



KELLOGG
RURAL LEADERSHIP
PROGRAMME

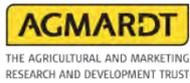
Kellogg Rural Leadership Programme
Course 43 2021
Tryphena Carter

*The benefits
of carbon farming inclusion
into pastoral farming*



I wish to thank the Kellogg Programme Investing Partners for their continued support:

Strategic partners



Programme partners



Service partners



Disclaimer

In submitting this report, the Kellogg Scholar has agreed to the publication of this material in its submitted form.

This report is a product of the learning journey taken by participants during the Kellogg Rural Leadership Programme, with the purpose of incorporating and developing tools and skills around research, critical analysis, network generation, synthesis and applying recommendations to a topic of their choice. The report also provides the background for a presentation made to colleagues and industry on the topic in the final phase of the Programme.

Scholars are encouraged to present their report findings in a style and structure that ensures accessibility and uptake by their target audience. It is not intended as a formal academic report as only some scholars have had the required background and learning to meet this standard.



This publication has been produced by the scholar in good faith on the basis of information available at the date of publication, without any independent verification. On occasions, data, information, and sources may be hidden or protected to ensure confidentiality and that individuals and organisations cannot be identified.

Readers are responsible for assessing the relevance and accuracy of the content of this publication & the Programme or the scholar cannot be liable for any costs incurred or arising by reason of any person using or relying solely on the information in this publication.

This report is copyright but dissemination of this research is encouraged, providing the Programme and author are clearly acknowledged.

Scholar contact details may be obtained through the New Zealand Rural Leadership Trust for media, speaking and research purposes.

Acknowledgements

The Kellogg Rural leadership program, has been a very worthwhile course for my professional development. I've really had to think outside my comfort zone, adapting exciting new thought processes and modern reasoning. It has been special meeting Cohort 43, and working alongside them. This interaction and learning from each other's experiences made this programme enjoyable and added to the learning experience. A big thanks to everyone in the Cohort.

Many thanks must go to Patrick Aldwell for his mentoring through the project, Scott Champion & Chris Parsons for their insights and guidance into leadership and to Lisa Rogers & Desley Tucker for their skills at organising and running the programme.

A special thanks to my employer Rabobank. By sponsoring me through the programme they have exemplified their investment in 'growing a better world together'. Their ethos and what I have learned through the course makes me excited about the opportunities in agriculture going forward. Personally, this has helped me develop additional skills gave me insight into leadership and more adaptive thinking.

Strategic, programme, service & academic partners, many thanks for your ongoing support to the programme.

1. Executive Summary:

Carbon farming at present is a hot topic in New Zealand, ongoing pressure from the government and industry leaders to be Zero carbon in all the food we produce.

The purpose of this report is to understand the ongoing factors and importance carbon farming has in New Zealand agriculture now but more so in the future. To understand the opportunities farmers have in making a more profitable business and farming more sustainably through planting trees in low productive land.

Forestry plantings are driven by farmers for many reasons. These include reducing carbon, utilising unproductive land, additional avenues of income, and helping with succession.

These opportunities are not just limited to farmers utilising land for off-setting carbon. On a more larger scale the commercial sector are actively looking to off-set their main business in carbon for example Air New Zealand, Contact, Genesis & Z are in partnership, who are trying to convert on marginal productive land.

A small percentage of forestry integrated into a farming enterprise utilising the ineffective more contoured areas will not significantly impact stock production. This can increase income and off-set the farms carbon emission footprint.

The methodology I used in this report was a literature review where I did a lot of reading and research where similar themes became apparent. The themes are:

- **Forestry returns for farmers are variable for farmers but positive if well managed.** Good cash flow and also carbon returns are possible. It has enabled the ability to match the land to best use in a sustainable way.
- **Climate change in New Zealand is becoming more topical, with farmers needing to be accountable for their emissions and actively offsetting them.** Climate change is at the forefront of media and importance to knowing your business and environmentally farmers are needing to know their emissions with ways of accounting for them and also a straightforward ways to offset these. With the latest draft of the government's climate change policy there is some real uncertainty and pressures for farmers. A lot of farmers will lag behind and some will leave the industry. They need support to adapt to changes and regulations to keep up with the new farming regulations.
- **Further education, understanding and active embracement of the impact of Climate change is, and will continue to be, required by farmers.** A lot of education is needed to fully understand emissions on farm and environmental impacts. Environmental standards are only going to get tougher.

A common theme was that forestry was going to have huge impact in off-setting emissions. When examining this we have to be careful as some opinions explore that there is not enough land in New Zealand for this to occur fully or at the current rate that it is happening.



Some of my recommendations for farmers integrating forestry into their farming systems indicates it to be worthwhile diversification, but through my research it is clear that it is key for farmers to achieve the best results they must get the correct advice from professional consultants right from the start on plantings and schemes.

With the latest Climate Commission draft we are seeing more changes with environmental responsibility and if a farmer can off-set their own carbon use it will put them ahead of the legislation, whilst also offering tax saves and including a new revenue stream.

Introduction

New Zealand is under pressure in all its industries to reduce carbon emissions to combat climate change.

Farmers are finding solutions to reduce carbon footprints on farm and are also growing economic growth simultaneously.

Every country in the world that signed up to the Paris agreement must reduce emissions (MFE, 2020). To get a Net Zero economy which is the aim of the Paris agreement we need to generate domestic credits. New Zealand imports about 98% of its liquid fossil fuel from overseas as a mix of crude oil and refined fuels. These were worth about NZD\$5 billion in 2015, or almost 10% of total imports. This importation of such a large quantity of fossil fuels begs the question, how can we change? What can we do to stop this?

Agriculture accounts for almost half of New Zealand's greenhouse gas emissions- this is one way the government is encouraging tree planting for carbon credits. There is approximately 12.1 million ha of farmland in New Zealand compared to 1.7 ha of forestry by 2028 the government wants to increase this to 2 million ha by planting one billion trees (Huffadine, 2012).

From 2025, farms will be required to measure all their greenhouses gases and pay a yet-to-be-determined price, under a government and industry plan. Basically, carbon trading is allowing farms or businesses to buy or exchange carbon credits, which finance the removal of greenhouse gases from the atmosphere. Each credit represents one metric tonne of CO₂ equivalent.

