IN THE MATTER of the Resource Management Act 1991 (**RMA**)

AND

IN THE MATTER of the Freshwater Planning Instrument Parts of the Proposed Otago Regional Policy Statement 2021

STATEMENT OF EVIDENCE OF
Barbara Helen Beattie FOR Wise Response Inc

28/06/2023

SUMMARY OF EVIDENCE

1. My name is Dr. Barbara Helen Beattie and I am a veterinarian. I summarise my evidence, according to the key headings in this statement, as follows:

Intensification

(a) Intensification has been enabled by increasing a variety of input into farms systems. Intensification has negatively impacted the environment and also been detrimental to animal and human health and welfare.

(b) Pathogens, sediment and nutrients leach and/or run off and enter receiving environments, in some instances, soil structure is destroyed and animals in intensive farm systems require prophylactic antimicrobial treatments to keep them healthy, as they experience increased stress from their living environment.

(c) Deintensification will not necessarily be enough to resolve the impacts of all farming practices and in some instances, farmers are unlikely to be able to meet industry expectations, for the environment or the animals. Simply, the land's capability to manage these practices is exceeded. In these instances, land use change is needed.

Zoonotic Diseases and Antimicrobial Use

(d) Generally, higher concentrations of animals and humans living close together increases the risk of transmission of organisms, including zoonoses.

(e) Intensification has resulted in increased numbers of animals in smaller areas (i.e., higher stocking rates) which is tied to increased use of antimicrobials.

(f) Antimicrobial resistance (AMR) is a top ten concern for the World Health Organization.

Conclusion

(g) Intensification in farming systems is harmful on multiple fronts, with some currently accepted practices failing to protect the health and welfare of our animals, people and our environment.

(h) Deintensification, and/or preventing further intensification will reduce some of the risk on environmental damage and contamination, zoonosis and the development of antimicrobial resistance.

(i) In other instances, where land use exceeds capability alternate land use is needed.

INTRODUCTION

1. My name is Barbara Helen Beattie.

2. I hold the qualifications of Bachelor of Veterinary Science, a Graduate Certificate in Tertiary learning and Teaching, a Certificate in Animal Welfare Investigations and a Certificate in Mata ā Ao Māori.

3. I have been a registered veterinarian for 25 years, across a variety of roles that include being a clinical veterinarian (mixed, companion, shelter, educator), an animal welfare inspector and formerly, I was the Chief Veterinary Officer for the New Zealand Veterinary Association (NZVA CVO).

4. As the NZVA CVO, I was involved in advocacy, consultation, persuasion and policy development, both internally (i.e., to the NZVA's members) and nationally (i.e., contributing to Government policy). I was a member of various advisory groups within and outside of government (e.g., the MPI-led Farm to Processors Animal Welfare Forum) and I was a member of the Beef and Lamb (B+LNZ) Winter Grazing workshops, the outputs of which helped inform B+LNZ's own and government policy development (i.e., through the Freshwater Regulations 2020).

5. I was a member of the Ministerial Taskforce on Winter Grazing, and formerly part of Pāmu's Veterinary One Health Advisory Group that provided animal welfare advice within a One Health context. Both these roles included advising on the needed improvements to intensive winter grazing practices to improve both animal and environmental welfare.

6. I am the Minister of Agriculture's appointment to the Telford Farm Training Institute Board.

7. I am currently the Managing Director of Veterinarians for Animal Welfare Aotearoa.

8. I have been retained by Wise Response to prepare a statement of evidence on the interconnected nature of animal and environmental welfare and how changing and/or improving animal management and welfare can reduce adverse environmental effects.

CODE OF CONDUCT

9. I have read the Environment Court Code of Conduct for expert witnesses and agree to comply with it.

10. I confirm that the topics and opinions addressed in this statement are within my area of expertise except where I state that I have relied on the evidence of other persons. I have not omitted to consider materials or facts known to me that might alter or detract from the opinions I have expressed.

Scope of Evidence

11. I have been asked to cover the following issues

- pathogens, chemicals or other contaminants associated with farm animals that can end up in freshwater;
- the nature of the hazard posed by any such contaminant;
- any mitigation options there are to avoid or reduce the impact of these effects;
- whether any such hazards are completely understood or do we need to be precautionary.

