4. Discussion

4.1 Why is farmland continuing to be sold?

With projected returns on forestry investments increasing due to the addition of carbon revenues, ‘forestry’ is now able and prepared to pay more for the land than ‘traditional farming’, and as forestry buyers have arrived on the scene, some landowners have chosen to take the opportunity to benefit, with the time being right to move on to the next farm or next stage in life.

Based on the initial sales information for 2017-2020 this appeared to represent land of the higher ESC and LUC, with areas of existing vegetation sitting at 27.5% of total land area.

In this update of the sales information, this has fallen to 14.0% and the % of high producing grassland has risen to 38.2% from a previous level of 24.2%.

The evidence would, on the surface, suggest that the price of carbon has certainly had an increased effect on not only the land values, but also the type of land that is able to be traded, as demand remains to purchase and the properties with lesser effective areas are taken up.

While this is making it attractive for some existing landowners to exit the industry or move onto better land, the potential for increased afforestation of pastoral land is real, and the area appears to be increasing with the rolling 12-month sales information showing combined sales of 35,549 hectares.

Expected Purpose by Entity	2020/2021				**Total (Hectares)**	% of Total Area
	Qtr3	Qtr4	Qtr1	Qtr2		
Honey	0	3295	2641	0	**5936**	17%
Carbon Forestry	1610	7949	2291	1278	**13128**	37%
Forestry	1304	3318	2599	1328	**8549**	24%
Forestry OIO	1521	2306	1400	2709	**7936**	22%
Grand Total	**4435**	**16868**	**8931**	**5315**	**35549**	**100%**

5. Summary

Throughout the project it was evident that the data was continually changing as land was purchased, on-sold, approved, or declined by the OIO office and simply in relation to the timing of available information, for when contracts settled, and information could be released.

Our original objective was to:

"Independently validate the amount of land that has been or will be planted into exotic plantation species in the near future that is likely to take land out of pastoral production".

The results of our review estimate:

1. The gross land area of whole farms purchased in the period (including those properties not recorded in the previous information) for planting is estimated at **23,052 ha**.
2. Of that amount, based on an analysis of the 2016 LUCAS layer, 19,793 ha is estimated as 'plantable (effective) area'.
3. Approximately 5,936 ha gross land area is identified for Honey operations.
4. Approximately 7,876 ha gross land area is identified as purchased by a known Permanent Carbon Entity.
5. Approximately 6,968 ha gross land area is identified through the OIO decision summaries.
6. The balance of 5,574 ha gross land area is assumed to be for domestic purchasers interested in both forestry and carbon.

The data was based on sales that could be verified during the stated period. The areas identified include sales dated 2020 that emerged confirmed, as a result of timing issues around the OIO approvals process and apparent conditional domestic sales in November/December 2020 that have since settled.

The amount of land that has been and continues to be purchased for mānuka operations has remained static at around 11.4% vs 15.6%, a land-use change that was not necessarily on the table at the start of the project albeit on land that traditionally is starting to revert. Given the increase in the carbon price, it may become increasingly difficult for honey producers to compete in the current market to purchase land.

The perceived economics of forestry with the updated carbon cashflows, continues to be attractive and the demand for potential forestry land from investors remains strong. There is unsatisfied demand amongst prospective purchasers, however, limitations with seedling and labour supply going forward will, to a certain extent delay the speed of transition.

