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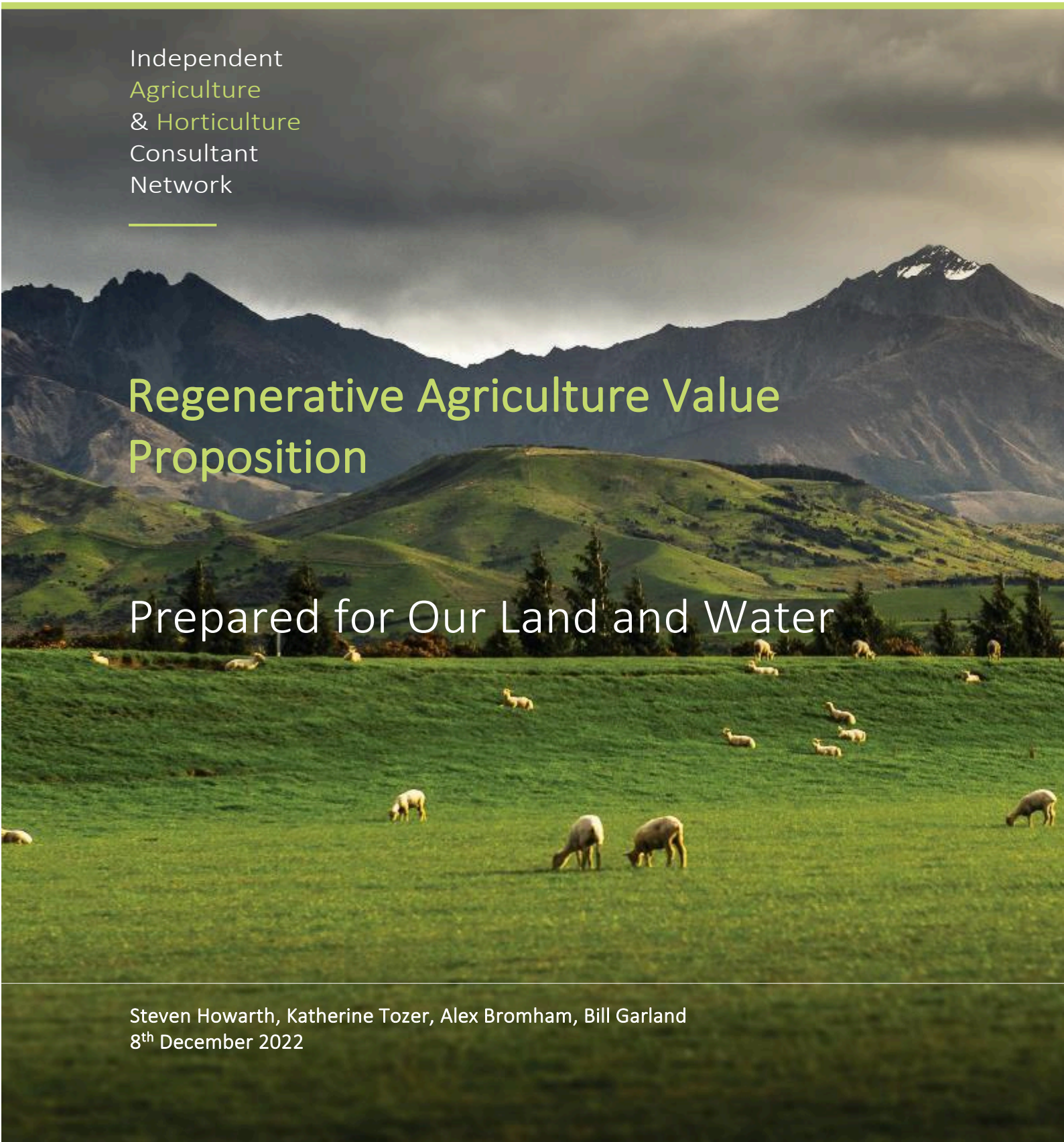

Regenerative Agriculture Value Proposition

Prepared for Our Land and Water

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1.0 EXECUTIVE SUMMARY

The purpose of this project was to define the value proposition for regenerative agriculture in a sheep and beef context for New Zealand, using a survey approach to compare the economic performance of conventional and regenerative farms. The assessment of financial performance was based on a Profit and Loss budget, with Earnings before Interest, Tax, Rent and Management Wage (EBITRm) used as the main profitability measure. FARMAX modelling provided insight into the drivers behind the physical performance by assessing feed harvested and livestock performance.

A total of 8 regenerative and conventional farm pairs (16 farms total) provided actual financial and performance data: three in Waikato, two in Northland, two in Taranaki, and one pair in Canterbury. Pairing criteria were based firstly on location (same region, in a similar climate), secondly on land class, and thirdly on having similar livestock policies.

The performance of each farm was influenced by a multitude of variables, and as such, the purpose was to identify major differences in economic performance that could be used to design more in-depth studies.

Verified annual accounts data were collected from the survey farms between 2017/18 and 2020/21. The data showed that:

- Total gross revenue was $382/ha higher for conventional farms ($1473/ha) than regenerative farms ($1091/ha, $P<0.05$).
- Total farm expenses and individual expense items were highly variable. Many expenses were driven by factors such as base asset condition, land class, owner's management objectives, and farm scale, rather than whether the farm was conventional or regenerative.
- Earnings Before Interest, Tax, Rent and Management Wage (EBITRm) was $340/ha higher for conventional farms ($613/ha) than regenerative farms ($273/ha, $P=0.050$). This difference was driven by the higher revenue, as total farm expenditure was similar.

