

## **Nutrient mitigation options in agricultural landscapes: the New Zealand experience**

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The latest review of surface water in New Zealand based on a long-term national sampling program has demonstrated deteriorating quality in many water-bodies, as has been seen in many European countries. While pollution from point sources is reducing, diffuse pollution, due to the expansion and intensification of agriculture, particularly in the pastoral sector, is increasing. Trend analysis of this data set showed that concentrations of TN, NO<sub>3</sub>, DRP and TP are increasing, and that increases are positively and significantly correlated with the percentage of pastoral land cover in catchments. In an effort to reverse this concerning trend of reduced water quality, much attention is therefore currently being directed at the mitigation of nutrient loss from land to water, and various mitigation options have been put in place throughout New Zealand to protect water quality, selected examples of which are given below.

### *Grass filter strips*

These are bands of managed grass that provide a buffer between possible contamination sources and water bodies. Grass filter strips are placed across intermittent overland-flow water pathways and are designed to intercept surface runoff during rainfall or irrigation events and remove key pollutants e.g. phosphorus, suspended sediment. These are being tested in the Rotorua Lakes catchment.

### *Livestock exclusion*

This is highly applicable to New Zealand livestock farming and is suitable for margins of lakes, streams, water races, wetlands and estuaries. Many kilometres of streams which flow through grazed dairy pastures have been fenced in New Zealand through the Clean Streams Accord to ensure effective livestock exclusion.

### *Constructed wetlands*

CWs attempt to replicate and optimise treatment processes that occur naturally in swamps, fens and marshes. CW performance has been measured in New Zealand for three constructed systems treating nitrate rich tile drainage from intensive dairy pastures in Northland, the Waikato and Southland. More recently Environment Bay of Plenty funded the establishment of a 2.4 ha wetland at Lake Okaro, near Rotorua which will provide valuable data on the performance of larger-scale systems. N removal has been observed for the wetlands; however P removal is generally negative.

### *Floating wetlands*

These are a novel ecological water treatment technology in which emergent wetland plants grow hydroponically on floating mats or rafts. Their roots form dense growths below the floating mats, taking up nutrients from the underlying water. They are useful for nutrient removal in ponds, dams and irrigation storage reservoirs. Results from trials of floating wetlands undertaken in New Zealand suggest this technique has potential for both N and P removal.

### *Plant and algae harvesting*

Dissolved nutrients can be removed from water by uptake into aquatic plant tissues and then harvesting and removal. Removal of the biomass ensures that nutrients incorporated in plant tissue are permanently removed rather than be returned to the

water. In New Zealand watercress is currently being tested for its nutrient removal rates in the Rotorua Lakes catchment.

#### *P sorbing materials*

While constructed wetlands are generally quite efficient at N removal, P removal has been very low and even negative in New Zealand constructed wetlands. Various materials are currently being tested to enhance the P adsorption capacity of constructed wetlands. Similar techniques have been tested to reduce the P content of drainage water.

#### *Mitigation of N loss*

Nitrogen inhibitors work by preventing the accumulation of the mobile nitrate form of soil mineral N and are used in New Zealand to reduce losses of nitrogen from animal urine patches on grazed pastures.

#### *Catchment management and best management practices*

Five regionally representative dairying catchments are the subject of a long term monitoring programme. In these catchments, baseline water quality monitoring was carried out to establish water quality, the most appropriate best management practices have been put in place with the aim of improving water quality and monitoring has continued to assess changes in water quality after implementation of BMPs.

#### *Management tools*

Models are available to support farmers and assist with more efficient nutrient management on farms, the best known of which in New Zealand is OVERSEER. This model is widely used by researchers, farmers, industry and government for nutrient budgeting. Farm plans are encouraged by regional councils.

These options detailed above are a selection from a wider range of potential mitigation options which would be suitable in New Zealand, further details of which have been compiled in a study undertaken to document main mitigation options for pastoral farming.