



# SICK OF TOO MANY COWS

How intensive livestock farming  
could be endangering our health

**GREENPEACE**



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**A change in perception to view the environment as an essential element of health protection, while adequately preserving it, would greatly benefit people's health.**

The World Health Organization (2016)

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Published in June 2017 by:  
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This report has been produced by Greenpeace New Zealand. It examines the potential connections between livestock farming, water pollution and public health. Greenpeace is an independent global campaigning organisation that acts to change attitudes and behaviour, to protect and conserve the environment and to promote peace.

# MAIN POINTS



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- 💧 **Agriculture has intensified in NZ over the last few decades.**
- 💧 **Intensive livestock farming could increase risk to human health.**
- 💧 **Contaminated water increases the risk of acute (sudden) illnesses from pathogens and chronic (long-term) illnesses from drinking water nitrate.**
- 💧 **High livestock (in particular dairy cattle) density has been associated with increases in reported disease.**
- 💧 **Good work by farmers to clean up pollution will be undermined by Government-supported plans for dairy expansion.**
- 💧 **The Government has earmarked \$480 million of public money to build irrigation schemes, which will lead to the expansion of intensive dairying.**
- 💧 **A precautionary approach would see health warnings heeded rather than millions of taxpayer dollars spent on irrigation schemes.**
- 💧 **A recommended way forward is the new ecological model of farming.**



# FOREWORD

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Water is a major public health issue. The 2016 Hawke's Bay campylobacter outbreak, which affected an estimated 5,500 people and was linked to at least four deaths, was a shocking reminder of how vulnerable our water is, and why nation-wide action is vital.

Not only are safe water supplies and good water management fundamental to public health, as shown in an increasing number of disease outbreaks, but water is important for recreation and for our mental and spiritual wellbeing. In te ao Māori, waiora (pure water, as from springs) and wai māori (running water for human use, such as from rivers) are taonga which nourish people and provide good health, and in turn must be nurtured and cherished.

As the PM's Chief Science Advisor Sir Peter Gluckman pointed out recently:

**“Humans are part of the whole freshwater ecosystem, and our actions affect the system that we depend on for our drinking water, for sanitation and for growing our food.**

Sir Peter went on to say that the people of Aotearoa New Zealand can no longer keep our heads in the sand and continue doing what's been done for decades. We agree. It's no longer enough just to monitor the state of our water – the public health, environmental, tourism and industry sectors must start working together to stop the pollution in the first place.

We value the work that Greenpeace has done to bring together the evidence on intensive farming and health. We hope that national and local decision-makers take it seriously and use it to restore the health of the nation's waterways.

**Warren Lindberg**  
Chief Executive, Public Health Association

I will never forget that public meeting in Springston Community Hall on March 13th 2008. The community were well aware of dairy intensification around the town – many of them worked in the industry. The Council knew that the water supply had been contaminated and a boil water notice had been issued. An astute public health officer had recognised that three cases of campylobacteriosis was way above average for such a small community, but probably only represented the tip of the iceberg. Nothing could have prepared us for the shocking scale of the infection. Nearly half of the five hundred residents had suffered from vomiting, from diarrhoea or from stomach cramps in recent weeks and their stories were heart rending: The mother who had held a birthday party for a group of toddlers – when they all got sick she had assumed it was her food preparation and had telephoned the families to apologize; the wife of the long distance truck driver who noticed that her husband always left home sick, but returned well; the cancer patient whose water borne gastroenteritis had brought them close to death and confined them to a hospital bed for weeks. These are the personal realities for rural communities in New Zealand, where one of the important principles of drinking water protection – protecting the source – is put at risk by intensified dairy farming.

Cow urine is contaminating our groundwater in Canterbury, just as it is in many parts of New Zealand, where levels of nitrate are continuing to climb as a direct result of dairy conversions and dairy intensification. Family doctors and midwives in Canterbury are now required to arrange water testing as part of pregnancy booking tests for women on private drinking water supplies – formula feed for babies made with nitrate contaminated water still kills a few babies every year in the US, and we want to avoid that in New Zealand.

Seventy per cent of New Zealand rivers are now un-swimmable, contaminated with cow faeces or choked with algal blooms, and all that public health organisations can do is put up signs warning people against swimming where their parents and grandparents used to swim.

How much better it would be if we could protect our source water. Instead, the growth of intensified dairying is relentless, driven by government subsidised irrigation schemes – predominantly to sell milk powder to China.

This report sets out clearly how livestock intensification directly affects our health. It complements other reports from our Parliamentary Commissioner for the Environment, from the OECD and many other reputable independent sources which have pointed out that livestock intensification is destroying the New Zealand we love. Our well-being is inextricably linked with our environment – it is time we looked after both.

