Socio-economic impacts of large-scale afforestation on rural communities in the Wairoa District

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Client Report

Case Study: Socio-economic impacts of large-scale afforestation on rural communities in the Wairoa District

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EXECUTIVE SUMMARY

The New Zealand Government has set a goal to plant one billion trees by 2028 with the aim of offering the opportunity to drive integrated land use and build greater resilience for rural communities while reducing New Zealand's Greenhouse Gas (GHG) emission profile. However, there is growing concern from New Zealand sheep and beef farmers arising from the recent trend of converting large areas of pastoral farming land to forestry. It appears that several decisions made by Government have not been informed by analysis of the socio-economic impacts large-scale forest planting will have on rural communities', particularly sheep and beef farming communities.

The purpose of this report is to "ground-truth" the assumption that large-scale afforestation is detrimental to rural farming communities. Our aim is to have a greater understanding of the economic impacts of large-scale forestry development on sheep and beef farms in the Wairoa District, and the direct flow-on impacts for the Wairoa and its communities.

Wairoa district was chosen for this case study as it has great reliance on sheep and beef farming, yet it is currently undergoing substantial land use change. The district covers 411,963 ha, and as of June 2017, there were a total of 189 commercial sheep and beef businesses and 81 commercial forests operating in the region. The area in sheep and beef covered 131,798 ha and the area in forests covered 55,164 ha. Since June 2017, there have been seven sales (totalling 8486 ha) where pastoral farming has or will be converted to forestry (note three of these sales are still to be approved by the Overseas Investment Office).

Our approach for this report was to undertake a case study by comparing an average sheep and beef property with an average pine forest plantation in the Wairoa region. The sheep and beef models were based on four years of average production data from the Beef and Lamb NZ Economic Service database and then scaling this out to 1,000 ha. Economic analysis was taken over 60 years to compare with 2 forestry rotations. The forestry models were based on taking actual and forecast data based on two 30-year pine (60 years) rotations under a clear wood regime in Wairoa. A three-year rolling average for log prices and current carbon prices were used and the area set to 1,000 ha to compare to the sheep and beef model.

Using the sheep and beef and forestry models, we measured the impacts on metrics of net return, direct local expenditure and local employment generated, and extrapolated these impacts across the entire area in pastoral farming in Wairoa. We further investigated what impact would be generated if an integrated land use (10% planting) or wholesale forestry conversion (100% planting) was to occur on the scaled 1,000 ha.

Based on our modelling, carbon farming forestry generated the highest NPV to landowners of all scenarios, while having the lowest contribution to the region. In contrast, sheep and beef farms overall tended to have a greater direct spend and create more jobs. When analysing the forestry and sheep and beef sector contributions to the region, we found that while sheep and beef farms delivered these metrics consistently year-on-year, forestry was much more irregular. This is because within the forestry sector, the majority of spend and employment occurs at harvest, meaning that for the first 29

years of each plantation rotation the contribution to the wider community is much lower. Carbon farming had minimal contribution to the region.

We make one other point related to long-term planning around land use and the concept of Katiakitanga or acting as a guardian and managing the environment. Land use should be considered over the long-term. While the NPV on various land uses provide the economic aspect on land use, other issues such as environmental and societal impacts should also be considered. For example, questions about the long-term ability to change the use of a parcel of land should be factored into decisions over how land should be used now. Many farmers and landowners take an inter-generational view on their properties and the sustainability of their land is a key consideration. This aligns with the concept of Katiakitanga, but the concept it is not only for Maori in the region, it is also for those who work and love the land over many generations.

Taking this longer-term view means that consideration of the, for example, value and restricted ability to use of land post-forestry should be considered as should the issue that gaining carbon credits from planting trees has a finite life.

1. INTRODUCTION

The New Zealand Government has set a goal to plant one billion trees by 2028. The aim of this 'One Billion Trees Programme' is to offer the opportunity to drive integrated land management and build greater resilience for rural communities while reducing New Zealand's Greenhouse Gas (GHG) emission profile.

Reaching the one billion trees target will see 230,000 to 430,000 hectares (ha) planted across New Zealand over 10 years. This will take the total land planted in forestry from 1.7 million ha to about 2 million ha (Collins, 2019). By comparison, farming covers 10.4 million ha.

The Government's stance is that the right species, planted in the right place, and for the right purpose will enhance land management outcomes and build resilience, particularly to environmental shocks and a changing climate (Collins, 2019). The Government has allocated $120 million to build on this. Note, whole farm conversions are not being subsidised by the Government and the target is for two-thirds native plantings. The intended outcomes of planting more trees are: landowners will have diversified income by way of timber, honey and carbon credits; improved land productivity; environmental issues such as erosion addressed; improved water quality; important habitats provided for a range of native species; enhanced natural landscapes; and the creation of jobs and careers (MPI, 2019).

The Government has entered into the Emission Trading Scheme (ETS) to use as its main tool to meet its climate change targets. The ETS puts a price on GHG emissions and is intended to create a financial incentive for businesses who emit GHGs to invest in technologies and practices that reduce emissions. It also encourages forest planting by allowing eligible foresters to earn New Zealand emission units (carbon credits) as their trees grow and absorb carbon dioxide.