INTENSIFICATION

12. Intensification of agriculture is characterised by high inputs - whether those are for example but not limited to, capital, labour, irrigation, fertiliser, pesticides, herbicides, fungicides, antimicrobials, palm kernel expeller, electricity, high yield crops - or through increasing mechanisation to ensure increases in food production per hectare.

13. Agricultural intensification can result in higher levels of nutrients, sediment and microbial contamination of our rivers, lakes, wetlands and groundwater.[1]

14. The intake of microbes and nitrates through contaminated water presents a human health risk (e.g., gastroenteritis and organ dysfunction; blue baby

[1] Agricultural intensification factsheet; September 2020; Ministry for the Environment and Ministry for Primary Industries; Publication number: INFO 971

syndrome [2] and colorectal cancer, respectively (see later)), nitrogen derivatives entering waterways accelerate algal growth which is toxic to rivers[3] and animals,[4] and sediment in the waterways blocks light, harms fish gills, reduces visibility for fish, alters water flow patterns and when it settles in the interstitia, covers or affects access to the habitats of the waterway's inhabitants.[5]

15. From a farmed animal perspective, concerns about intensive farming have been raised as far back as the mid-1960s.[6] Intensification increases stress on animals meaning even more inputs (e.g., use of antimicrobials to merely maintain animal health) are needed to support the system and these have impacts on the environment and people.

16. Cattle do not like lying on wet, muddy surfaces and lying on concrete increases stress levels.[7,8] Increasing muddiness results in cattle choosing to lie on concrete.[9] On heavy soils, lying surfaces that cattle find acceptable are tightly aligned with better environmental outcomes (i.e., pasture-covered, firm, dry). This is not the case on light, leaky soils that may have acceptable lying surfaces but poor outcomes for receiving waterways due to leakage through the soil.

17. Animal management and farm systems that provide acceptable welfare outcomes for animals as well as the environment would include disallowing grazing systems where animals live in wet, muddy conditions with no appropriate - as assessed by the cow - lying surface. Not only do these conditions fail to meet the purposes of the Animal Welfare Act 1999 (i.e., do

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[2] Humphrey, A, Medical Officer of Health Canterbury District Health Board Christchurch, What Do GPs Need to Know About Drinking Water?; 2017; powerpoint presentation
[3] Stats NZ
[4] https://www.ecan.govt.nz/your-region/your-environment/water/health-warnings/keeping-dogs-safe-from-toxic-algae/
[5] https://niwa.co.nz/our-science/freshwater/tools/kaitiaki_tools/impacts/sediment
[6] Brambell, FRS, Report of the Technical Committee to Enquire into the Welfare of Animals kept under Intensive Livestock Husbandry Systems(1965).
[7] Fisher, A. D., M. Stewart, G. A. Verkerk, C. J. Morrow, and L. R. Matthews. 2003. The effects of surface type on lying behaviour and stress responses of dairy cows during periodic weather-induced removal from pasture. Appl. Anim. Behav. Sci. 81:1-11.
[8] Fisher, A.D., Verkerk, G.A., Morrow, C.J., & Matthews, L.R., (2002), The effects of feed restriction and lying deprivation on pituitary-adrenal axis regulation in lactating dairy cows. *Livestock Production Science 73: 255-263.*
[9] Chen, Jennifer M., Stull, Carolyn L., Ledgerwood, David N.,Tucker, & Cassandra B., (2017), Muddy conditions reduce hygiene and lying time in dairy cattle and increase time spent on concrete; Journal of Diary Science, 100(3), 20902103.

not allow normal behaviour per Section 4(d)[10]) and so are illegal, but during grazing they also destroy soil structure and leave soil bare which risks sediment, nutrient and pathogen run off entering waterways. Additionally, most of these farm systems require annual tillage and use of herbicides and/or pesticides during establishment.

18. It is generally accepted that high (e.g., 20-30 tonnes/hectare) dry matter/hectare crops and grazing systems (e.g., grass and bailage) are a risk for environmental and animal welfare. At high tonnage per hectare, the allowable grazed area per break is smaller, meaning more animals trample a smaller area (e.g., swedes or turnips at 10T/ha animal require 3 times as much crop area per break than fodderbeet at 30T/ha). With root/bulb crops (e.g., fodderbeet, turnips etc) grazing leaves the soil bare (i.e., there is no residual dry matter).[11]

19. In some instances, deintensification (i.e., less inputs and lower stocking rates) will not necessarily be enough to resolve the impacts of some farming practices. For example, farms with heavy soils in South Otago, wintering mature cows (~450-500kg) on grazing systems such as grass and bailage or fodderbeet (DM=~20-30T/ha) are unlikely to be able to meet industry expectations[12,13]. Simply, the land's capability to manage these practices is exceeded and land use must change.