**Dr. Alistair Humphrey**  
Public Health Physician and GP

# EXECUTIVE SUMMARY

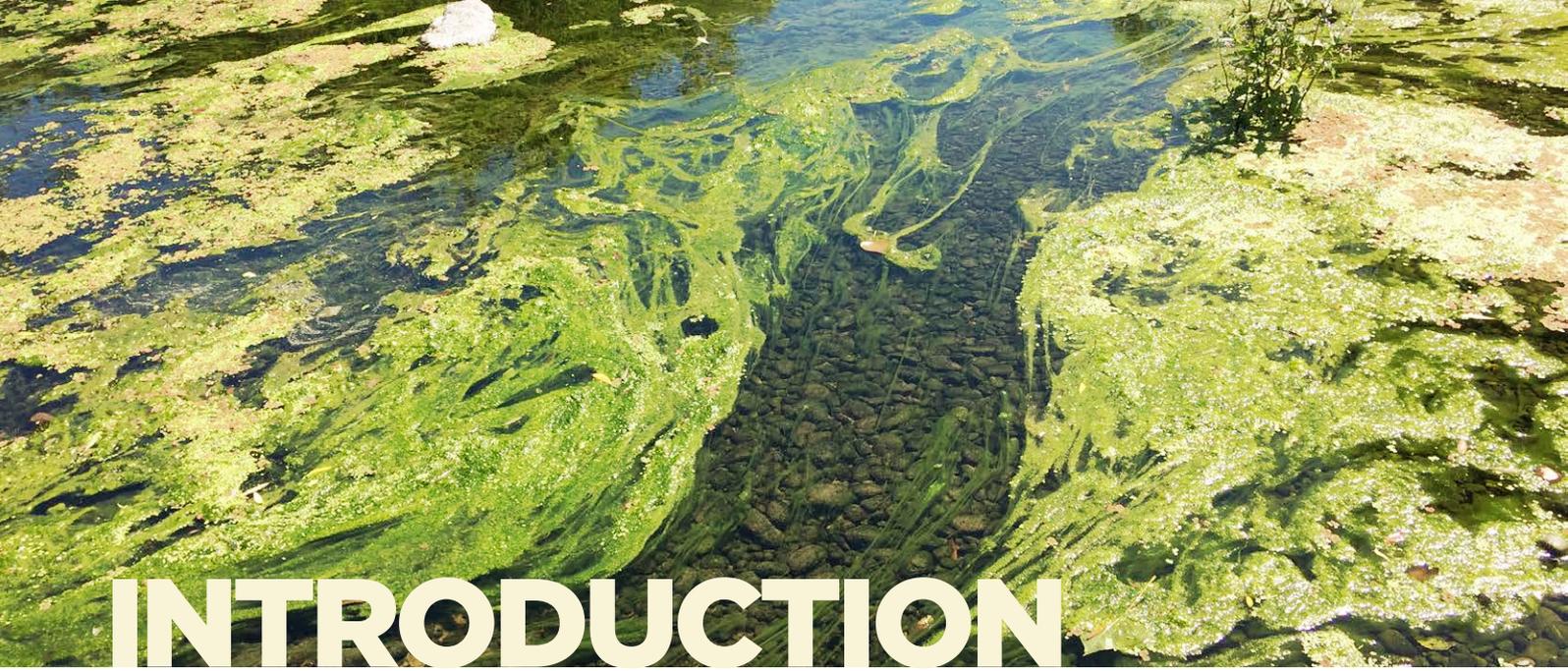
👉 **New research has heightened concerns that intensive livestock farming could increase risks to human health. In order to maintain a healthy population, we need to understand how livestock farming could affect our health. These risks must be carefully weighed, especially at a time when the Government is preparing to spend millions of taxpayer dollars to expand the dairy industry through irrigation.**

👉 **In the last few decades, there has been an increase in agricultural intensification in New Zealand, particularly in dairy farming. This has had significant impacts upon freshwater quality. Scientific evidence suggests that poor water quality could increase the risk of acute illnesses from pathogens. It may also increase the risk of chronic illnesses associated with drinking-water nitrate.**

👉 **Many farmers today are working hard to reduce water pollution. But their good work is set to be eclipsed by Government and industry plans to further intensify and expand dairy farming. There is a risk that the unchecked expansion of our current low value, high volume dairy model could come at the price of public health and wellbeing.**

👉 **There is an urgent need for further investigation into the potential health impacts of livestock farming, before proceeding with plans to expand and intensify dairying. Where there is evidence of potential risk to human health or the environment, Government and industry leaders have a responsibility to take a precautionary approach.**

👉 **But the New Zealand Government has done the opposite. They've set aside nearly half a billion dollars to build massive new irrigation schemes which will help expand and intensify dairy production. Instead, Greenpeace recommends that this money should be used to transition New Zealand and our farms to a new model which is good for farmers and good for the environment: ecological agriculture.**



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# INTRODUCTION

Environmental protection is increasingly intertwined with protecting public health. As the quality of our environment deteriorates, scientists are observing more negative impacts on human health.

The world's population is growing and more people are eating more meat and dairy products. While there is strong evidence that a diet low in meat and dairy is better for health, and that livestock farming is one of the least efficient ways to utilise land for providing human nutrition on a global scale<sup>[38]</sup>, this report is not focused on the negative social and health impacts of animal consumption, but on the human health risks of livestock production.

**“The World Health Organization says that agriculture, including the expansion of livestock farming, is an important driver behind the emergence (and re-emergence) of infectious diseases<sup>[1]</sup>.**

This is a global trend but, also here in New Zealand, there is “growing concern about the public health impacts of high-density livestock production”<sup>[2]</sup>.

The recent outbreaks of gastroenteritis in Canterbury and the Hawke's Bay have many people worried about contaminated water. Several public health researchers are now investigating whether intensive livestock farming could increase the risk of infections<sup>[3, 4, 5]</sup>.

Together with many community and environment organisations, Greenpeace has been at the forefront of efforts to protect New Zealand's rivers, lakes and streams from water pollution, which has been exacerbated by the intensification and expansion of dairy farming. Through this work, we have become increasingly concerned about the potential health risks that could be emerging from unsustainable farming practices.