Contents

1. Executive Summary:.....	4
Introduction	5
2. Aim and Objectives:	7
3. Methodology:	7
4. Current schemes and proposed plans:	8
4.1. Emissions Trading Scheme:	8
4.2. One Billion Trees Scheme:	9
4.3. He Waka Eke Noa- A government industry agreement.....	10
5. Integrating trees into farming operations:	11
5.1. Reducing farm level carbon footprints	11
6. Integrating forestry for profitable land use change:.....	14
6.1. Costs of tree establishment:.....	16
6.2. Income streams of carbon & timber:.....	16
6.3. Generating income from native bush:.....	17
6.4. Case Study: Carbon Zero Farming:.....	17
7. Effects on land value	18
8. Carbon returns to take security over (from a bank perspective).....	21
9. Transition into biofuels the future in NZ:.....	23
10. Conclusions:	25
11. Recommendations:	26
12. References:	27



2. Aim and Objectives:

The aim of this research report:

- is to understand the benefits of planting trees on unproductive land
- how it will generate extra income for farmers
- how it can help to off-set carbon

I have focussed primarily on the pastoral sector for my case studies and they tend to have more hill country and marginal land making the recommendation more relevant to them.

3. Methodology:

Primarily I have used Literature reviews to gather themes for my project. Both data from New Zealand and overseas was used.

I had a number of informal interviews (approximately eight) with people of interest in the industry and found themes amongst them where I built up more ideas for my project. I used the thematic qualitative analysis. This helped me with my categories and themes.

Thematic analysis is a widely used methodology to analyse and report themes and/or patterns within a researched topic (Braun and Clarke 2006). Themes were identified through a process of data familiarisation and theme coding. Themes were then reviewed, researched and defined.

I have reviewed a number of case studies that have been completed to gather more insight into the practicalities of integrating carbon into pastoral farming.

I have included personal insights from my professional experience based on my Rural Valuation experience as well as working within a financial institute in the last five years.

4. Current schemes and proposed plans:

Currently there are a number of schemes in place to help guide the way trees are counted for carbon. Below we discuss each of them, some are more tailored for farmers or larger scale commercial forestry land owners.

Every country in the world that signed up to the Paris agreement has to reduce emissions (McCarthy, 2015). To get to Net Zero economy which is the aim of the Paris agreement we need to generate domestic credits. This is why these schemes are important to help drive this initiative.

4.1. Emissions Trading Scheme:

The Emissions trading scheme(ETS) this is one of 31 trading schemes around the world established in New Zealand 2008 the ETS barely functioned in the early years, a glut of allowances – this gave the holder the right to emit a certain amount of greenhouse gasses and cheap offsets kept price close to zero (EPA, 2021).

To reduce greenhouse gases -ETS is a scheme to trade carbon units called NZUs. proving to not be working, trees are not being felled in this scheme.

1 NZU represents 1 tonne of carbon dioxide. Forest owners can earn NZUs and sell them. To sell them there are two ways. The crown auctions credits with the first auction in March(4x/yearly) and currently at \$36/tonne.

If not bought at auction there is a secondary market- Forestry. There is a price floor of \$20 and ceiling cap of \$50 proposed it will be at \$150 by 2035 on exotic trees. There is a wide range of estimations of price with a lot of uncertainty going forward. Changes next year to New Zealand's unit auction prices where the floor price and trigger prices were lifted from \$20 to \$30/unit and \$50 to \$70/unit respectively, would only raise the range of value that New Zealand unit prices would move into overtime..

A native forest must have been planted post 1989 on new land (not previously in forest) and must be larger than 1 ha and the canopy must cover more than 30% of the ground and a height of 5 metres. Generally pre 1990 forests are not eligible for the scheme and can be either native or exotic tree species.

There are two options in the ETS scheme:

Averaging option is a carbon accounting method in which you receive carbon credits equivalent to the long-term average level of carbon in the forest across multiple rotations. This will be compulsory from 2023 onwards. Claim carbon for a set number of years (up to 16 years) and then once harvested you do not need to pay any more carbon and the forest must be replanted. This rotation cannot be commenced again, it must always be replanted and can only claim carbon once. The option will prove to be interesting in the future once majority of forests are past the first rotation (MPI,2020).



Pre-1990 trees are being felled and not replanted around the country.

Permanent Forest (PFSI) has to be left for 50 years. Carbon claiming can happen every year and the forest cannot be cut down. If the forest was to be cut down it can be reverted back to the averaging option say in year 24 and still have to pay the difference from year 16.

A key factor is insurance in the past has been the forest owner's responsibility. Say the forest burns down in year seven. Payment of carbon has to be paid back for those seven years. In the future the government is going to hold this liability and once the forest has grown back to year seven since a fire (there will be a seven year gap of no carbon payment) then new carbon can be claimed again. The forest must be replanted within four years of the event. This option isn't going to come into effect until 2023 (Holgate,2021).

Currently forests in the ETS scheme farmers cannot offset carbon due to its regulations. Farmers are lacking scale. Farmers are wanting to be part of this scheme and is seen as a wealth transfer platform. Seen as a more academic response and there is a way of working with farmers & stewards of the land to protect soil, water & air. Work with the national capital still a way to work and leverage to be pitched to farmers.

4.2. One Billion Trees Scheme:

One billion trees scheme(1BT)- has been developed by the government to increase tree planting with an aim to double the current planting by 2028 (MPI 2020). The aim for this is to make it easier to plant the right tree, in the right place for the right purpose. Instead of seeing large scale land conversion to forestry but focusing on planting trees to integrate within the landscape to complement & diversify our existing land uses. This scheme is for farmers & community groups to help fund the planting of native & exotic trees on their land.

There has been some real concern for rural communities involved where large forestry companies have been purchasing farms to plant out in trees.(these companies are not eligible for the 1BT funding). Communities are being swallowed up as soil types are not being differentiated by the worst unproductive soils to plant trees to productive soils and where is the social licence in this. Good intentions but poorly thought through without the robust parameters in place with some poor outcomes. Incentives are great at telling stories for example wetland and promoting good stewardship for farmers.

The base rate for the grant is \$1500/ha for pines and \$4,000/ha for natives with additional costs of approx..\$500/ha for erosion prone land and \$500 for fencing this is a guide of grants that are available.

4.3. He Waka Eke Noa- A government industry agreement.

'Our future in our hands' is a primary sector climate action group preparing farm plans for reducing emissions this is the beginning of a five-year plan. Working by making a pathway forward for farmers & growers to protect, restore and sustain our wellbeing and that of future generations.

Agricultural greenhouse gas emissions (methane and nitrous oxide) are a significant source of emissions in Aotearoa New Zealand. He Waka Eke Noa is focussed on reducing agricultural emissions, Greenhouse Gases (GHG) by 2025.

Sequestration is discussed as a long-term storage of carbon in the soils or trees. They have a work stream focused on incentives, simple & cost-effective on-farm carbon off-set integration in a farming business that doesn't qualify under ETS scheme. How can this be recognised, needs to be credible and robust measurement are still uncertain but is being investigated.