As a result of the Government's investment and ETS incentives, there has been a substantial uptake of planting and regenerating forests on farms. However, there is growing concern from New Zealand sheep and beef farmers arising from the recent trend of converting large areas of pastoral farming land to forestry. While the One Billion Trees Initiative cannot be blamed for wholesale conversions of sheep and beef farms to forestry, these concerns are likely to continue to amplify given the policy direction from central Government which would require, and result in, vast areas of pastoral farmland being converted to forestry. This is highly likely to negatively impact sheep and beef farmers, the rural economy, and in turn the national economy. There is already growing evidence of losses of stock units, and concerns around the long-term sustainability of the industry (e.g., from vets, shearers etc).

It appears that several decisions made by Government have not been informed by analyses of the socio-economic impacts large-scale forest planting will have on rural communities', particularly sheep and beef farming communities. Therefore, the purpose of this report is to "ground-truth" the assumption that large-scale afforestation is detrimental to rural farming communities. Our aim is to have a greater understanding of the economic impacts of large-scale forestry development on sheep and beef farms in the Wairoa District, and the direct flow-on impacts for the district and its communities. Wairoa district was chosen for this case study as it is a district that has great reliance on sheep and beef farming, yet it is currently undergoing substantial land use change.

2. METHODOLOGY

To achieve a greater understanding of the economic impacts of large-scale forestry development on sheep and beef farms and the direct flow-on impacts for the district and its communities, a case study modelling approach was taken. The aim was to show the impacts on a district and community whose economy relies heavily on sheep and beef farming. Wairoa District was selected for this case study as it has great reliance on sheep and beef farming, yet it is currently undergoing substantial land use change to forestry.

2.1. WAIROA DISTRICT

Based on population statistics, Wairoa's population has fallen steadily since the 2001 census, with 40% of the total population in paid employment (***Table 1***).

Anecdotally, the Affco Wairoa processing plant employees on average 200-300 full time equivalent employees each year.

Table 1: *Population statistics and employment in Agriculture, Forestry and Fishing for the Wairoa District. Source (Statistics New Zealand, 2001, 2006 and 2013)*

	2001 Census	2006 Census	2013 Census
Population	8,916	8,481	7,890
Number in paid employment	3,522	3,723	3,183

In terms of land use capability, the Wairoa District has a land area of 411,963 ha or 4,120 km² (ID Community, 2018). The Land Use Capability map shown in ***Figure 1*** shows the majority of the land within the Wairoa district can be described as having moderate limitations for use under perennial vegetation such as pasture or forestry. Some land has been classified as having severe to extreme limitations or hazards that make it unsuitable for cropping, pasture or forestry.

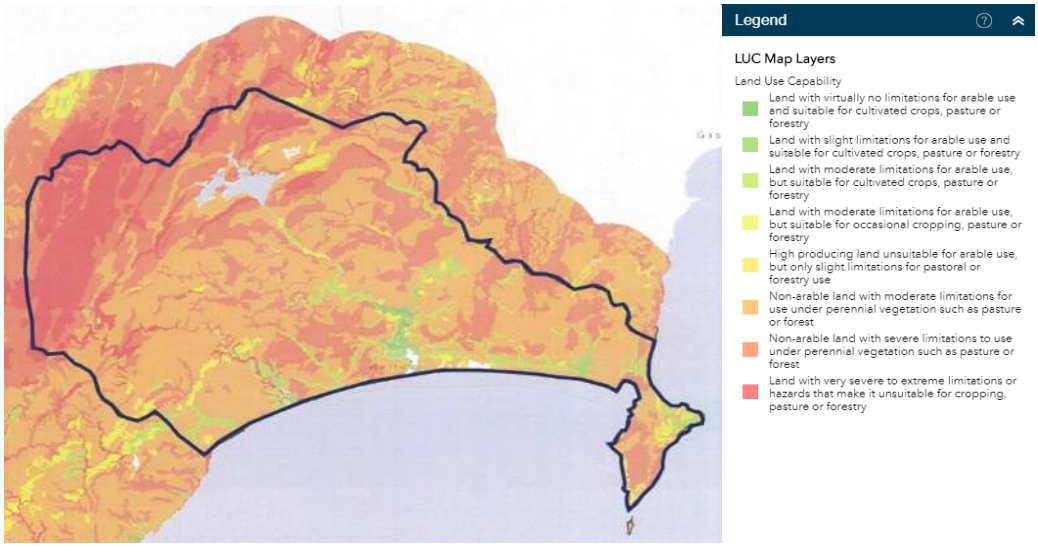

Figure 1: Land Use Capability of the Wairoa District. Source: https://hbmaps.hbrc.govt.nz/mapviewer/?map=67686b47a9dc4def9987143ded8c6f60

Wairoa District's contribution to the farming sector, as at 30th June 2017, was 189 farms over 20 ha in size (Statistics New Zealand, 2017). Of those farms, 81% were sheep and beef businesses, with the remainder being horticulture, cropping or dairy farms. The average size of Wairoa farms (greater than 20 ha, *n* = 189), as at 30 June 2017, was 697 ha (Statistics New Zealand, 2019). As such, there is an estimated 131,798 ha in agricultural production in the Wairoa District. This area has been used in this report to quantify the potential impacts of wholesale forestry conversion in the Wairoa District.

Wairoa District's contribution to the forestry sector, as at 30th June 2017, was 55,164 ha of forestry (Te Uru Rakau, 2019) spread across 81 forestry blocks (Statistics New Zealand, 2017). The predominate tree species included Pinus Radiata covering 53,846 ha, Douglas Fir 178 ha, Cypress 204 ha, softwoods 433 ha, Eucalypts 403 ha and other hardwoods 100 ha (Te Uru Rakau, 2019). As at 1 April 2018, 23,014 ha of forests were between 21 and 25 years of age, and as such would likely be harvested within the next 7-10 years. A breakdown of the area and age of trees is shown in ***Table 2***.