This report looks at the science which associates livestock farming with water contamination and with public health. It starts with an overview of livestock expansion and its impacts on freshwater quality. Then it explores the possible impacts of livestock-associated water contamination on illnesses caused by pathogens. It goes on to look at the known health risks of drinking water containing unhealthy levels of nitrate. It concludes with recommendations for policymakers.

# INDUSTRIAL AGRICULTURE & WATER CONTAMINATION

Global food production has changed dramatically since the 1950s. Farming has been industrialised, meaning more mechanisation and more irrigation, a higher density of crops and animals on the land and more land put into production. There has also been an enormous increase in pesticide and fertiliser use<sup>[41]</sup>.

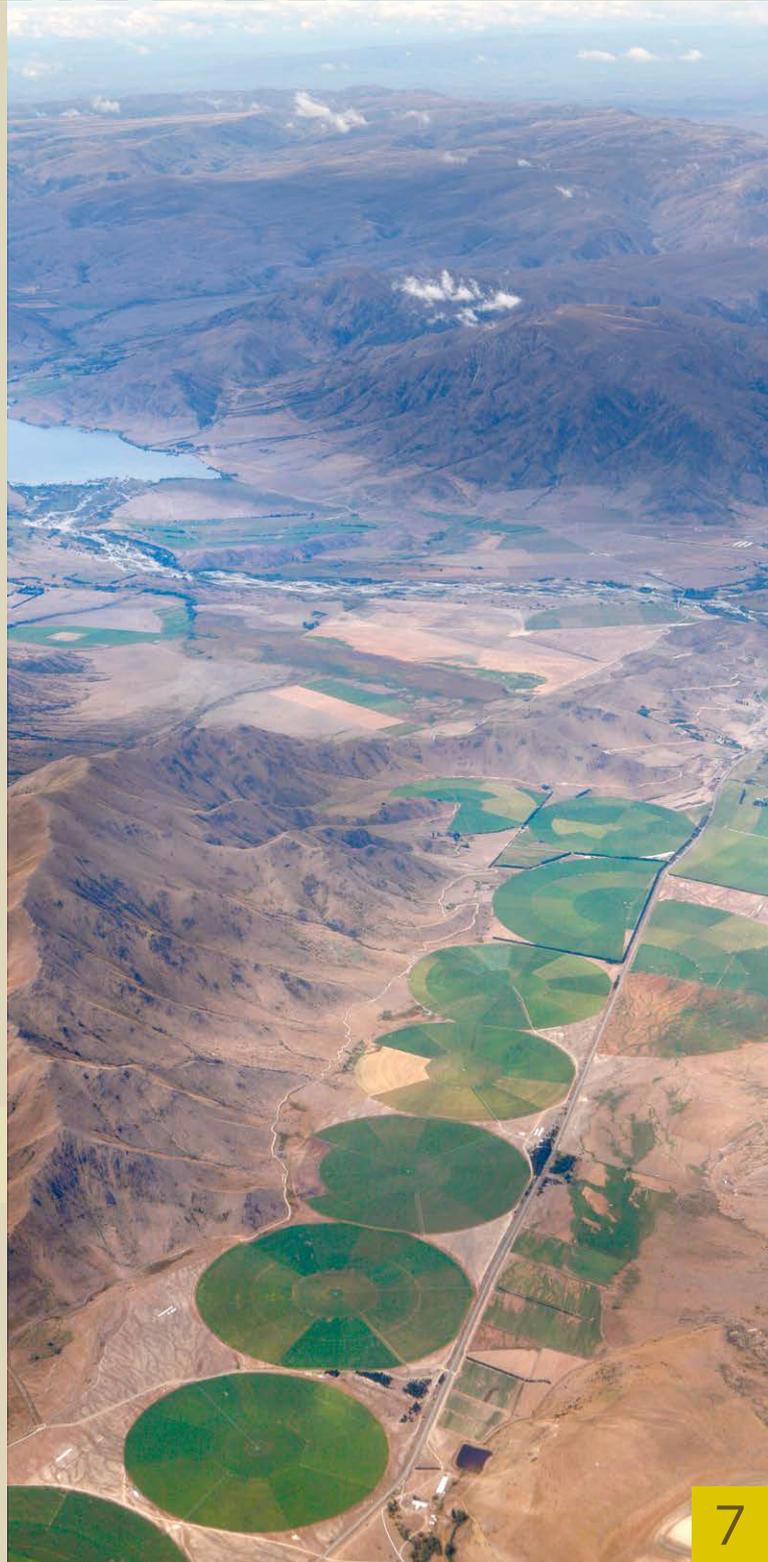
The Ministry for the Environment says New Zealand has recently experienced one of the world's highest rates of agricultural intensification<sup>[6]</sup>. Much of this has been in livestock farming. In New Zealand, there are now over 40 million head of livestock, including sheep, cattle and deer. The number of dairy cows continues to increase, while other livestock numbers are falling<sup>[7]</sup>. Between 1990 and 2014, the national dairy herd grew by nearly 95 per cent<sup>[8]</sup>.

The industrialisation of agriculture has taken a real toll on the environment, including on our rivers, lakes and streams. As a sector, livestock farming is considered by some scientists to be the largest source of water pollution globally<sup>[9]</sup>.