There are key milestones & framework to deliver He Waka Eke Noa targets: There is a small team that bring both the work and people together including stakeholders of farmers and government departments. Everyone wants the same outcome to support farmers and growers to reach environmentally goals. Mission as a collective to implement a framework by 2025. Empowered to measure, manage and reduce emissions. To recognised and maintain sequestration on their farms. The aim for sustainable farming for future generations. Initially farmers need to know their farm GHG emission number to help record their nitrate accounting.

Late 2020/21

- Information on how to measure and manage GHG emissions

2022

- 100% Farmers know individual emissions profile
- Government reviews progress

2024

- Emissions reporting & benchmarking system completed

2025

- Reporting and paying for individual emissions
- Environmental plan to deal with emissions

Part of this government led industry agreement the five-year initiatives still to be developed are:

- Improved tools for estimating and benchmarking emissions on-farm
- Integrated farm plans that include a climate module incorporating GHG mitigations/offsetting at the farm level



- Investment in research, development and the commercialisation of any technologies developed
- Increased farm advisory capacity and capability
- Incentives for early adopters
- Recognition of on-farm GHG mitigation such as small planting, riparian areas and natural cover.

Source Key signals and Actions under Zero Carbon Act The Journal March 2020

The main thing to consider under He Waka Eke Noa is that farmers will not have a cost until 2025 unless the government decides to bring agriculture under the ETS scheme earlier. This will not be achieved without cost. The farmers need to know a galvanised cost to get them on board, the positives need to be identified to act as a driver for change. To make it work an appropriate pricing system needs to be developed that recognises the good things that farmers are doing and incentive to do this. (Forster, 2021)

He Waka Eke Noa – the Primary Sector Climate Action Partnership is committed to finding the best outcomes for Aotearoa New Zealand and farmers and growers, while playing our part in global efforts to tackle climate change. The partnership will equip farmers and growers with practical information and tools to measure, manage and reduce on-farm emissions; recognise, maintain or increase integrated sequestration on farms; and adapt to a changing climate.

5. Integrating trees into farming operations:

There are a number of ways for farmers to integrate trees into their farming operations. Below discusses different options and scenarios for this to happen.

5.1. Reducing farm level carbon footprints

Farmers main outcome for integrating forestry into their farming operations mainly is to get better use out of the marginal land, achieve economical returns and to look after the environment.

A perspective from Henry Pinkney, Farmer, The Gates, Waiau

“There are areas on the farm which are still challenged by weeds which we spend a lot of time and effort trying to manage. These areas are marginal from a farming perspective currently, and would require significant intensive development to get them to where they would need to be, which we don’t think is sustainable. Forestry provides an economic return, manages the risk of soil erosion, gives the ability to fence off waterways, enhances native biodiversity in gullies where regeneration is happening in the forestry blocks, and helps to diversify our income, thereby reducing risk. It also enables a focus our efforts into farming the land that is best suited to pastoral farming and really making it perform wile meeting objectives.”

Farmers objectives are based on a number of options and firstly a consideration on whether it stacks up financially, then it is a no brainer especially due to the environmental positives.

Carbon farming does not have to be planting trees, soil carbon is where expensive land and land that does not have any areas suitable for forestry can utilise no wastage and store carbon.

There has been some confusion around the Zero Carbon Act (ZCA) about what farmers need to do to reduce Greenhouse gas emissions. The ZCA names these targets.

- A 10% reduction in biogenic methane levels by 2030, and a 24–47% reduction by 2050, relative to a 2017 base
- Net nitrous oxide emissions to be zero by 2050. 'Net' means that actual emissions may not need to be zero, as long as they are offset presumably by forestry. The trajectory of the reduction is not set, and given there are 30 years to 2050 (and assuming a linear trajectory), this would mean a 33% reduction by 2030.

Source Key signals and Actions under Zero carbon act The journal march 2020

These targets are national targets and agriculture makes up a large amount of methane & nitrous oxide emissions. Key targets that happen at a sector level will very much be determined by individual farmers whereas ideally it would happen naturally. A recent report states that a projection of 500,000 dairy cows will be reduced by 2025 (10% of the national herd) this will reduce stocking rates and change the land use of some dairy farms, ideally on the farms that were converted on marginal land initially. In the later six months of 2019 there was approximately 63,000 ha had been sold for forestry conversion partly overseas and to local investors. This will mean that emission will decrease at a sector level although may not be direct to the ZCA.

Farmers look at trees as income for off-farm family members, as helping with family succession within the family business and as a means to reduce on-farm carbon. In the past it was primarily for the timber before carbon was a factor. Initially it was for the timber income and not to save the planet.

The new government directive is a change from the 1970's government incentives which were to clear forests. Seeing land that is steep, erosion prone that should never have been cleared back then and now using government incentives to plant into trees.

Areas best to be planted out are Hill country & erosion prone areas.

If you have some hill country with some steep terrain, adding a carbon farming system is optimising the farming operation.

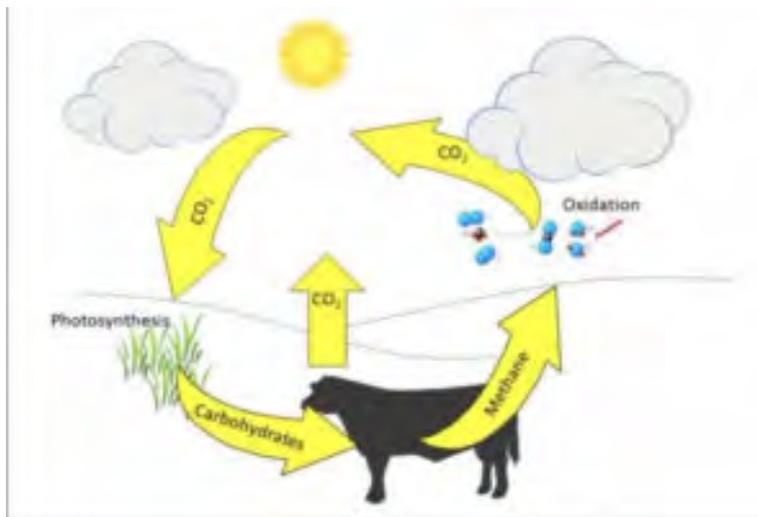
Best land use for every enterprise and class of land. Sensible approach on unproductive land. \$1100 carbon/tree/year for 28 years (paid only for first 16 years) for land not making \$100/ha.

Farmers will dislike the cost of planting trees and cost of pruning etc and the idea to team up with a company to cover these costs & regulations will be favourable. For example Dryland carbon or New Zealand Carbon farming.

New Zealand carbon is a supplier of carbon credits, they own 46,000 ha of pine trees they are targeting unproductive land and have bought blocks of land with existing trees already planted.



