Beyond the Shed: poultry, poo and pasture

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Key Points

- There are over 30 intensive poultry farms within the Karuah River catchment which flows into Port Stephens Marine Park.
- MidCoast Council and Hunter Local Land Services have developed a project in cooperation with local Poultry farmers to reduce their impacts on the Karuah River estuary.
- As a specific sector that has not had a local history of engagement in NRM activities the project has been developed to grow and adapt in response to the farmers requirements and needs
- 200 soil tests have been undertaken to date on 23 farms.
- 18 on ground projects have been completed or are in progress to improve these farm's nutrient management and impact on nearby waterways.

Abstract

There are over 30 intensive poultry farms within the catchment of the Karuah River which flows into Port Stephens Marine Park on the NSW mid-north coast. These farms are a crucial part of the local economy. The poultry litter produced by these farms is used extensively as a fertiliser and has played a significant role in the growth of local grazing and dairy industries. Most poultry farms have established ancillary grazing enterprises to make the most of the land buffers required around their poultry sheds as well as having access to a readily available cheap fertiliser.

MidCoast Council (MCC)and Hunter Local Land Services (HLLS) have partnered to focus on the areas *beyond the shed.* The program works with poultry farmers to understand what's happening in their paddocks and improve nutrient management to reduce impacts on the Karuah River.

To date, 200 soil tests have been undertaken on 23 participating farms to profile their nutrient levels. Most farms found that their paddocks were highly productive, without the need for more nutrients in the form of chicken litter. Funding for on-ground works has also been provided to each participating farm and 18 projects have now been completed or are currently in progress. Almost $700,000 has been spent on-ground to date. This amount includes contributions from government (including the NSW Environmental Trust) as well as the farmers themselves through their own cash and labour contributions.

The Farmers who participated in this program are now selling most of their litter off-farm to other areas low in nutrients. They have also implemented on-farm management strategies such as rotational grazing, fodder conservation, waterway fencing, off-stream watering, alternate fertiliser applications to meet nutrient deficits, reduction of runoff and new pasture mixes.

This project is giving poultry farmers the opportunity to understand, and proactively take control of, nutrient management on their farm to improve their grazing businesses and reduce the risk of any negative impacts on the Karuah River. There is great opportunity to expand this program to other regions or intensive farming industries

Keywords

Poultry, catchment management, grazing, fertilizer, free range, nutrients, water quality

Introduction

The ecological health of the Karuah River is of economic significance to New South Wales. The Karuah River discharges into Port Stephens, one of the largest oyster growing areas in the state, in addition to being an important commercial and recreational fishery and a popular tourist destination. Landuses within the Karuah River Catchment have historically put pressure on this resource, and this continues today. These landuses have also brought significant economic value to the community through key rural industries of grazing, dairy and forestry.

The catchment itself has also been a center for intensive poultry farming since the 1960's (GLC, 2016). The local poultry industry (which includes a mix of eggs, meat, and turkey in both free-range and shed-based farming configurations) is now seen to be the most valuable agricultural commodity within the MidCoast region (greater than dairy and grazing), and supports a significant workforce (CERD, 2018.

The Ecological Assessment of the Karuah River (Haine, et al 2012) identified that the Karuah River Estuary was in moderate ecological condition. Although pressures on the system were generally low, nutrient loads to the estuary, both nitrogen and phosphorous were reported as moderate. Major sources of these loads are grazing, rural residential areas, forestry and intensive poultry operations. Inappropriate spreading of manure as a fertilizer within the catchment is also expected to generate significant nutrient loads.

Based on these findings key actions to address this were included within the Karuah River Catchment Management Plan (2016). Actions to improve the capacity of the local poultry industry to mitigate risks to water quality associated with the storage and application of poultry litter, is the focus of this discussion.