NIWA says that, here in New Zealand,

**“There is no doubt that our declining river water quality over the last 20 years is associated with intensification of pastoral farming and the conversion of drystock farmland to dairy farming, particularly in Waikato, Southland, and Canterbury” [35].**

The pollutants of most concern in New Zealand are nutrients (nitrogen and phosphorous), pathogens (bacteria, viruses and protozoa) and sediment<sup>[10]</sup>.



# HOW DO CONTAMINANTS MAKE THEIR WAY INTO THE WATER?

## DIRECT CONTAMINATION

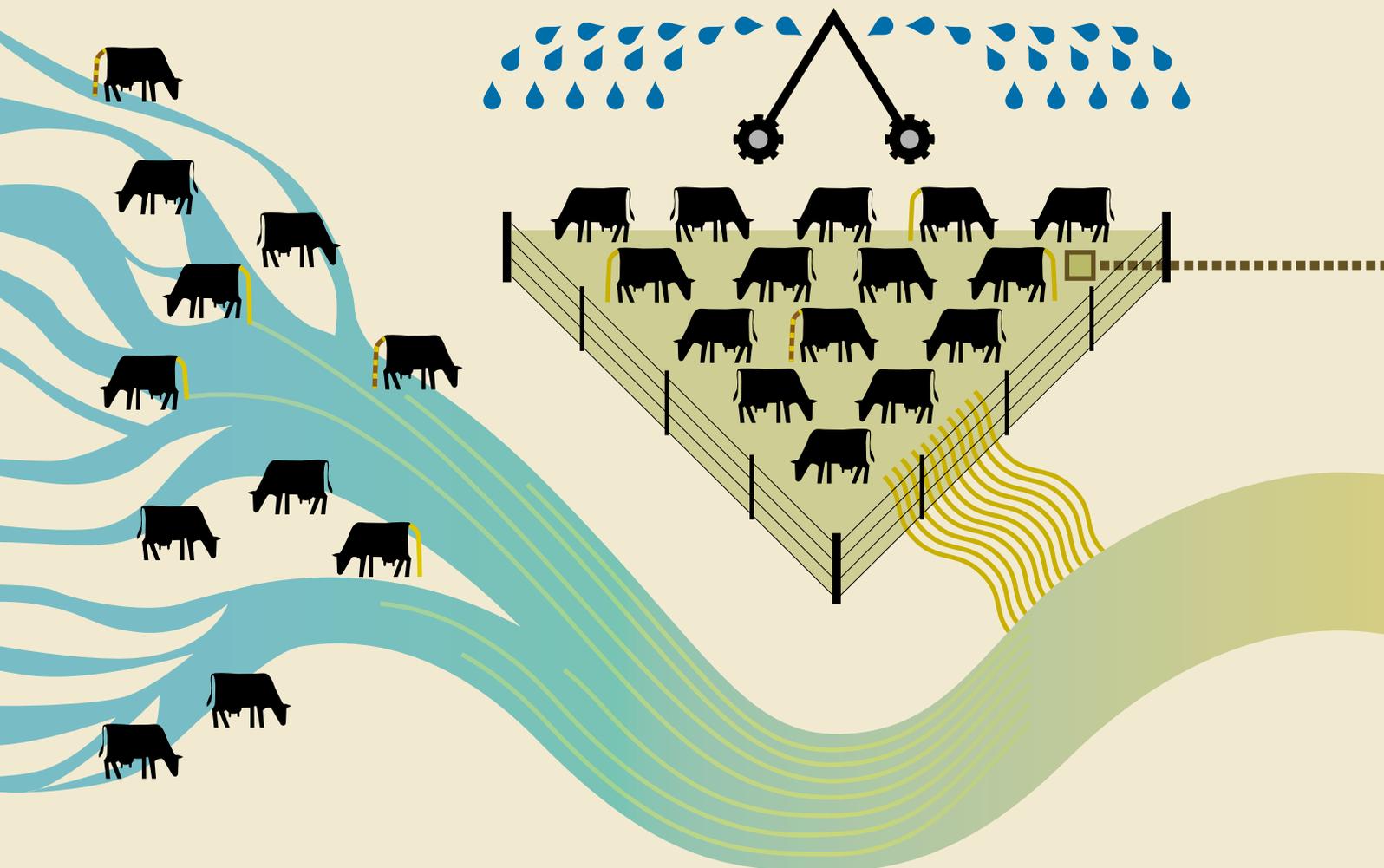
Where rivers, streams and lakes have not been fenced off, livestock are known to defecate and urinate directly into waterways.

## SURFACE RUNOFF

Especially after heavy rains or through irrigation, water can overflow from pastures into streams and rivers, carrying contaminated livestock waste with it.

## LEACHING THROUGH TO THE GROUNDWATER

Contaminants like nutrients, pesticides and pathogenic organisms can move in water through the layers of the soil into groundwater. This is more likely in rockier, coarser soils, like those found on the Canterbury Plains. This is a growing cause for concern.



Grazing livestock are now considered to be the main source of faecal contamination to freshwater in New Zealand<sup>[11]</sup>. And, unlike human sewage, livestock sewage is not usually treated first. Researchers estimate that one dairy cow excretes the same amount of faecal bacteria as about 14 people. Added together for all the dairy cattle in New Zealand, that's equivalent to the bacteria produced in the waste of 90 million people<sup>[12]</sup>.

