

Wetlands secret ingredient to future water quality

Wetlands are the kidneys of the land – filtering, absorbing and transforming contaminants before they can affect streams or lakes. Here, DairyNZ's water science team and NIWA experts share how wetlands benefit water quality.

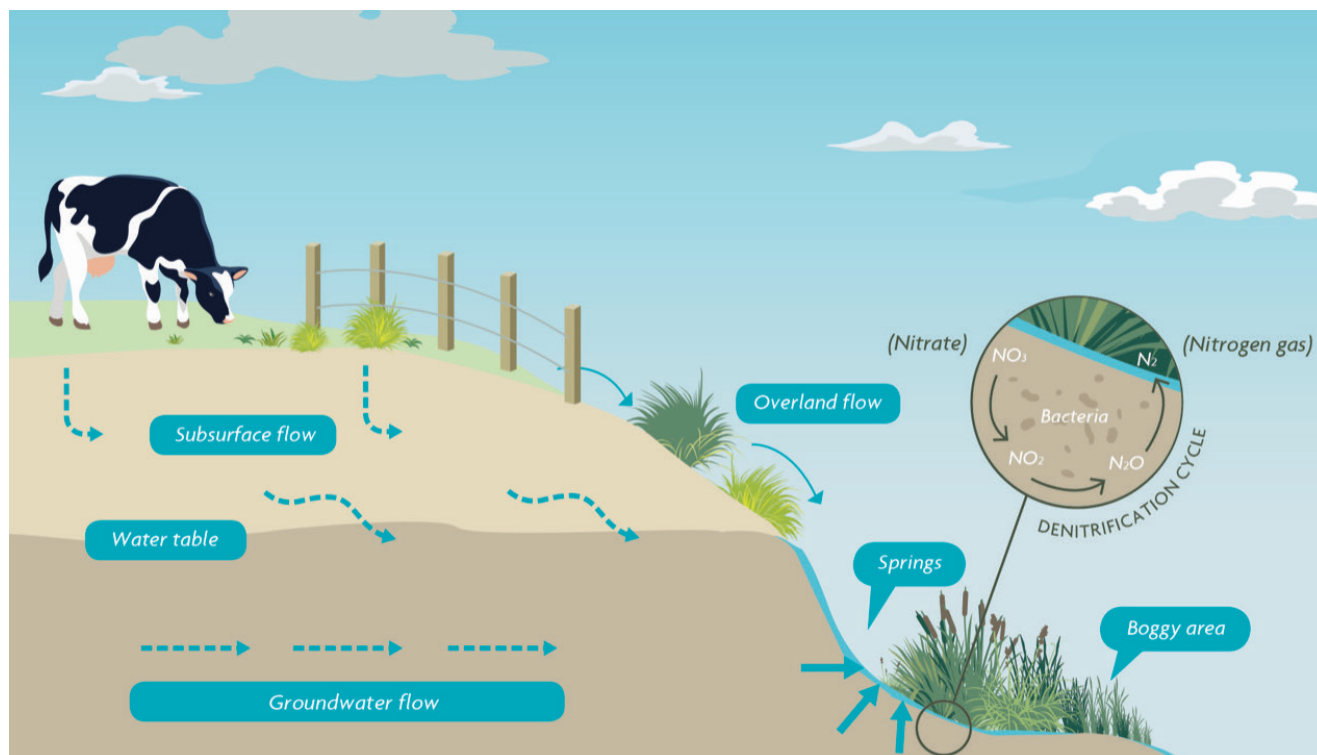
A NIWA review of research into seepage wetlands in New Zealand over the past two decades showed wetlands are remarkably effective at stripping nitrate, a problematic form of nitrogen, through a process known as denitrification.

The review offers robust evidence into 'how' seepage wetlands benefit water quality. DairyNZ commissioned the NIWA work because it firmly believes that seepage wetlands offer a unique opportunity to reduce nitrogen loss and should be prioritised for stock exclusion and protected against further drainage. The independent research commissioned certainly supports those claims.

DairyNZ is actively researching wetlands and supports the benefits of wetland ecosystems to improve water quality. Many wetlands already exist on dairy farms and DairyNZ is keen to drive their protection and the creation of more that could benefit many different land uses.

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<https://www.stuff.co.nz/business/farming/dairy/102326878/wetlands-hold-secret-ingredient-of-future-water-quality>



How a seep wetland works.

So, what do we know about wetlands?

Lesson one

Wetlands aren't just picturesque areas of open water, covered in reeds and home to game birds. Any land with soils saturated for much of the year can support wetland plants and denitrifying bacteria, whether permanently or periodically flooded. Even small boggy areas of paddock.

Saturated, organic-rich soils are a key requirement for bacteria to transform potentially harmful nitrate into harmless nitrogen gas.



