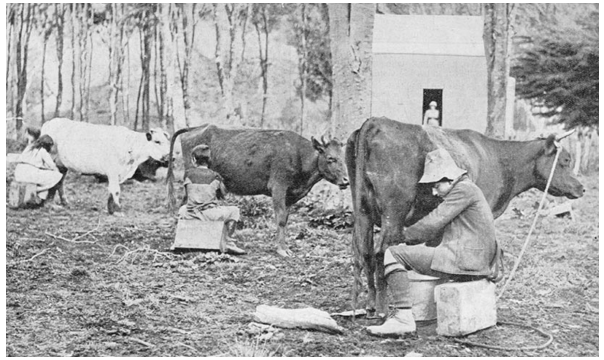
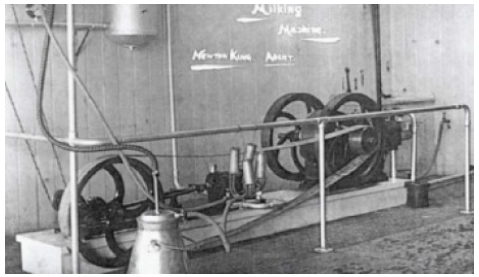
The Future of NZs Agricultural Industry: What have we learnt in the past 2010 years since 1814?

Dr Tanira Kingi

Presented at the Our Choice: Better Farming, Better Business, Better Future Conference
Mercury Bay Park, Bay Venues
Mount Maunganui
13 March 2024

The First 110 years of the Dairy Industry[1]





NZDRI

NZ Agricultural College

NZ Dairy Board

First milk powder produced

First milking machines

Anchor Butter Factory, Waikato

First Cooperative, Otago

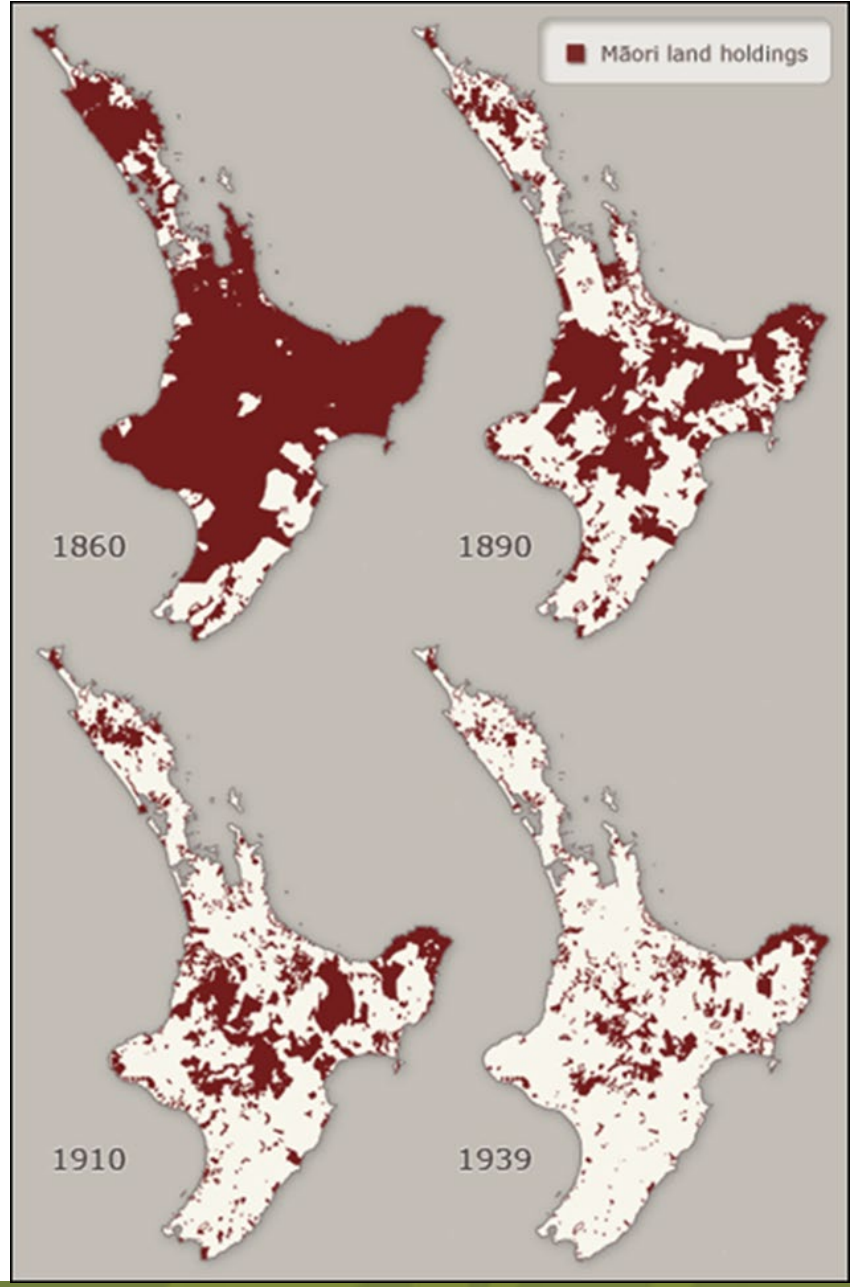
First ships to Sydney

Introduction of Shorthorns

1814 1845 1871 1886 1890 1904 1923 1926 1927

[1] https://www.dairybarnsystems.co.nz/knowledge-centre/a-timeline-of-dairy-in-nz/