Overall, we estimate that there is 186,962 ha either in pastoral farming or commercial forestry (45% of the total land area in the Wairoa District).

Table 2*: Age and area of Wairoa forestry stands as at 1 April 2018. Source: (Te Uru Rakau, 2019)*

Age of stand (years)	Area (ha)
1-5	4,892
6-10	8,481
11-15	7,686
16-20	8,399
21-25	23,014
26-30	1,528
31-35	536
36-40	322
41-50	208
51-60	61
61-80	37

Over the last five years, there has been nine forestry sales (forest to forest), 27 pastural sales (farm to farm), and seven forestry conversions (farm to forest) (***Table 3***). Of the seven sales of farm to forestry, the total area covered came to 8,486 ha. Without knowing the quality of properties that transacted, it is difficult to compare the average sale price between pastural and forestry conversion. Anecdotally and based on the closeness of Pastural to Pastural and Forestry Conversion values, the two end land uses appear to be in direct competition.

Table 3: *Recent land sales for the Wairoa District. Source: (Lewis Wright Valuation and Consultancy Ltd)*

Year	Number of sales			Average sale price ($/ha)			Average sale price all land use ($/ha)
	Forestry to forestry	Pastural to pastural	Forestry conversion	Forestry to forestry	Pastural to pastural	Forestry conversion	
2015	0	7	0	0	4,171	0	4,171
2016	3	4	0	3,142	4,925	0	4,161
2017	5	5	0	3,683	6,740	0	5,212
2018	1	8	3	4,621	9,863	10,018	9,465
2019	0	3	4	0	7,767	7,046	7,355

2.2. CASE STUDY MODELLING

Our approach was to undertake a desk top case study by comparing an average sheep and beef property with an average pine forest plantation in the Wairoa region. The sheep and beef models were based on four years of average production data (2014 to 2018) from the Beef and Lamb NZ Economic Service database (Beef + Lamb New Zealand, 2019) and then scaling this out to 1,000 ha. The forestry models were based on taking actual and forecast data (sourced from Forest 360) based on two 30-year pine rotations under a clear wood regime in Wairoa. A three-year rolling average (2017-2019) for log prices was used and the area set to 1,000 ha to compare to the sheep and beef model.

Using the sheep and beef and forestry models, we measured the impacts on metrics of net return, direct local expenditure and employment rate, and extrapolated these impacts across the entire area in pastoral farming in Wairoa (131,798 ha). We further investigated what impact would be generated if an integrated land use (10% planting) or wholesale forestry conversion (100% planting) was to occur on the scaled 1,000 ha.

We choose to use a 60-year time frame for the analysis to include 2 full forestry rotations (at year 30 and year 60), this allows the first rotation to accumulate carbon credits that can be traded. The second rotation accumulates no tradeable carbon.

Because these investment options play out over 60 years or more, we used an NPV formula to compare returns. NPV is the present-day value of a future income stream, and it recognises the fact that income is worth more today than it is tomorrow and there is an opportunity cost of money. This opportunity cost is called a “discount rate”. We used a discount rate of 5% to represent the cost of funds required to finance these investment options.

3. RESULTS

3.1. FARMING –ECONOMIC POSITION USING CASE STUDY FARM

A case study farm was made using the weighted average of the Wairoa farms in the Eastern North Island Class 3 (hard Hill Country) and Class 4 (Hill Country) farms (Beef + Lamb New Zealand, 2019). Four years of data (2014 to 2018) was analysed.

To give a clear and straight forward analysis of the data, this average farm was scaled to 1,000 ha. As a result, the four-year average Class 3 and Class 4 total stock units (SU) at open for 1,000 ha effective was 8,173 SU, with 8.2 SU/ha. Based on these numbers, per 1,000 ha, a typical sheep and beef farm carried 8,173 SU, comprising of 4,583 sheep (2,323 mixed age (MA) ewes, 798 two-tooths (2ths), and 977 ewe hoggets) and 912 cattle (355 in-calf cows and 557 trade and young stock) (***Table 4***).

Scaling these figures out over the entire 131,798 ha sheep and beef area of the Wairoa Region gave a total of 1,077,185 SU comprising of 604,040 sheep and 120,201 cattle (***Table 4***).

Table 4: *Stock units (SU) and number of animals modelled for a case study farm using the weighted average (2014 to 2018) of the Wairoa farms in the Eastern North Island Class 3 (hard Hill Country) and Class 4 (Hill Country) farms. Results have been extrapolated to effective areas farmed of either 1,000 ha or for the total Wairoa sheep and beef farming area of 131,798 ha.*

Measure	Per 1,000 ha	Per 131,798 ha
Stock Units	8,173	1,077,185
Number of sheep	4,583	604,040
Number of cattle	912	120,201

3.1.1 Farm performance

The weighted average sheep and beef farm produced 145 kg of product per ha over the 2014 to 2018 period. A breakdown of the production data is shown in **Table 13** in Appendix A.

Taking the weighted average number of animals sold over the last four years and scaling this over 1,000 ha, a typical sheep and beef farm sold to the works 2,777 sheep (466 adult sheep and 2,341 lambs) and 241 cattle (58 manufacturing and 183 prime) (***Table 5***).

When these figures were scaled up to the Wairoa Region's total sheep and beef area, this resulted in animal sales of 365,934 sheep and 31,781 cattle (***Table 5***).