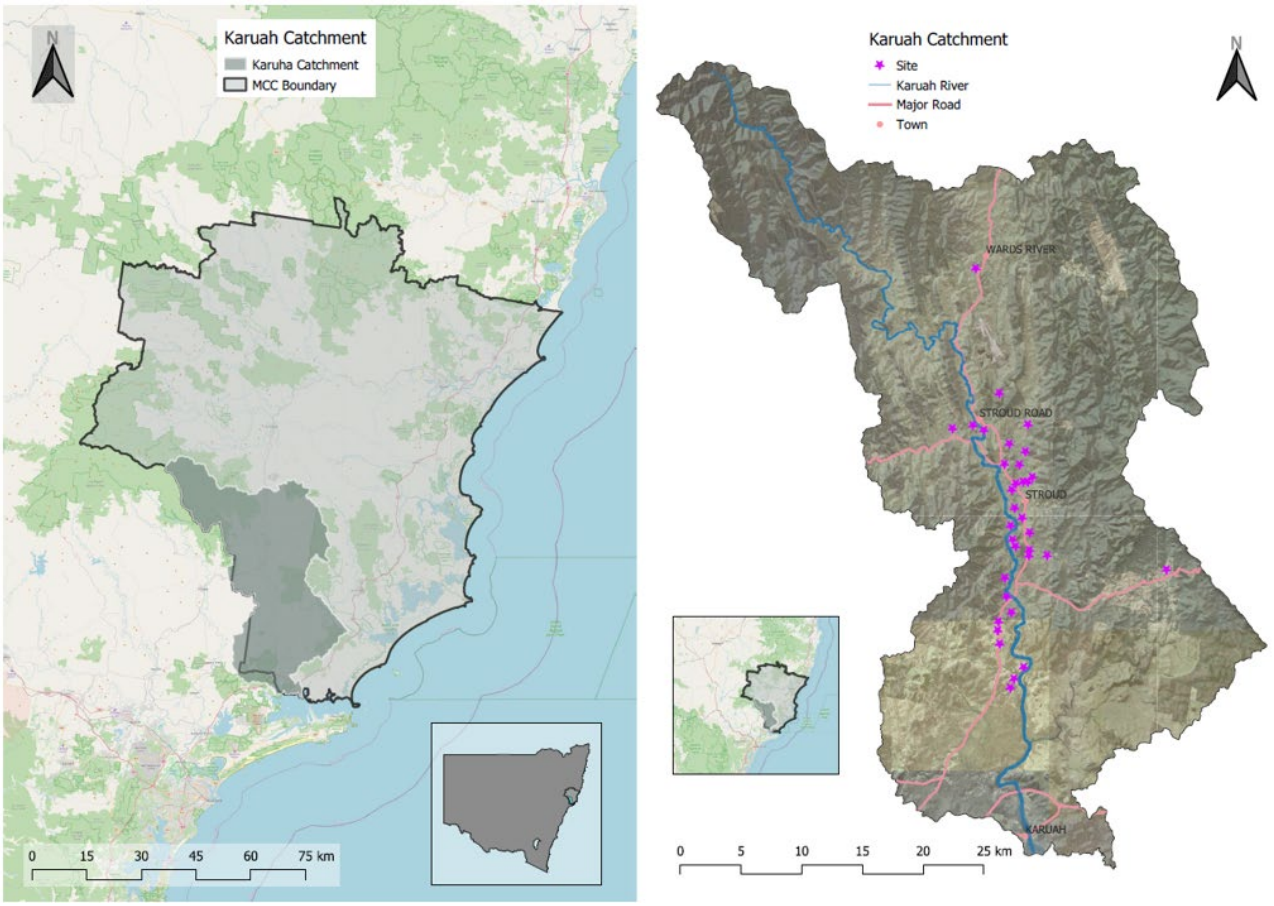
In 2016 a pilot project was developed between MidCoast Council and Hunter Local Land Services to work with intensive poultry farmers within the Karuah River Catchment to establish a baseline picture of nutrient management on their properties. This information would then be used to explore and implement ways to improve the on-farm nutrient management over time whilst also delivering an economic benefit to the business. To date, over 200 soil tests have now been undertaken on 23 participating farms and 18 on-ground projects have been undertaken.

1. Location and background

The MidCoast Council Local Government area (LGA) is on the east coast of New South Wales, approximately 2 hours north of Newcastle. The Karuah Catchment is a coastal catchment draining to Port Stephens and is almost entirely within the MidCoast Council LGA (Figure 1). The landuse within this catchment is predominantly rural, with the major centres of Stroud and Karuah each having a population of around 1000.