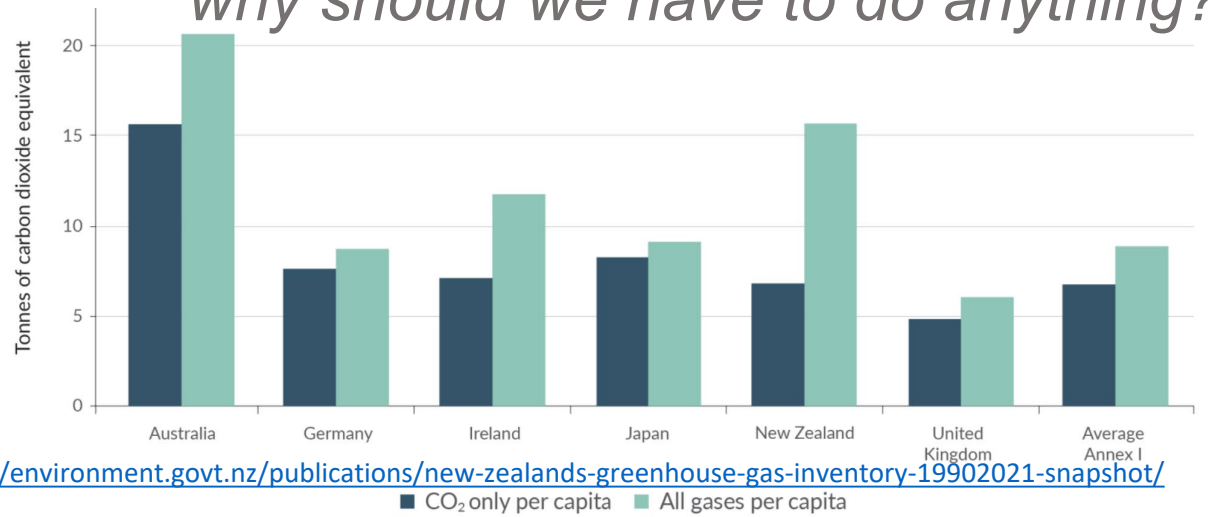
Deforestation of New Zealand [2]
And the loss of Maori land [3]



[2] Deforestation Maps: https://envirohistorynz.com/2009/11/21/237/
and https://teara.govt.nz/en/interactive/11674/deforestation-of-new-zealand see also
Paul, T., Kimberley, M.O. & Beets, P.N. Natural forests in New Zealand – a large terrestrial carbon pool in a national state of equilibrium. *For. Ecosyst.* **8**, 34 (2021). https://doi.org/10.1186/s40663-021-00312-0

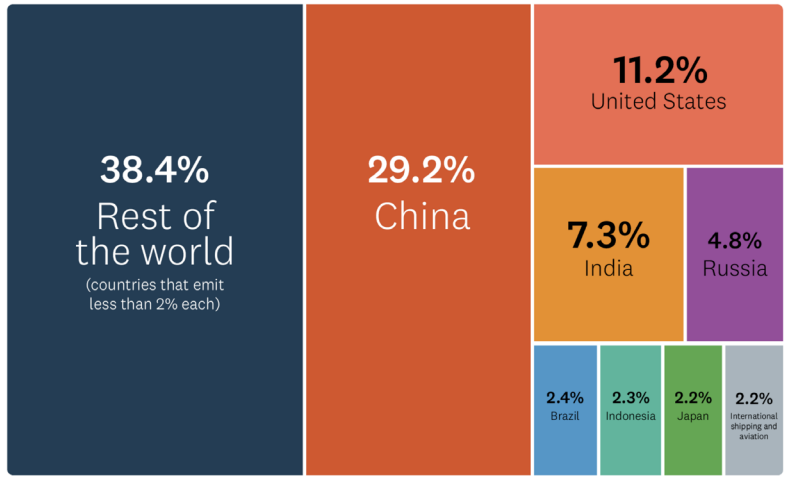
[3] Māori land loss, 1860-2000', URL: https://nzhistory.govt.nz/media/interactive/maori-land-1860-2000
(Ministry for Culture and Heritage), updated 21-Apr-202. The majority of the SI was confiscated between 1840 and 1864

"If we are less than 0.15% of total global emissions why should we have to do anything?"



https://environment.govt.nz/publications/new-zealands-greenhouse-gas-inventory-19902021-snapshot/

Share of global greenhouse gas emissions by country



Data source: EDGAR (Emissions Database for Global Atmospheric Research), European Commission. GHG total emissions excluding LULUCF.