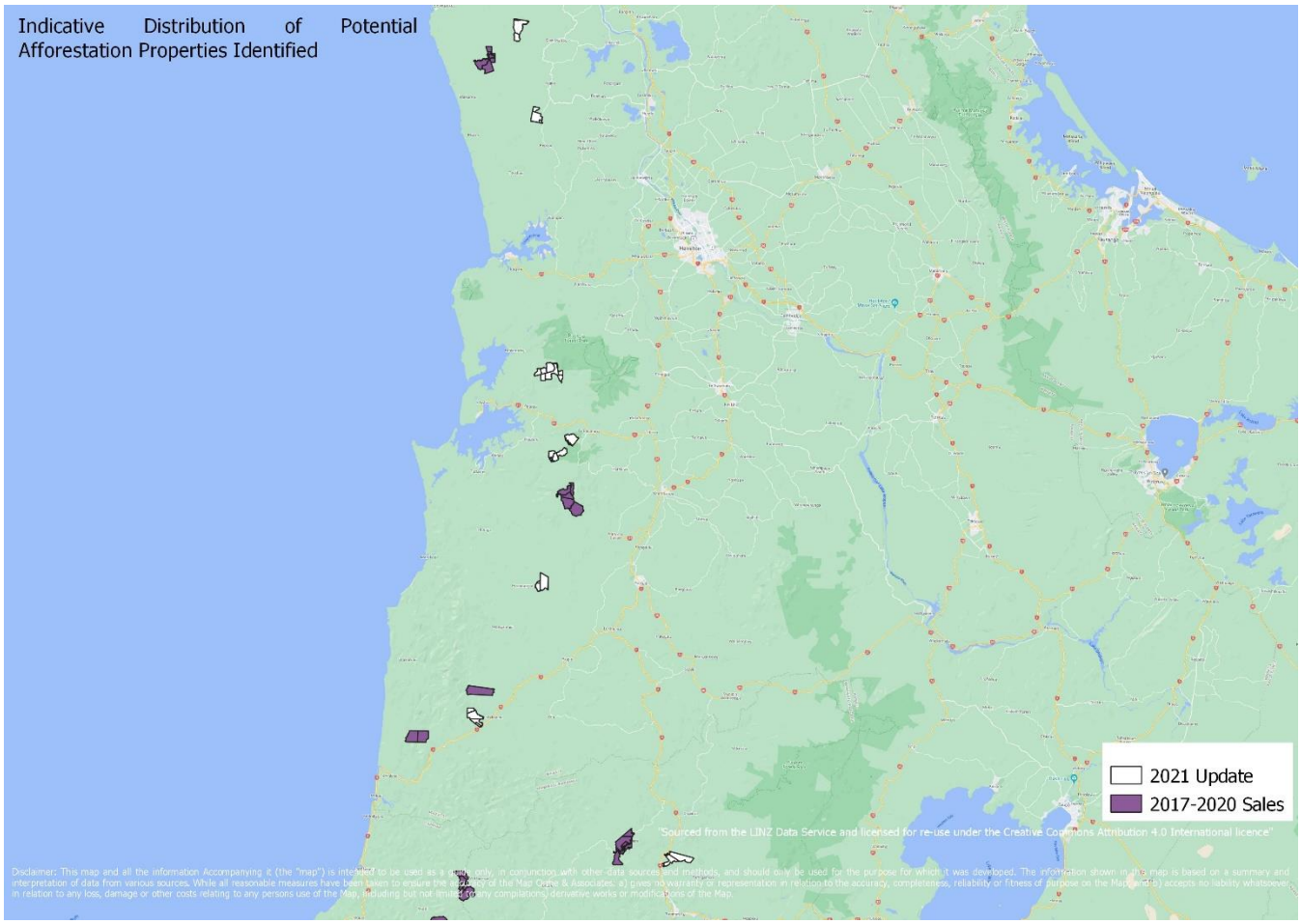
There is also an increasing interest/commitment from farmers and landowners to consider within-farm plantings, to diversify their income options and Greenhouse Gas (GHG) obligations.

The strong uptake of the One Billion Trees (1BT) planting grant by existing landowners, provided evidence that many farmers were assessing the long-term benefits associated with putting part of their farm in trees, planting 'the right trees in the right place' - where the right place is one which increases overall farm profitability, reduces total farm emissions, and may also confer other sustainable environmental and social benefits.

