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Levelling the Grazing Paddock

Abstract

This article assesses the financial contribution made by the primary sector in terms of taxes paid. It also reports on some of the subsidies, concessions and other forms of assistance that the primary sector receives from the government. We provide illustrative examples of indirect subsidies to intensive farming. We also provide examples of farmers being paid to de-stock their land. In highlighting the significant direct and indirect financial subsidies to the agriculture sector, and concluding that national and local governing bodies are reluctant to take direct action that results in costs to farmers, we propose the radical solution of paying the polluters to stop polluting. This approach has recently been adopted in Europe and is also already in place in Taupō and Rotorua. While it will be unpalatable to many who do not pollute, it overcomes the current self-interested stymieing of reform by polluters. As a one-off payment, it could provide a quick resolution to mitigate ongoing harms. It also addresses the privatisation of profits for polluters and the socialised costs that are otherwise passed on to future generations.

Keywords agriculture, emissions, option for change, pollution, subsidies, taxation

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In 2021 we saw large public protests organised by Groundswell over several new policies, including a ‘ute tax’, freshwater policy, and increased environmental regulation (see Box 1 for more information on each of these). All these policies are intended to improve environmental outcomes for all people in Aotearoa New Zealand, including the many living in rural areas.

So, why the protests? The protestors’ argument is that environmental regulation hurts parts of the primary sector and therefore hurts the rest of the country. We are unconvinced of this argument. This article makes a counterargument: that some farmers are directly damaging the rest of the country with their lack of willingness to acknowledge and internalise the full costs of their activity.¹ This unwillingness is facilitated by an apparent lack of appetite from the government and regional councils to hold the agriculture sector to account for harm to the environment and hence to other New Zealanders. The problem is partly a classic collective action one of large, concentrated benefits from environmental degradation for the few and individually small and dispersed environmental costs on the many, including the yet to be born (Olsen, 1965).

It is also a problem exacerbated by the benefits of degradation being immediately observable in terms of money in the polluters' pockets, while the costs of degradation typically take time to emerge and are often difficult to observe and costly to measure.

In this article, we highlight the financial contribution that the primary sector makes to the country by way of tax paid, alongside some of the financial benefits that the primary sector receives by way of subsidies, concessions and other forms of assistance. The extent of the financial and other support provided to the sector is not well recognised. The same could be said, at least until relatively recently, of the ecological subsidy that is made from society to the sector. This lack of recognition of the ecological subsidy has constrained effective decision making and embedded poor land and water use. Recognising the need to transition farms in selected catchments away from intensive farming or farming unsuited to the biophysical capacity of the catchment, we propose the radical solution of compensating farmers to change their land use to a purpose that is less polluting, to address the environmental damage done by the sector. Despite the direct and indirect assistance that farming has received over decades, it may be necessary for society to incur a one-off compensatory expense – a full and final pollution settlement – to ensure that future generations do not continue to pay the financial and social costs associated with farming-generated pollution. Such a full and final settlement would recognise the benefit that the sector contributes to society, while acknowledging the unsustainability of the status quo.

Concessions and subsidies (direct and indirect)

There are several unique tax concessions offered to parts of the agricultural sector that are not extended to other industries. They include:

- Special rules for deductibility of farmhouse expenses, such as full deductibility of rates and interest expenses, for some farmhouses.²
- Deductibility from income of some long-lived expenditure that would be classified as capital expenditure in other

industries, and therefore not be tax deductible (e.g., fence construction for farming purposes).³

- An income equalisation scheme that allows income smoothing. This scheme allows primary sector businesses to deposit money into the scheme and treat this as a deduction in the year of deposit, with the money treated as income in the year it is withdrawn. This approach allows primary sector businesses to make deposits to the scheme in years where they have higher income (as the deposit is treated as a deduction, it reduces taxable income) and withdraw it in years where income is lower, and the funds may be taxed at a lower rate. Interest on deposits is paid at 3%, except where it is withdrawn within 12 months; deposits may be held in the scheme for five years.⁴
- A tax exemption for income derived by a herd improvement association or society established mainly to promote an improvement in dairy cattle.⁵

The sector also receives financial and other support from the government. Some of this is ongoing and some of it relates to specific events.