FARMAX models were developed for one selected year in common for each farm. The modelling showed that:

- Net pasture production or the amount of pasture consumed by stock (excluding supplement) was 0.8 t DM/ha higher for conventional farms (7.3 t DM/ha) than regenerative farms (5.5 t DM/ha, $P<0.05$).
- Net product per ha (meat and wool) was 125 kg/ha higher for conventional farms (326 kg/ha) than regenerative farms (201 kg/ha, $P=0.051$).
- Sales of product was the main revenue stream for all surveyed farms, with a higher volume of product aligned with higher revenue.
- The drivers of net product, such as the type of livestock policies run, animal performance and sales/purchase decisions varied greatly between the two farm types ($P>0.05$). There were some interesting trends which warrant further investigation, such as trends towards higher cattle growth rates for conventional farms, and heavier carcass weights for regenerative farms.

- Green House Gas (GHG) emissions intensity was lower (less GHG per kg product) for conventional farms (16.3 kg CO_2e/kg product) than regenerative farms (20.2 CO_2e/kg, $P<0.05$).
- There was no difference between the farm types in total emissions per hectare (5.0 T CO_2e/ha for conventional and 3.9 T CO_2e/ha for regenerative), which reflected the large variation between farms ($P>0.05$).

A survey was completed to provide further insight into the importance that conventional and regenerative farmers placed on financial performance.

- All farmers had goals around profitability to fulfil other goals, such as farm development or lifestyle goals. Profit for the sake of profit was not raised by any farmers.
- When compared to conventional farmers, regenerative farmers placed a lower emphasis on profitability and more emphasis on the health of the pasture (e.g. nutrient content) and livestock, and land improvements. This is not surprising considering that these are core attributes of the regenerative farming philosophy.
- The challenge, however, is that the lower profitability of regenerative farming creates a barrier for adoption for conventional farmers, given they place a greater emphasis on profitability.
- It should be noted that regardless of the farm type, all farmers involved in the project sought to maintain a financially viable business, to maintain healthy soils, pastures, and livestock, and to improve the land. It was just the relative importance of these factors that differed between the two farm types.

There is significant interest in regenerative agriculture by the consumer and large multinational companies such as Danone and Nestle. This project indicates that to provide a value proposition for regenerative agriculture at the farm gate, premium pricing is needed to offset the reduction in production to encourage greater uptake among conventional farmers.

2.0 INTRODUCTION

There is growing interest in regenerative farming throughout New Zealand, with some farmers aligning with a regenerative approach (Grelet 2021). There are many definitions of regenerative agriculture, with some focusing on processes, some on outcomes, and some a combination of both processes and outcomes (Newton et al. 2020). Characteristics of regenerative agriculture frequently include a focus on higher pasture covers before grazing, higher residuals after grazing, a longer grazing round, increased botanical diversity and reduced synthetic fertiliser use (Newton et al. 2020).

In the Impact of "Regenerative Farming on Meat Quality" Rural Professional Fund project for the National Science Challenge (2020-2021), the subcontractor worked with nine regenerative-conventional farm pairs. Each of the 18 farmers were asked about their suggested research priorities in the regenerative agriculture space. While there was a range of suggestions, assessing the economic viability of regenerative farming was the most requested topic with half the farmers asking for this. Some of the conventional farmers believed that regenerative farming would lead to productivity and profitability losses and that it would not be economically viable. Conversely, some of the regenerative farmers believed that regenerative farming would lead to healthier soils, pastures and livestock and this in turn would lead to improved productivity and profitability.

Despite the growing interest in regenerative farming, there are little published data to quantify the productive and economic performance of regenerative farming (Francis 2021). These data are vital to assist farmers with the decision-making process in adopting regenerative agriculture.

The aim of this project was to compare the economic performance of paired regenerative and conventional sheep and beef farms.

A further aim was to understand the personal goals and aspirations of farming practitioners and how they have integrated regenerative farming practices in their farm systems; hence the use of self-classification.

FARMAX models were established for all survey farms based on a representative year; this provided a basis for identifying differences in pasture and livestock performance which drive farm revenue.

The financial and physical performance of the farming system is a major component for those considering adoption of regenerative farming. However, there are many other factors such as complexity, fit with the system, environmental impacts, and personal, social and cultural that drive farming decisions (Pannell et al. 2006). A holistic view of regenerative farming is needed for those considering adoption.

3.0 MATERIALS AND METHODS

3.1 Farm Selection

A total of eight regenerative and conventional farmer pairs (16 farms total) provided data; three in Waikato, two in Northland, two in Taranaki, and one pair in Canterbury.

Regenerative farms were identified first, then conventional farms were selected to form each of the eight pairs. Pairing criteria for the conventional farm was based firstly on location (same region, in a similar climate as the regenerative farm with which it was paired), secondly on having a similar land class, and thirdly on having similar livestock policies. The purpose of this pairing was to minimise variation in the basic productive potential of the farm, such as flat land versus hilly land, or farms in regions with wet summers versus dry summers - factors which would cause significant variation between farm types.

Farmers classified themselves as regenerative or conventional for the purposes of this survey. Regenerative farms were considered by the farm manager to have been farmed under regenerative principles for a minimum of five years, with a similar approach used in selecting conventional farms.