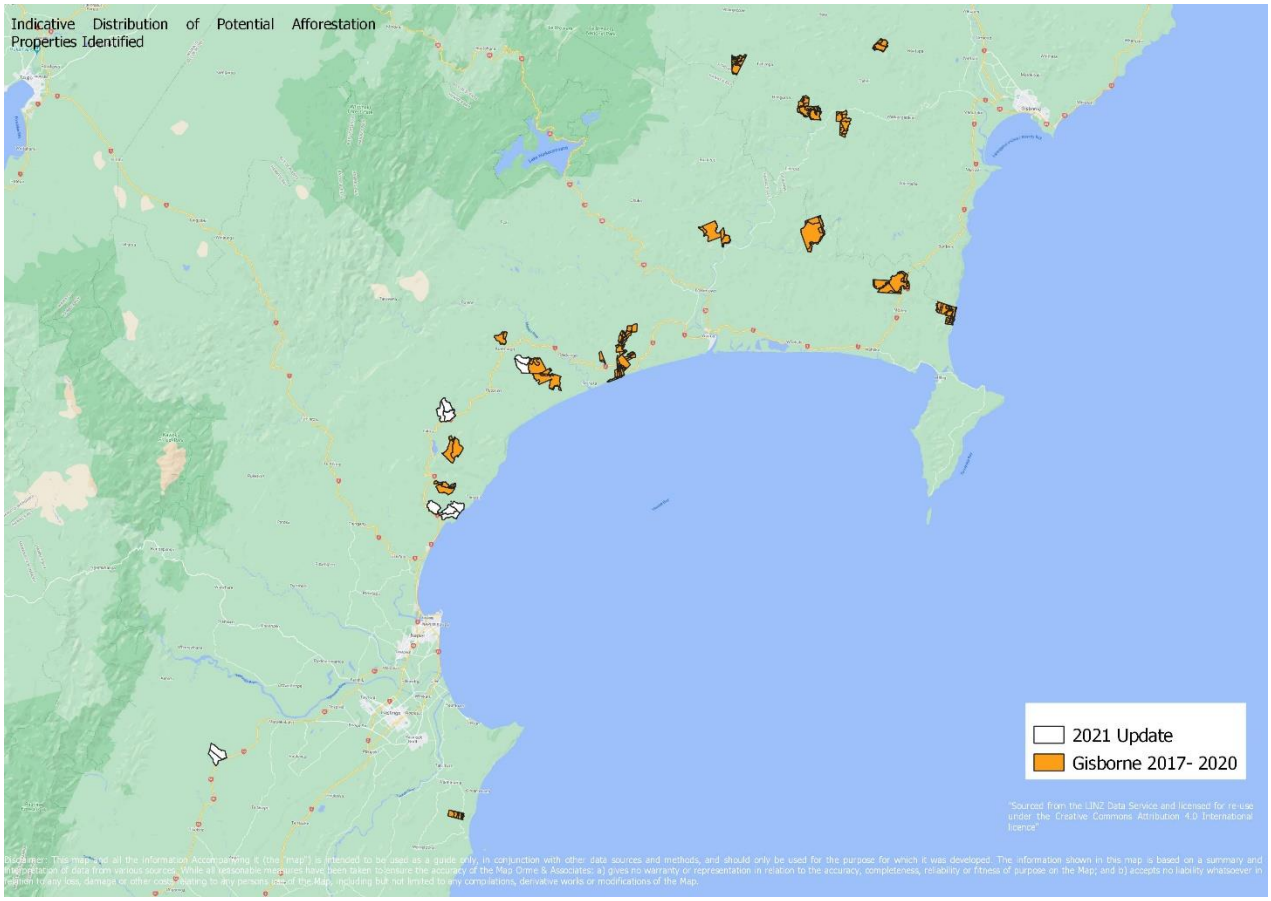
Since the fund was stopped, so has landowner commitment/ability to plant. Demand is increasing for a funding model to help landowners establish indigenous vegetation. This is widely expected to come as part of the Government response to the Climate Change Commission report due in November, however, nothing is guaranteed and there is strong demand and a desire to plant within farms across the country **NOW.**