- Support is provided for adverse events such as flooding, biosecurity incursions and drought. By way of example, Ministry for Primary Industries annual reports show expenditure of \$137 million on *Mycoplasma bovis* eradication in 2018/19, \$149 million in 2019/20 and \$82 million in 2020/21 (Ministry for Primary Industries, 2020). Additional costs are incurred for compensation of farmers: \$151 million over the three years.⁶ The recovery is intended to be partly funded by industry, with an agreed split of 32/68 between industry and the ministry. At 30 June 2021, the ministry reported recoverable costs of \$172.6 million, of which \$72.4 million remains outstanding.
- The agricultural sector is currently excluded from the Emissions Trading Scheme (ETS), having reporting but no surrender obligations.⁷ While the agriculture sector may be included in the ETS from 2025, this is likely to have minimal cost for the sector.
- Government spending on the primary services in 2019/20 was \$961 million

BOX 1

The 'ute tax' is part of the government's Clean Car Programme aimed at reducing CO₂ emissions of light vehicles. New Zealand is many years behind the rest of the world in its provision of incentives/disincentives for purchases of low/high-emitting vehicle purchases (Marriott and Mortimore, 2017). The Clean Car Programme adopts a polluter-pays approach: if an individual wishes to drive a high-emission vehicle, the individual will incur a higher cost than someone driving a low-emission vehicle.

There is no shortage of evidence attesting to the degradation of waterways. Freshwater policy is intended to introduce measures to improve water quality in lakes, streams and rivers. These include pragmatic measures such as limiting stock access to, and fencing, waterways.

Increased environmental regulation includes greater controls on nitrogen pollution and enforceable farm environmental plans.

and forecast to increase to \$1.3 billion in 2020/21 (Treasury, 2021).⁸ These expenditures include biosecurity risk management, food safety and fisheries management.

An example of the consequences of the current indirect subsidy to intensive farming can be found in Te Waihora (Lake Ellesmere) in Canterbury. Like most of our lowland lakes in intensive agricultural catchments, it is dying due to excess nutrient inputs. To save the lake from further deterioration, the amount of nutrient entering the lake must be reduced, which requires curtailment of farming intensity in the catchment. Analysis by Environment Canterbury (ECan) and the Ministry for the Environment of two actions to reduce the pollution concluded that the land use intensity reduction

Table 1: Emissions from sectors, New Zealand, 2019

Sector	Emissions (kt CO ₂ -e)	Percentage	@ \$76.20/tonne (\$000)
Energy	34,263.06	41.6%	\$2,610,845
Industrial processes and product use	5,115.91	6.2%	\$389,832
Agriculture	39,617.71	48.1%	\$3,018,870
Land use, land use change and forestry (LULUCF)	-27,425.09		-\$2,089,792
Waste	3,316.91	4.0%	\$252,749
Agriculture minus LULUCF (net)	12,192.62		\$929,078

Source: Ministry for the Environment, 2019b

Table 2: Cost of nitrate leaching to water

Animal type	Nitrate-nitrogen leached kg/yr	Nitrate-nitrogen leached kg/yr @ \$400/kg/yr
Beef cattle	37,244,652	\$14,897,860,859
Dairy cattle	129,806,132	\$51,922,452,800
Deer	1,644,536	\$657,814,491
Sheep	30,493,616	\$12,197,446,477
Total	199,188,937	\$79,675,574,627

required to stop the lake declining would result in a revenue loss of \$250 million for the dairy farmers, the source of 95% of the problem nutrients (Ministry for the Environment, 2019a). The study's conclusion was that ECan should take no action as the economic impact for farmers was too high. The lake continues to die.

ECan's decision is similar to those made by other councils: privatise profits for polluters and socialise the costs onto all New Zealanders, both current and future generations, by not charging the polluters for this harm. It is effectively a vast public subsidy to dairy farmers in this catchment to the tune of a quarter of a billion dollars a year.

The harm caused by agricultural nitrate is not just to freshwater ecosystems, but also to drinking water. A recent study by Christchurch City Council estimated the costs to remove the nitrate from dairy farming from their drinking water to protect human health at \$1.5 billion, or almost \$4,000 per person in the city (Christchurch City Council, 2020).