20. This opinion aligns with that of Dr Alison Dewes in her Statement of Evidence to the Fonterra Consent application for the Studholme Milk Factory Expansion [14]

    'Pathogen pathways are a combined result of management on farm, the characteristics of a soil, and the management practices such as effluent spreading when soils are saturated, winter cropping and set stocking and

[10] Animal Welfare Act, 1999
[11] Winter Grazing Taskforce Final Report & Recommendations Improving Animal Welfare on Winter Grazing Systems
[12] Expected outcomes for animal welfare
[13] Winter Grazing Taskforce Final Report & Recommendations Improving Animal Welfare on Winter Grazing Systems
[14] Dewes, A, Statement Of Evidence in Support Of Submissions By The Wise Response Society Inc; in the matter of Resource Management Act 1991; Fonterra Cooperative Group Limited Resource Consent Applications for the Studholme Milk Factory Expansion

irrigation. Therefore, in many cases reducing stocking rate[15] *fencing streams and undertaking nutrient management plans will be unlikely to fix the zoonotic pathogen issue'.*

21. Where land use conflicts with land capability, whole-of-system change is required to shift to a system that the land can support. A combination of global (e.g., climate change) and local (e.g., water quality) drivers are pushing for a transition in our land-use systems in New Zealand.[16]

ZOONOTIC DISEASES AND ANTIMICROBIAL USE

22. A report on the Public Health Implications of Land Use Change and Agricultural Intensification provides a clear overview regarding issues over and above water quality effects [17]

"Apart from water quality, agricultural intensification and urban expansion have the potential to affect health through increased greenhouse gas emissions, loss of biodiversity and ecosystem services, and weaker rural communities. Furthermore, agricultural intensification could also affect health through increased zoonotic disease risk and increased antimicrobial resistance. The evidence for the health implications of these effects is not specific to Canterbury, but national and international evidence demonstrates that the kinds of changes occurring in Canterbury are likely to have similar effects as elsewhere."

Antimicrobial Use

23. The most intensive farmed animal systems (e.g., pigs, poultry, dairy) require the most antimicrobials to support the health (though not welfare) of the

[15] Dewes. A, (2015) Economic resilience and environmental performance of dairy farms in the upper Waikato region (MSc) Waikato University
[16] Bayne K, Renwick A. Beyond Sustainable Intensification: Transitioning Primary Sectors through Reconfiguring Land-Use. *Sustainability*. 2021; 13(6):3225. https://doi.org/10.3390/su13063225
[17] Public Health Implications of Land Use Change and Agricultural Intensification with respect to the Canterbury Plains: A Literature Review: Prepared by Dr. Jackson Green & Dr. Cheryl Brunton: Community and Public Health CDHB July 2014.

animals, given the inherent stresses and disease risks associated with high stocking rates.[18]

24. Where restrictions are placed on antimicrobial use (AMU) in farmed animals, there is a reduction in number of antibiotic-resistant bacteria in these animals.[19] There's no evidence in New Zealand that use of antimicrobials in dairy cattle has resulted in the emergence of pathogens that are multidrug resistant - this is due to a lack of data.[20]

25. The use of intra-mammary antimicrobials has been linked with some farming practices (e.g., intensive winter grazing of cows on crops/ grass bailage grazing systems) because of the risk of mastitis from the dirty environment.[21] Future-proofing farm systems will mean moving to systems that do not require prophylactical use of antimicrobials to keep animals healthy. This is in line with the global concerns about antimicrobial resistance[22] and therefore trends to reduce antimicrobial use in animals.[23]

26. Community water supply contamination with nutrient pollution,[24] faecal coliforms,[25] and veterinary drugs[26] has also been linked to farming.

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[18] Hillerton, Eric & Bryan, Mark & Beattie, BH & Scott, D & Millar, A & French, N. (2021). Use of antimicrobials for food animals in New Zealand; updated estimates to identify a baseline to measure targeted reductions. New Zealand Veterinary Journal. 69. 1-6. 10.1080/00480169.2021.1890648.