6. Appendices

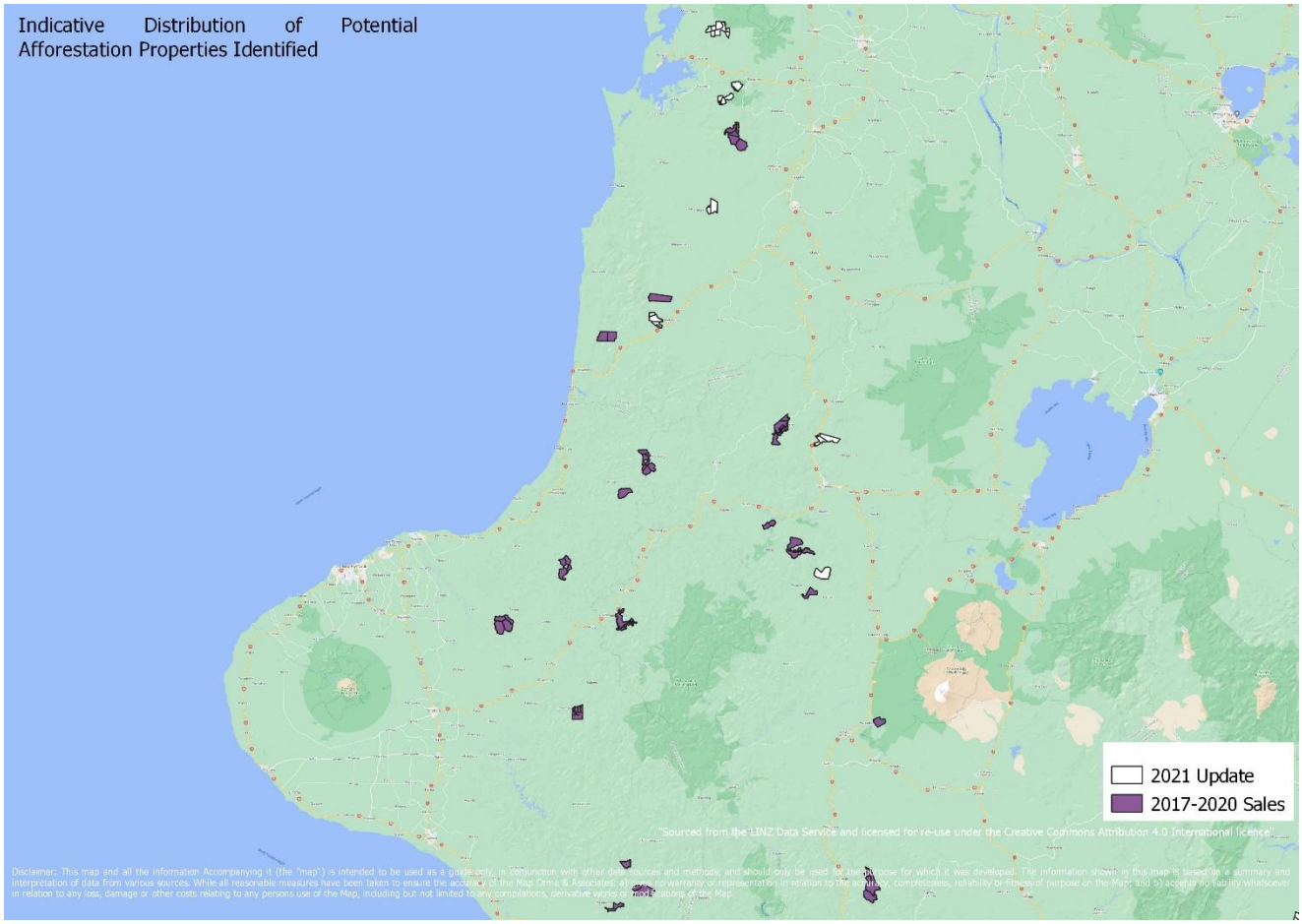
6.1 Appendix A: Regional distribution of land acquisitions identified as likely for forestry conversion