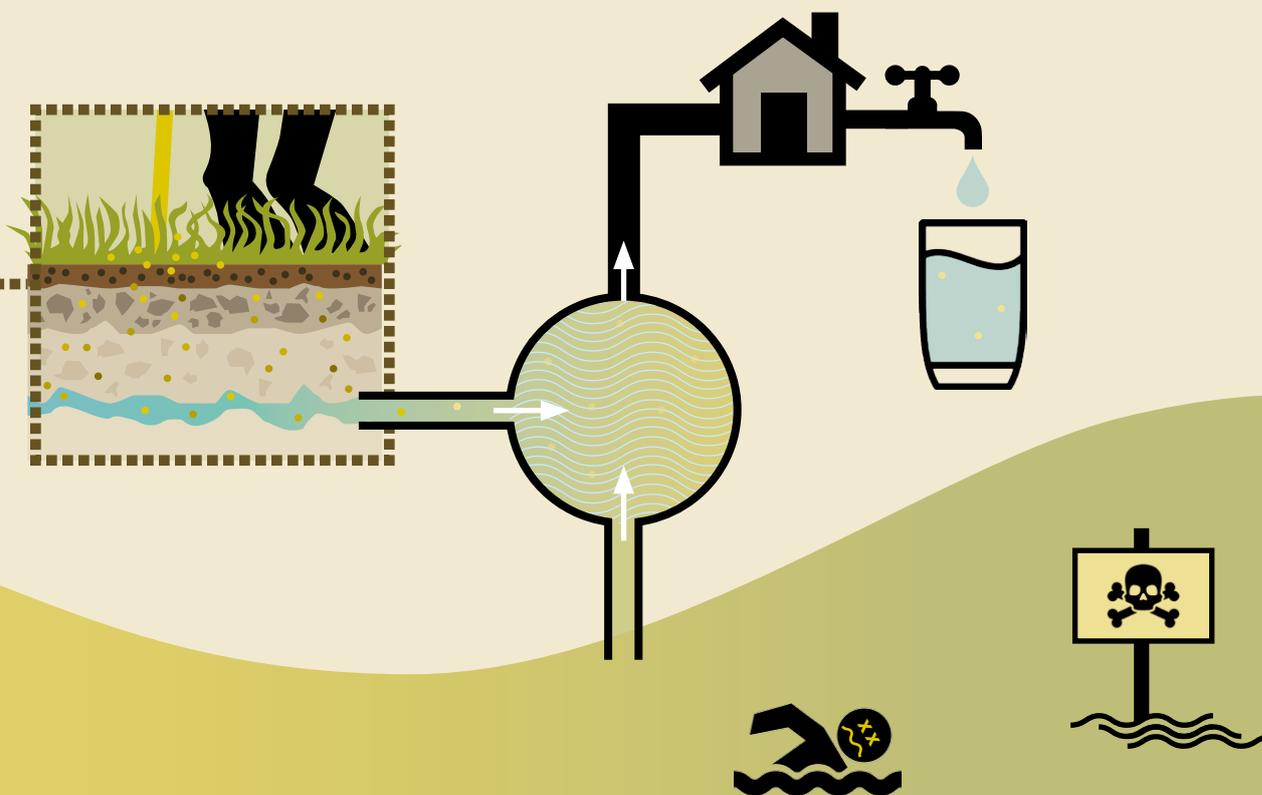
But what's equally alarming is the serious increase in nutrient pollution caused by livestock farming, including phosphorous and nitrogen (especially in its dissolved form, nitrate). For example, between 1990 and 2012, nitrogen entering soils increased about 29% in New Zealand. This is considered to be mainly due to the growth in dairy cattle numbers and their production of urine which contains nitrogen, as well as a major increase in the use of nitrogen fertiliser<sup>[7]</sup>. Nitrogen pollution is getting progressively worse in more than half of the rivers monitored in New Zealand<sup>[6]</sup>.

**“Seventy percent of the combined length of New Zealand rivers now fail to meet the acceptable swimming standard\* [13].**

Our already-stressed waterways will almost certainly become even more polluted if Government-backed irrigation schemes are allowed to go ahead.

# HOW IRRIGATION DRIVES WATER POLLUTION

- ❖ Irrigation makes it possible for more land areas to be used for intensive agriculture - areas that would normally be too dry to support livestock, especially dairy cattle
- ❖ It leads to the replacement of natural vegetation, including forests, with pastures that allow for greater run off
- ❖ It saturates the soil, encouraging runoff and leaching of contaminants into waterways
- ❖ Through water extraction, it reduces groundwater levels and river flow, changing natural processes that would normally help dilute contaminants.<sup>[5]</sup>



\* This is according to the 2014 National Policy Statement, which is still the relevant standard at the time of going to print. Note that the Government is currently in the process of changing the pollution limit. The Government's revised standard will allow for more *E. coli* in waterways that meet the 'swimmable' standard.

# FARM ANIMALS & PATHOGENS



Diseases that are passed on from animals to humans are known in the medical world as zoonoses. Some of the most common diseases transmitted from animals to humans are caused by pathogenic gut bacteria, viruses and protozoa. With increasing contamination of surface waters (and to a lesser extent groundwater) with these pathogens, public health experts are increasingly focussing on the potential human health impacts of the expansion of livestock farming<sup>[15]</sup>.

There are many such pathogens that can be transmitted from livestock to humans. These include *Escherichia coli*, *Campylobacter spp.*, *Salmonella spp.*, *Giardia spp.* and *Cryptosporidium spp.* Symptoms vary depending on the type of infection. But vomiting, diarrhoea, cramps, fever and abdominal pain are common symptoms of the kinds of gastrointestinal illnesses caused by these zoonotic pathogens.

