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CONCEPTUAL FRAMEWORK TO ENABLE COORDINATED SOLUTIONS FOR CLIMATE CHANGE AND WATER QUALITY

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Introduction

Climate change has the potential to significantly shift our planets weather and climate patterns. This may lead to an increased occurrence of extreme weather conditions, which modify the normal balance of water bodies and ecosystems, leading to the degradation of water quality (UNESCO, 2020). A coordinated approach to managing the potential impacts of climate change and water quality within New Zealand may help to minimise the effects on ecosystems, biodiversity, economic and social welfare.

Currently, regional councils within their regional plans often have requirements for landowners which are aimed at reducing the overall environmental impact of their farming system. One of the main areas that councils tend to focus on in terms of water quality is nutrients losses. Nutrient reductions are becoming a common requirement of regional plans and while a catchment may have nutrient loss targets, actual reductions efforts are usually implemented at a farm level. Plans generally require a blanket N loss reduction occurring at a point in time. For example, the Horizon One Plan requires a reduction to a fixed N loss target based on on-farm land type over time. There are currently no or limited frameworks within regional plans for whole catchments options for managing N losses.

Recently the Government has announced the Zero Carbon Act 2019, which sets new domestic greenhouse gas reduction targets. The targets include a reduction of net emissions of all greenhouse gases (except biogenic methane) to zero by 2050 and a reduction of emissions of biogenic methane to 24–47 per cent below 2017 levels by 2050. There is a target of reducing biogenic methane to 10 per cent below 2017 levels by 2030. To achieve this it is likely that regional councils will eventually add a greenhouse gas component to the rules within the regional plans. If a similar method to nutrient losses is taken with greenhouse gasses, then it is likely to also be losses required at an individual property level. Providing a differentiated approach based on the mass of emission may be more beneficial as individuals on-farm have a limited toolbox of options but collectively there are wide options. The current farm level approach to managing problems may be preventing real opportunities to find solutions that help address both water quality issues but also future climate change issues.

This paper discusses a framework that provides the potential for coordinating solutions at a catchment level, to help address both further climate change and water quality issues. The suggested framework uses a coordinated approach and innovative use of spatial data GIS modelling to classify land. The framework seeks coordination between landowners to identify areas that could be changed or adapted to improve both water quality outcomes and to protect against future climate change impacts.

Method

A catchment cooperative approach could be taken as an alternative to individual loss reductions. Expanding to a catchment approach allows for a greater number of mitigation options and allows for a pooled investment between catchment landowners to achieve greater results. Catchment hot spots can be targeted, and mitigations focused on areas where greatest reductions are likely allowing more rapid improvement in the short term building confidence to tackle more complex sources and issues in the catchment.

Changes to farm practices, utilising favorable topography, the establishment of new wetlands or improvement of existing and alternative land uses are all examples of activities that could become easier to implement at a catchment level.

The proposed framework uses GIS modelling of a catchment which can incorporate layers for climate change impacts, water resource requirements, soil type and leaching potential as examples. Nutrient loss potential factors can be overlaid to identify target areas for action. Multiple layers combined using scales and weighting for individual attributes depending the important or that attribute to a proposed outcome can be used to produce an overall matrix, for targeting effort. Based on the outcomes of the GIS special modelling, landowners can work together to find solutions for the wider catchment. Some changes that could be made as a result of the framework include crop changes, retirement of land and or repurposing land for example to a cut and carry system.

Figure 1 below shows an example of mapping which rates the lands nutrient uptake potential. In this example areas with low nutrient uptake could be retired from grazed pastural production and land uses focused on the areas that have higher nutrient uptake. This would lead to nutrient loss reductions overall.