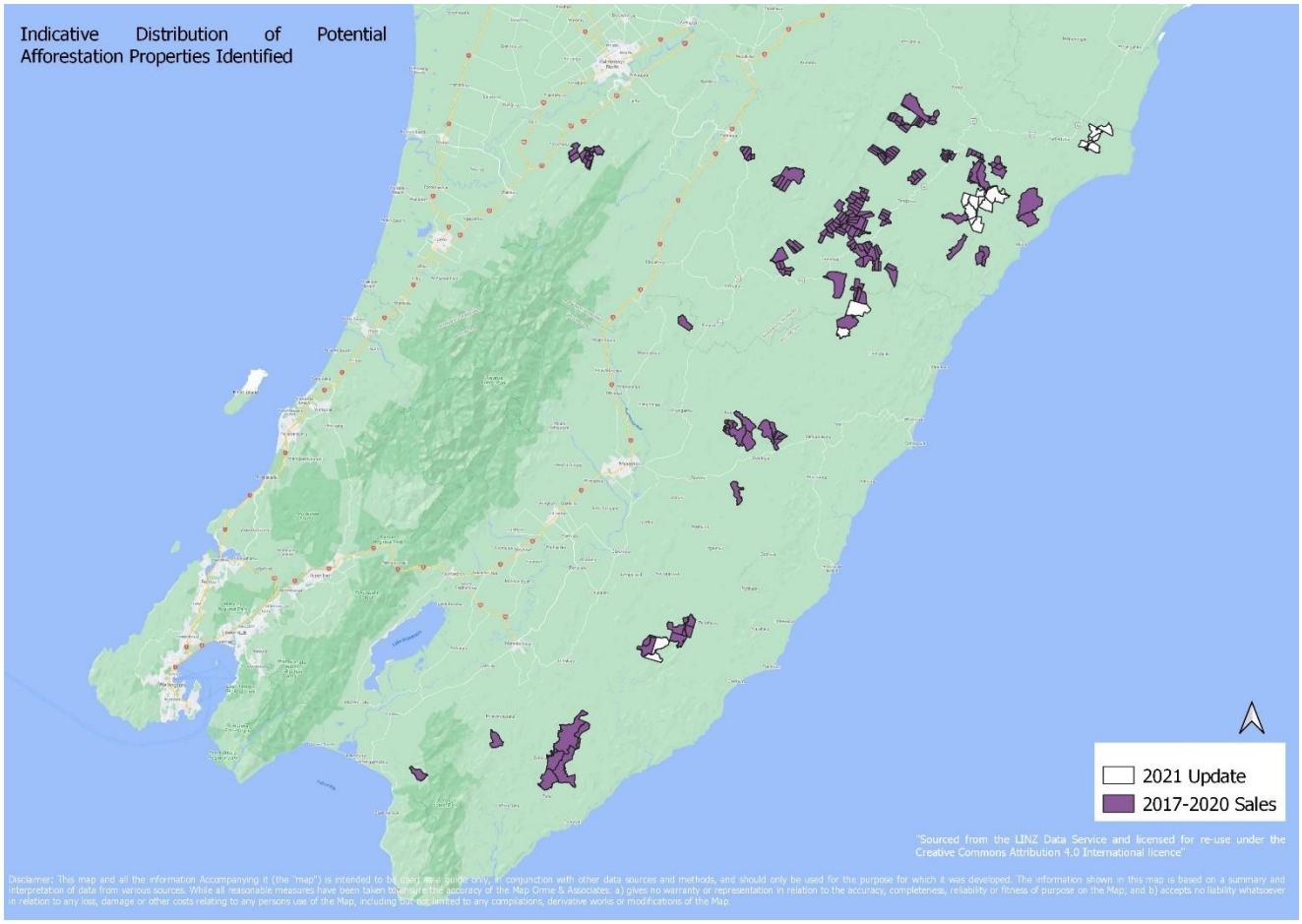
Map 1: Auckland Zoned land acquisitions for forestry