[19] Tang KL, Caffrey NP, Nobrega DB, et al. 2017. Restriction in the use of antibiotics in food-producing animals and its associations with antibiotic resistance in food-producing animals and human beings: a systematic review and meta-analysis. The Lancet Planetary Health 1:e316-e327 (accessed 4 September 2018).

[20] Burgess, S,, French, N,; Antimicrobial resistant bacteria in dairy cattle: A review; (2017); New Zealand Food Safety and Science Research Centre

[21] Dohmen, W., F. Neijenhuis and H. Hogeveen. 2010. Relationship between udder health and hygiene on farms with an automatic milking system. J. Dairy Sci. 93:4019-4033

[22] https://www.who.int/news-room/spotlight/10-global-health-issues-to-track-in-2021

[23] Lacy-Hulbert, SJ, Kuhn-Sherlock B, 2022; Changing Use of Dry Cow Antibiotics since 2015; Conference Proceedings of the Dairy Cattle Veterinarians Branch of the NZVA.

[24] Jayne Richards, Tim Chambers, Simon Hales, Mike Joy, Tanja Radu, Alistair Woodward, Alistair Humphrey, Edward Randal, Michael G. Baker, Nitrate contamination in drinking water and colorectal cancer: Exposure assessment and estimated health burden in New Zealand, Environmental Research, Volume 204, Part C, 2022, 112322, ISSN 0013-9351, https://doi.org/10.1016/j.envres.2021.112322.

[25] Report of the Havelock North Drinking Water Inquiry; (2017).

[26] Chee-Sanford JC, Aminov RI, Krapac IJ, Garrigues-Jeanjean N, Mackie RI. Occurrence and diversity of tetracycline resistance genes in lagoons and groundwater underlying two swine production facilities. Appl Environ Microbiol. 2001 Apr;67(4):1494-502. doi: 10.1128/AEM.67.4.1494-1502.2001. PMID: 11282596; PMCID: PMC92760.

Zoonotic Disease

27. Zoonotic diseases are infectious diseases that can transfer from animals to humans. Globally, approximately 60% of reported emerging infectious diseases are zoonotic and of the 30 new human pathogens detected in the last three decades, 75% have originated in animals.[27,28]

28. Impacts of contaminants from farming entering waterways range from gastrointestinal disease, colorectal cancer[29] to contributing to the deaths[30] of at least three people following the Havelock North water disaster. In the case of leptospirosis, serious organ dysfunction, chronic fatigue, depression[31, 32] and suicide have been attributed to the disease, with veterinarians, farm and meat workers being most at risk.

29. An extensive literature survey revealed the link between zoonotic disease and landuse:

    "An updated literature survey identified 1,407 recognized species of human pathogen, 58% of which are zoonotic. ***Emerging and reemerging zoonoses are associated with a wide range of drivers, but changes in land use and agriculture and demographic and societal changes are most commonly cited****."*[33]

30. Generally, higher concentrations of animal and human populations living close together increases the risk of transmission of organisms. Intensification enables rapid evolution and spread of novel viruses,

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[27] https://www.emro.who.int/fr/about-who/rc61/zoonotic-diseases.html

[28] Woolhouse M, Gowtage-Sequeria S. 2005. Host range and emerging and reemerging pathogens. Emerging Infectious Diseases 11:1842-1847.
DOI: 10.3201/eid1112.050997 (accessed 12 September 2018).

[29] Schullehner J, Hansen B, Thygesen M, Pedersen CB, Sigsgaard T. Nitrate in drinking water and colorectal cancer risk: A nationwide population-based cohort study. Int J Cancer. 2018 Jul 1;143(1):73-79. doi: 10.1002/ijc.31306. Epub 2018 Feb 23. PMID: 29435982.

[30] Report of the Havelock North Drinking Water Inquiry; (2017).

[31] https://www.worksafe.govt.nz/topic-and-industry/agriculture/working-with-animals/prevention-and-control-of-leptospirosis/gpg/#lf-doc-21005

[32] https://www.dairynz.co.nz/animal/cow-health/leptospirosis/

[33] Woolhouse ME, Gowtage-Sequeria S. Host range and emerging and reemerging pathogens. Emerg Infect Dis. 2005 Dec;11(12):1842-7. doi: 10.3201/eid1112.050997. PMID: 16485468; PMCID: PMC3367654.

including zoonotic influenza and antibiotic-resistant bacteria, such as methicillin-resistant *Staphylococcus aureus* (MRSA).[34]

31. In New Zealand, the number of endemic zoonotic diseases found is relatively few compared to other countries. Micro-organisms causing important zoonotic diseases include the bacteria Salmonella, Yersinia, Campylobacter, Leptospira, some strains of *Escherichia coli* and the protozoa, Giardia and Cryptosporidium.