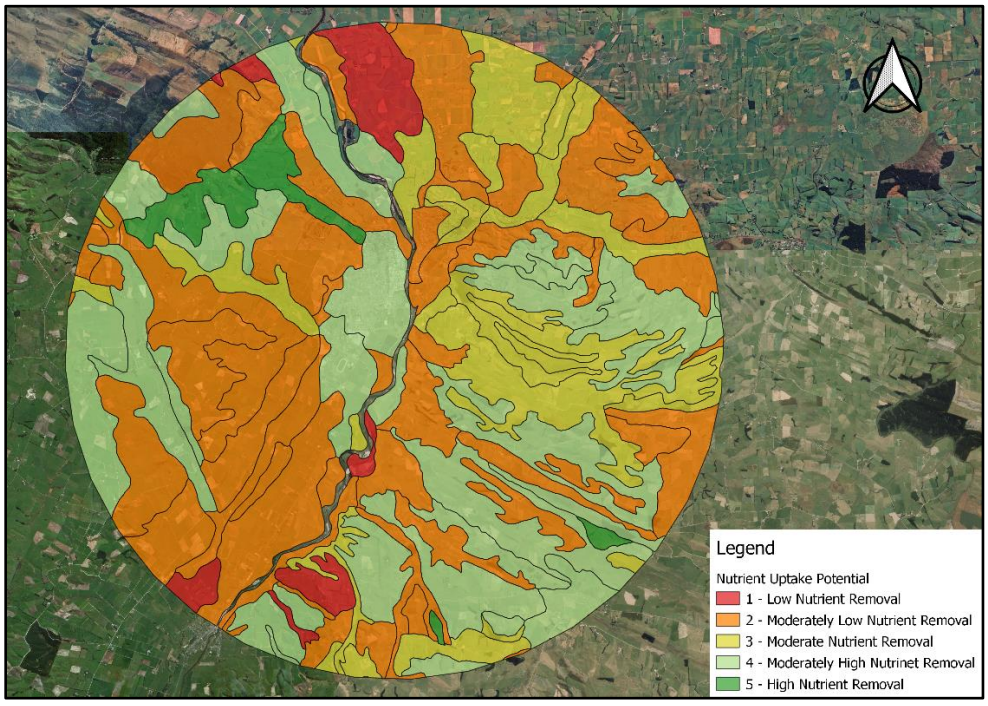

Figure 1: Example of Catchment Nutrient Uptake Potential Mapping.

Figure 2 shows an example of a catchment area that has been mapped for nutrient losses based on farm system, soil type, climate and irrigation system. The high root zone N loss highlighted in red and orange areas could be targeted for reductions. In this example, the high loss rate properties identified are limited in their options for mitigation. They do not have access to land to create wetlands to strip nutrients and their main options to reduce soil nitrate leaching are changes in farm intensity, farm garzing practices or a change to their irrigation system. With a catchment approach there could be mitigation options off-farm on a neighbouring property.

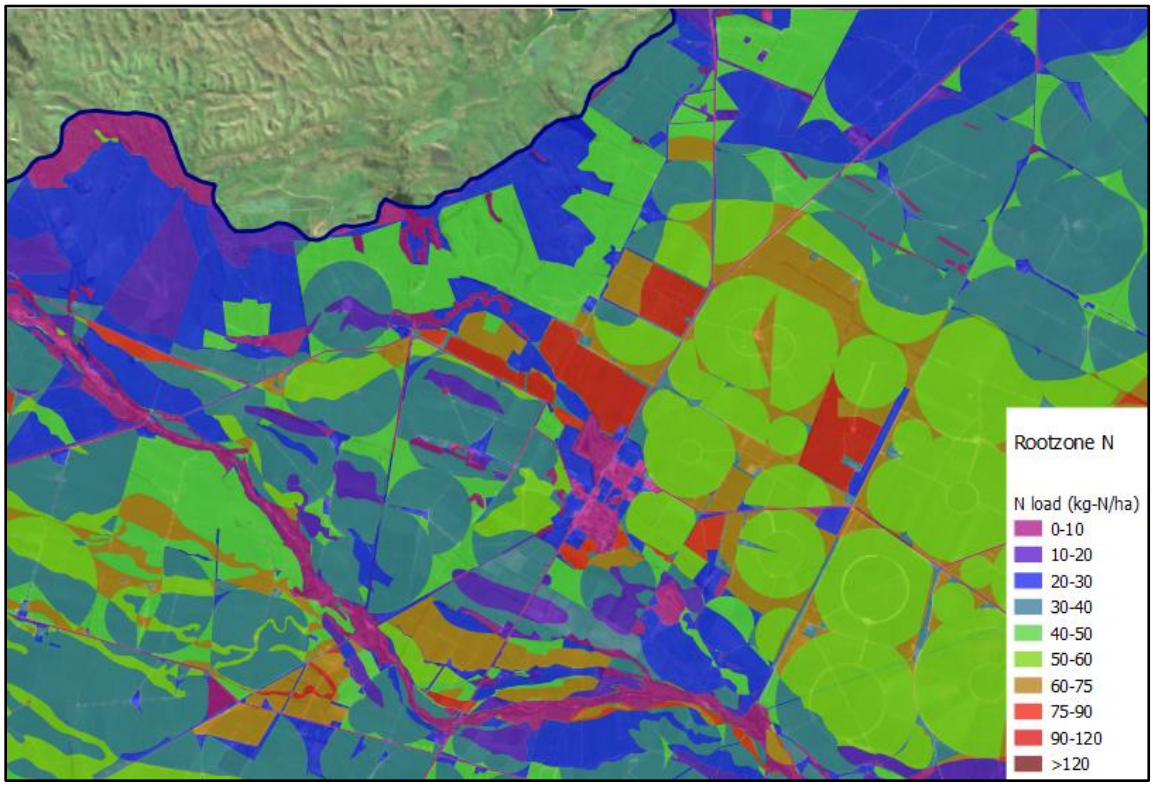

Figure 2: Example Catchment Mapping Based on Root Zone N Losses

Another potential benefit of the framework is that it could allow changes in land use to systems that have both lower nitrate loss rates or Green House Gas (GHG) emissions. Land use change can be hard to achieve for individuals, as there are many barriers to change, the barriers include risk in establishing viable alternatives, the required skills in a new landuse, farm system, access to technology, markets, scale of production and supporting infrastructure (pack houses, harvesters etc.)