3.2 Financial Performance

Verified annual accounts data were collected from the survey farms from 2017/18 through to the 2020/21 financial years; four years of data were used to obtain an average to minimise annual fluctuations.

A standardised chart of accounts using a B+LNZ Economic Service template was used and adjustments for each survey farm were made to conform to this format.

The collated accounts data was reviewed by each farmer. This provided an opportunity to review their performance trends over the four years and to anonymously benchmark themselves with the other farmers in the project. This meeting was also used to ensure the collected data was a fair representation of the operational performance of the farm. Adjustments to the data included:

- Removal of off-farm income sources such as contracting income, interest received, and housing rental.
- Removal of on-farm income not related to the operational running of the farm, such as beehives, timber sales, and airstrip fees (used by neighbours).
- Removal of capital spending (considered as operational costs in the accounts) under repairs and maintenance. Examples included new fence lines, housing renovations, expansion of the water systems, or new tracks.

3.3 FARMAX Modelling

A FARMAX model was developed for one selected year for each farm. The year was selected in consultation with each farmer on the following basis:

- The year was common for each pair.
- The year was one of the financial years between 2017/18 and 2020/21 to align with accounts data collected in Section 4.2.
- Performance represented a typical year (based on cash flows, livestock policies and climate (e.g. typical rainfall)). Examples where performance was not typical included large changes in stock numbers or years subject to climatic extremes.
- A recent year was selected where possible as this made it easier for the manager to provide performance data not captured in the accounts, such as livestock weights, reproductive performance and supplement use.

Five farm pairs were based on the 2020/21 year, and the remaining three were based on the 2019/2020 year.

FARMAX is a biological model used to define livestock numbers and performance, land area, pasture growth, and land use; reports provide insight into physical and financial performance (Marshall et al 1991).

Data entered into Farmax included:

- Opening and closing livestock numbers, based on the annual accounts.
- Individual sale and purchase transactions including actual live/carcass weights.
- Reproductive performance of capital stock.
- Livestock weights where available. Where weights were not available, assumptions were made in conjunction with the farmer and any sale/purchase weights were used to ground truth such assumptions.
- Cropping areas, crop types and yields.
- Pasture conservation and supplements fed out.
- Nitrogen fertiliser use.

Once a base Farmax model was created from the records supplied, the farmer reviewed the model of their farm. Adjustments were made as necessary to ensure the model was a fair representation of actual performance. The farmer was also provided with the opportunity to benchmark themselves anonymously against the other survey farmers.

3.4 Statistical Analysis

Data were analysed as paired farm comparisons using Genstat, 21st edition (Genstat 2021). Initially, the analyses included 8 farm pairs. However, the eighth pair was omitted due to the regenerative farm making a significant financial loss each year (EBITRm in the order of -$1800 to -$2400/ha/yr). This was likely due to a combination of differing management objectives,

high expenditure, and a small size (25 ha); this farm was deemed not representative of the regenerative farms assessed here. Thus, analysis was undertaken only upon the remaining seven farm pairs.
Physical performance data were analysed by Residual Maximum Likelihood (REML) (Patterson and Thompson 1971) with region, farm type (conventional or regenerative) and their interaction as fixed effects, and farm pair as random effect.

Farmax data were analysed using REML with farm type as a fixed effect. Since all data met the normality assumptions of the analyses, no transformations of the data were performed.

3.5 Farmer Survey

To gain an understanding of how farmers defined regenerative farm management practices and how they view economic success of their farm business, a survey was completed by all 16 farmers.

The survey covered farm level attributes such as land area, pasture renovation and cropping, fertiliser inputs, supplement use, herbicide/pesticide use, animal health product use, rotation lengths, pre/post grazing targets and documentation aligned with compliance. Farmers were asked to provide information based on typical management practices and were not asked to define this for a selected year.

The survey also covered how each farmer measured economic success, with questions including what they enjoy about farming, what a successful farmer looks like, and goals and key projects going forward. A copy of the survey is included in the appendix.

The survey results were collated to identify general themes, and where numerical data was available, data were averaged by farm type. The survey was largely qualitative by nature and based on farmers opinions and practices; therefore statistical analysis was not performed.

4.0 RESULTS AND DISCUSSION

4.1 Financial Performance

The financial performance outlined in Table 1 is based on an average of four years of accounts data (2017/18 to 2020/21) averaged over seven farm pairs.

The results show total gross revenue was $382/ha higher for conventional than regenerative farms (P<0.05). Differences behind the total gross revenue in terms of sheep and cattle revenue were variable due to differing ratios of sheep to cattle, different livestock policies and fluctuating end of year numbers.

Expenditure was also highly variable across the farms with many costs driven by the base assets and their condition, land class, owner's management objectives, and farm scale. However, overall total farm expenses were very similar between the two farm types (P>0.05).

Some of the regenerative farmers commented that lower fertiliser expenses was a feature of their type of system, while other regenerative farmers continued to invest in fertiliser products; as a result, fertiliser expenses were broadly variable.

There was insufficient data for analyses of wages and shearing expenses, as not all farms were running sheep or employed staff.

Earnings Before Interest Tax Rent and Management Wage (EBITRm) were higher for conventional farms than regenerative farms, by $340. This was largely driven by a higher revenue for the conventional farms (P=0.05).

Table 1: Summary Profit and Loss financial data based on the 2017/18 to 2020/21 financial years for seven conventional and regenerative farm pairs, based on the effective grazing area.