They also pay leases on land of smaller land areas off farmers around 10-15% of the worst unproductive area to plant trees.



Dryland carbon is a mirror image company of New Zealand carbon. It forms a partnership between Air New Zealand, Contact Energy, Genesis Energy & Z Energy. It helps these companies meet its obligations under the Emission Trading Scheme to off- set the carbon that they produce. Dryland Carbons values are to not plant productive land but instead work with farmers that have steep and erosion prone areas.

Figure 1 . Methane production by cattle within this cycle no long term impact on climate as emissions & oxidation are in balance.

Farmers need to measure current emissions now on the farming operation and what needs to be required to sequester carbon emissions from the farm. This measurement will determine how big an area farmers need to plant to meet their obligations and to off-set their carbon that is produced.

There currently isn't an incentive to plant trees to help the industrial industry overseas and it needs to be more localised and individualised. There are costs to bridge for the first four-five years before any income is realised on forests.

Going forward it is forecasted that at current carbon price an average dairy farm will have to pay \$70,000/year to offset its carbon footprint The Green Party is wanting \$250 per ton of carbon=\$425,000/year the need to integrate this into farmers business is greater than ever. - There is more research needed to understand agricultures share of emissions as it seems to be overstated and does not stack up numbers wise.

Ruminant emissions have been falling in New Zealand due to reduced stock numbers it has been proven that methane takes about 10 years to disappear from the atmosphere and therefore it isn't building up or increasing. The draft report of the climate commission is discussing cuts to methane emissions with the only reason is to offset Carbon footprints.

Negative impacts of the draft is that it seems that they are penalising New Zealand farmers for success. We produce food with the lowest carbon footprint in the world and according to the Paris Agreement that the climate commission going forward would "in a manner that does not threaten food production" the attitude of the climate commission is short-sighted considering that New Zealand farming is like whaling- a dying industry.

Farmers are worried that attempts to reduce greenhouse gas emissions will lead to paying high taxes.

Prospects for farmers wanting to participate in the carbon market are highly positive, with integrated farm-forestry looking like an appealing option.

*“ we have some classes of land that are prone to erosion and slumping, and it is also hard to keep regenerating scrub off. We wanted to explore other options for this type of land to see if there was something better to do with it that generates a financial return”
(post quake farming, Sandy Chaffey).*

6. Integrating forestry for profitable land use change:

Since 2019 there has been an increase of 70,000 ha targeted for conversion to forestry mainly by sheep & beef (S&B) farmers. This is only a small percentage of <1% of S&B farmers but 13 times more interest in the past five years. With strong drivers policy wise in place for more forestry and corporates are looking more in this direction to offset their carbon dioxide emissions without the need to be improving their emission efficiency. I think there will be an increase in sheep & beef farmers looking to diversify. In 2020 we saw an increase in the carbon price from \$25 to \$35 which increases the positivity in the carbon/tree market(40% increase).

Forestry in the past has provided employment opportunities in communities but with carbon farming this may not be an option due to ‘carbon farming’ being the sole purpose or drawdown of forestry that the trees will not be harvested for up to 80-100 years for pines or longer for other exotic species. If you look back at the integrated farm-forestry work done back in the late-80s on South Otago drystock farms, those farms are now among the most profitable sheep and beef units in the country, and that was done before carbon was an income factor.

Concerns over farmers motivations to planting trees with both physical and environmental constraints.

Factors that are a concern are topography, climate and pasture management. Pasture management is lacking due to the history of low stocking rates because of scrub and contour in these areas and have produced poorer quality feed. Environmental constraints include nutrient management plans and reduction targets due to Greenhouse gases.

Radiata pine is a fast capture compared to Native bush- slow carbon that is never harvested. Pines are cheaper and faster to plant and grow. Incentives are weighted so heavily on exotics because of this compared to natives. Early sequestration of Exotics maximises internal rate of returns. See figure below.

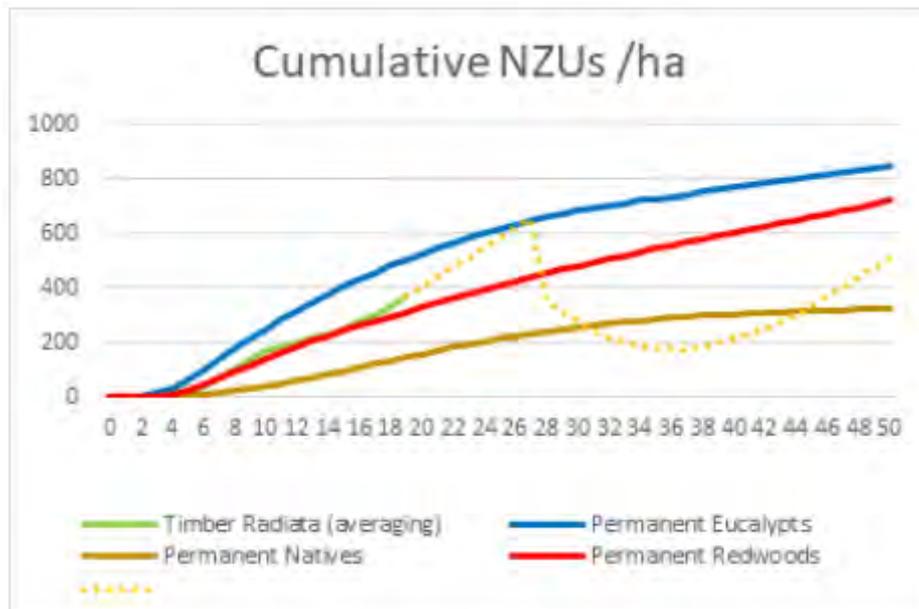


Figure 2 . Carbon Benefits

Exotics added diversification to take the ups & downs of the S&B industry and the trees serve this. Record highs in carbon which has been favourable for farmers to utilise. The Pine tree seems to be the tree of the moment due to fast growth and hardy timber. Oregon is a self-seeding tree and can be worse than gorse.

Every five years farmers have to measure the carbon stocks to see how much growth there has been, measure a sample of trees and diameter at breast height. Sequest normally 50 tonne carbon/ha/year.

Benefits of planting promote bio-diversity, protect streams, freshwater quality, visually enhance the farm, reduce carbon footprint & reduce nitrogen & phosphorus farming losses, strengthen soil. A forestry element to farming business's creates financial resilience through diversified incomes, and the opportunities in forestry are more lucrative than expected through timber production, carbon crediting, conservation, and erosion mitigation to name a few.

Farmers recognising low end product of land and optimising there farms by adding a form of forestry which can be integrated with natives & exotics to strengthen farm systems.