https://genless.govt.nz/stories/new-zealand-isnt-too-small-to-make-a-difference/

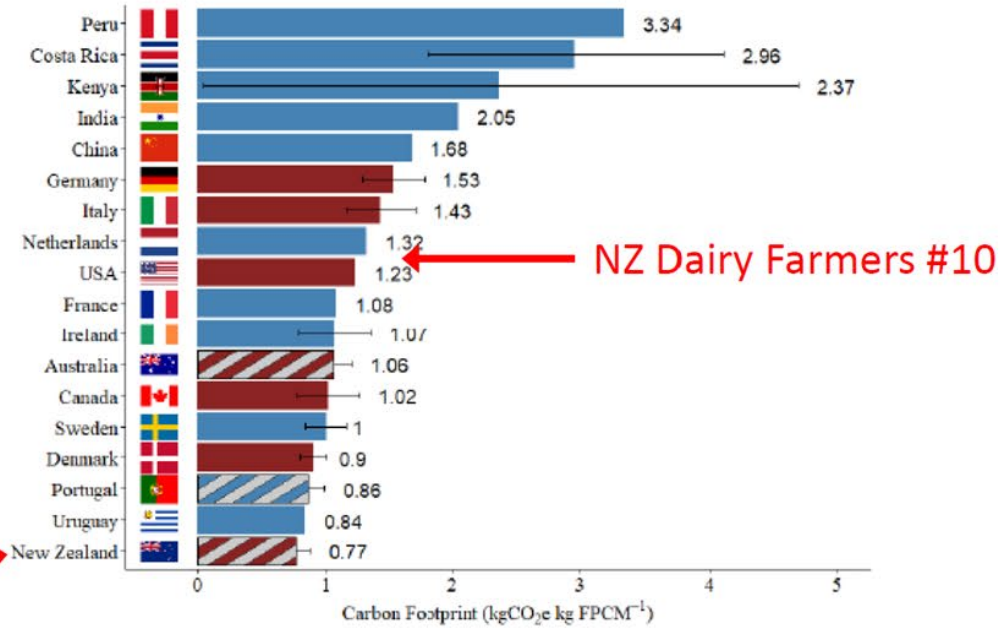


Figure 4: Carbon footprint of milk production (kg