Store stock sales came to 930 sheep and 142 cattle per 1,000 ha. Scaled out over Wairoa Region's total sheep and beef area gave stock sales of 122,507 sheep and 18,727 cattle (***Table 5)***.

Table 5: *Annual sales modelled for a case study farm using the weighted average (2014 to 2018) of the Wairoa farms in the Eastern North Island Class 3 (hard Hill Country) and Class 4 (Hill Country) farms. Results have been extrapolated to effective areas farmed of either 1,000 ha or for the total Wairoa sheep and beef farming area of 131,798 ha.*

Annual Sales (number of animals)	Per 1,000 ha	Per 131,798 ha
Sheep sold to works	2,777	365,934
Cattle sold to works	241	31,781
Sheep sold store	930	122,507
Cattle sold store	142	18,727

Average sale prices for key livestock lines are shown in **Table 14** in Appendix A. Prime lambs were sold for $96.90/hd, store lambs for $74.03/hd and cull ewes for $82.68/hd. Of the lamb sales, 73% were sold prime. Prime steers were sold for $1,556.83/hd while cull cows averaged $1,010.80/hd over the 2014 to 2018 period.

Since the time of these analyses, sheep product prices have increased by 20%, however for analysis purposes we only used actual data.

3.1.2 Economic returns and NPV

Overall, the model farm generated an average Gross Farm Revenue (GFR) of $727/ha and Economic Farm Surplus (EFS) of $212/ha over the four-year period (***Table 6***).

EFS is calculated by taking GFR ($727/ha) and subtracting all farming working expenditure ($450/ha) assumed Wages of Management or drawings ($60/ha) and depreciation ($28/ha).

Returns have shifted more recently due to the lift in product prices; however, for purpose of this analysis, we chose to stay with the four-year average.

An NPV was calculated based on the average EFS of $212/ha for the weighted average Wairoa sheep and beef farm. A discount rate of 5% per annum was used over a 60-year period.

The NPV of the sheep and beef farming operation for the 60-year period was $4,225/ha.

Table 6*: Gross Farm Revenue and Economic Farm Surplus per year for the weighted average of a Class 3 and 4 Wairoa Sheep and Beef farm, according to year.*

Year	Gross Farm Revenue ($/ha)	Economic Farm Surplus ($/ha)
2014/15	749	225
2015/16	637	133
2016/17	673	178
2017/18	848	310
Average 2014-2018	727	212

3.1.3 Direct local expenditure per 1,000ha

Total Expenditure for the case study 1,000ha sheep and beef farm has been broken down in **Table 15** in Appendix B. The total farm expenditure per 1,000 ha came to $552,517. This spend was consistent year-on-year.

Using this actual spend we have used our best judgement in each cost code to allocate the proportion of product (material) vs service (labour), including where the product or service originated from (in or outside the region). A summary of local and external spend is summarised in **Table 15** also.

Using this calculation, of the total direct expenditure per 1,000 ha, approximately $285,988 was spent locally i.e. in the Wairoa District. The remaining spend of $266,529 was comprised of items such as interest, fencing and water materials, fuel, electricity, insurance and the like.

Due to the owner operator nature of the typical sheep and beef business (i.e. the owners reside in the district) we have also assumed that $30,000 of Wages of Management allocation ($60/ha x 1,000ha) is spent with the region.

Sheep and Beef farms in Wairoa had a direct local expenditure of $315,988 per annum per 1,000ha.

3.1.4 Employment per 1,000ha

Local employment generated for the 1,000ha case study sheep and beef farm in the Wairoa District was calculated using the direct local expenditure figures (**Table 15**) and Beef and Lamb Economic Service Data (to extract full time employees and yearly stock transactions).

Excluding wages expenditure came to $202,511. Using our understanding of sheep and beef businesses and their requirement for products and services we have assumed this spend would go towards a mix of physical labour (shearing, fencing, agricultural work) and advisory and technical services (animal health, agronomy, materials and advice). Assuming a New Zealand average of 1,920 h worked per year (48 weeks per year x 40 h weeks) and an hourly rate of $25/h, there would be 4.2 jobs per 1,000ha

In addition to this, as per the Beef and Lamb Economic Service Data the case study 1,000ha sheep and beef farm employees 2.6 full-time labour units per 1,000ha

Stock agents and meat works also operate in the Wairoa community. A 5.5% commission was applied to all store livestock sales, and a killing fee of $2.40/hd for sheep and $36.78/hd for cattle was applied. Using the same logic of a 1,920 h work year and $25/h pay rate, this generated an additional 0.6 jobs per 1,000ha.

Sheep and beef farms in Wairoa are estimated to generate 7.4 local jobs per annum per 1,000 ha.

3.2. FORESTRY –ECONOMIC POSITION USING CASE STUDY FOREST

To ensure fair comparisons could be drawn between forestry and sheep and beef farms, a 1,000ha property with a similar mix of land classes to the Class 3 and Class 4 sheep and beef farm model was used.

We choose to use a 60-year time frame for the analysis to include 2 full forestry rotations (at year 30 and year 60), this allowed the first rotation to accumulate carbon credits that could be traded. The second rotation accumulates no carbon. This gives a longer term and sustainable view on forestry returns.

Using averaging, in a harvesting operation carbon credits can be claimed up to the first 18 years of the first rotation without incurring any liabilities. If the forest is not harvested carbon credits can be claimed for the entire lifespan of the forest (in this case 60 years)

Three different forestry options were investigated to understand what is driving the economic returns and NPV. These were: harvesting with carbon credits (timber plus 18 years of carbon), harvesting without carbon credits (timber only) and no harvesting (carbon farming).