Pre-1990 trees that are cut down have an obligation to replanted.

Native trees on a larger scale is difficult to establish and not as popular due to diminishing return on investment and lengthy process. Hard to keep alive or have poor growth due to obnods and feral pests that they compete with. A natural seed source from native forest species have a competitive advantage- this is a great opportunity for the carbon farmer. It is encouraged especially around ecological significant areas eg waterways that take advantage of the existing native seed stock and these areas are developed to accelerate growth of native forest areas in the future. Regenerating indigenous native forests have a slow sequestration rate - a 50 year carbon period in comparison to

exotic species. With a one year cash payback with no capital investment, high environmental, ecological and biodiversity value as well as an annual cash flow. Forests that meet the pre-1990 are not eligible only post 1990 are assessed. A natural seed source must be present and favourable native growth. Manuka & Kanuka are aggressive growers any native species can be included as long as it can reach the 5 m in height regulation.

Pest control and animal management is a critical element of native forest management once it is in the ETS scheme.

6.1. Costs of tree establishment:

Below shows the cost of different forestry options for 2000 ha sheep & beef farm with some steeper downs and hill country. It shows natives are the most expensive to establish while pines are the cheapest but have a higher income average.

	Timber radiata	Permanent eucalyptus	Permanent redwoods	Permanent mixed natives
Area	225ha	88ha	123ha	223ha
Forest cost year 1 /ha	\$1,800	\$2,000	\$3,000	\$4,500
Forest cost year 2 /ha	\$200	\$500	\$500	\$1,000
Forest cost year 9 /ha	\$800	\$0	\$0	\$500
Annual forest cost /ha	\$50	\$50	\$50	\$50
ETS cost year 1 /ha	\$5	\$5	\$5	\$5
Annual ETS cost /ha	\$2	\$2	\$2	\$2
5-yearly carbon measurement cost	\$30	\$30	\$30	\$30
One Billion Trees Grant year 1 /ha	\$450	\$450	\$540	\$1,200
One Billion Trees Grant year 2 /ha	\$750	\$750	\$900	\$1,000
One Billion Trees Grant year 3 /ha	\$300	\$300	\$360	\$800
Estimated stumpage income (after 28 years)	\$20,000			
Carbon years	12	50	50	50
Carbon Income average per year (@\$25/NZU)	\$485	\$420	\$355	\$160

Figure 3 . Economic options

6.2. Income streams of carbon & timber:

Below indicates overall income for forestry area. Depending on variety indications are showing that Radiata income is between \$20,000-\$40,000/ha on an age of 30-32 years and Douglas Fir id \$40,000-\$50,000 per ha on an age 45-50 years variability on returns are due to growth rates, management, access and harvesting.

	\$/Year	EBIT/ha	Description
Carbon income	\$185,000	\$644.60	Cash income
Timber growth	\$220,000	\$766.55	Timber growth
TOTAL	\$405,000	\$1,411.16	Per ha per year

Figure 4 . Total income from carbon and timber(based on an average carbon yield recognised in ETS) based on 287 ha forestry block.

6.3. Generating income from native bush:

There is a lot of native bush or woody cover on hill farms that in the past has been ineffective areas but there is an opportunity to derive income from these areas that are regenerating from the carbon that they sequester. These areas often are a honey resource as you can add more native trees and bushes to these areas. An area of native bush of 150 ha in the ETS scheme can currently earn roughly \$60,000/yearly. A side income of honey can be drawn from this say \$20,000 for three sites with a total of 80 hives.

6.4. Case Study: Carbon Zero Farming:

It is possible to be a carbon zero farm by not having to decrease stock numbers...this seems to be the only option for dairy farmers but an example of a pastoral farm is Lake Hawea Station.

It has become the first carbon zero farm in New Zealand. They have increased stock numbers and wool production while increasing tree plantings as well as retiring marginal land. They have found a market to sell their merino wool to climate conscious brands in the UK and New Zealand founded footwear company All Birds. New Zealand already has a competitive advantage to other farmers around the world due to having established native bush and tree lots that support alongside consumer preference sustainably produced products. 71 percent of the farms carbon equivalent emissions are due to methane from the stock.

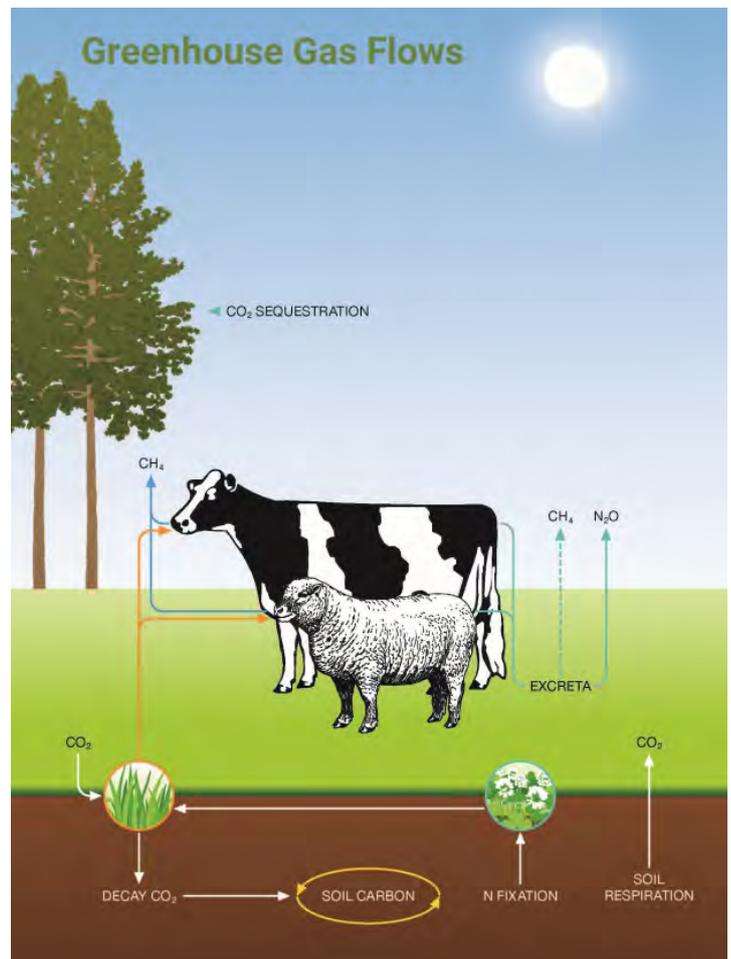
On the other side of the carbon ledger the farm locked up 3966 tonne of carbon through its regenerative planting and bush areas. They still have more avenues to pursue to retain less carbon

emissions by exploring genetics, regenerative farming and utilising seaweed. (Farmers Weekly, 2021)

Figure 5 Mitigation and cost of on-farm Greenhouse Gas Emissions; (Agfirst: April 2019)

Average emissions on a per ha basis is 9.6 tonne/GHG/ha for Dairy and 2.8 tonne/GHG/ha for sheep & beef. Every farm is different and the impact or difference depends on the original system and how intensively it is being farmed. The planting of forestry is to offset farming emissions.