CO_2e kg FPCM^{-1}) in different countries (after

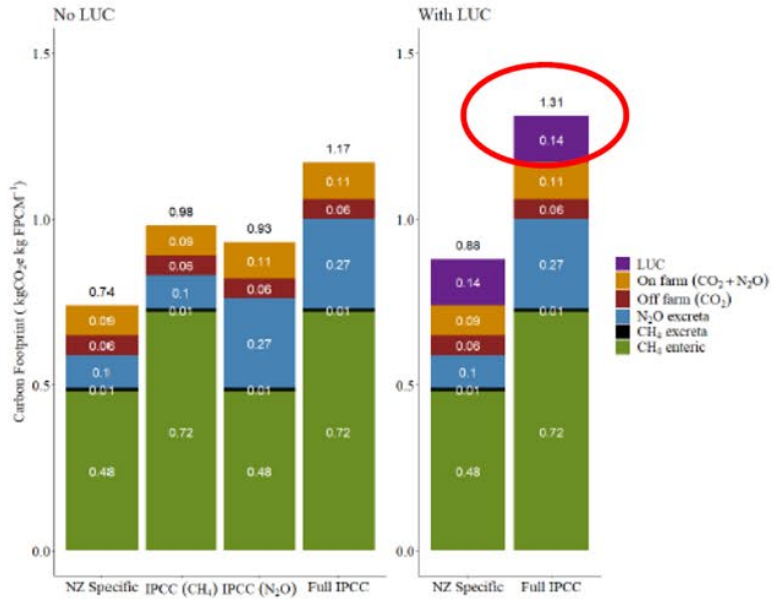
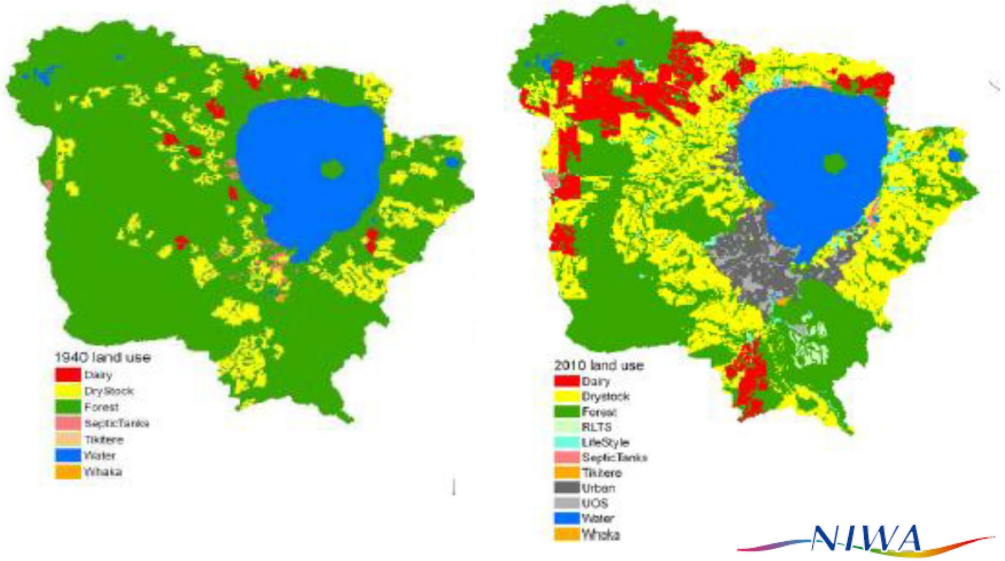
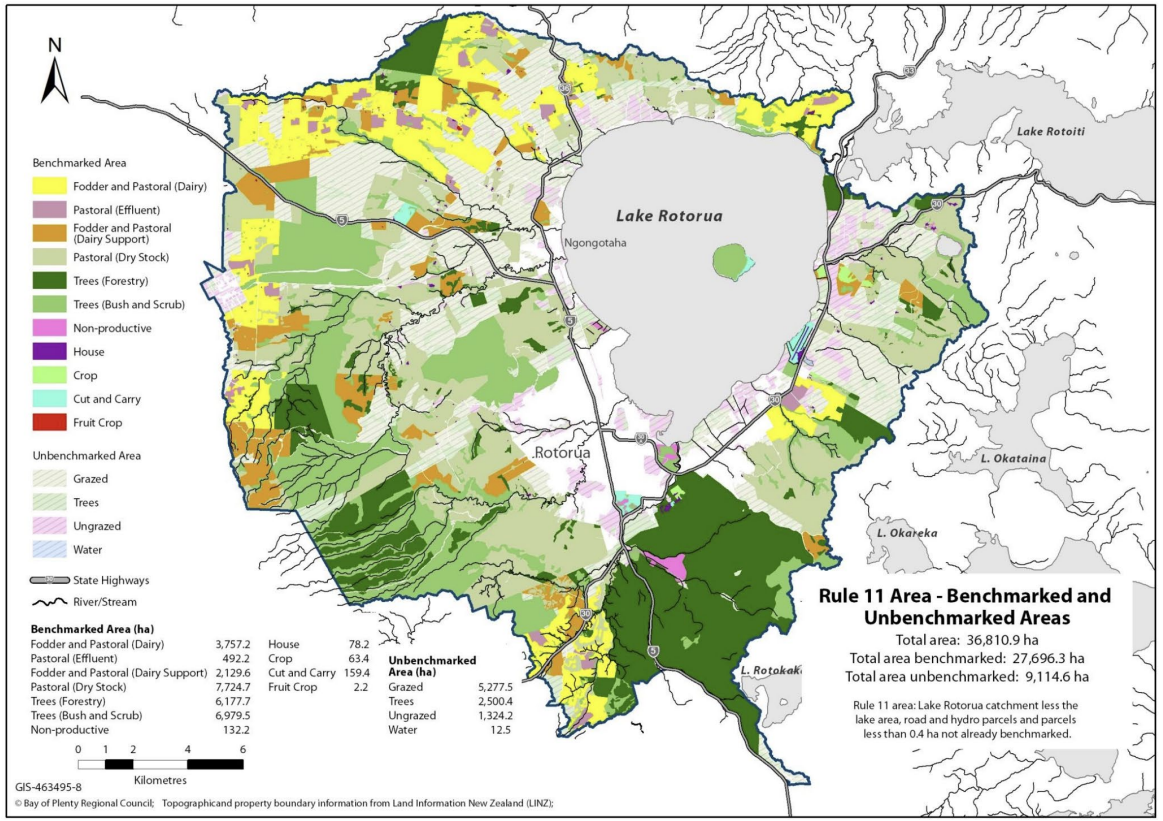