In New Zealand, infections from zoonoses “are among the highest reported for any developed country ... and are a major public health concern”<sup>[16]</sup>.

**“Reported cases of cryptosporidiosis are higher in New Zealand than in Australia, the UK, Germany and the USA<sup>[17]</sup>.”**

The same is true for Shiga toxin-producing *E. coli* (a group of *E. coli* bacteria that cause infection in humans, also known as verocytotoxigenic *E. coli*)<sup>[18]</sup> and giardiasis<sup>[9]</sup>.

Although there are several possible sources of exposure, farm animals are important carriers of these pathogens<sup>[2]</sup>. New Zealand dairy cattle and other livestock are known to carry strains of pathogens that cause infection in humans<sup>[3, 18]</sup>. For rural New Zealanders, ruminants (like cows, sheep and deer) are now the leading cause of *Campylobacter* infections. This is especially true for rural pre-school children<sup>[16]</sup>.



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## WHY ARE WE GETTING SICK?

Pathogens can spread from livestock to humans in many ways. For example through direct contact with animals. Eating contaminated milk and meat can also cause illness <sup>[18]</sup>. Pathogens can even be breathed in through water droplets from livestock sewage that is sprayed as fertiliser on fields. Eating fruit or vegetables that have been irrigated with contaminated water is another possible cause of infection <sup>[19]</sup>. People can even get sick from eating shellfish that have absorbed pathogens from runoff. This happened recently in the Waioatahe Estuary in the Bay of Plenty <sup>[20]</sup>.

Swimming in or drinking contaminated water is a growing cause for concern in New Zealand.

“Contaminated drinking water caused the *E. coli* outbreak in Dunsandel in 2009 and *Campylobacter* outbreaks in Springston (2008), Darfield (2012) and Havelock North (2016).

In the recent case of Havelock North, a government inquiry found that heavy rains very likely caused surface water to become contaminated with sheep faeces, which eventually made its way into the municipal drinking supply via a bore pump <sup>[36]</sup>.

“Scientists estimate that contaminated water causes between 18,000 and 34,000 cases of gastrointestinal illness in New Zealand each year <sup>[21]</sup>.

But, these confirmed numbers are almost certainly underestimates as many cases are undiagnosed and unreported.

Different organisms get into the human food chain in different ways. Traditionally, salmonellosis and campylobacteriosis have been linked to contaminated meat, especially chicken. But better food safety in the poultry industry has significantly reduced campylobacteriosis risk <sup>[37]</sup>. A recent review of the research found that water contaminated by livestock waste may also be an important cause of campylobacteriosis in rural areas. Climate change and livestock intensification mean that contaminated water has the potential to become a more important cause of infection <sup>[4]</sup>.

Giardiasis and cryptosporidiosis are positively associated with rainfall, which “has important implications for water borne transmission of these diseases” <sup>[4]</sup>. The cause of infection is also likely to be seasonal, with animal-to-human transmission being a key pathway during the spring when new calves are born <sup>[4]</sup>.



## THE IMPACT OF DAIRY

As dairy farming has intensified and expanded, public health researchers are becoming increasingly concerned about the potential impacts on health<sup>[2, 3, 5]</sup>. Scientists are now investigating the effects of livestock farming on human health more closely. Some of the results that they have reported are outlined below.

“A study from the Waikakahi catchment in Canterbury found a significant increase in the incidence of campylobacteriosis, cryptosporidiosis and salmonellosis among people living near irrigated dairy farms<sup>[22]</sup>.”



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Researchers have also found that higher cattle stocking densities appear to be associated with increases in reported cryptosporidiosis in children under the age of five. They conclude that this relationship is likely to be a causal one<sup>[2]</sup>.

Of all the livestock considered in a study of *Cryptosporidium*, only dairy cattle density was associated with an increased risk of cryptosporidiosis in New Zealand<sup>[4]</sup>. The researcher also looked at sheep, poultry, pigs and deer. Another study did find a positive association between sheep density and cryptosporidiosis<sup>[18]</sup>.

Researchers have also started to find possible associations between dairy farming and high levels of giardiasis infections in the New Zealand population. The reasons for their concern include “the high prevalence of *Giardia* in dairy calves, the detection of *Giardia* in aquatic environments across the country, the intensive use of surface water for recreational purposes and municipal drinking water supplies, the high human rates of giardiasis compared to other nations and the isolation of identical *Giardia* genotypes from humans and calves located in the same geographic region”<sup>[39]</sup>.

Another study found that high dairy cattle density was associated with an increased risk of campylobacteriosis in two of the three regions which were investigated<sup>[23]</sup>.

Other research has found that cases of illness caused by *E. coli* were significantly higher in dairy farming areas where livestock density is correspondingly high. By comparison, cases of illness did not appear to be affected by sheep stocking density and did not vary significantly with beef cattle density<sup>[18]</sup>.

Increased dairy cattle density has also been associated with a rise in cases of Shiga toxin-producing *E. coli*, a very serious pathogen which has caused fatalities around the world. According to Dr. Michael Baker, professor of public health at Otago University, “We have by far the highest documented rate in the world of this infection.” There are now around 400 cases a year, compared to virtually none 20 years ago<sup>[40]</sup>.

In conclusion, therefore, an increasing body of research points at associations between intensive livestock farming - especially for dairy cattle - and human health risks. Further research is urgently needed to better quantify the risks.