Now consider greenhouse gasses. Almost half of New Zealand's greenhouse gas emissions come from agriculture in the form of methane and nitrous oxide from farmed livestock. However, as livestock is exempt from New Zealand's ETS, this amounts to another subsidy to the sector, paid for in this case by the global

community, including future generations, in terms of its impact on planetary heating. To give an indication of the value of this subsidy, in 2019 the minimum annual net emissions from agriculture (giving the country's total sequestration from land use, land use change and forestry (LULUCF) to agriculture) at today's carbon price (\$76.20/tonne CO₂e) amounts to \$929 million⁹ (see Table 1).¹⁰

Yet another example of publicly subsidising harm by not making the polluter pay is visible in two iconic North Island lakes, Taupō and Rotorua. To halt ecosystem health declines in these two lakes, taxpayers and ratepayers are paying farmers in the lake catchments to de-stock. The price tag was calculated in 2015 at around \$80 million for Taupō (Monge et al., 2015) and \$40 million for Rotorua (Bay of Plenty Regional Council, 2015). The amount paid was based on the amount of nitrate reduction required to stop the decline. For Rotorua a reduction of 100 tonnes of nitrogen per year was achieved, which works out at \$400 to prevent each kilogram of nitrate from reaching the lake. We observe similar policy recently announced in the Netherlands, where farmers will be paid to remove animals to protect the environment (Levitt, 2021).

If we applied the same preventive approach to protecting the rest of our lakes, rivers and groundwater as we have with

Lake Taupō and Lake Rotorua, the eyewatering indirect subsidy to farming nationally would become clear. The total amount of nitrate leached to water from dairy farming in the 2017 year for the whole country was 130m kg (Statistics New Zealand, n.d.). If we add sheep, beef and deer farming, it comes to 200m kg/yr. Thus, at \$400/kg leached per year, annual costs would amount to \$52 billion for dairy and a total of \$79 billion to include sheep, beef and deer. Given December 2021 GDP of about \$350 billion in current prices, we would need to make a one-off payment of over one fifth of our annual market incomes. Instead, we allow the harm to occur, thereby effectively subsidising agriculture to the tune of \$79 billion per year (see Table 2 for the calculation).

These issues are not new. Reports from the Ministry for the Environment have shown worsening nitrate-nitrogen levels in the majority of monitored river sites for many years (Ministry for the Environment, 2017), alongside academic research highlighting the main causal factor – increasing intensive agricultural practices adversely affecting water quality (Joy, 2015; Monaghan et al., 2007; Quinn and Stroud, 2001; Wilcock et al., 1999). Just one example is provided by Snelder, Larned and McDowell (2017) who show that the anthropogenic increase in nitrate loads exported from our rivers is three times higher than natural nationally, and four times higher in Canterbury and Southland, areas where intensification has been most profound.

Alongside clear evidence of deterioration of water quality, research has demonstrated the public's concern about pollution of rivers and lakes. For example, a Colmar Brunton survey undertaken for Fish & Game New Zealand in 2018 reported that 82% of respondents were very or extremely concerned about water pollution (Colmar Brunton, 2018). A huge number of submissions – 17,500 – responding to consultation by the Ministry for the Environment in 2019 on proposals to stop further degradation of freshwater resources and address historic damage were largely supportive of a stronger conservation direction (Ministry for the Environment, 2020).¹¹

Contribution to society

The primary sector employs people – about 5.5% of total New Zealand jobs were in agriculture, forestry and fishing in March 2019, according to the Household Labour Force Survey (Statistics New Zealand, 2019a). While it is not as large as many people may think, it also contributes to market incomes – 10.6% of GDP in the year to March 2019 (Statistics New Zealand, 2019b). The higher share of GDP than employment to a large extent reflects the sector's very high relative use of the natural environment – land, freshwater and sea – to produce its output.

Income taxes paid by the sector are outlined in Table 3. Taxes have been relatively stable over the period shown: for agriculture, forestry and fishing between 1.6% and 1.8% of total tax revenue collected. Dairying contributed 0.5%, 0.5% and 0.7% to total tax revenue over the 2017–18, 2018–19 and 2019–20 years respectively. The total tax paid by the dairy industry of \$531.7 million in 2019–20 covers a mere 1% of costs of nitrate leaching to water attributable to that sector (as per Table 2).

There are few incentives for much of the agricultural sector to change its behaviour, which is why regulation is required.¹³ But in the apparent absence of political appetite to fully implement a polluter-pays approach, the rest of society continues to subsidise poor environmental practice.

An option for change

The first necessity is a trustworthy, regular, robust, transparent and independent provision of information to New Zealanders about the non-market costs which the sector is imposing on current and future generations. While the provision of such high-quality information alone is highly unlikely to solve the problem, it is the necessary bedrock on which any rational and enduring solution must be built.