7. Effects on land value



We are seeing negative impacts, particularly in the Gisborne area, from forestry conversions. Conversion areas are seeing value of pastoral farms rising due to the increasing value of carbon. And they are trying to compete for properties against forestry buyers where the returns on sheep & beef commodities are a lot lower than carbon. The increased competition between forestry groups and pastoral farmers have seen a 30-40% increase in land values. This has a flow on effect on where carbon is making new forestry profitable and pastoral land more valuable although the pressure on the pastoral sector is reflected in their rates. This has been a very fast uptake/increase in value and seen pastoral farmers pay higher rates where they have no ability to service or extract the value unless the convert the land to forest. There has come a time where fairness, stability & transparency for all land-owners, irrespective of industry when it comes to rating these properties and non-forestry land owners are carrying the burden of higher rates because of this. This has also hindered land ownership hopes of young farmers.

Forest	Sale date	Potentially plantable area (ha)	Lead to port (km)	Gross sale price	Net sale price	Less on-sells	Overall Land Value per PPA	Land value analysis Post 1989		
								Greenfields	Hauler	Un-plantable bush
								Ground based per ha	per ha	per ha
Genlyon	Nov 2020	545	56	\$8,700,000	\$8,700,000	\$630,000	\$14,680	\$15,085	\$12,075	\$175
Whaitirinui	Dec 2018	530	75	\$6,700,000	\$6,700,000	\$500,000	\$12,400	\$15,250	\$12,210	\$200
Black	Dec 2020	575	75	\$6,720,000	\$6,720,000		\$11,590	\$13,925	\$11,135	\$110
Aropoanui	Feb 2020	460	35	\$5,250,000	\$5,250,000		\$11,300	\$13,750	\$10,860	\$150
Toromiro	Dec 2020	195	60	\$2,605,000	\$2,605,000	\$405,000	\$11,140	\$13,300	\$10,650	\$125
Ponui	Oct 2019	745	85	\$8,000,000	\$8,000,000		\$10,610	\$13,000	\$10,400	\$165
Tunanui	May 2019	1525	65	\$17,000,000	\$17,000,000	\$1,400,000	\$10,190	\$15,385	\$11,100	\$150
Te Au	Aug 2018	460	85	\$5,500,000	\$5,500,000	\$750,000	\$9,740	\$12,000	\$9,615	\$151
Ngapuke	May 2019	450	66	\$4,565,000	\$4,565,000	\$330,000	\$9,250	\$11,500	\$8,965	\$150
Willowflat	Dec 2018	255	70	\$2,400,000	\$2,400,000		\$9,050	\$10,400	\$8,325	\$150
Kanui	Feb 2021	395	52	\$3,460,000	\$3,460,000		\$8,680	\$10,800	\$8,625	\$100
Karaka	Nov 2018	343	30	\$3,500,000	\$3,500,000	\$640,000	\$8,450	\$10,100	\$8,100	\$350
Mangaaruhe	Jan 2019	890	85	\$7,200,000	\$7,200,000	\$575,000	\$7,320	\$9,700	\$7,785	\$155

Figure 6 : Relevant farmer to forestry sales post -1989 forests

In terms of the sales, when assessing value of productive area revolves around the Potentially Plantable Area (or PPA). PPA is made up of the area that is plantable plus utilities, landings and roads. The unproductive area includes power corridors, zones not economic to harvest, indigenous vegetation, riverbeds, erosion and riparian margins. The above areas and boundaries for lifestyle on-sells from ex sheep and cattle properties have been estimated.

We believe that the forestry sector in the Gisborne/Wairoa/Northern Hawkes Bay region revolves around three main sub-groups.

- Large corporate companies, generally with offshore capital, whose goal is to establish a sustainable forest to supply either their own mill or to export logs. They generally operate under freehold title often with an additional mix of Maori lease or Crown Forest licence.
- Private companies and individuals who operate some of the smaller forests in their own right or through syndication of smaller lots. Generally, these blocks are less than 100 hectares in size.
- Farmers with woodlots planted for production forestry, frequently associated with conservation plantings spawned by subsidies under the initial East Coast Forestry Project.

As a generalisation, it is only the first two categories that become active in acquiring or selling land where the principal purpose is for forestry. We believe that two separate markets operate, namely, the corporate market for larger blocks and the syndicate market for the smaller lots. Smaller forests tend to be more “affordable” and as such tend to sell at a premium to larger forests. Carbon prices softened during the latter part of 2011 and early 2012, “crashing” completely towards the end of 2012. Demand to purchase land in the Gisborne/Wairoa/Opotiki region to plant completely stopped, with one instance in this region of land bought for that purpose continuing to be farmed. Prior to this period, Post 1989 land was selling at a significant premium to Pre 1990 land due to the flexibility of the former category.

2013, 2014 and early 2015 were characterised by low forestry land sales volumes, primarily due to depressed carbon and to a lesser extent log price. Late 2015- 2019, carbon prices recovered to \$25 per tonne (after a low of \$2.50 per tonne). The price of carbon over the last two years has increased. NZUs traded between \$37 and \$39 during April 2021. Because of this has increased the number of sales.

For the last two years, forestry has re-entered the pastoral market, purchasing to plant for production forestry and carbon, with some intending to plant for carbon sequestration only especially larger corporate companies. A lot of interest from overseas is active in the forestry sector with government policy making it more attractive for foreign investors compared to other forms of rural investments. Both pastoral/finishing farmers and foresters are currently driving the Gisborne/Wairoa hill country market, with the latter now out-bidding farming interests as we have seen from recent sales.



8. Carbon returns to take security over (from a bank perspective).

New Zealand is becoming the first country in the world to make it mandatory for banks to report on what the impact their investments have on climate change. New Zealand is making the financial sectors environmental records transparent. (BBC,2021).

Climate minister James Shaw said

"We simply cannot get to net-zero carbon emissions by 2050 unless the financial sector knows what impact their investments are having on the climate,"

If the legislation passes this will become mandatory in 2023. Because of this we are seeing banks and finance companies starting to lend against Carbon. (Phys Org, 2021)

Climate change is presenting new opportunities and revenues for banks. Banks are using green loans which are a type of loan offered by financial institutions on the basis that the money is used for environmentally friendly products for example.