32. Enterococci, faecal coliforms and *E. coli* are considered to be of faecal origin and are typically found in dairy factory wastewaters in high numbers.

33. Changes in environmental factors such as rainfall and land use may lead to changes in the incidence and characteristics of zoonotic diseases. For example, outbreaks of leptospirosis, the commonest occupationally-acquired infectious disease in New Zealand, have been reported overseas following flooding.[35] In relation to leptospirosis, in New Zealand farming systems, flood water, and water-logged paddocks and waterways, are a particular risk.[36] Due to climate change, flooding is expected to become more common in New Zealand in some areas.

[34] Gilchrist MJ, Greko C, Wallinga DB, Beran GW, Riley DG, Thorne PS. The potential role of concentrated animal feeding operations in infectious disease epidemics and antibiotic resistance. Environ Health Perspect. 2007 Feb;115(2):313-6. doi: 10.1289/ehp.8837. Epub 2006 Nov 14. PMID: 17384785; PMCID: PMC1817683.
[35] Levett PN. 2001. Leptospirosis. Clinical Microbiology Reviews 14(2):296-326.
[36] https://www.worksafe.govt.nz/topic-and-industry/agriculture/working-with-animals/prevention-and-control-of-leptospirosis/gpg/

34. The following extract (Figure 1) on the prevalence of zoonotic pathogens specifically mentions Canterbury[37] - the principles are relevant to Otago.

Health effects of land use change and agricultural intensification

Zoonotic disease emergence and transmission

Importance for health

Emerging zoonoses have the potential for catastrophic human health impacts due to a lack of immunity to novel infections. Recent examples of emerging zoonotic diseases are avian influenza, including the 1918 pandemic (Taubenberger & Morens, 2006), bovine spongiform encephalitis (BSE), and Nipah virus. Lingering zoonoses, while unlikely to be catastrophic, also have a substantial health burden. Lingering zoonoses having a substantial impact in some parts of the world today include brucellosis, dog rabies and various parasitic diseases (World Health Organization, 2014b). The United States Centers for Disease Control estimate that approximately 75% of emerging human pathogens, and 60% of all human pathogens, are zoonotic (Centers for Disease Control, 2014).

Effect of land use change

Land use change and intensification can increase the risk of emergence and transmission of zoonoses by bringing people into closer contact with livestock, bringing livestock into contact with new environmental conditions, and increasing the potential for disease transmission amongst herds (World Health Organization, 2005b). The effects on zoonotic disease emergence of any one form of land use change in any one area are unpredictable.

Within Canterbury, the most common zoonotic diseases are enteric infections such as campylobacteriosis, cryptosporidiosis, and *E. coli* 0157. The burden of disease from these illnesses is high; Campylobacteriosis is the most frequently notified disease in New Zealand and is responsible for between 18,000 and 36,000 illnesses nationwide annually (Ball, 2006). Although these diseases are frequently of animal origin, they are usually transmitted through drinking water so they are discussed more fully in the "Reduced water quality – Pathogens" section of this document. Nevertheless, it is important to acknowledge that even within Canterbury, rates of zoonotic enteric disease such as campylobacter are higher in areas with more intensive animal farming (Close, Dann, & Ball, 2008; Kaboré et al., 2010).

Figure 1 – Health effects of land use change and agriculture intensification

CONCLUSION

35. In summary, I conclude that:

(a) Intensification in farming systems is harmful on multiple fronts, with some currently accepted practices failing to protect the health and welfare of our animals, people and our environment

(b) Deintensification, and/or preventing further intensification will

[37] Public Health Implications of Land Use Change and Agricultural Intensification With Respect To The Canterbury Plains: A Literature Review: Prepared By Dr. Jackson Green & Dr. Cheryl Brunton: Community And Public Health CDHB July 2014.

reduce some of the risk on environmental damage and contamination, zoonosis and the development of antimicrobial resistance.

(c) In other instances, where land use exceeds capability, alternate land use is needed.

Dated this 28th day of June, 2023

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Dr. B. Helen Beattie