	Conventional	Regenerative	P Value
Revenue Per Hectare ($/ha)			
Wool	39	3	N/A
Sheep Total	516	256	N/A
S Sales	561	248	N/A
S Purchases	22	74	N/A
S Capital Value Change	30	82	N/A
Cattle Total	700	690	NS
C Sales	1046	1082	NS
C Purchases	557	485	NS
C Capital Value Change	214	187	NS
Dairy Grazing	207	130	N/A
Other	11	13	N/A
Total Gross Revenue ($/ha)	1473	1091	0.022
Expenditure Per Hectare ($/ha)			
Wages	78	2	N/A
Animal Health	59	54	NS
Weed & Pest Control	11	9	NS

Shearing Expenses	41	4	N/A
Fertiliser	174	123	NS
Vehicle Expenses	62	81	NS
Electricity	14	12	NS
Feed and Grazing	113	90	NS
Repairs and Maintenance	91	130	NS
Cartage	17	17	NS
Administration	46	53	NS
Total Farm Working Expenses ($/ha)	716	587	NS
Insurance	24	28	NS
ACC Levies	6	5	NS
Rates	40	45	NS
Depreciation	74	154	NS
Total Farm Expenses ($/ha)	1017	1085	NS
EBITRm ($/ha)	613	273	0.050

NS = Not significant (P>0.10)
N/A = Insufficient farm pairs to run an analysis

4.2 Physical Performance

Based on the financial data, revenue was higher from the conventional farms than regenerative farms. The Farmax data provide further insights into why this occurred.

Net pasture production or the amount of pasture consumed by stock (excluding supplement) was 0.8 t DM/ha higher for conventional than regenerative farms (P<0.05). One of the principles of regenerative farming raised by several regenerative farmers in the study is to 'eat ⅓, trample ⅓, leave ⅓'. This is consistent with the results that less pasture was consumed on regenerative farms. Secondly, from the survey (reported in Section 4.3.6), target pre/post-grazing heights were higher for some regenerative farms, although it should be noted that the majority of both regenerative and conventional farmers did not use objective measures as part of their grazing program so it was not possible to assess if this occurred in practice.

Net product per hectare (i.e. the kilograms of carcass and wool produced), tended to be higher for conventional than regenerative farms (by 125 kg/ha, P=0.05). Sales of product were the main revenue stream for all surveyed farms and were aligned with the higher revenue from conventional farms.

Green House Gas (GHG) emissions (methane + nitrous oxide) intensity is defined as the kilograms of Carbon Dioxide Equivalents produced per kilogram of meat and wool. Emissions intensity was 4 kg CO_2e/kg product lower for conventional farms than regenerative farms (P<0.05), showing conventional farms were more efficient at producing meat and wool. When compared to regenerative farms, the greater pasture production (+31%) on conventional farms would increase GHG emissions. However, the greater net product per hectare (+62%) on conventional farms would dilute the GHG emissions. It was the lift in production that drove the improved efficiency.

There was no difference in absolute emissions which averaged 5.0 T CO_2e/ha for conventional farms and 3.9 T CO_2e/ha for regenerative farms (P>0.05). We believe this lack of significance was due to the variability of the data and that a larger sample size is needed.

In a global context, there is an advantage to lowering GHG emissions per unit of food produced. This increased efficiency favours conventional farms. Yet given the New Zealand government's intention to tax agriculture GHG emissions based on the total quantity emitted from the farm, there is little to no incentive to improve efficiency.

Table 2: Farmax performance data for a selected year for seven conventional and regenerative farm pairs, based on the effective grazing area.

	Conventional	Regenerative	P Value
FEED			
Nitrogen Boost (t DM/ha)	0.2	0.0	NS
Net Pasture Production (t DM/ha)	7.3	5.5	0.042
Feed Conserved (t DM/ha)	0.13	0.17	NS
Total Feed Eaten (t DM/ha)	7.6	5.8	NS
Demand from Supplements (%)	5.3	3.9	NS
Standardised Stocking Rate (SU/ha)	13.9	10.6	NS
Live Wt. Wintered (1 Jul) (kg/ha)	769	629	NS
Net Product (kg/ha)	326	201	0.051
Feed Conversion Efficiency (kg DM/kg product)	25.1	30.4	NS
REVENUE			
Gross Farm Income per kg DM Eaten ($/kg DM)	22.2	18.4	NS
Gross Farm Income per ha ($/ha)	1705	1060	0.046
GHG EMISSIONS			
Total GHG Emissions (T CO2e/ha)	5.0	3.9	NS
GHG Emissions Intensity (kg CO2e/kg product)	16.3	20.2	0.040
REPRODUCTION			
Sheep Scanning %	146	152	NS
Sheep Weaning % - Overall	128	122	NS
Sheep 90 Day Weaning Wt	26	31	NS
Ewe Efficiency	58	58	NS
Beef Weaning %	52	85	NS
Beef 200 Day Weaning Wt	146	222	NS
Cow Efficiency	24	44	NS
SHEEP PERFORMANCE			
1SB GM / DM (c/kg)	14	17	NS
1SB kg DM / kg Product	22	31	NS
1SB Avg. Carcass Weight	16.3	19.1	NS
1SB Avg. Value ($/hd)	109	134	NS
1SB Avg. Value ($/kg Cwt)	5.6	7.0	NS
BEEF BREEDING PERFORMANCE			
1BB GM / DM (c/kg)	7.1	11.9	NS
1BB kg DM / kg Product	31	43	NS
1BB Avg. Carcass Weight	93	180	NS

1BB Avg. Value ($/hd)	506	967	NS
1BB Avg. Value ($/kg Cwt)	3.6	5.4	NS
BEEF FINISHING PERFORMANCE			
1BF GM / DM (c/kg)	14.8	14.8	NS
1BF kg DM / kg Product	19	26	NS
1BF Avg. Lwt. Gain	0.54	0.51	NS
1BF Avg. Carcass Weight	225	267	NS
1BF Avg. Value ($/hd)	1272	1402	NS
1BF Avg. Value ($/kg Cwt)	4.7	5.2	NS

NS = Not significant (P>0.10)

It was not possible to obtain robust comparisons of livestock policy performance (Table 2) due to variation between the farm types in numbers and types of policies. This was due to differences in land class and management objectives (Table 3).