# THE NITRATE TIME-BOMB



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New Zealanders have become increasingly aware of the impact of nutrient pollution in waterways in recent years. The industrialisation of agriculture has caused enormous amounts of phosphorous and nitrogen, in particular, to be released into rivers, lakes and streams.

**“Between 1998 and 2009, nitrogen pollution worsened more in New Zealand than in any other OECD country<sup>[10]</sup>.**

Conversions of forestry and sheep/beef farms to dairying are increasing both nitrogen and phosphorous pollution<sup>[31]</sup>.

As the Parliamentary Commissioner for the Environment explains, “These two elements are essential for plant growth, and so are valuable fertilisers on land. But in water, they can also cause the growth of choking invasive weeds, riverbed slime and (sometimes toxic) algal blooms”<sup>[31]</sup>. The environmental impacts can be severe. For example, the Ministry for the Environment says, “This growth can reduce oxygen levels in the water, impede river flows, and smother the riverbed and plant life, which fish and other aquatic animals depend on for food and habitat.” Nearly half of monitored river sites in New Zealand are now polluted enough to trigger algal blooms<sup>[8]</sup>.

There are notable health impacts for people coming into contact with polluted waterways. Swimming in rivers and lakes which contain cyanotoxic algal blooms can lead to “asthma, eye irritations, rashes, blistering around the mouth and nose and gastrointestinal disorders including abdominal pain, cramps and diarrhoea”<sup>[5]</sup>.

# NITRATE IS INCREASING IN OUR DRINKING WATER

While the health risks of coming into contact with algal blooms are relatively well-understood by New Zealanders, the risks of illnesses from drinking water with high concentrations of nitrate are less well-known and could be a serious cause for concern.

High drinking-water nitrate is associated with methemoglobinaemia in humans and in animals. In humans 'blue baby syndrome' is mostly reported in children under the age of six months. When young babies drink water with high levels of nitrate, the bacteria present in their gut convert it to nitrite. This is absorbed into the blood where it converts the red oxygen carrying pigment haemoglobin to an inactive form. This impairs the transport of oxygen around the body. "Symptoms include blueness around the mouth, hands and feet ... and in severe cases can affect breathing and be life-threatening" [24]. In Canterbury, midwives and family doctors are now required to encourage pregnant women to test their water if it comes from a shallow private bore. Those who find their water is contaminated, or at risk of nitrate contamination, are strongly advised to make up infant feeding formula using bottled water.

Other studies have linked nitrate to cancers [26], including colon cancer [27] and thyroid cancer [5]. The mechanism is thought to be the transformation of nitrate into nitrite, which in turn is transformed into carcinogenic nitrosamines when it interacts with processes in the gut.

A Canterbury District Health Board report says:

**“There is good evidence for an association between water supply nitrate concentration and the incidence of some cancers” [5].**

Importantly, research in this area is limited and conflicting [25]. Some researchers question the role of nitrate in causing the above diseases [26]. It is likely that there are complex interactions which make some people more at risk. For example, studies have found that people who eat above average amounts of meat are more at risk from colon cancer linked to drinking water nitrate [29]. The same is true for people with inflammatory bowel disease (e.g. Crohn's disease and ulcerative colitis) [26].



## ONLY THE TIP OF THE ICEBERG

Many shallow bores in rural areas already exceed regulatory limits for drinking-water nitrate. But nitrate can take several decades to leach through to the deeper groundwater. Scientists believe that the nitrate found in the groundwater around Christchurch today is from the use of nitrogen fertilisers 30-60 years ago<sup>[30]</sup>. This will be exacerbated by the recent dairy boom, which has caused a significant increase in the amount of nitrate entering our waterways.