Figure 7: Carbon footprint (kg CO_2e kg FPCM^{-1}) for New Zealand milk calculated using different methodologies. IPCC refers to the use of IPCC default emission factors for individual gases (CH_4 and N_2O) or in total (Full IPCCC).

Impact of the 1984 agricultural reforms:

Diversification in the 1980s[4] to Competitive Specialisation in the 1990s[5] - Lake Rotorua Catchment and Land Use Change[6]



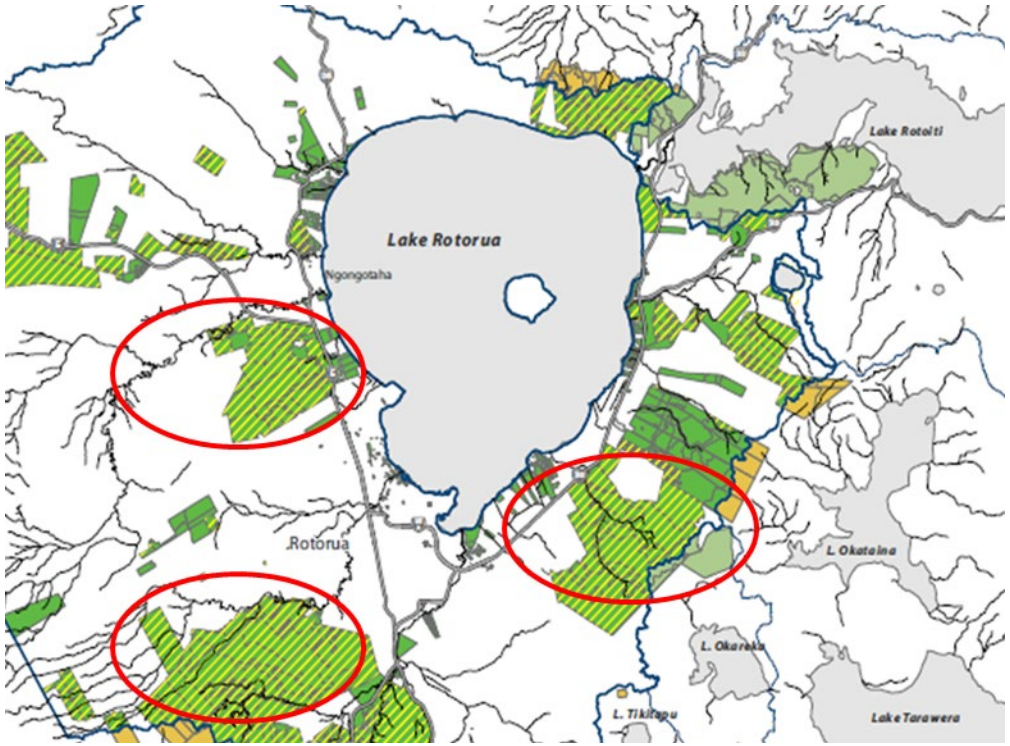


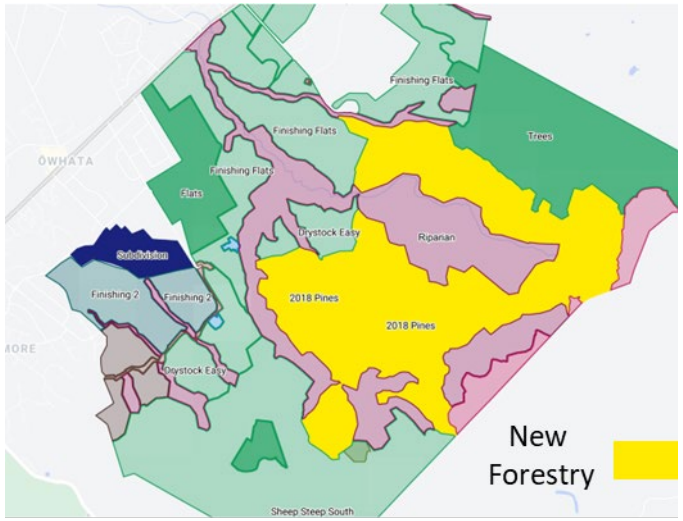
[4] MacLeod, C.J. and Moller, M. (2006). Intensification and diversification of New Zealand agriculture since 1960: An evaluation of current indicators of land use change, Agriculture, Ecosystems & Environment, Vol115 (1–4)

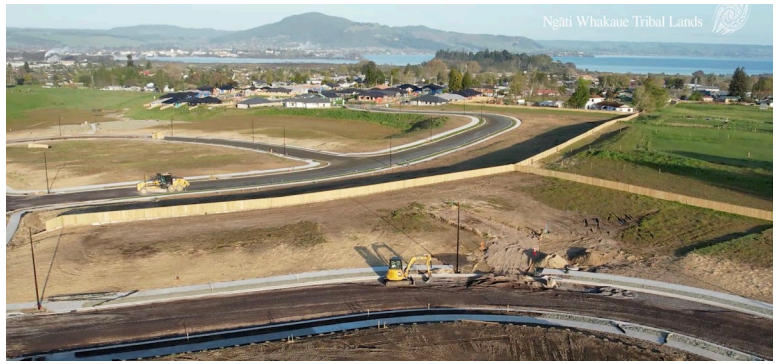
5 https://www.eastonbh.ac.nz/1991/06/the_porter_project/

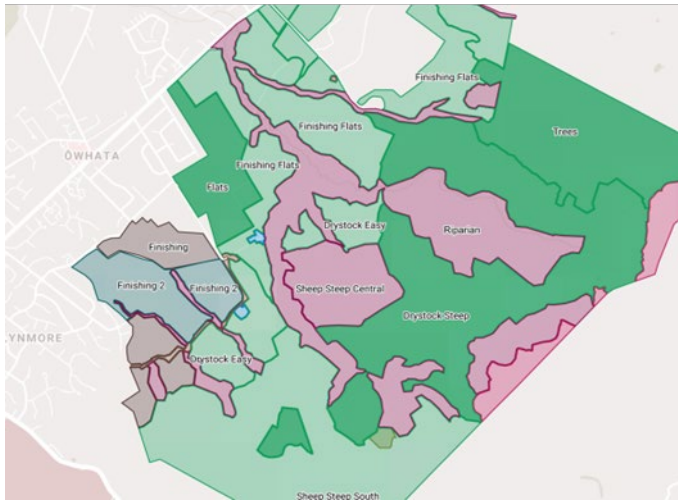
6 https://www.rotorualakes.co.nz/vdb/document/1157

Diversification options when bordering a city
- High rates
- Marginal land to forestry
- Residential housing
- Solar panels









What do we now know?

"If the foundation for the current agricultural sector was laid over 200 years ago – are we exactly where the designers of our 19th century economy expected us to be?"

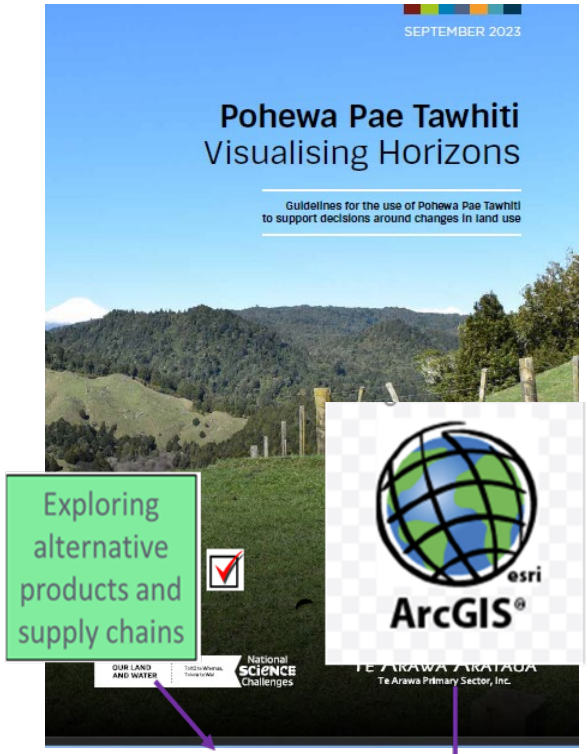
And *"if our unique carbon profile[7] puts us at risk of being continually exposed to fluctuating commodity prices, droughts & floods, pest infestations, and to buyers that will demand NZ farmers continually reduce our GHG emissions?"*