Table 3: Number of regenerative and conventional farms with the listed livestock policies.

	Regenerative	Conventional
Sheep Breeding	3	5
Beef Breeding	4	2
Steer/Heifer Finishing	5	5
Bull Finishing	1	3
Dairy Grazing	2	2

4.3 Farmer Survey

4.3.1 Farm Background

Farm areas varied within both farm types; the regenerative farm size ranged from 25 ha to 325 ha, and conventional ranged from 115 ha to 800 ha.

All surveyed farmers had been farming under their self-classified farm type for a minimum of five years, with some much longer, for up to 30 years. Some of the regenerative farmers noted they had been farming under the regenerative style of farming before the current label was given.

Of the regenerative farmers, three had switched from conventional to regenerative, and the remaining five had farmed regeneratively for the whole time that they had been present on the surveyed property.

4.3.2 Pasture Renovation

Pasture renovation was done infrequently on all surveyed farms. Six of the eight conventional farms typically regrassed 1-7% of the effective farm area, and four of the eight regenerative farms regrassed between 3-16% of the effective area. Species sown differed between farm types with all conventional farms sowing ryegrass-clover pastures and some including cocksfoot and prairie grass. Sown pasture mixtures were a lot more diverse on regenerative

farms, with up to 20 species sown (e.g. timothy, prairie grass, cocksfoot, tall fescue, ryegrass, clovers, plantain, chicory, buckwheat, vetch, radish, sunflower and kale).

Cropping followed a similar pattern to regrassing, with six of the conventional farms sowing crops such as maize, chicory, fodder beet, and rape. For regenerative farms, cropping was less common. Only two regenerative farms practiced cropping, and in both cases used a diverse species mix that included brassicas, legumes, grains and herbs.

Cultivation was consistently used on both farm types, with the common aim of minimising soil disturbance. Most farmers used direct drilling or oversowing. One conventional farmer used shallow cultivation (3 inch) and one regenerative farmer used a full plough cultivation; this regenerative farm was organic and ploughing was important for weed control.

4.3.3 Fertiliser

Fertiliser product use differed between the two farm types. Conventional farms focused on nitrogen, phosphorus, potassium, sulphur and lime. Seven farms used either ammonia sulphate, urea or DAP, and two of the farmers included trace elements such as selenium, cobalt, boron and copper.

For the regenerative farms, there was a wide range of fertiliser products including lime, humates, microbes, compost, RPR, Guano, milk powder, liquid seaweed, fish hydrolysate, chicken manure, and trace elements including boron, molybdenum, copper, and sodium. The emphasis was on using natural products, synthetic fertilisers were avoided, and there was a wider focus on the number of nutrients used. It was also noted that two regenerative farms used sulphate of ammonia, which is a synthetic fertiliser. No other regenerative farms used any nitrogen fertilisers.

4.3.4 Supplements

The majority of farms used hay and baleage harvested on farm. No other supplements were used (except meal for calf rearing) on regenerative farms. Two regenerative farms purchased some baleage/hay, and one farm did not use any supplement.

For conventional farms – one did not use any supplement, two used palm kernel (bought in), and one used maize (grown on farm).

4.3.5 Chemical use

Most regenerative and conventional farms used herbicides. Chemicals included Glyphosate, Brushkiller, Metsulfuron 24-D, and MCPA, to control weeds including gorse, blackberry, thistles and flat weeds. Some farmers noted that they would like to move away from herbicides in the future once weeds were controlled. One regenerative and one conventional farm did not use any herbicides.

Pesticides were only used by conventional farms, but only as part of the cropping program.

Animal heath treatments were used by every farm. Products included oral/pour-on/capsules/injectable drenches to treat internal parasites, clostridial vaccinations, fly/lice pour-ons, and mineral supplements such as oral/injectable/licks to provide minerals including selenium, copper, zinc, B12 and sodium.

4.3.6 Grazing

All farmers were asked about their target grazing plans, in terms of both rotation lengths and pre/post- pasture grazing heights. Most farmers provided very limited information as demonstrated by Table 4. Generally, the surveyed farmers placed little emphasis on these objective measures.

Rotation lengths were largely similar, although some regenerative farmers aspired to longer rounds. Rotation lengths were shortest in the spring and longest in the winter for both farm types, which is common practice to match the rate of pasture growth.

Pasture cover targets were dependant on the stock class. Two conventional farmers provided set stocking targets (pre-grazing) for ewes of 1300-1600 kg DM/ha, and post grazing of 900-1100 kg DM/ha. These targets are not included in the table as sheep and cattle targets differ. All pre/post grazing targets in Table 4 are for cattle.