The forestry block under the two harvest models was assumed to be planted at 1,000 stems per ha in a Clearwood regime (this means the forestry is strategically thinned and pruned).

The forestry block under the carbon farming model was assumed to be planted at 300 stems per ha.

3.2.1 Production data

Using actual Wairoa district data supplied by Forest 360, the forest was shown to produce 720 t of wood per ha at harvest. This equated to 400 stems per ha at 1.8 t per stem, with two rotations whereby harvesting occurred at year 30 and 60.

Carbon credits were shown to be generated up until year 18 of the first rotation resulting in 556.7 t of tradable carbon (no liability attached) with returns completed at five-year intervals (year 5, 10, 15, and 20)

If the forest was not harvested, carbon credits were shown to generate 1079t of tradeable carbon (no liability attached) with returns completed at five-year intervals (through to year 60).

3.2.2 Economic returns and NPV

1) 60 Years Harvesting – No Carbon

Assuming a three-year (2017-19) average log price of $128.75/t at port, the revenue per ha generated was $92,700 at harvest (720 t/ha yield). Harvest costs of $93.87/t would be incurred, leaving $34.88/t or $25,113.60/ha net at the time of harvest. An NPV was calculated over two rotations, so the time period was 60 years.

In a Clearwood regime, with no carbon income from the Emissions Trading Scheme (ETS), this gave an **NPV over 60 years at a discount rate of 5% of $659/ha.**

2) 60 Years Harvesting – With Carbon

Baseline assumptions (log price, costs and yields etc) have been carried forward from the Forestry Only option given in 1) above. In this scenario, carbon income using averaging assumptions (first 18 years carbon revenue realised, if the forest is re-planted) was added to the baseline forestry NPV. Carbon has been valued at $25/t as it is the current carbon cap in New Zealand.

In a clear wood regime, with an additional $25/t revenue for the carbon sequestered for the first 18 years, the **NPV over 60 years at a discount rate of 5% was $8,410/ha.**

3) 60 Years Carbon Farming – No Harvest

This scenario assumes the forest will not be harvested, but rather will continue to sequester carbon (carbon farming). Seedlings were planted at 300 stems per hectare with no silviculture once the stand is established. Carbon has been valued at $25/t as it is the current carbon cap in New Zealand.

Carbon only generates an **NPV of $9,386 per ha over 60 years at a discount rate of 5%.**

Important to note that we have looked at economic cash returns and have not included a salvage value of the land at the end of the 60 year. There needs to be further consideration on both the land value and environmental impact a permanent pine forest would have.

The economic returns for the three forestry options are summarised in ***Table 7***. Carbon revenue is the key driver of the forestry option profitability, especially when using NPV at the metric due to the fact that you are rewarded for early cash returns.

Table 7*: Summary of economic returns for various forest options. Note all values presented are discounted. Revenues and expenditure items highlighted in grey are used to calculate the NPV.*

Measures	Forest options per ha		
	Harvesting – No Carbon	***Harvesting – With Carbon***	***Carbon Farming – No Harvest***
Planting costs, $	1,843	1,843	786
Rates, Insurance, Admin, $	1,217	1,217	1,217
Thinning, $	1,004	1,004	0
Pruning x 3, $	2,368	2,368	0
Discounted Forest Expenses	6,432	6,432	2,003
Harvest revenue, $/ha	92,700	92,700	--
Harvest expenses, $/ha	67,586	67,586	--
Net harvest revenue, $/ha	25,114	25,114	--
Discounted harvest revenue, $	**7,091**	**7,091**	**0**
Discounted carbon revenue, $	**--**	**7,751**	**11,389**
NPV, $	**659**	**8,410**	**9,386**

3.2.3 Direct local expenditure per 1,000ha

Expenditure for a 1,000 ha forestry block is shown (per ha) in ***Table 7*** as supplied by Forest 360.

With the help of Forest 360 consultants, the same method was applied to each cost code as was in the sheep and beef expenditure around product vs service and in or outside the region. We have assumed that most of the forest expenditure was spent locally leading up to harvest. Once harvest begins crews are expected to be brought in from the wider East Coast region.

The timing of expenditure in the forestry sector was an important factor as it differs from that in sheep and beef. Generally, minor expenditure occurs around planting and thinning, with the majority of expenditure being incurred at harvest (**Table 16**).To fairly represent this, in **Table 8** we broke out the direct spend out to excluding harvest (regular or consistent) and including harvest (irregular or inconsistent). This demonstrated that up until harvest there was a significant reduction in direct local expenditure compared to sheep and beef.

We have assumed the owner (or investors) of the forests don't reside within the region therefore no management wages, drawings or profit have allocated within the region.

Plantation Forestry in the Wairoa District had a regular direct local expenditure (excluding harvest costs) of **$107,283 per year per 1,000 ha.**

Plantation Forestry in Wairoa District had an irregular direct local expenditure (including harvest costs) of **$246,723 per year per 1,000 ha.**

Carbon Farming (planting then ongoing administration costs) in the Wairoa district has little to no direct expenditure at **$27,417 per 1,000 ha**

***Table 8**: Estimated direct local forestry expenditure and likely spend per year. This spend relates to the wages that would be paid into the local Wairoa economy using similar methodology to the Sheep and Beef example presented in **Table 15** in Appendix A*

	Harvest Forestry	Carbon Farming
Year	**Total spend per 1,000ha p.a.**	**Total spend per 1,000ha p.a.**
0-29	$107,283	$27,417
30	$4,290,482	$27,417
Average 30 years	$246,723	$27,417

3.2.4 Employment per 1,000ha

Direct local employment from forestry varies depending on the timing in the rotation creating a lack of consistency or regularity.