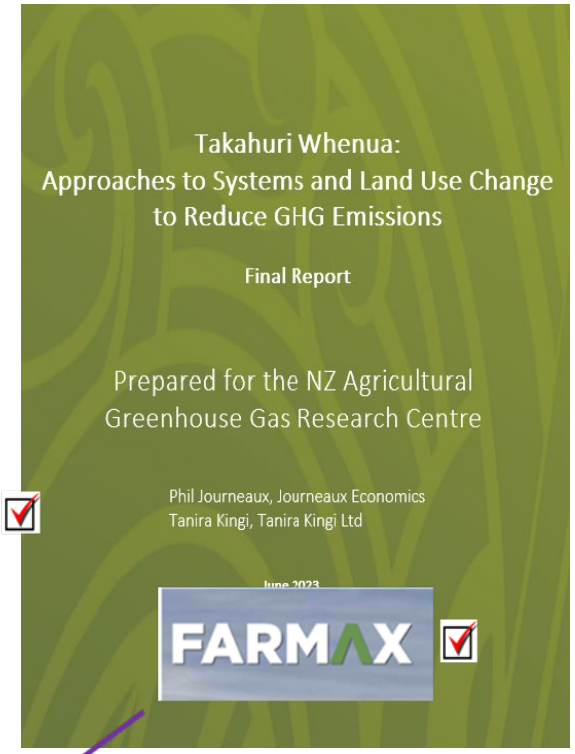
And "if we have a history of diversification, then where does diversification fit into the future? (what do we mean by diversification)?"

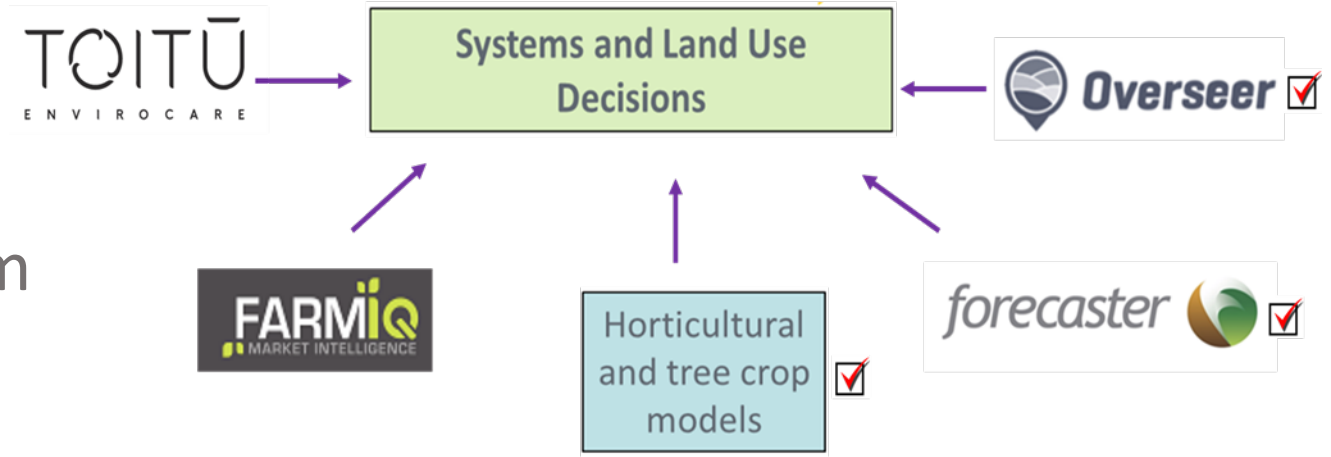
[7] Nearly half of our 77M annual tonnes of $CO2^{-eq}$ comes from agriculture and nearly half of that is CH4

Modelling Production Systems and Landuse Change Scenarios

Takahuri Whenua methodology developed over 9yrs (funded by NZAGRC) - underlying principles:
(1) That diversification needs to be designed around modelling improved performance
(2) Modelling baselines and diversification scenarios; and
(3) Identifying opportunities to form supply networks for new products

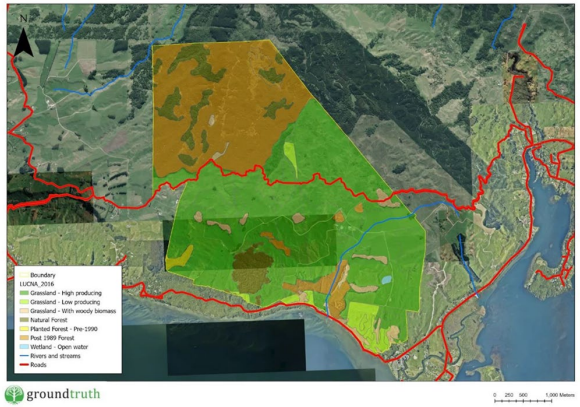






Percy, H., Kingi, T.T., Allen, W., Tamepo, R., Cichota, R., Young, B., and White, T. Pohewa Pae Tawhiti (Visualising Horizons): A Māori holistic approach to the co-design of land-use system. Submitted to the Journal of the Royal Society of NZ. Feb 2024.
Kingi, T.T. and Journeaux, P. Takahuri Whenua (The Changing Land): A Decision Support Framework for GHG Emissions Reductions and Land Diversification. Submitted to the Journal of the NZ Institute of Primary Industry Management. February 2024