- Solar panels, hot water systems, pool heater or battery systems
- "Green" or eco-friendly vehicle
- Double glazing for windows or external awnings
- Water tanks
- Insulation
- Grey water treatment system
- Energy-efficient appliances and white goods
- Energy-efficient electric heaters or split system, evaporative cooler or energy-efficient air conditioner
- Home ventilation

This is going in the right direction of becoming Zero Carbon with funding initiatives, but although only a small step of reaching target although this is more front of mind to the general public. Banks that secure on rural lending are having to reconsider its policies and now that individual farmers are starting to diversify their farming operations their banks are having to lend against also.

It's projected this year that the international market for climate finance is to reach \$640 billion. International companies pledge to slash their emissions and to invest in a more environmental avenue. Prices for carbon could quadruple by 2030. (BBC,2021).

Banks have historically been risk-averse to greener farming systems even though they have a history of being profitable. With carbon forestry proving to have more sustainable models, this is given it a scale up industry within the banking sector.

When carbon trading was first introduced there were issues of lacking transparency & regulatory enforcement and this led to double counting of credits.

Banks want to continue to support farmers and their businesses by recognising value in trees and New Zealand carbon units. (Rabobank,2021) Policy to apply where revenue from the sale of carbon units are relied on my servicing debt. Some banks are looking at lending on carbon with criteria that applies this is focused on clients implementing succession planning, land acquisition and diversifying income streams.

Parameters need to be put into place by rural lenders for example it's important to have a registered forestry consultant to prepare a carbon budget and oversee the process. Including planting, management & measurement.

A certain size of forest is warranted for lending for example 100 ha and require measurement every five years. This will mean for smaller scale farmers that are trying to integrate some forestry but not on this scale they will have to look elsewhere like Dryland Carbon or New Zealand Carbon; both are companies that will manage the carbon and advise.

Some good incentives and requirements for banks to adopt with their lending are sustainable forest management practices that avoid negative impacts on the environment, avoid all uncontrolled and illegal use of forest fires for clearing use, apply good land governance, comply with Land & Water plants at a regional & national level.

When a bank secures over the property for carbon the client is prevented from selling the forestry rights without consent from the bank. Its fundamental that the clients have the appropriate insurance cover for the trees including replanting costs, loss of income, public liability and comprehensive insurance cover.

Banks will heavily rely on forestry consultant reports in their lending.

Evidence for assuming eligibility for the Emissions Trading Scheme (ETS)*

- Historical imagery
- Actual photos from late 1980's or early 1990's (if available)
- Land Use Classification maps
- Carbon Unit Profile outlining projected annual carbon sequestration rates over the life of the forest. This should include estimates of 'safe' carbon
- Based on Lookup tables for all species and regions for all projects
- Projected measurement tables for forest areas >100 ha
- Silviculture plan and costings if this is part of the proposed forestry regime and how this will be funded. Details and competency of proposed contractors who will conduct planting and complete forestry maintenance

- Harvesting and Sustainability. Provide a National Environmental Standard Erosion Susceptibility Map (NES – ESC) of the area to be planted. This determines the level and type of compliance required at planting and harvest.
- Projected harvest volumes and estimated time until harvest.
- Detailed map of proposed or actual forestry plantings
- Confirmation that the proposals comply with NES – PF provisions. (Rabobank,2021)

9. Transition into biofuels the future in NZ:

Transition to Biofuels, trees to fuel instead of coal in the future is a 35 year plan. Currently we are importing coal to fuel Huntly power station to meet our current power demand as the storage capability of our hydro lakes are insufficient. It is said by 2030 New Zealand will be 100% renewable energy and proposes to use natural gas as a back-up fuel after 2013. (Suckling et al, 2018).

Currently our renewable power plants will have to generate another 20 percent more power to meet the demand for our country's electricity by 2035 and because of this we will see new wind and solar farms emerge as well as increase in bio fuels. (Suckling et al, 2018).

Part of the Paris agreement in which New Zealand signed up for in 2016 committing us to climate change and reduce greenhouse gas emissions. New Zealand has committed to decrease Greenhouse gas emissions by 30% over our year 2005 levels by 2030. There has global market pressure on the world trade market that dictates our export of goods & services. We need to show our commitment to reducing our greenhouse gas footprint and look at ways to more low-carbon transport fuels. This also impacts our overseas investments. Overseas investments in Carbon forestry that are environmentally friendly continue to be popular, as the 'greens up' investments portfolios and are socially responsible. Tax benefits also play a massive incentive.

The idea of using existing tools for a new purpose has taken off and research has been developed in ways that we can change the climate path. 6% of logs are traded in the world and 3% are from New Zealand. Expected 300% more wood fibre by 2030 needed worldwide (Tanner, 2021).

Key messages revealed by the study (New Zealand Biofuels Roadmap Summary Report, 2018) Biomaterials and forest research institute, Scion took the initiative to consult with stakeholders in the potential liquid transport biofuel value chain and build a shared view around possible scenarios if the country wants to pursue a biofuel, low greenhouse gas future.

“1. We can do this. Credible large-scale biofuel production and use routes exist for New Zealand, based on sustainably-produced feedstocks.

2. The opportunity has major national and regional implications, but biofuels could make a substantial contribution to meeting New Zealand's greenhouse gas (GHG) commitments and provide transport fuel independence. “

Conclusions from the study have revealed that a forest the size of the Taranaki region and processing logs onshore from it instead of exporting that it could make 2.3 billion litres of liquid fuel annually. This would exceed the amount of fuel needed to meet the South Island's allocation for a year.

If forests are decided to be one of the best options then planting is needed to begin to be able to provide a sustainable supply needed for biofuels. There is worry that the international demand for logging has been driving up the price of woodchips which are utilised to fuel eco-friendly fuels. We are seeing the increased interest overseas of transitioning to bio-fuels which will lead New Zealand to follow. This has led to an increased number of logs being exported rather than processed here in New Zealand. We are beginning to see that because of this there is a risk of businesses not wanting to convert to bio-fuels as the cost of wood-chips is so volatile presently.

Currently we are seeing the world short of wood fibre and that low –grade logs has increased 40% in the past four months this is due to lack of freight routes because of Covid-19 and boom in housing globally. The problem with moving away from coal in the next 15 years is that there will be needed large volumes of bio-fuels to place it and woodchips is the obvious answer but there will not be the supply for the demand. There is hope that the market for woodchips will settle and mature and will be traded just like coal in the future.

10. Conclusions:

The benefits of carbon farming inclusion into pastoral farming has been discussed and although is complicated if it can be done right is beneficial to the farmer with areas of unproductive land.