An example of how a catchment approach could help to overcome these barriers, would be if a collective of landowners jointly converted 10 % of their farm to an alternative crop/system. This spreads the investment risk for that business, while createing scale in the new industry to allow downstream infrastructure to be supported like a powder dryer or fruit pack house. If the land use chosen was low GHG or low nitrate emitting then emissions and nutrient loss would be reduced, but not land productivity or business viability.

Figure 3 below shows a catchment which is prodominately dairy farming, with very little diversity in land use. In this 25,000 ha catchment, a 10 % change would be 2,500 ha and enough for an alternative industry to be sustainable.

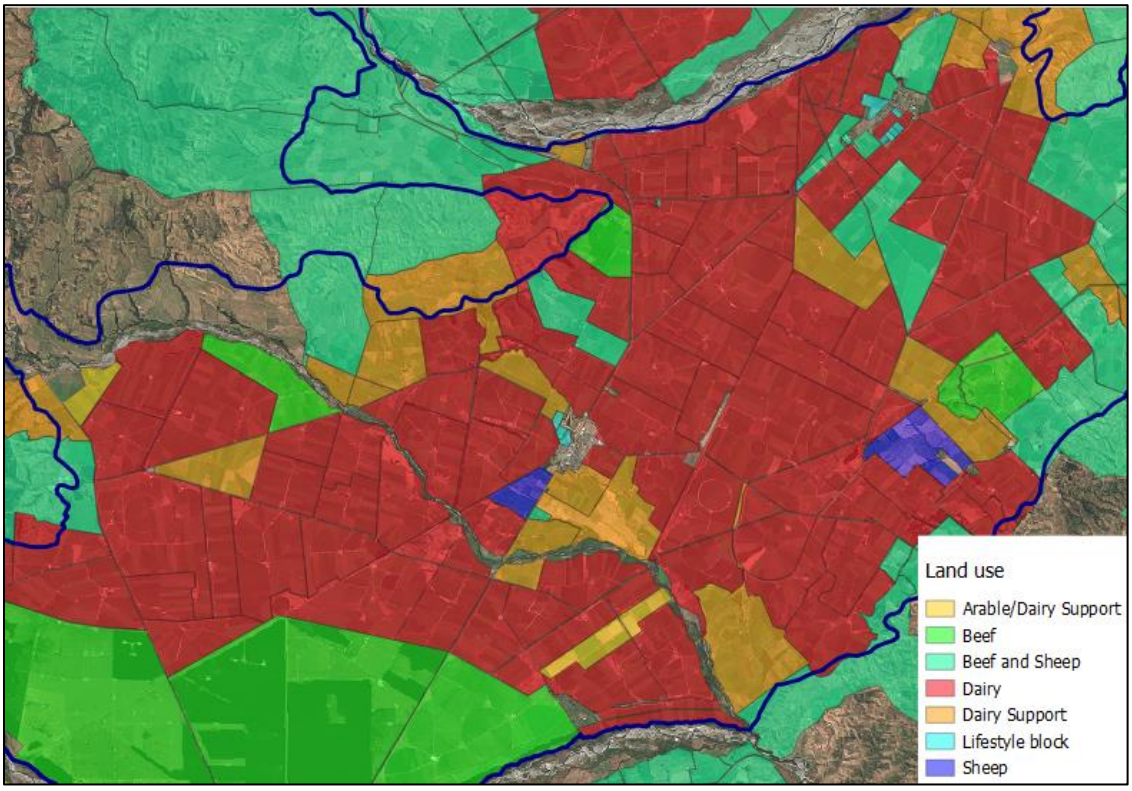

Figure 3: Example Catchment Mapped by Landuse.

For the catchment framework approach to work there are a number of requirements. The key being that regional plans need to be flexible to allow management at both the individual or catchment level. Regional Councils should consider including a pathway that allows catchment level nutrient losses to be achieved. While retaining the option for ndividuals who did not want to be part of a catchment collective to still be required to make GHG or nutrient reductions at a property level if outside of collective management group.

Other requirements involve the establishment of the organized group or collective that would help implement the framework and where new industries were to be created, then industry co-op and/or collective supply companies would need to be established with collective membership/ownership.

The major requirement for the collective approach is access to accurate and timely data for the parameters that are to be managed. Being able to model initial nutrient or GHG losses and then being able to monitor mitigation reductions over time as changes are made is essential for accountability and on going self imrovement.

Conclusion

The framework approach allows coordination between landowners to identify areas that could be changed or adapted to improve both water quality outcomes and to protect against future climate

change impacts. The framework collectively allows landowners to put in place the mechanisms to give confidence to make change or support the change already occurring within the catchment. There are benefits such as the sharing of resources and minimizing exposure to risk. The approach has applications to achieve improvements in nutrient loss and acheieving greenhouse gases emmsion reduction targets, supporting future diversified farming systems and rural communities to become remain antifragile.

Reference

UNESCO (2020). Water Quality and Climate Change. Sourced from https://en.unesco.org/waterquality-IIWQ/activities-projects/water-quality-climate-change