Takahuri Whenua: Farm System Mitigation Scenarios



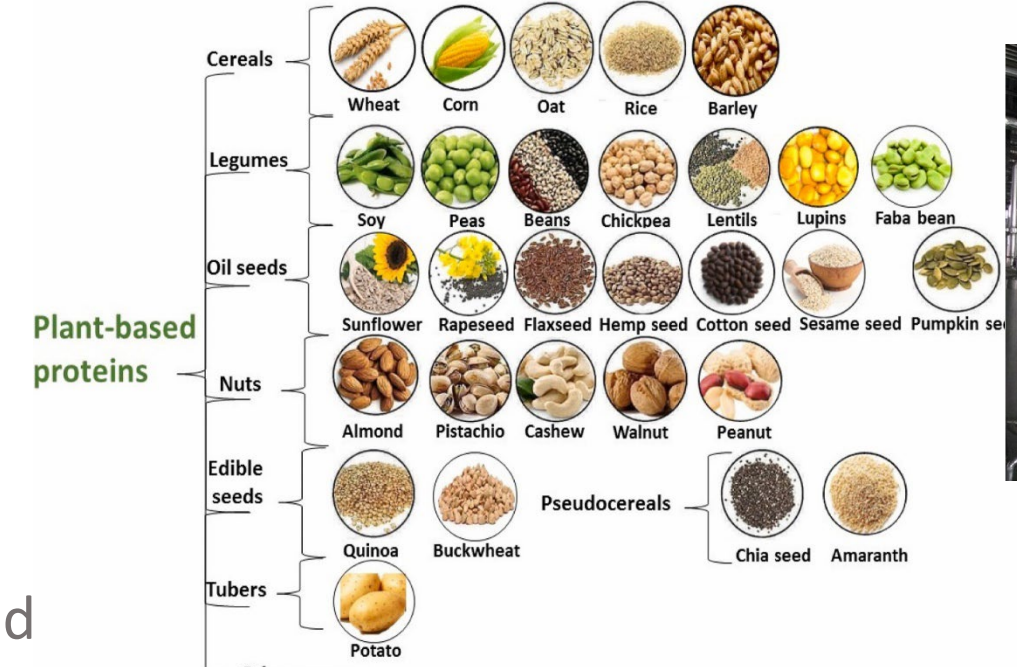
	Pastoral Area (ha)	Area planted in Forestry or Horticulture (ha)	Cows Wintered 1 July (head)	Stocking rate (Cows/ha pastoral area)	Milksolids/peak cow (kgMS)	CH_4 emissions (kg CO_2e/ha)	N_2O emissions (kg CO_2e/ha)	N Fertiliser CO_2 emissions (kg/ha)	CO_2e over pastoral area (T/ha)	Total property net CO_2e (T/ha)	Total GHG % change from Base	(kg N/ha/yr)	% Change from Base	EBITDA ($ effective ha/yr)	% change from Base model
Base model	570.5	0	1,094	1.9	307	3,446	915	61	8.5	4.4		29		$2,241	
Reduce SR 10%, no improvement in productivity	570.5	0	984	1.7	308	3,142	850	61	7.8	4.1	-8%	27	-7%	$1,831	-18%
Reduce SR 10%, Increase per cow production	570.5	0	984	1.7	372	3,360	887	61	8.3	4.3	-3%	28	-3%	$2,457	10%
1/2 Nitrogen	570.5	0	1,061	1.9	308	3,375	836	32	8.2	4.2	-4%	27	-7%	$2,183	-3%
No Bought-in Supplement	570.5	0	962	1.7	308	3,159	901	61	7.9	4.1	-7%	28	-3%	$2,331	4%
Replace Pkh Kernel with Maize Silage	570.5	0	1,094	1.9	308	3,563	879	61	8.7	4.5	2%	28	3%	$2,234	0%
Forestry - plant 56ha in pines	514.5	56	1,050	2.0	308	3,340	882	59	9.1	3.2	-27%	28	-3%	$2,218	-1%
Forestry - plant 56 ha in other exotic softwood	514.5	56	1,050	2.0	308	3,340	882	59	9.1	3.6	-18%	28	-3%	$2,185	-3%
Forestry - plant 56 ha in natives	514.5	56	1,050	2.0	308	3,340	882	59	9.1	3.9	-11%	28	-3%	$2,101	-6%
Horticulture - 10 ha Chestnuts	560.5	10	1,072	1.9	308	3,378	905	64	8.5	4.3	-2%	29	0%	$2,282	2%
Arable - 10ha Oats	560.5	10	1,072	1.9	308	3,378	899	61	8.5	4.3	-2%	28	-3%	$2,128	-5%

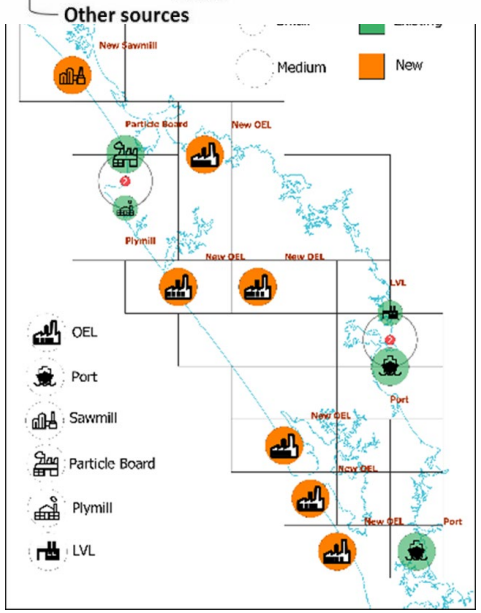
S1 – Reduce cows by 10% = GHGs ↓ -9% and profit ↓ -18%

S2 – Reduce cows by 10% + Productivity = GHGs ↓ -3% and profit ↑ +10%

Where do alternative proteins, precision fermentation, low emission dairy etc. fit?