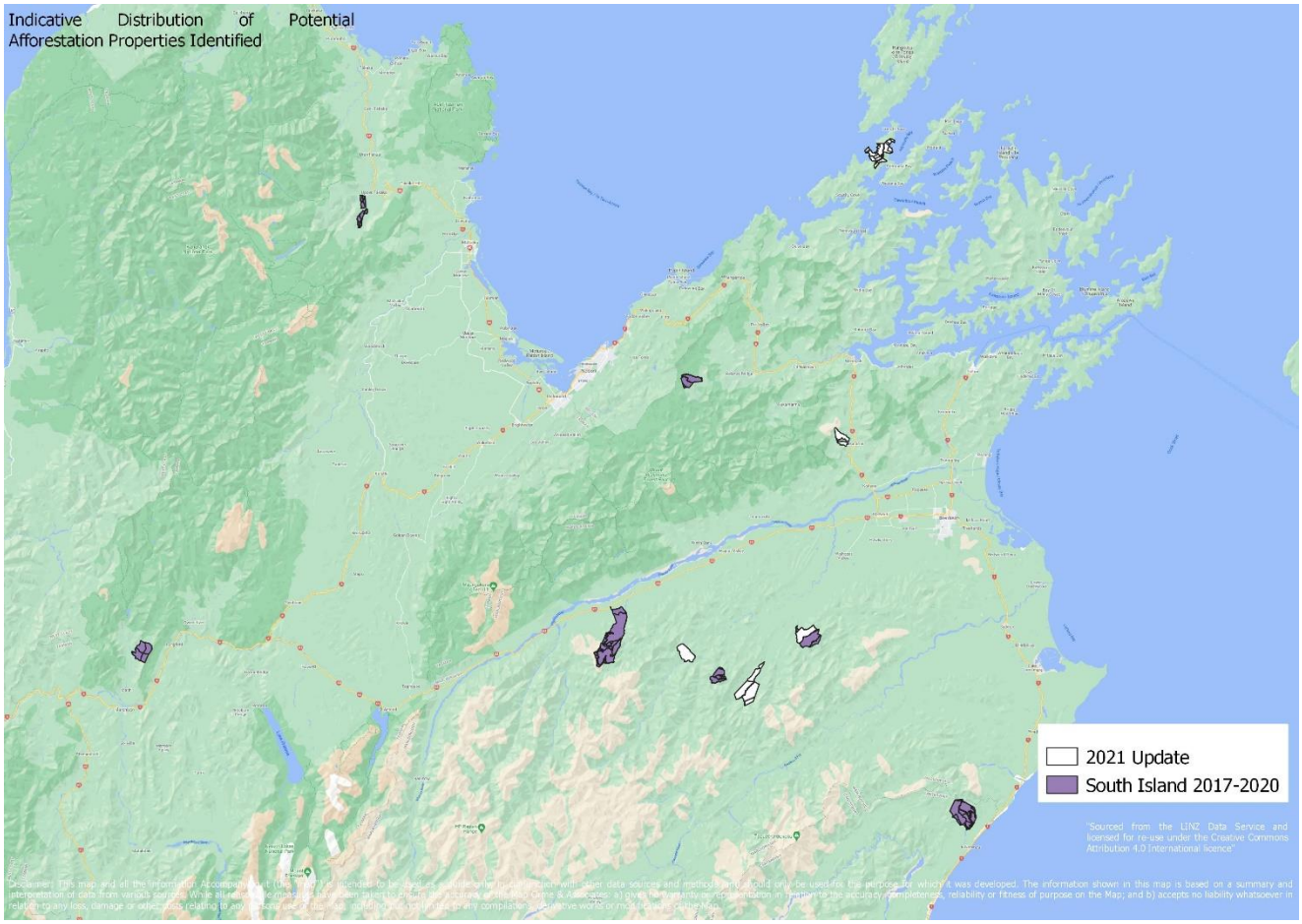
Map 2: Gisborne / Hawke's Bay land acquisitions for forestry