DairyNZ is investing heavily in wetland science. The focus is on natural, seepage wetlands that occur at changes in slope, as subsurface water emerges and soils become saturated. Look for areas on-farm where ponding occurs, soils pug easily or that remain green throughout drier months.

Seepage wetlands occur on pastoral farms nationwide, with DairyNZ's latest data suggesting a third of dairy farmers using the Riparian Planner are managing wetlands and other critical source areas, in farm riparian plans – the potential is greater still. Lesson two sheds light on why.

Lesson two

Over 90 percent of wetlands have been drained in the past 200 years, with many North Island regions most affected. Continued drainage is an ongoing threat. Environment Southland recently estimated one in five wetlands on private land had decreased in size, leading to a 9 percent total reduction in wetland extent on private land in Southland from 2007 to 2015 (on sheep, beef, deer and dairy land alike).

The problem is, little is known about ongoing changes in other regions or nationally. To help, farmers can use the Riparian Planner to record their improvements to wetlands and riparian zones for water quality. The Riparian Planner is a free online tool developed by DairyNZ and Landcare Research to help prepare riparian plans (www.dairynz.co.nz/riparian-planner).

Draining wetlands impairs the ability to reduce losses of nitrogen from land-use in a catchment. Water quality limits are the new norm, with many farms looking to reduce their nitrogen loss. So, instead of draining those boggy areas for limited change to profitability, why not protect them for their ability to strip nitrogen?

Lesson three

Let's explain what seepage wetlands do for water quality, especially nitrogen loss. Wetlands slow and treat runoff and subsurface water. NIWA's review found that over a year, the majority of water passing through a seepage wetland is contributed by subsurface flow (on average 90 percent). And this is where bacteria denitrify, beneath the surface in saturated soil with little oxygen.

Wetlands provide many additional benefits to water quality. By capturing runoff, wetlands can lessen the intensity of flooding, reducing erosion and degradation of downstream and estuary habitats.

Little robust data exists about natural wetland effects on surface runoff, but we expect wetlands to be as effective, if not better than, riparian grass filters which science tells us can reduce nutrient, sediment and faecal losses to water by 35-87 percent over just 3m of grass. Watch this space as joint trials into constructed wetlands are assessed for performance too.

Lesson four

Seepage wetlands contain microbial communities, including denitrifying bacteria which remove about 75-98 percent of nitrate loads received.

Denitrification is a natural process that occurs in the waterlogged and anoxic (oxygen-deficient) soils found in wetlands, but also riverbanks and riverbeds where similar conditions exist. The process is the result of bacterial activity fuelled by leaf litter and other sources of organic carbon in soil. For instance, a recent University of Canterbury study demonstrated that planting riverbanks could increase denitrification rates in streams four-fold.

In NIWA's review of 14 seepage wetland studies across New Zealand where nitrogen concentrations were monitored entering and leaving the wetland, the same consistent finding emerged of remarkably high nitrate removal rates (75-98 percent).

Bigger seepage wetlands will deliver greater denitrification benefits, with an optimum wetland size at about 5 percent of their catchment area (the land drained). However, even small areas of wetland (across 1-5 percent of the catchment) can markedly reduce a farm's overall nitrogen footprint.

Now you understand why DairyNZ's water science team are so keen to reverse the loss of wetlands and actually increase their extent in New Zealand – potentially large gains in water quality.

Lesson five

Wetland research challenges still exist. Firstly, comparing how denitrification rates vary between seepage and constructed wetlands, as well as why. That's being done right now.

Lesson six

What can farmers do now? Simple. Prioritise and retire seepage wetlands in riparian plans.

The process of restoring seepage wetlands is relatively straight-forward because of where they naturally occur – in areas with organic-rich, low-oxygen and saturated soils (the perfect mix for denitrifying bacteria). Then, apply good riparian practice to what is often marginal land.

First, exclude stock. Second, plant only lower bank natives from the Riparian Planner or ask for native wetland rushes and sedges at the local nursery (the Riparian Planner regionally tailors all plant lists). Alternatively, maintain rank grass cover which wetland plants like reeds and rushes can naturally recolonise.

Trampling by stock compacts wetland soil and reduces plant cover, limiting their capacity for nitrogen removal. Planting with low-growing, lower bank natives prevents channels forming that otherwise reduce denitrification rate by carrying water away more quickly from the wetland.

So, seepage wetlands benefit water quality. Stopping their drainage and reversing historic losses is a priority nationwide to meet water quality limits.

DairyNZ is working with other science agencies and regulators to make it easier and rewarding. Farmers can already act by prioritising wetlands in farm riparian plans – try out the Riparian Planner (www.dairynz.co.nz/riparian-planner).

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Idealised fencing of a seepage wetland: Typical seepage wetland landscape. Note the change of slope and non-pasture plant species. This image highlights the critical source for protection and suggested fence location (white line).