- Market channel development and in-market partners are critical
- Lack of alternative processing and supply chain infrastructure
- High risks for individual farmers
- Collective approaches are critical to reduce and manage risk





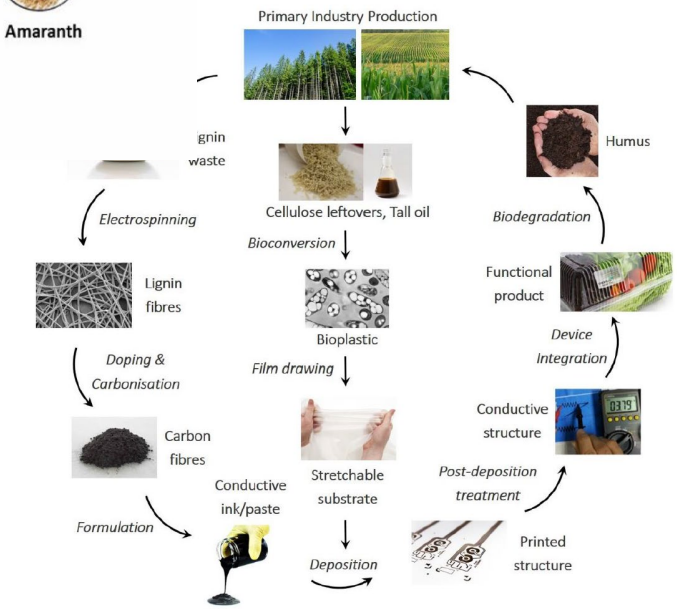
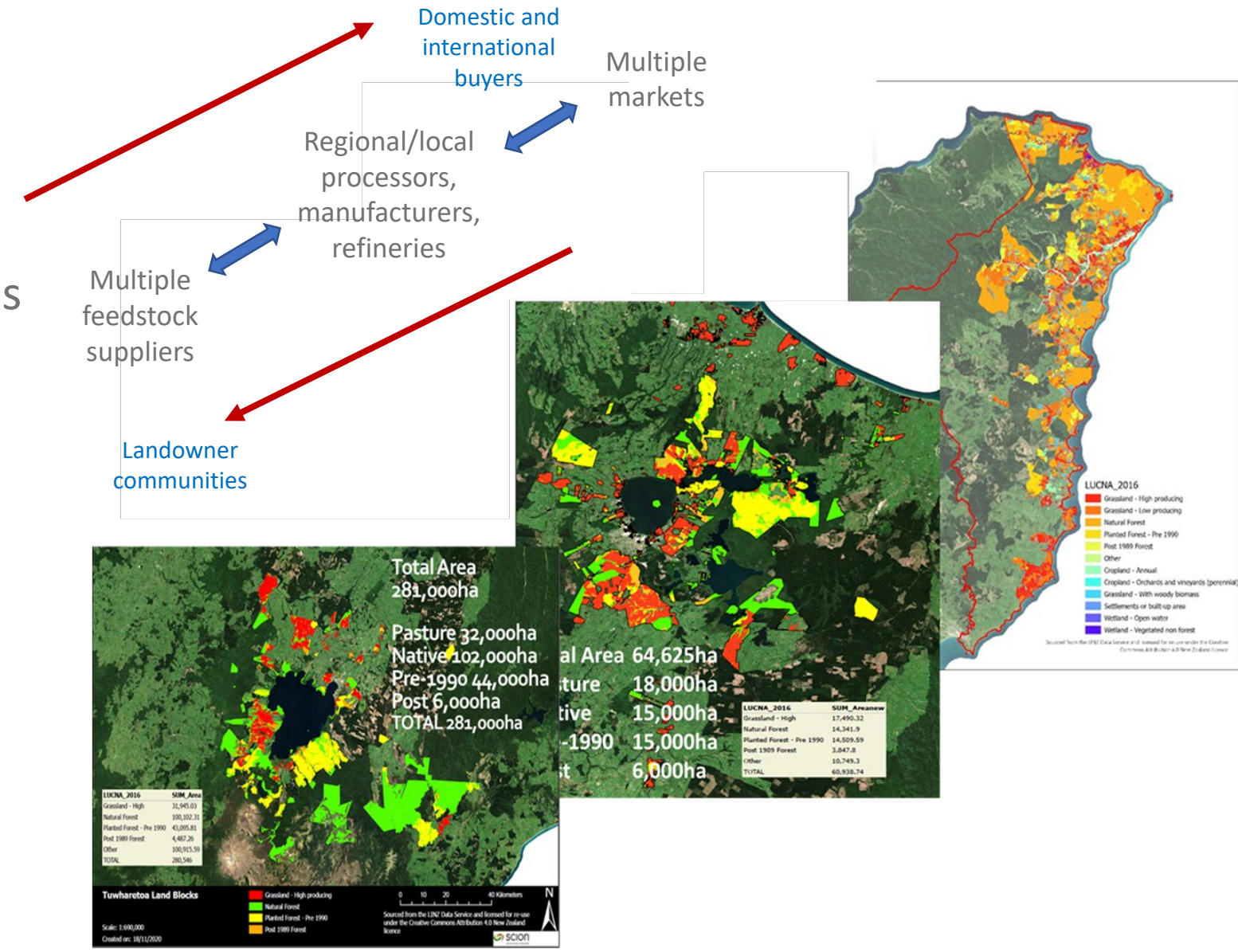


Fig. 1: GPE as an industry contributing to the circular bio-economy

PHAs for Digitalization of packaging

Collective Supply Networks

- Exploring supply network options across collectives and across catchment and district boundaries
- Lowers risk profile for individual farms
- Investment needed - into processing and market infrastructure
- Needs to be farmer/grower driven



What now?

New Zealand's farmers are resilient and capable of change, but the costs and risks of that change cannot be expected to be carried solely by farmers

Today's industry was built on tracks laid over 200 years ago- how long will it take to lay the infrastructure for the new industry?

What can we learn from the Māori sector? These farms are usually larger, more diversified and with lower debt