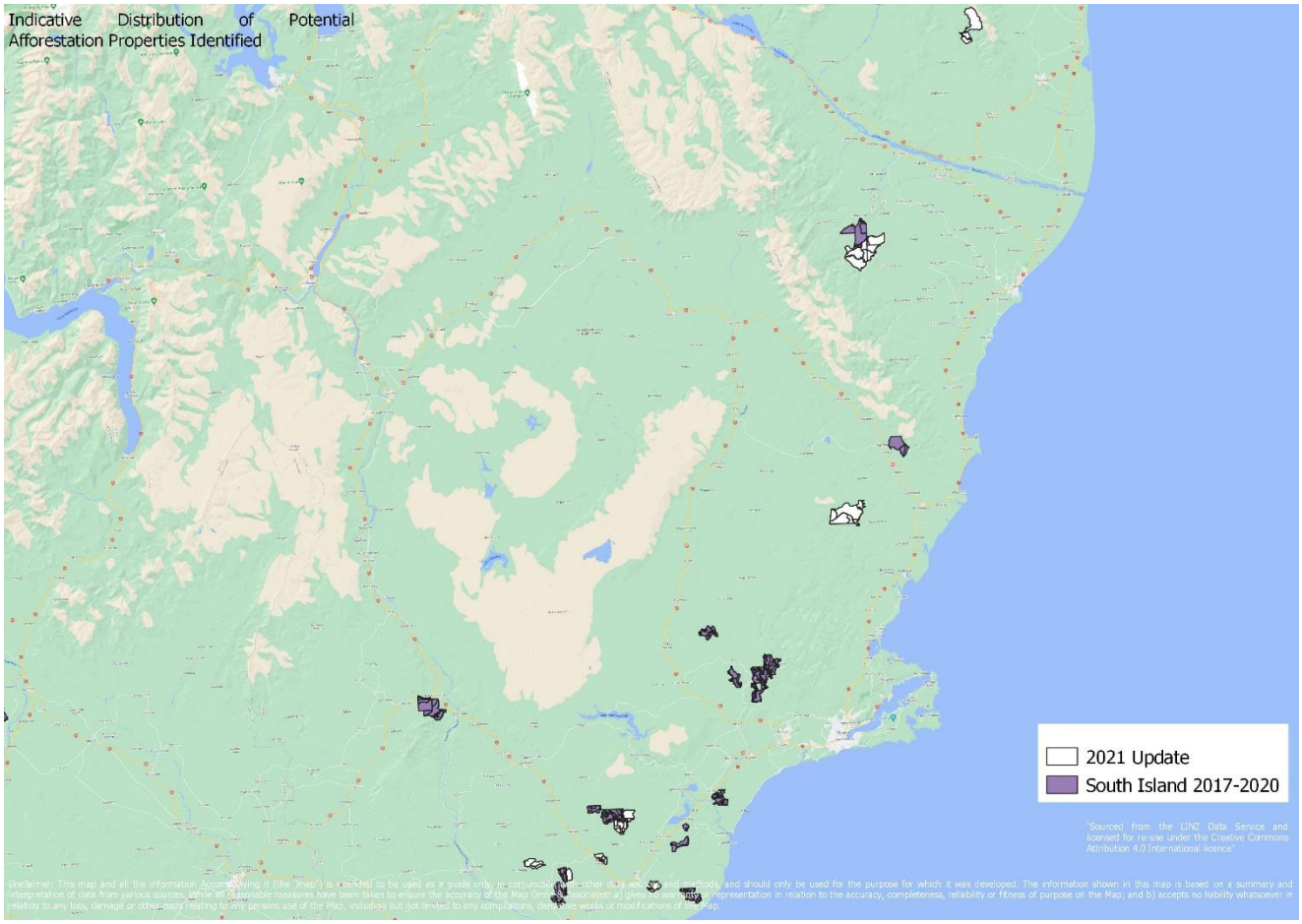
Map 3: Taranaki land acquisitions for forestry