We acknowledge that government action to make the users pay for their environmental damage is unlikely. The figures presented here reveal how the failure to limit the environmental harm resulting from agricultural intensification has shifted the real costs of this harm away

Table 3: Income taxes paid in the primary sector

Industry	2017–18 (\$ million)	2018–19 (\$ million)	2019–20 (\$ million)
Viticulture	36.8	36.0	41.3
Other horticulture	140.9	141.7	146.6
Dairying	379.1	367.3	531.7
Other livestock farming	332.6	317.6	317.1
Services to agriculture	115.8	129.1	126.8
Forestry and logging	159.8	180.7	137.2
Aquaculture	6.7	7.0	7.7
Fishing	64.0	72.5	60.6
Hunting and trapping	2.0	1.7	2.0
Total (agriculture, forestry and fishing)	1,237.7	1,253.6	1,371.0
Total tax revenue	72,100	77,900	77,700
Agriculture tax paid as a % of total tax revenue	1.7%	1.6%	1.8%

Source: Inland Revenue¹²

BOX 2 The Netherlands situation

The Netherlands has the highest density of livestock in Europe, with an average 3.8 livestock units per hectare, nearly half of which is cattle (Eurostat, 2019). This contrasts with the average livestock density in the European Union of 0.8 livestock units per hectare of agricultural area (ibid.). Intensive farming has made the Netherlands the world's second-biggest agricultural exporter by value (after the United States) (Kotkamp, 2021).

In December 2021, the Dutch government announced a plan to buy out farmers to reduce nitrogen pollution: €25 billion is allocated to the long-term plan to reduce the numbers of pigs, cows and chickens in the country.

The policy is the result of decisions from courts in the Netherlands and the European Court of Justice determining that farming emissions, among other activities, breach European Union legislation (Kotkamp, 2021; Schaart, 2019). The majority of the nitrogen that ends up in the environment comes from farms and 70% of the country's surface area exceeds critical limits for nitrogen (Schaart, 2019).

The proposal is intended to work on a voluntary basis, with farmers compensated for relocating, leaving the industry or transitioning to less-intensive methods of farming (Levitt, 2021). However, the Netherlands is not alone in emitting phosphates and nitrogen that are problematic within EU directives. Reports suggest that Denmark, Belgium and Germany may have to consider similar (or alternative) proposals (Kotkamp, 2021).

For context, the dairy stocking rate in the Netherlands is lower than in New Zealand, at 1.77 cows/hectare compared to 2.85 cows/hectare here (Statistics Netherlands, 2021; Tupu, 2019).

from the polluter to wider society and future generations. Moreover, the harm has been facilitated by ongoing direct and indirect subsidies and concessions. Now that the damage done to freshwater and the climate by agricultural intensification is

becoming clearer, calls for change have become more urgent. Intensive agriculture in New Zealand is, however, in a quandary because, in the absence of limits, farmers have maximised intensity and land values have grown based on an embodied 'right

to pollute'. Removing this right will mean a one-off loss of land value.

A rarely contemplated alternative solution is that that part of the current national community who are non-polluters pay the polluters to stop polluting for the sake of global citizens and future generations. This approach overcomes the stymieing of reform by polluters in their self-interest, but it also entails a one-off transfer of monetary wealth from non-polluters to polluters. At a stretch, it may be argued that an element of fairness resides in this solution, whereby, while society has incurred much of the cost of the environmental damage generated by agriculture, it has also gained from agriculture's presence. Therefore, one-off compensation is a redistributive bullet, we suggest, that we may have to bite, no matter how unpalatable.

The precedent here has been set in the Taupō and Rotorua lakes example of paying farmers to de-intensify farming to make up for the loss in land value. The clear advantage of this payment is that it is a one-off payment, whereas doing nothing means ongoing harms and effective subsidisation of one sector.

We propose some form of sliding scale for agricultural landowners. Some land values are inflated due to recent increases in dairy intensification. Deliberate polluting activity such as this should not be treated the same as dairy farmers who have been operating for decades under more traditional methods.

The argument against 'buying off' polluters will be the net output loss resulting from such a policy. However,

intensive livestock dairy farming is not the only use for land, so the net loss is likely to be considerably less than the gross loss. In the Netherlands, land acquired under its new policy to reduce nitrogen emissions may be designated for other agricultural usage, or returned to a natural state where it produces a good to society which is not exchanged in a market. (See Box 2 for more detail on this initiative.)

A benefit of adopting a policy like that for lakes Taupō and Rotorua, or the Netherlands, is timing. These policies can be implemented within short time frames that result in almost immediate results. This is preferable to further time-consuming consultation, report writing and incremental policy changes that have little impact on water quality in practice.