Figure 1 below shows the more than 30 active poultry farms in the Karuah River Catchment, many of which are in the Mill Creek drinking water catchment which supplies water to the township of Stroud and surrounds.

Figure 1 - Karuah River catchment showing poultry farms



The role of Poultry litter as fertiliser

The many poultry farms in the Karuah River catchment also provide a steady supply of poultry litter. This litter is either used on the farms' associated cattle grazing enterprises or sold to other properties requiring nutrients. Poultry litter can be an excellent fertiliser when used appropriately. It also has a high carbon content, can increase water holding capacity of soils, improve soil structure and infiltration and contains other valuable trace elements (Wiedemann, 2015).

While a potentially excellent fertiliser, the Nitrogen (N)-Phosphorous (P)- Potassium (K) elements in poultry litter are not balanced. Some farmers use poultry litter as a source of N for their crops or pasture and apply litter based on the desired N application rates. This can result in over application of P which, as well as being wasteful, can find its way into waterways. Knowing what sort of nutrients your crops or pasture require, and matching chicken litter application rates with these requirements, while maintaining appropriate buffers between application areas and waterways is key to avoiding nutrient losses (Wiedemann, 2015). Nutrient testing of soils is a first step to identifying what nutrients are currently available.

2. Project outline

While intensive poultry farms are a heavily regulated industry from the perspective of bird health, hygiene and food safety, there appears to be limited focus on issues that occur *beyond the shed* such as the nutrient management issues discussed above. Many poultry farms in the area have an ancillary grazing business attached to the poultry farm to utilise the buffer lands established around the sheds as well as make use of the abundant fertiliser in the form of poultry litter.

The Beyond the Shed project was developed between HLLS and MCC officers for the local poultry industry. It was initially trialed with 7 farms and has since been expanded. A summary of the project (as provided to farmers) is shown in Figure 2 and explained in further detail below.

Figure 1 - Beyond the Shed project overview provided to farmers

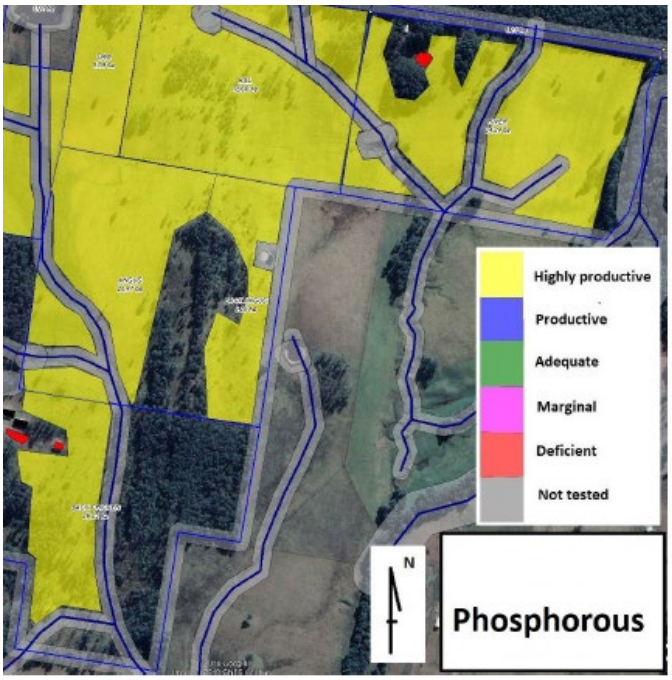
a. Soil Testing and Nutrient Mapping

The initial focus of the program was establishing a baseline of nutrient management on the poultry farm and its accompanying grazing lands based on Department of Primary Industry (DPI) recommendations for Beef production. The inclusion of nutrient management plans in Development Applications for new poultry sheds had recently become an issue for farmers (Pers comms) and this was seen as an opportunity to provide farmers with this initial baseline information which they could use for future management of their property.

Soil tests were taken on key paddocks on the property identified by the owner. This included both paddocks that had and hadn't historically received regular treatments of litter.

Key nutrients were mapped as shown in Figure 3 below, and total paddock areas calculated (excluding buffer areas for applying litter). Estimates of total litter produced, sold and used on farm were calculated.