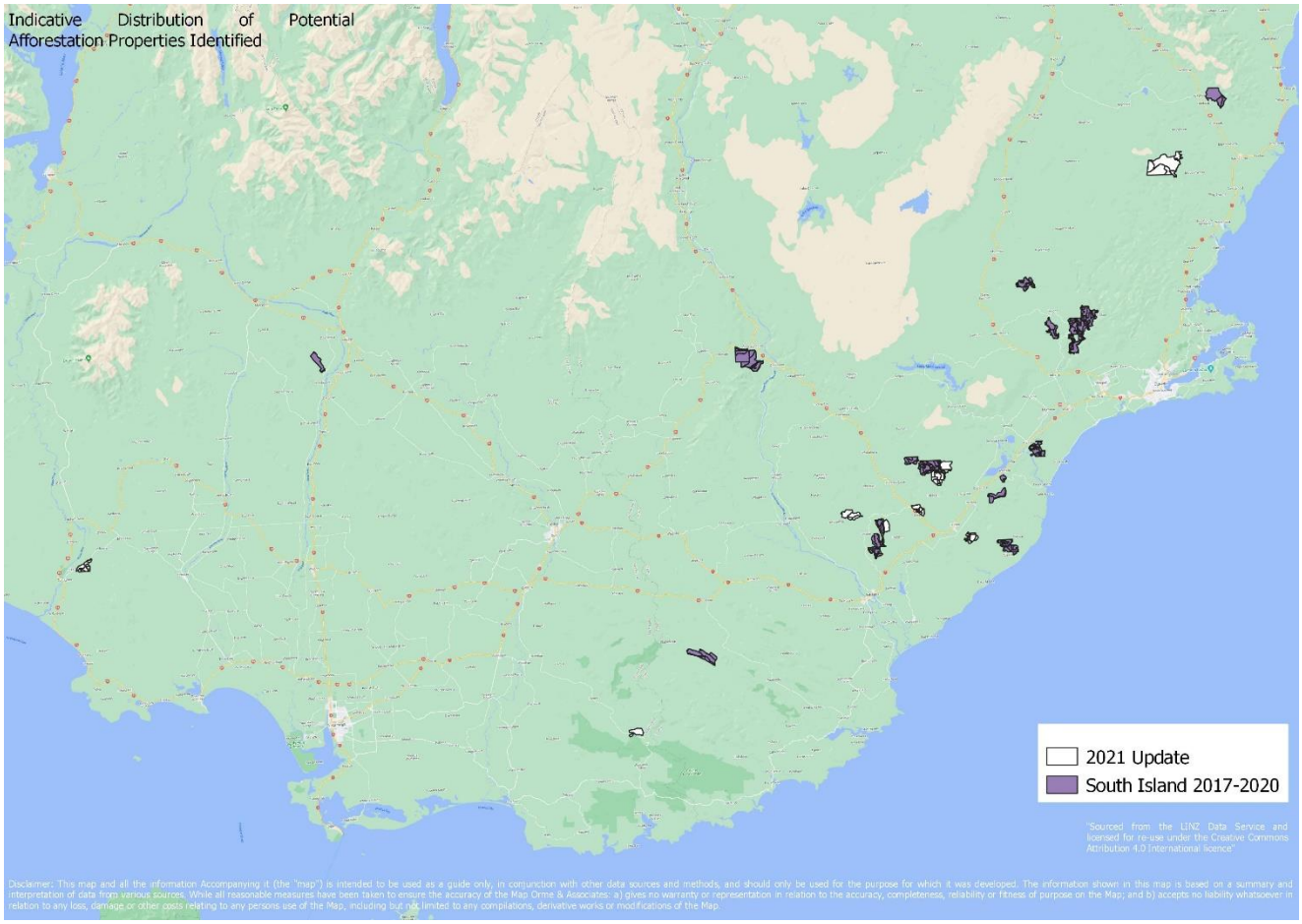
Map 4: Lower North Island land acquisitions for forestry



Map 5: Top of the South Island land acquisitions for forestry



Map 6: Otago / South Canterbury land acquisitions for forestry



Map 7: Otago / Southland land acquisitions for forestry