For cattle, regenerative farmers were generally targeting higher pre-grazing pasture covers, yet post-grazing covers were similar for both farm types. It is difficult to see how regenerative farms can achieve a higher pre-grazing pasture cover given that rotation lengths and post-grazing pasture cover targets were similar. This could only be achieved by high pasture growth rates, which is contrary to net pasture harvested data (see Section 4.2).

Overall, there appeared to be a poor understanding of objective grazing measures, only two conventional and one regenerative farm were able to provide targets throughout the year.

Table 4: Pasture rotation length and pre/post pasture grazing targets for cattle on the surveyed farms. The number of farmers that responded are shown in brackets.

Rotation Length (days)	Spring	Summer	Autumn	Winter
Conventional	21-30 (5)	28-60 (5)	30-80 (4)	30-120 (6)
Regenerative	18-30 (4)	30-90 (4)	30-90 (4)	30-150 (5)
Pre Grazing Pasture Cover (kgDM/ha)				
Conventional	2000-3000 (4)	3000 (2)	3000 (2)	2700-3250 (3)
Regenerative	3500-4700 (3)	3000-4200 (3)	3000-4000 (2)	2500-4000 (4)
Post Grazing Pasture Cover (kgDM/ha)				
Conventional	1500-1800 (3)	1500-1600 (2)	1500-1600 (2)	1000-1600 (3)
Regenerative	1600-2000 (2)	1477 (1)	1266 (1)	1055-1600 (3)

4.3.7 Documentation

Approximately 50% of regenerative and conventional farmers were part of an accreditation scheme. These included New Zealand Farm Assurance Program (NZFAP), and processor led schemes through Greenlea, AFFCO, Wilson Hellaby's and Firstlight Foods. One farm was organically certified.

Short answer yes/no questions were asked to assess each farmer's understanding of Green House Gas (GHG) and nitrogen leaching losses and if they had a documented Farm Environmental Plan. Conventional farms were more active in this space, with a greater number demonstrating accreditation and / or having documented records.

Table 5: Environmental compliance, number of farmers which have documented records for GHG emissions, nitrate leaching, and a farm environment plan

	Conventional	Regenerative
Audit/Accreditation	4	4
Green House Gas	7	2
Nitrogen Leaching Loss	3	1
Farm Environment Plan	5	3

4.3.8 Enjoyment of farming

The farmers were asked what they most enjoy about farming. Attributes that were common across both farm types were:

- Working outside, especially on fine days
- Being their own boss and not being told what to do
- Working with animals and dogs
- Developing/improving the farm

Less frequently mentioned areas of enjoyment included:

- The challenge that comes with working with livestock and climate
- Producing a quality product
- Having family involved on farm

Some conventional farmers also mentioned being hands on/working hard and having a variety of work. These factors were not mentioned by regenerative farms and were the only notable difference.

4.3.9 Key Projects and Changes

Farmers were asked about key projects and changes they intend to make in the next few years.

For conventional farmers, there was a greater emphasis on subdivision and forestry, both shelterbelts/poplars and retirement/planting of marginal areas, along with production forestry. For regenerative farmers, the focus was more evenly spread. In addition to key projects listed for conventional farmers, there was also a focus on soil fertility, pasture renovation and weed control.

There were no notable differences between farms regarding livestock or people, with both farming types aiming for changes to livestock policies and/or livestock numbers.

Under the business category, two regenerative farms were aiming to lift profitability. This is consistent with the lower profitability of regenerative farms noted in Section 4.1, prompting the need to financially improve. While regenerative farmers placed a lower emphasis on

profitability, it is still a requirement to maintain a viable business and to support other farming goals. None of the conventional farms raised lifting profitability as a core focus. Two regenerative and two conventional farmers were looking to downsize their land holding or diversify away from livestock, with the aim of reducing their level of input on farm.

Table 6: Key project areas on which surveyed conventional and regenerative farmers intended to focus within the next few years.

	Conventional	Regenerative
Land		
Improving soil fertility	1	4
Subdivision	5	3
Weed Control	0	3
Shelterbelts/natives/Poplars	4	3
Production Forestry	4	2
Regrassing/improved pasture species	1	3
Livestock		
Breeding/Genetics	2	2
Improved drought resilience	2	1
Changes to livestock policies/numbers	3	4
People		
Increase casual/permanent labour	2	2
Slow down and look after health	2	1
Business		
Alternative land use	2	2
Increase land holding	1	
Reduce land holding / sell	2	2
Lift profitability		2

4.3.10 Successful farmers

Farmers were asked what a successful farmer looks like. For conventional farmers, the top three attributes were to maintain a profitable/financially sustainable business, to be contributing to the local community, and to have family involvement in both on farm and off farm activities.

For regenerative farmers, the top four attributes differed; they were healthy animals and pastures, land improvement, for the farmer to be happy, and to run a profitable/financially sustainable business.

The divergence of success here is not surprising considering a core component of regenerative farming is a focus on the health of the farm ecosystem. Profitability was less important for the regenerative farmers; it was ranked highly by three regenerative farmers in comparison to six conventional farmers.

4.3.11 Goals

The financial goals were reasonably consistent across farm type, to either maintain or improve profitability, then depending on individual circumstances, pay down debt, reinvest in development on farm, provide a comfortable lifestyle, pay children's boarding school fees or

pay a reasonable owner's wage. Profit for the sake of profit was not a goal, but rather a requirement to fulfil other goals. In section 4.3.9, two regenerative farmers were more specific about the need to improve profit, this was an unsolicited response to key business projects. When asked more specifically about their financial goals, more regenerative and conventional farmers stated they wanted to improve profit. However, as this was not raised as a 'key project', it is most likely improving profit was a lower focus.