Excluding harvesting and assuming planting and thinning are constant, $107,283 is spent in the first 29 years (**Table 8**, **Table 16** and **Table 17**). Assuming an hourly rate of $25/h and 1,920 h per year, 1,000 ha of forest was found to create 2.2 local jobs for the first 29 years. In consultation with Forest 360 we have assumed that the majority of these jobs are centred around physical tasks (silviculture) and would be completed by people in the Wairoa community.

When harvesting occurred and cartage and roading were added into the equation (year 30 only), forestry created 5.1 local jobs per 1,000 ha averaged over 30 years. Harvest time therefore created 89.4 jobs in one year (assuming all harvest is completed in one year). These jobs were more of a mix between labour (logging, trucking) and services (mechanics).

Peer reviewing these numbers with Forest 360, they state that 6.4 jobs are created over a full harvest rotation, therefore we have assumed this variance of 1.3 jobs is meet by travelling forestry gangs that harvest in multiple regions of New Zealand, this does not necessarily support the local Wairoa economy.

When running the carbon farming expenditure through the same calculation, it was found to create 0.6 local jobs. However, as the majority of this labour is centred round planting, once forests were planted the jobs would cease.

Forestry in Wairoa District (excluding harvest) generated 2.2 local jobs per annum per 1,000 ha.

Forestry in Wairoa District (including harvest) generated 5.1 local jobs per annum per 1,000 ha.

Carbon farming in the Wairoa District generated 0.6 jobs local per annum per 1,000ha.

3.3. COMPARATIVE ANALYSIS

The comparative analysis was based on comparing the modelled sheep and beef farm to the forest plantation, on key metrics of NPV, direct local expenditure and employment rate.

3.3.1 NPV

The returns show that with the both carbon farming and the combination of carbon sequestration and harvesting of timber the returns are twice that of the typical sheep and beef property operation in the Wairoa District (***Table 9***).

For a sheep and beef farming to compete on an NPV basis, the EFS would have to lift to $422/ha (up from $212/ha). Note these numbers are being achieving by the top 25% of sheep and beef farming businesses in New Zealand, based on BakerAg Financial Analysis Benchmarking (BakerAg, Pers Comm).

3.3.2 Direct local expenditure (per 1,000 ha)

The expenditure analysis for forestry showed that for the regular spend with harvest excluded (i.e. the first 29 years of the rotation), forestry expenditure was only a fraction of the sheep and beef spend (37.5%). However, when we factor in the irregular spend of harvest expenses (logging, roading and trucking), average spend increased significantly up to 87% (***Table 9***).

To harvest 1,000 ha at year 30, it would incur a $4,290,483 or $4,291/ha direct local spend. This highlights irregularity or the lag phase of direct expenditure until a forestry crops reaches steady state harvest profile.

3.3.3 Employment (per 1,000 ha)

Sheep and beef properties generated 7.4 per local jobs consistency each year. Up until harvest (regular), forestry generated significantly less that this at 2.2 local jobs year on year (sliver culture, management etc). When the harvest is included (irregular), the average local employment generated increased to 5.1 (**Table 10**). The roles associated with the harvest process of 1,000 ha created up to 89 jobs.

Table 9*: Comparative analysis of the average Wairoa sheep and beef farm versus varying forest options for economic returns based on NPV*

Metric	Sheep and beef farm	Forest options		
		Harvesting – No Carbon	***Harvesting – With Carbon***	***Carbon Farming – No Harvesting***
NPV, $	4,225	659	8,410	9,386

Table 10: *Comparative analysis of the average Wairoa sheep and beef farm versus varying forest options for direct spend and local employment.*

Metric	Sheep and beef farm	Forest options		
		Excluding Harvest	***Including Harvest***	***Carbon Farming***
Direct spend, $/1,000 ha*	315,988	107,283	246,723	27,417
Employment, no. labour units/1,000 ha*	7.4	2.2	5.1	0.6

* Direct spend for sheep and beef farms is based on year-on-year.

3.4. EXTRAPOLATION

Using the data described above, we have taken the 1,000 ha use case study sheep and beef farm and modelled the flow on impacts for the district and its communities based on an integrated land use (10% planting) and wholesale forestry conversion (100%)

Taking this further, we have then look at these impacts across the entire area in pastoral farming in Wairoa (131,798 ha).

3.4.1 Land area and production data

If 10% of the land area was converted from sheep and beef to forestry it would result in 13,180 ha loss of sheep and beef farming area and a reduction of 107,718 SU (***Table 11***). This would in turn reduce the number of sheep sold by 48,857 and cattle by 5,048.

Wholesale planting (100% planting) would see all animals exit from farmed land and animal sales cease all together (***Table 11***).

Table 11. *Land area and production data for a 1,000 ha typical Wairoa sheep and beef farm when modelled on two scenarios of integrated land use (10% planting) or wholesale forestry conversion (100%).*

Area (ha)	Current position	10% forest planting	100% forest planting
Sheep and beef farmed area (ha)	131,798	118,618	
Forestry (ha)	55,164	68,344	186,962
Total area (ha)	186,962	186,962	186,962
Total Stock Units	1,077,185	969,467	
Sheep numbers	604,029	543,626	
Cattle numbers	120,200	108,180	
Number of sheep sales (all classes)	488,574	439,717	
Number of cattle sales (all classes)	50,479	45,431	

3.4.2 Direct local expenditure (excl. harvest or Regular)

If 10% of the land area was converted from sheep and beef to forestry it would result in $2,355,289 less direct local expenditure each year up until harvest (***Table 12***).

