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TREATMENTS AND SIDE EFFECTS:
SUBSTITUTING ONE LOSS FOR ANOTHER

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Abstract

Some of the strategies that have been suggested to manage nutrient losses to water, have involved shifting an activity from one place to another. An example of this is off-farm stock wintering for N management. Are these sorts of strategies solutions, or do they shift problems to another place, or transform one problem into a different one to be dealt with in the future? This paper will discuss these issues in relation to the example of use of stony soils for feedlots and intensive wintering.

Past research efforts by CRIs and communication efforts by regional councils drew attention to the need to protect vulnerable soils from pugging and associated structural damage. Pugging damage reduced productivity and led to sediment runoff to streams. These risks are high in winter when soils are more likely to be waterlogged.

Many farmers have identified areas of stony soils, or river gravel areas with little soil development as areas of value for intensive winter management of cattle. These offer alternative feeding areas to avoid pugging other more vulnerable areas of their farms. This has led to an increased use of these areas for growing winter crops and for use as feedlots. In feedlots, supplements are brought on to these areas and fed to cattle which are kept at high stocking rates (eg. 70 s.u./ha) for long periods.

In Southland alone, roughly 19, 000 to 25, 000ha of stony soils are estimated to be used for winter cropping. In Hawke's Bay some areas have been identified in the Tukituki plan as priority sub-catchments due to elevated nutrient levels. Winter feedlot operations in these sub-catchments have been identified as potential critical source areas for P and N loss, but tools to quantify these losses are not available.

Introduction:

Many of us are involved in some way in the diagnosis and treatment of ailments of the land or water. These might range from treating a nutrient deficiency in soil to dealing with an excess of nutrients in the rivers of a catchment.

A medical analogy might be useful when looking at the treatment of environmental issues. Any medical research testing the application of a new medication (treatment) also looks for side-effects.

A side effect is something predictable. We know it will happen in a portion of the population. There are also adverse reactions which are not predictable (things like an allergic reaction to a drug). Any doctor prescribing a medication will consider the side effects on the patient. For example; treatment with an antibiotic wipes out good bacteria a well as bad, and can cause diarrhoea. Codeine for the treatment of pain may cause constipation. The treatment in both these cases commonly cause other “back end” problems further down the system.

We are familiar now the with water quality side-effects of applying treatments to improve productivity of farm systems, involving nutrient enrichment of soils and increased stocking rates. We are now applying treatments to deal with these side-effects. This is what medicine calls a “cascade of intervention” where we respond to the side effect of a treatment with another treatment.

<u>3 examples of treatments</u>

Two Nitrogen examples

1. Taharua catchment is at the edge of Hawke’s Bay Region, bordering Bay of Plenty and Waikato Regions– Taharua has the highest in-stream nitrate levels of the catchments in Hawke’s Bay. One recommended way of reducing N losses on farm is to graze stock off farm, over the winter period. If we applied this to the whole catchment we could walk all the cows over the hill to BOP catchment. It would solve our problem but the side effect could be dealing with the same issue in another location. The problem may resurface at a later date in a different location.

2. <u>Taharua wetland</u> – Wetlands have been recommended as a way of removing N from a catchment. This catchment has a large area (50ha) of pristine wetland adjacent to the Taharua river. Questions are sometimes raised about the possibility of using this wetland area to treat the N issues by diverting some of the flow from the Taharua into this wetland. One possible side-effect of feeding nutrient enriched water into this wetland might be to change the plant communities that live there. In future people might ask ‘why we degraded that pristine wetland?’ There might also be adverse effects that we can’t predict.

<u>A Phosphorus example</u>
Research more than 20 years ago drew attention to the need to protect vulnerable soils from pugging damage.

A single pugging event could reduce pasture growth by more than 30% on an annual basis[1]. It also reduced infiltration and increased runoff of nutrients and sediment.

CRIs, consultants, regional councils and others communicated the need to avoid pugging and look after vulnerable soils.

Some of the <u>recommendations</u> were:

- Remove animals from pasture after 3-4 hours grazing or when finished their feed allocation.
- At high risk times, graze animals on freer draining parts of the farm.

[1] http://www.waikatoregion.govt.nz/PageFiles/19416/publications/farmmanagementissues2.pdf. Pg 2.

Following this encouragement many farmers have identified areas of stony soils or river gravel areas with little soil development as areas of value for intensive winter management of cattle. In Hawke's Bay, this has led to an increase in use of these areas for growing winter crops and as feedlots. In feedlots, supplements are brought in and fed to cattle which are kept at high stocking rates (eg 70-500 s.u/ha) for long periods. Farmers can readily list the benefits of this practice.

<u>Farmer Benefits</u>

- Protection of vulnerable Pallic soils on other parts of the farm.
- Reduced pugging
- Making use of areas that have limited productivity.
- Building up the organic matter and "improving" the soil
- Less runoff of sediment
- Little mess

In the past we had assumed vertical loss of P was negligible due to the soils ability to sorb P. Most P was expected to be lost in runoff.

In Papanui catchment we have (arguably) the highest P levels of any stream in Hawke's Bay. This caused us to take another look at likely contaminant losses from feedlots.

A recent assessment of risk factors for these practices in Hawke's Bay and Southland suggested a high risk of vertical loss of P to subsurface flow[2].

On these feedlots we have the following conditions:

- Bare soil
- Flat ground
- Well drained, highly permeable soils.
- Low anion storage capacity
- Close proximity to water

We may have substituted one loss pathway for another, but tools to assess these losses under this particular set of conditions are not available.
There is more potential for these soils to be used this way, as stony soils cover an area 20% larger than Hawke's Bay Region(1.68 million ha).

<u>Empty world vs Full world model</u>

Before 1800 the world was relatively empty of people, with 0.98 billion people in 1800. Demand for resources was so small compared to supply, that they seemed limitless. In today's full world, each person has more than double the resource throughput compared to 1800. There are also more people in the world today (6.8 billion)[3]. We are more aware of limits but we still carry some of the residual thinking of the empty world model; thinking if we mess things up in one place we can shift our activities and practices to another place.

[2] Dodd R and McDowell R. 2014. Risk Assessment Framework to Assess the Potential for P loss from Stony Soils. Report prepared for Hawke's Bay Regional Council and Environment Southland. p 39.
[3] Egan A.R. 2013. Sustainable Scale: Empty World vs. Full World
http://www.eoearth.org/view/article/156369/

Summary:

In the full world of today there are limited options to treat by shifting problems to another place. When we do, we can expect side-effects or to revisit the solutions more often than we have in the past.

Wherever possible deal with the issues in the place they occur, rather than shifting them. We are running out of other places to go.

In line with the law of diminishing returns, in earlier times we had the easy gains in agriculture in NZ. Now and in the future we will more often find ourselves working in the area of harder gains, with high effort and increased complexity. Side-effects to our treatments are to be expected.

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