Conclusion

This article has assessed the significant direct and indirect financial assistance provided to the agriculture sector. We have also reported on the significant environmental damage resulting from the sector's activities. As the majority of the sector remains (rationally) unwilling to internalise the costs associated with their farming activity, we propose a radical solution: that farmers are compensated for loss of land values when the land use is changed to a less environmentally damaging activity.

This approach addresses the self-interest present in the sector, alongside the ongoing harms generated by, and subsidisation of, this sector. Moreover, there is precedent for this action, as illustrated in the case of Lake Taupō and

Lake Rotorua. Importantly, this approach recognises that this is a societal problem. Ultimately, whether farmers don't pay for the cost of their pollution and society suffers, farmers directly pay for the cost of their pollution and society indirectly pays, or society directly pays, it is the economy that bears the cost.

- 1 We acknowledge the complexity of the sector, with a wide range of approaches to farming, from large corporations using conventional methods through to regenerative farms. We also acknowledge that some farmers make proactive attempts to mitigate the environmental impacts of their farming practices.
- 2 Inland Revenue Interpretation Statement 17/02: Income tax – deductibility of farmhouse expenses.
- 3 Income Tax Act 2007, sD04.
- 4 Income Tax Act 2007, subpart EH – Income equalisation schemes.
- 5 Income Tax Act 2007, sCW51.
- 6 This cost increased to \$220 million in compensation claims over the four-year period (Farmers Weekly, 2022).
- 7 Note that the sector does pay for farm inputs involving CO₂, although this is a small component of the sector's emissions, in the order of 10%.
- 8 This spending is on the broader primary sector, rather than just agriculture.
- 9 <https://www.carbonnews.co.nz/story.asp?storyID=23813>.
- 10 Methane is a short-lived greenhouse gas distinct from long-lived greenhouse gases such as nitrous oxide and carbon dioxide. The first two come predominantly from agriculture, but all are combined to give carbon dioxide equivalent for the emissions profiles in Table 1.
- 11 The proposals included taking a broader approach to manage all aspects of ecosystem health and improving farm practices.
- 12 Information received in response to an Official Information Act 1982 request, 13 December 2021.
- 13 We acknowledge that some farmers are motivated to change their behaviour. Research suggests that drivers of this include farmers' view of their role as stewards of the land, social norms in their community, and reference to the public's concerns. Reasons for not engaging in environmentally friendly practices include competition to have a productive and financially successful farm, a perceived imperative to provide food for society, and environmental concerns seen as a distraction (Mills et al., 2017).

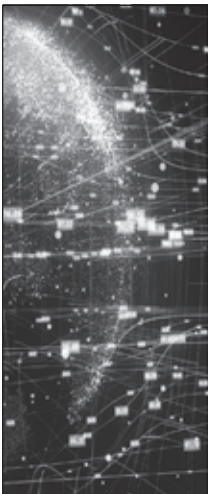
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References

- Bay of Plenty Regional Council (2015) *Section 32 Evaluation Report: Lake Rotorua Nutrient Management Rules Plan Change 10*, <https://www.boprc.govt.nz/media/509000/s-final-section-32-lake-rotorua-nutrient-management-plan-change-10-pdf-copy.pdf>
- Christchurch City Council (2020) Evidence for the Land and Water Regional Plan proposed change 7 and Waimakariri River Plan proposed change 2, 17 July, <https://api.ecan.govt.nz/TrimPublicAPI/documents/download/3909177>
- Colmar Brunton (2018) 'Perceptions of the environment: what New Zealanders think', Colmar Brunton for Fish & Game New Zealand, <https://fishandgame.org.nz/news/water-pollution-is-now-new-zealanders-number-one-concern/>
- Eurostat (2019) 'Agri-environmental indicator: livestock patterns', https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Agri-environmental_indicator_-_livestock_patterns
- Farmers Weekly (2022) 'Government marks M Bovis milestone', *Farmers Weekly*, 5 May, <https://www.farmersweekly.co.nz/government-marks-m-bovis-milestone/>
- Joy, M. (2015) *Polluted Inheritance: New Zealand's freshwater crisis*, Wellington: Bridget Williams Books
- Kotkamp, L. (2021) 'Political animals: Dutch parties stuck over livestock', *Politico*, 15 November, <https://www.politico.eu/article/livestock-netherlands-cows-pigs-chickens-farming-agriculture/>
- Levitt, T. (2021) 'Netherlands announces €25bn plan to radically reduce livestock numbers', *Guardian*, 15 December, <https://www.theguardian.com>