Wholesale planting would result in $23,552,893 less direct local expenditure each year up until harvest (***Table 12***).

3.4.3 Direct local expenditure (incl. harvest or Irregular)

If 10% of the land area was converted from sheep and beef to forestry including harvest (and in steady state situation) sees no significant change in direct local expenditure each year (***Table 12***).

Wholesale planting including harvest would result in a decrease of $5,175,021 direct local expenditure each year (***Table 12***).

3.4.4 Employment (excl. harvest or Regular)

If 10% of the land area was converted from sheep and beef to forestry up until harvest would result is a loss of 69 direct jobs (***Table 12***). The equated to 2.2% of the people in paid employment in Wairoa.

Wholesale planting excluding harvest would result in a reduction of 686 jobs (22% of people in paid employment in Wairoa) (***Table 12***).

3.4.5 Employment (incl. harvest or Irregular)

If 10% of the land area was converted from sheep and beef to forestry area, including harvest (and in a steady state situation), there was a reduction of 31 jobs (***Table 12***).

Wholesale planting including harvest would result in a reduction of 303 jobs (***Table 12***).

Table 12. *Metrics of direct expenditure (excluding and including harvest) and employment for a 1,000 ha typical Wairoa sheep and beef farm when modelled on two scenarios of integrated land use (10% planting) or wholesale forestry conversion (100%).*

Metric	Current position	10% forest planting	100% forest planting
Direct local expenditure (excl. harvest), $			
Sheep and beef	37,692,589	33,923,330	
Forestry	5,918,178	7,332,147	20,057,874
Total	**43,610,767**	**41,255,478**	**20,057,874**
Direct local expenditure (incl. harvest), $			
Sheep and beef	37,692,589	33,923,330	
Forestry	13,610,246	16,862,003	46,127.814
Total	**51,302,835**	**50,785,333**	**46,127,814**
Employment (excl. harvest), no. of jobs			
Sheep and beef	980	882	
Forestry	123	153	418
Total	**1,104**	**1,035**	**418**
Employment (incl. harvest), no. of jobs			
Sheep and beef	980	882	
Forestry	284	351	961
Total	**1,264**	**1,233**	**961**

4. OBSERVATIONS

Using the sheep and beef and forestry models, the following observations were made on metrics of net return, direct local expenditure and employment rate.

4.1. ECONOMIC RETURNS AND NPV

Based on current log prices and the value of carbon, the typical sheep and beef farm was found to be unable to complete with forestry returns over a 60-year period.

Forestry returns were under-pinned by the value of carbon and the ability to generate cash flow early (previously had to wait 30 years until harvest for a return).

It is important to note that over a 60-year period, the top 25% of sheep and beef businesses (EFS/ha over $422/ha) were on par with these returns.

For sheep and beef farmers, there are clearly opportunities to tap into these returns on country that may not be as suitable to for pastoral farming or not capable of $422/ha returns. However, they must take a long-term view as once the land use has changed there is no going back.

4.2. DIRECT LOCAL EXPENDITURE

Both the consistency and total of amount direct local expenditure by sheep and beef farms is crucial for local businesses. These businesses that provide the products and services for sheep farm depend on this spend for their livelihood.

While overall, forestry expenditure was comparable (87%), a significant proportion of this spend occurred at harvest – at year 30. This irregularity and lag phase in expenditure before harvest occurs (i.e. little spend occurring prior to harvest) will have a detrimental effect on local communities. It would be worth understanding the multiplier (ripple) effect of the spend through the regional economy.

4.3. EMPLOYMENT

Again, the consistency of employment in the sheep and beef business sets it apart from the forestry sector. Year-on-year the products and services required change very little and a steady local job market can be built around this. Sheep and beef farms appeared to generate a greater mix of job types both in terms of labour and services.

At present, 980 direct jobs come from sheep and beef farms – 30% of the people in paid employment in Wairoa. Employing this number of people flows into other sectors (education, health, retail, entertainment). As with the direct expenditure, the full generation of jobs in forestry did not occur until harvest time – year 30. This irregularity is a weakness of the forestry industry's contribution to the wider communities.

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6. APPENDICES

Appendix A – Weighted Average 1,000ha Farm Performance, Revenue and Expenditure

Table 13: *Wool, sheep meat, beef meat and total meat and wool production for a case study farm using the weighted average (2014 to 2018) of the Wairoa farms in the Eastern North Island Class 3 (hard Hill Country) and Class 4 (Hill Country) farms.*

Year	Wool Sold (kg Greasy)	Sheep Meat Production (kg)	Beef Meat Production (kg)	Total Meat and Wool Production (kg	Total Meat and Wool Production per ha (1,000ha)
2014/15	16840	60310	69693	162077	162
2015/16	19180	61130	64012	144322	144
2016/17	17113	65841	74332	157285	157
2017/18	15702	60416	58322	134441	134
4-year weighted average	**17163**	**61879**	**66339**	**149074**	**149**

Table 14*: Sale prices for wool, sheep and beef cattle for a case study farm using the weighted average (2014 to 2018) of the Wairoa farms in the Eastern North Island Class 3 (hard Hill Country) and Class 4 (Hill Country) farms.*