Goals for land and stock included physical improvements such as weed control, drainage, subdivision, retiring land, planting of trees and developing wetlands. The overarching goal was to improve the land for the future, and this was consistent across both farm types.

Livestock goals differed between farm type. Conventional farmers were more focused on production, with some giving specific production targets, whereas regenerative farms noted higher level goals around stock health and producing high quality products.

Goals for the people in the business were specific to each individual's situation. Goals included family involvement, time off farm, reduced input into the farm, succession planning, and in many cases, to enjoy what they do.

4.3.12 Measures of success

Each farmer was given 100 points and asked to attribute this to the categories in Table 7.

Table 7: Farmers ranking of broad areas to measure success

	Conventional	Regenerative
Financial Performance	24	14
Land Health and Development	18	26
Family and Community	19	19
Stock and Pasture Performance	22	25
Lifestyle	17	16

There was a clear divergence on the importance of financial performance, with conventional farmers rating this highest, followed by stock and pasture performance, which are key drivers of financial performance. For regenerative farmers, land health and development followed by stock and pasture were prioritised; financial performance showed the lowest ranking.

Many farmers commented on the difficulty to rank these components in isolation as they are all interrelated in the farming system.

Lifestyle was given a low rating for both farm types. However, many considered they have the lifestyle they want with farming, so this aspect was not important when considering areas of success.

4.3.13 Background questions

The questions in the table below were asked to provide background context for the financial performance data. Responses were similar for both farm types.

Table 8: Background information on financial performance

	Conventional	Regenerative
Do you have a succession plan?	Yes – 2 No – 6	Yes – 2 No – 6
Do you/your partner earn off farm income?	Yes – 5 No – 3	Yes – 5 No – 3
Are you considering land use changes?	Yes – 4 No – 4	Yes – 5 No – 3
Are you concerned about rising interest rates?	Yes – 2 No – 6	Yes – 3 No – 5

4.3.14 Advice for others considering Regenerative Farming

Regenerative farmers were asked about the advice that they would give to other farmers considering adopting regenerative farming. The general feedback was:

- Talk to other regenerative farmers in your area and visit their properties, ideally throughout the seasons.
- Regenerative farming is not a set of rules, it is a self-defining label that encompasses a wide range of practices which are intended to promote a particular effect, without being prescriptive. Consider how these practices fit your system.
- You need to be open to new ideas and be prepared to experiment.
- Don't make large whole-sale changes, take it slowly.
- It is a conviction, you need to believe in the regenerative philosophy.
- Observe the land and stock, don't focus on the outcome, maintain a high level view, don't try to isolate and pick out components, it is a whole system change.

4.3.15 Barriers to Regenerative Farming

The conventional farmers' feedback on barriers to adopting regenerative farming were:

- Concerned over the impact this would have on profitability, six of the farmers mentioned concerns about profit.
- Brought up on conventional thinking, this would require a real mind shift.
- Reduced food production globally, and lower stocking rates/production on farm.
- Poor definition of regenerative farming, it is hard to understand what practices would need to change.
- Question if they are already farming regeneratively, just through a more conventional method.
- Lack of evidence on the differences between the two systems to make informed decisions.

5.0 GENERAL DISCUSSION AND CONCLUSIONS

The profit and loss data from the four years of annual accounts showed the revenue was $382/ha higher for conventional than regenerative farms. This was consistent with the revenue calculated through Farmax which showed revenue was $645/ha higher, based on one year of data for each farm (either 2020/21 or 2019/20). Farmax modelling showed the drivers behind the higher revenue on the conventional farms were higher pasture eaten (+0.8 t DM/ha) and higher meat and wool produced (+125 kg/ha).

Farm expenses were highly variable within both regenerative and conventional farms and on average there was no difference between the farm types. Analyses of the accounts data and discussions with farmers demonstrated that expenses were driven by factors such as the base assets and their condition, land class, owner's management objectives, and farm scale; farm type did not influence spending directly. This is supported by the farmer survey: with the exception of fertiliser, management practices including cropping, regrassing, chemical use and supplements were similar.

There was a divergence among the regenerative farmers in their approach to fertiliser. Four regenerative farmers spent less than $100/ha/yr on fertiliser and the remaining four ranged between $189 - $295 /ha/yr, when averaged over four years. Those with lower spending felt that through working with nature and getting the soil biology right they could utilise the nutrient contained in the soil and apply less fertiliser. The remaining four with the higher spend had the same aim to work with nature and the soil biology through continued use of fertiliser products. Regenerative farmers were generally united in their view that synthetic fertilisers should not be used, although two did use synthetic products containing nitrogen.

From a practitioner's point of view, the financial performance of a farm business is an output. In Farmax, net pasture production and product per hectare were greater in the conventional than regenerative farms - but these are largely outputs too. More insight is needed on what factors led to the differences between the two farm types in net pasture production, product per hectare and overall financial performance. These include differences between farm types in livestock policies, growth rates, sale and purchase timing, prices, and reproductive performance. Pasture growth, cropping and supplement use, alongside the match between feed supply and feed demand, are also all important and contribute to differences in feed supply and performance. While this project captured data on these factors, it was insufficient to draw conclusions. An analysis incorporating more farm pairs is needed to draw robust conclusions on the attributes leading to differences in net pasture production and product per hectare.