- com/environment/2021/dec/15/netherlands-announces-25bn-plan-to-radically-reduce-livestock-numbers
- Marriott, L. and A. Mortimore (2017) 'Emissions, road transport, regulation and tax incentives in Australia and New Zealand', *Journal of the Australian Tax Teachers Association*, 12 (1), pp.23–52
- Mills, J., P. Gaskell, J. Ingram, J. Dwyer, M. Reed and C. Short (2017) 'Engaging farmers in environmental management through a better understanding of behaviour', *Agriculture and Human Values*, 34, pp.283–99
- Ministry for the Environment (2017) *Our Fresh Water 2017*, Wellington: Ministry for the Environment
- Ministry for the Environment (2019a) Official Information Act response (recipient redacted), <https://environment.govt.nz/assets/OIA/Files/18-D-02833.pdf>
- Ministry for the Environment (2019b) 'New Zealand's interactive emissions tracker', <https://emissionstracker.mfe.govt.nz/#NrAMBoEYF12TwClByBTALo2wBM4eiQDs2AHEgMQDuAhuqgE4BmNANqwPoBGArughSAdlmhA>
- Ministry for the Environment (2020) *Action for Healthy Waterways: summary of submissions on national direction for our essential freshwater*, Wellington: Ministry for the Environment
- Ministry for Primary Industries (2020) *Annual Report 2019/20*, Wellington: Ministry for Primary Industries
- Monaghan, R.M., R.J. Wilcock, L.C. Smith, B. Tikisettey, B.S. Thorrold and D. Costall (2007) 'Linkages between land management activities and water quality in an intensively farmed catchment in southern New Zealand', *Agriculture, Ecosystems and Environment*, 118 (1–4), pp.211–22
- Monge, J., S. Velarde, R. Yao, S. Pizzirani and W. Parker (2015) *Identifying Complementarities for the Dairy and Forestry Industries in the Central North Island*, <https://scion.contentdm.oclc.org/digital/collection/p20044coll6/id/206/>
- Olsen, M. (1965) *The Logic of Collective Action: public goods and the theory of groups*, Cambridge, Mass: Harvard University Press
- Quinn, J.M. and M.J. Stroud (2001) 'Water quality and sediment and nutrient export from New Zealand hill-land catchments of contrasting land use', *New Zealand Journal of Marine and Freshwater Research*, 36 (2), pp.409–29
- Schaart, E. (2019) 'The Netherlands struggles with nitrogen headache', *Politico*, 2 October, <https://www.politico.eu/article/netherlands-nitrogen-headache-pollution/>
- Snelder, T.H., S.T. Larned and R.W. McDowell (2017) 'Anthropogenic increases of catchment nitrogen and phosphorus loads in New Zealand', *New Zealand Journal of Marine and Freshwater Research*, 52 (3), pp.336–611, <https://doi.org/10.1080/00288330.2017.1393758>
- Statistics Netherlands (2021) 'Slightly smaller pig herd, barely reduced cattle herd', 1 October, <https://www.cbs.nl/en-gb/news/2021/39/slightly-smaller-pig-herd-barely-reduced-cattle-herd>
- Statistics New Zealand (2019a) 'Household Labour Force Survey: March 2019 quarter', Wellington: Statistics New Zealand
- Statistics New Zealand (2019b) 'National accounts (industry production and investment): year ended March 2019', <https://www.stats.govt.nz/information-releases/national-accounts-industry-production-and-investment-year-ended-march-2019>
- Statistics New Zealand (n.d.) 'Nitrate-nitrogen leached from livestock', https://statisticsnz.shinyapps.io/nitrate_leached/
- Treasury (2021) *Budget Economic and Fiscal Update 2021*, Wellington: Treasury
- Tupu (2019) 'Land use fact sheet: dairy', <https://www.tupu.nz/en/fact-sheets/dairy#:~:text=For%20the%20season%20ending%20June,was%202.84%20cows%20per%20hectare.>
- Wilcock, R.J., J.W. Nagels, H.J. Rodda, M.B. O'Connor, B.S. Thorrold and J.W. Barnett (1999) 'Water quality of a lowland stream in a New Zealand dairy farming catchment', *New Zealand Journal of Marine and Freshwater Research*, 33 (4), pp.683–96



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