Year	Store Lamb ($/hd)	Prime Lamb ($/hd)	Prime Hogget ($/hd)	2th Ewe Store ($/hd)	MA Cow Prime ($/hd)	2Yr + Steer Prime ($/hd)
2014/15	$65.69	$84.32	$11.52	$149.81	$986.76	$1535.25
2015/16	$68.11	$84.97	$97.26	$162.37	$1011.74	$1553.22
2016/17	$79.12	$91.20	$109.45	$133.07	$1015.64	$1652.88
2017/18	$105.43	$121.83	$122.98		$1034.40	$1467.67
4-year weighted average	**$74.03**	**$96.90**	**$109.33**	**$147.53**	**$1010.80**	**$1556.83**

Table 15: *Expenditure per year and 4-year weighted average for a case study farm using the weighted average (2014 to 2018) of the Wairoa farms in the Eastern North Island Class 3 (hard Hill Country) and Class 4 (Hill Country) farms. Expenditure has been allocated a weighting as to the % spent locally that would go directly into wages and the total direct local spend derived from that.*

Year	Weighted Average Spend $				4-year weighted average	% direct local expenditure	Total Direct Local spend p.a.
	2014/15	2015/16	2016/17	2017/18			
Wages & Rations	$65,454	$71,552	$88,621	$76,896	$83,477.37	100%	$83,477
Animal Health	$29,748	$34,772	$33,631	$37,642	$37,470.47	25%	$9,368
Weed & Pest	$6,947	$10,435	$5,432	$12,819	$9,832.51	50%	$4,916
Shearing	$22,667	$26,297	$28,229	$26,113	$28,505.69	85%	$24,230
Fertiliser	$73,032	$82,256	$62,880	$74,803	$80,841.69	15%	$12,126
Lime	$3,360	$672	$2,422	$5,289	$3,240.27	15%	$486
Seeds	$2,228	$857	$2,124	$4,234	$2,605.58	20%	$521
Vehicles	$14,813	$11,391	$11,889	$13,652	$14,278.30	90%	$12,850
Fuel	$8,209	$10,849	$9,450	$10,684	$10,814.35		$0
Electricity	$5,228	$5,845	$7,499	$6,713	$6,977.16		$0
Feed & Grazing	$26,782	$22,288	$6,005	$11,636	$18,407.93	50%	$9,204
Cultivation & Sowing	$2,051	$7,304	$1,283	$3,085	$3,786.42	90%	$3,408
Cash Crop Expenses	$4,869	$0	$0	$0	$1,343.54	90%	$1,209
R&M	$43,498	$50,394	$51,021	$59,535	$56,414.80	50%	$28,207
Cartage	$5,809	$7,294	$9,193	$8,213	$8,418.34	50%	$4,209
Admin	$14,893	$13,481	$12,717	$15,097	$15,504.48	75%	$11,628
ACC Levy	$3,588	$4,016	$4,864	$4,314	$4,630.46		$0
Insurance	$7,280	$8,274	$9,181	$8,483	$9,165.75	5%	$458
Rates	$17,632	$18,641	$20,548	$20,627	$21,370.81	100%	$21,371
Interest	$70,732	$87,064	$67,214	$69,155	$81,170.99	5%	$4,059
Rent	$56,225	$42,742	$52,915	$44,755	$54,259.75	100%	$54,260
Total Cash Expenditure	**$485,042**	**$516,419**	**$487,115**	**$513,745**	**$552,517**		**$285,988**

Appendix B –1,000ha Forest Expenditure

Table 16: *Forestry Expenditure by item spent locally in Wairoa. Note in the analysis completed all costs up until harvest were averaged over the first 29 years with the harvest costs being added at year 30.*

Expenditure item	Total Spend for 1,000ha	Incurred	% direct local expenditure	$ Spent Locally p.a.
Rates	19,200	Annually	100%	19,200
R&M and Admin	35,000	Annually	75%	26,250
Insurance fire	5,000	Annually from yr 5	0%	
Insurance wind	10,000	Annually from yr 10	0%	
Planting (seedlings, spot spray & labour)	1,510,000	Yr 0	42%	21,233
Thinning	525,000	At yr 5	80%	14,000
Prune 1st lift	367,500	At yr 7	80%	9,800
Prune 2nd lift	367,500	At yr 8	80%	9,800
Prune 3rd lift	262,500	At yr 9	80%	7,000
Harvest (logging, roading & cartage)	59,760,000	At yr 30	7%	4,183,200
Average Year 0-29				107,283
Average Year 30				4,290,483
Average for 30 years				246,723

Table 17: *Forestry expenditure for carbon farming**.** Note for Carbon Farming R&M and Admin are assumed to be lower given the minimal maintenance. Planting costs are also lower as 300 stems rather than 1,000 stems per hectare are planted. As such, the annual direct spend in Wairoa is $21,075. At planting the direct Wairoa spend is $190,260 or if averaged over 30 years this is an additional $6,342, so $27,417 spend annually over 30 years**.***

Expenditure item	Total Spend for 1,000ha	Incurred	% direct local expenditure	$ Spent Locally p.a.
Rates	19,200	Annually	100%	19,200
R&M and Admin	2,500	Annually	75%	1,875
Insurance fire	5,000	Annually from yr 5	0%	
Insurance wind	10,000	Annually from yr 10	0%	
Planting (seedlings, spot spray & labour)	453,000	Yr 0	42%	6,342
Average for 30 years				27,417