It was challenging for the project team to find sufficient regenerative farmers for this project, despite accessing farmer networks in the North and South Islands, from Northland to Canterbury. Given the geographic spread, there was a large range of livestock policies. To gain further insight into drivers that affect performance, surveys need to be more localised to reduce variability and to include a greater number of farms with similar livestock policies.

There was a significant spread in performance of the seven regenerative farms for which data are reported, from -$154 to $500/ha EBITRm, showing there is room to improve the performance of regenerative farming.

The survey showed that regenerative farmers placed a lower emphasis on profitability, with more emphasis on health of pasture and livestock, and land improvements. This is not surprising considering these are core attributes of the regenerative farming philosophy.

The challenge, however, is for conventional farmers who are considering regenerative farming, as conventional farmers place a higher emphasis on profitability. The lower profitability of regenerative farming therefore creates a barrier for further adoption. The concern that regenerative farming may be less profitable was raised by conventional farmers under the "Regenerative Farming on Meat Quality" Rural Professional Fund project for the National Science Challenge (2020-21) and was further emphasised in this project.

There is some promising potential for in market premiums for regenerative farming. Beef + Lamb New Zealand commissioned a market scan and consumer insights report into Regenerative Agriculture, focusing on the response of 'conscious foodies' (Anon 2022). It was found that between 36- 57% of those surveyed would pay an average of 20% more for sustainably produced foods.

Profitability is one component of a farm system. There are many other factors which were not considered here that will affect the whole farm system. Both regenerative and conventional farmers identified that the drivers of regenerative farming are primarily philosophical. Therefore, regardless of the economic outcomes, regenerative farming will continue to appeal to some, leading to continued uptake of regenerative agriculture.

The aim of this project was to examine the economic performance of regenerative agriculture for the New Zealand sheep and beef sector and to provide some preliminary objective data on real on-farm performance. Through the accounts analysis and Farmax modelling this has been achieved and provides useful information for those considering regenerative farming.

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8.0 APPENDIX A. FARMER SURVEY

Questionnaire: Regenerative Farming Economic Value Proposition Project

NAME:_____

1. General Farm Questions

1.1 Farm

Total and effective area:_____
Years farmed:_____
If Regenerative farming how many years for:_____
Farm management before you (if known) - any major differences?

_____
_____

1.3 Pasture renovation

How much of the farm do you regrass each year (ha):_____
How often do you regrass paddocks:_____
What pastures species are sown:_____
What tillage methods are used:_____
Any additional comments?

_____

1.4 Cropping

What crops are sown and areas sown for each
crop:_____
_____

1.5 Fertiliser policy

List all fertiliser products below, please include soil conditioners and humic acid if used

Product	Quantity applied	Area (ha)	Month applied

1.6 Supplementary feeding

List all supplementary feed including hay/silage below

Feed Type	Quantity Fed	Made on farm or purchased	Months fed out

1.7 Pasture/Animal Treatments:

Are Herbicides used? Yes/No:_____
Are Pesticides used? Yes/No:_____

If yes for either provide further details in the table

Herbicide/pesticide type	For which plant/pest	Quantities/areas used for

Animal health products used?_____

If yes for either provide further details in the table

Animal Health Product	Stock Class

1.8 Target Grazing Plans

Fill out the table to reflect the grazing targets that you aim for (this does not need to reflect actuals achieved it should be what you are aiming for, if the two differ):

	Spring	Summer	Autumn	Winter
Rotation Length (days)				
Pre grazing pasture cover (kgDM/ha)				
Post-Grazing pasture cover (kgDM/ha)				

1.9 Documentation

Is the farm part of any audit or accreditation scheme, e.g. NZFAP, BioGrow etc?

_____

Do you know your Greenhouse Gas Emissions number?

_____

Do you know your nitrogen leaching loss rate ?

_____

Do you have a documented Farm Environmental Plan?

_____

2. Measures of economic success

2.1 What do you enjoy about farming?

2.2 What are the key projects or changes do you want to have achieved in 1 years time?

Land

Livestock

People

Business size

2.3 What are the key projects or changes do you want to have achieved in 5 years time?

And why, what are the drives e.g. financial, environment, staff, time off farm, climate change, policy

2.4 What does being a successful farmer look like to you?

2.5 What are your goals and aspirations for:
The financial performance?

The land and stock you manage?

The people in your business?

2.5 Below are some broad areas to measure success. You have 100 points total to allocate to those areas which are important to you), using the number of points to indicate the importance:

- » Financial performance
- » Land health and development
- » Family / Community
- » Physical performance
- » Lifestyle
- » _____

And what do the top rank categories mean to you and why are they important

2.7 Do you have a plan for succession when you decide to retire?

2.8 Do you/your partner earn income from off farm sources, or are you planning to?

2.9 Are you planning to make any land use changes on the farm e.g. forestry, horticulture etc?

2.10 Are you concerned about the rising interest rates?

2.11 If farming regeneratively why did you decide to adopt regenerative farming?

What would you suggest to other farmers considering regenerative farming?

2.10 If farming conventionally what do you see as the barriers to adopting regenerative farming?

Thank you for filling out this questionnaire, we appreciate the time taken to complete the survey!

All data provided will remain anonymous and a draft report will be provided for feedback before publishing through Our Land and Water and through a scientific journal such as the New Zealand Grasslands Association

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