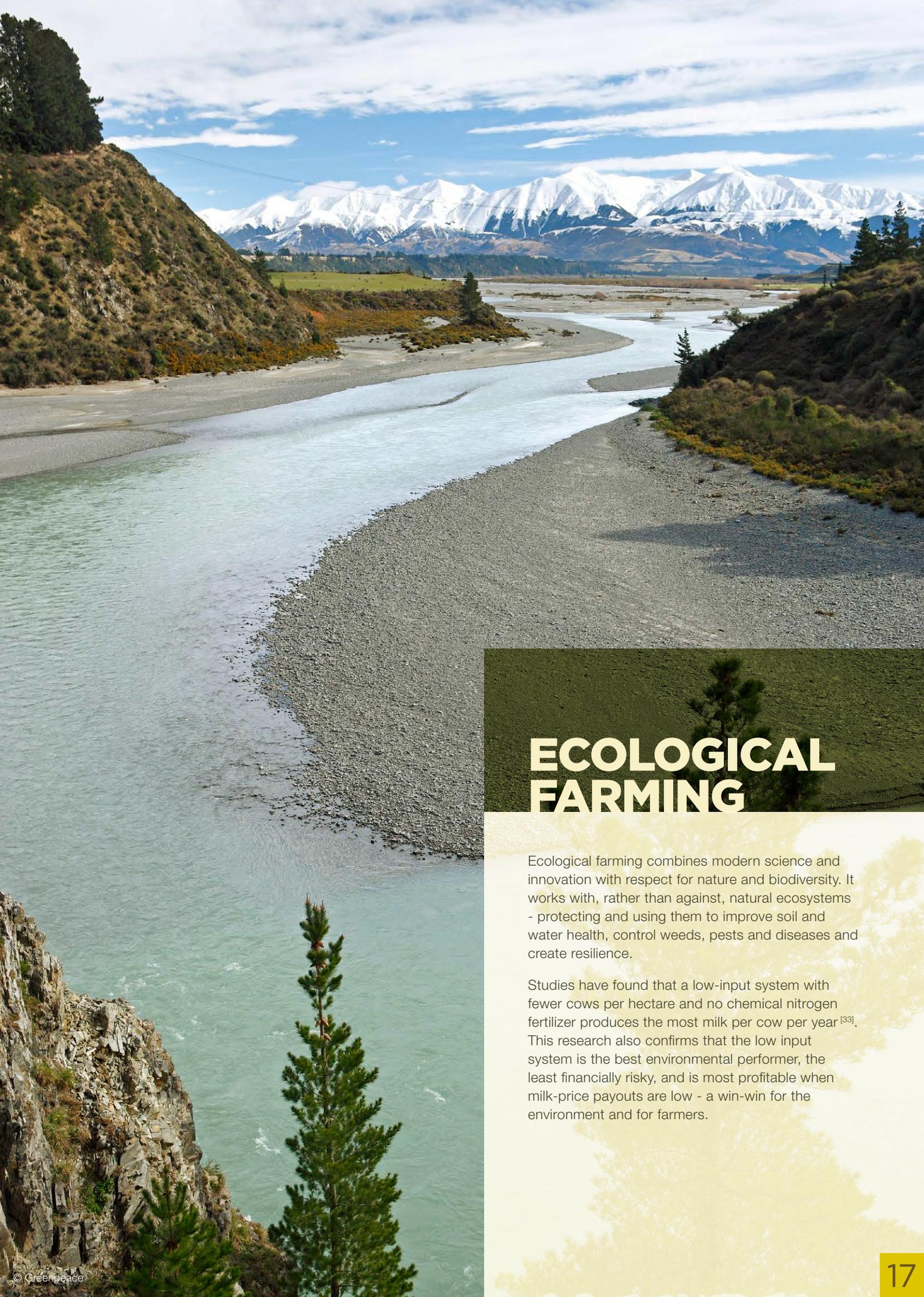
Concerningly therefore, there will be another 30-60 years' worth of nitrate that is still making its way into the groundwater system. Professor Jenny Webster-Brown, Director of Waterways at Lincoln University, said "[it] will be very difficult for more intensive irrigation and dairying to occur on the plains without the legacy of nitrate in groundwater increasing for future Cantabrians"<sup>[30]</sup>.

Unfortunately, nitrate is difficult and expensive to remove from drinking water. Filtering, boiling and chlorinating don't remove the problem<sup>[24]</sup>.

**“So there is a real need to better evaluate the impacts of drinking-water nitrate before Government-backed dairy intensification increases already-raised nitrate concentrations even more.**



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# ECOLOGICAL FARMING

Ecological farming combines modern science and innovation with respect for nature and biodiversity. It works with, rather than against, natural ecosystems - protecting and using them to improve soil and water health, control weeds, pests and diseases and create resilience.

Studies have found that a low-input system with fewer cows per hectare and no chemical nitrogen fertilizer produces the most milk per cow per year<sup>[33]</sup>. This research also confirms that the low input system is the best environmental performer, the least financially risky, and is most profitable when milk-price payouts are low - a win-win for the environment and for farmers.

# CONCLUSION & RECOMMENDATIONS

There is enough evidence for New Zealanders to be concerned about the potential risks that more intensive livestock farming could have for public health. This is why Greenpeace believes it is unacceptable for the Government to invest millions of taxpayer dollars in irrigation schemes that will increase dairy cow numbers.

The environmental and public health impact deserves much greater and more robust scrutiny, including through better collaboration between researchers, government and industry. This investigation is urgent and needs to be transparent.

Many farmers are already taking positive steps to reduce water pollution and should be congratulated for doing so. But Government and dairy industry leaders are pushing ahead with plans to convert more land to dairy farming. This would overwhelm the hard work and investment of today's farmers.

It seems the Government isn't listening to its own advice. The Parliamentary Commissioner for the Environment says, "[even] with best practice mitigation, the large-scale conversion of more land to dairy farming will generally result in more degraded freshwater"<sup>[31]</sup>.

On the basis of this evidence, Greenpeace believes that the most important way to stop dangerous water contamination from getting worse is to put the brakes on the expansion of intensive dairying. That starts with ending Government funding for major irrigation schemes, like the Ruataniwha Dam.

But alarmingly, irrigation projects are still being approved, even though there is compelling evidence of increased risk to health. For example:

**“A health impact assessment for the Central Plains Water Scheme (CPWS) found that “the potential risks of the CPWS to the health of Cantabrians as a whole outweigh the probable financial benefits to a few people”<sup>[32]</sup>.**

Health professionals and scientists are increasingly concerned about the impacts of intensive livestock farming on our health. These warnings from the experts should be heeded by both the Government and dairy industry leaders. It is our strong recommendation that public funding should be used to invest in the science and business advice to help farmers move to a new model, which is good for farmers and good for the environment: ecological agriculture.

## STOP BIG IRRIGATION

This map shows irrigation schemes planned throughout the country.



## RECOMMENDATIONS

**Greenpeace is calling on the Government to:**

- Stop the expansion and intensification of dairying, starting by withdrawing all public funding for irrigation schemes.
- Implement strategies to decrease cow numbers immediately.
- Redirect irrigation subsidies to an Agriculture Transition Fund for ecological farming.

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