Forestry returns for farmers are variable with a number of factors if managed well, food cash flow and also carbon returns are possible. It has enabled the ability to match the land to its best use in a sustainable way.

The last climate commission draft from the government in early June 2021 has decided that native deforestation from 2025 will be banned. With the plan for the country to start gaining more native forest with an estimated 25,000 ha planted annually. Hopefully increased number of native birds and wildlife and water quality will improve. Increased number of new pines will increase in planting but hopefully after 2030 exotics will taper off with new permanent native plantings.

Climate change in New Zealand is becoming more in the forefront of the nation's agenda with a lot of publicity around the climate commission draft that was just announced and the governments Zero carbon act. Farmers are needing to know their emissions with ways of accounting for them and also a straightforward plan to offset these. With the latest draft of the governments climate change there is some real uncertainty and pressures for farmers. A lot of farmers will lag behind here easily and will find some leaving the industry. They need support to adapt to changes and regulations to keep up with the new farming regulations.

With the government laying out a carbon-cutting roadmap in early June there seems to be fast track to start shrinking emissions from 2022 onwards. With cow & sheep numbers to fall by 13.6% by 2030.

A lot of education is needed to fully understand emissions on farm and environmental impacts. Environmental standards are only going to get tougher.

A common theme from my research was that forestry was going to have huge impact in off-setting emission although we have to be careful as some opinions were that there is not enough land in New Zealand for this to happen fully or at the current rate that it is undergoing.

Prospects for farmers wanting to participate in the carbon market are highly positive, with integrated farm-forestry looking like an appealing option.

11. Recommendations:

Throughout my research I have found that going forward and this is not only a very topical discussion but will become more important to every farmer.

What I have discovered from my research is some key recommendations for farmers:

1. Collaboration between industries and ETS allowing farmers to become part of the scheme. Industry leaders need to provide the information to help them understand their emissions to help them choose the right scheme. General lack of understanding out there and ETS seen as “bad/corporate” so no good for the average farmer as need economy of scale which is not true.
2. Identify the best areas most suitable for planting trees. Manage forests as a tool for soil erosion.
3. For farmers adding forestry to the business is a long-term decision and employing good people & advice from a reputable company is better than saving a dollar especially when it comes to H&S and managing the forest.
4. Recommendation of clarity from government (both national and local) on what is involved in the scheme and how it works for mixed species outside mono culture.



12. References:

- Admin. (2020, Sept) Averaging- a new method of carbon accounting in the Emissions Trading Scheme <https://interpine.nz/ets-new-method-of-carbon-accounting-averaging/#:~:text='Averaging'%20can%20be%20defined%20as,the%20forest%20across%20multiple%20rotations.>
- Beef & Lamb. 2020 Integrated Farming & Forestry Case Study Series
- Climate Change Commission. (2021, January 31). 2021 Draft Advice for Consultation. Climate Change Commission. <https://ccc-production-media.s3.ap-southeast2.amazonaws.com/public/evidence/advice-report-DRAFT-1ST-FEB/ADVICE/CCCADVICE-TO-GOVT-31-JAN-2021-pdf.pdf>
- Climate Commission. (2020). Reviewing Aotearoa's ND and biogenic methane. Climate Commission. <https://www.climatecommission.govt.nz/our-work/advice-to-governmenttopic/reviewing-new-zealands-nationally-determined-contribution-and-biogenic-methane/>
- Community Environmental Council. (2020). Carbon Farming and Regenerative Agriculture. <https://www.cecsb.org/rethink-food/carbon-farming/>
- FAO. (n.d.). Australia's Carbon Farming Initiative. FAO. <http://www.fao.org/fileadmin/templates/agphome/documents/faoecd/australia.pdf>
- Forster, Kelly. He Waka Eke Noa Primary Sector Climate Action Partnership, the way forward for how we will meet our environmental goals, international climate commitments, and financial goals. <https://www.interest.co.nz/rural-news>
- Funk, J., & Kerr, S. (2007). Restoring Forests Through Carbon Farming on Maori Land in New Zealand/Aotearoa. Mountain Research and Development, 27(3), 202-205. <http://dx.doi.org/10.1659/mrd.0921>
- Government of Canada. (2020, 1 30). Greenhouse gases and agriculture. Agriculture. <https://www.agr.gc.ca/eng/agriculture-and-the-environment/agriculturalpractices/climate-change-and-agriculture/greenhouse-gases-andagriculture/?id=1329321969842#e>
- He Waka Eke Noa. (2020, October). 5-Year Programme Overview. He Waka Eke Noa. <https://hewakaekenoa.nz/wp-content/uploads/2020/12/HWEN-Programme-OverviewOct-2020.pdf>
- Jennings.O, Grieve.R, Allison.J, Sexton.J, Alexander.D, Daniell.D, Henderson. N&H, Sexton.M, Edmeades.D (2020) No taxing Methane <https://farmemissions.co.nz/>
- Cowper.B (2021) Market Comments. Lewis Wright Valuation & Consultancy
- Meade. R, Fiuza. G & Lu. A (2008) Forest and Forest Valuation: How to value Forests and Forest Land to Include Carbon Costs and Benefits.
- MFE. (2020, 4 15). New Zealand's Greenhouse Gas Inventory. Ministry for the Environment. <https://www.mfe.govt.nz/climate-change/state-of-our-atmosphere-andclimate/new-zealands-greenhouse-gas-inventory>

Ministry for the Environment. (2019, November 25). About New Zealand's emissions reduction targets. Climate Change.

Ministry of Primary Industries (2020, March). One Billion Trees Scheme

<https://www.mpi.govt.nz/forestry/funding-tree-planting-research/one-billion-trees-programme/about-the-one-billion-trees-programme/>

New Zealand Agricultural Greenhouse Gas Research Centre. (n.d.). Government and climate change. Ag Matters. Retrieved 12/05/2021, from <https://www.agmatters.nz/topics/government-and-climate-change/>

Pacala, S., & Socolow, R. (2004). W Stabilization Wedges: Solving the Climate Problem for the Next 50 Years with Current Technologies. Science, 305(5686), 968-972. DOI: 10.1126/science.1100103

Phys Org (2021, April) In world first, New Zealand to make banks report climate impact

<https://phys.org/news/2021-04-world-zealand-banks-climate-impact.html>

Scott. A (2021, May 14) Focus on the Future, Farmers Weekly

Steyl. L (2021, May 28) Logging price boom drives up biofuel price in Southland

Suckling, I, Mercader, F, Monge, J, Wakelin, S, Hall, P and Bennett, P 2018, New Zealand Biofuels Road map Summary Report.

https://www.scionresearch.com/_data/assets/pdf_file/0005/63293/Biofuels_summary_report.pdf