Figure 2 - Example nutrient map provided to farmers (Phosphorous)



b. On farm results explained

The results of the sampling were explained on farm with the maps provided to the farmer. Current litter application rates and the market value of what is sold and used on farm were discussed.

Agronomic advice was provided to farmers based on current nutrient levels, what was missing and what could be added to maximise pasture production.

Most properties had adequate and higher Phosphorus, Potassium and Sulphur levels in their paddocks and were unlikely to benefit from additional litter applications. As the reason for applying litter was to improve pasture condition for stock, a common recommendation was developed to sell all the litter off the property, and use the returns from this to purchase a nitrogen-based fertilizer, such as Urea for winter pasture systems if needed for winter production. This was demonstrated through litter analysis and subsequent valuation of the various nutrients in the litter produced on farm (Figure 4).

Figure 3 - Example of information provided to farmers regarding the nutritional and financial value of their litter

POULTRY OPERATION

sheds with up to broiler chickens; clean-out every 8-9 weeks, up to 6 cycles per year.

Litter volumes: Approx 3000m3 litter per year is cleaned out of the sheds, most of which is sold off farm. Sawdust is purchased at $ 11.50/ m3.

Litter analysis: analysis of sample taken from the stockpile and typical broiler litter samples from tunnel sheds is summarised in the table right.

The sample from the '. farm is significantly lower in nutrient value in terms of Nitrogen and Phosphorous than samples taken from other broiler operations using tunnel ventilation. This may be due to leaching of nutrients or changes in clean-out regimes.

	% wet tonnes applied	
		Typical
N	1.82	3.04
P	0.43	0.82
K	1.11	1.15
DM%	65%	78%

Litter sold off farm: 3000m3/ year for $30,000 if sold at $10/m3

- contains approx.: 30.0 tonne N, 7.2 tonne P, 18.5 tonne K, 5.0 tonne S
- based on typical bagged fertiliser costs this is "worth" (if all utilised by soils/ pastures) in the order of $ 120,000.

Cattle stocking rates beef cattle are set stocked on the property.

Typical nitrogen application rates

To achieve high production levels typically 200- 400 kg N/ year would be applied.

To apply 200 kgN/ ha in the form of urea (46% nitrogen)

- on 92 Ha useable area would require 40 t urea, costing $ 32.000 with urea at $800/ t.
- on 133 Ha grazing area would require 58 t of urea, costing $ 46,400 at $800/ t.
- sulphur applications required on Hill, Angus and Back Angus paddocks would cost $830 with sulphur valued at $ 1.40/ kg.
- no applications of phosphorous are required.

To apply 200 kgN/ ha in the form of litter

- on 92 Ha useable area would require 1851 m3 of litter, worth $18,510 if sold at $10/ m3.
- however, 1851m3 of litter also applies 4.4 t P, 11.3 t K which are not required even for high production pastures.
- Litter also would apply 3.1 t of sulphur, 0.8t of which is required for Hill, Angus and Back Angus paddocks.
- on 133 Ha grazing area would require 2679 m3 of litter, worth $ 26,790 if sold at $10/m3, however, this also applies excess P, K and S nutrients

Use of LIME All paddocks have a pH (CaCl2) above 4.8, except which has a pH of 4.4 and applications of lime would be beneficial

have pH (Cacl2) levels between 4.8- 5.2; at these levels the application of lime is generally not required nor will deliver a significant production gain.

Composting and dead-bird disposal advice

A key issue that arose through the initial pilot was disposal of daily bird mortalities and methods for composting of these birds on farm. This was not an issue that MCC and HLLS had initially included in the project, but as it was raised by the farmers, and better management of this issue would have positive water quality and biosecurity outcomes if it was incorporated into the program. It was also an opportunity to address an issue that had clear management implications for farmers.

A consultant visited each interested farm involved in the program, reviewed the existing composting situation and provided advice on ways to improve each farmer's approach. There are restrictions on selling this product off farm, so the focus of this advice was not to produce commercial-grade compost, but to develop a process that would break down the birds as quickly and efficiently as possible. Compost could then be spread on those paddocks which were identified in the farm profile with lower nutrient levels.

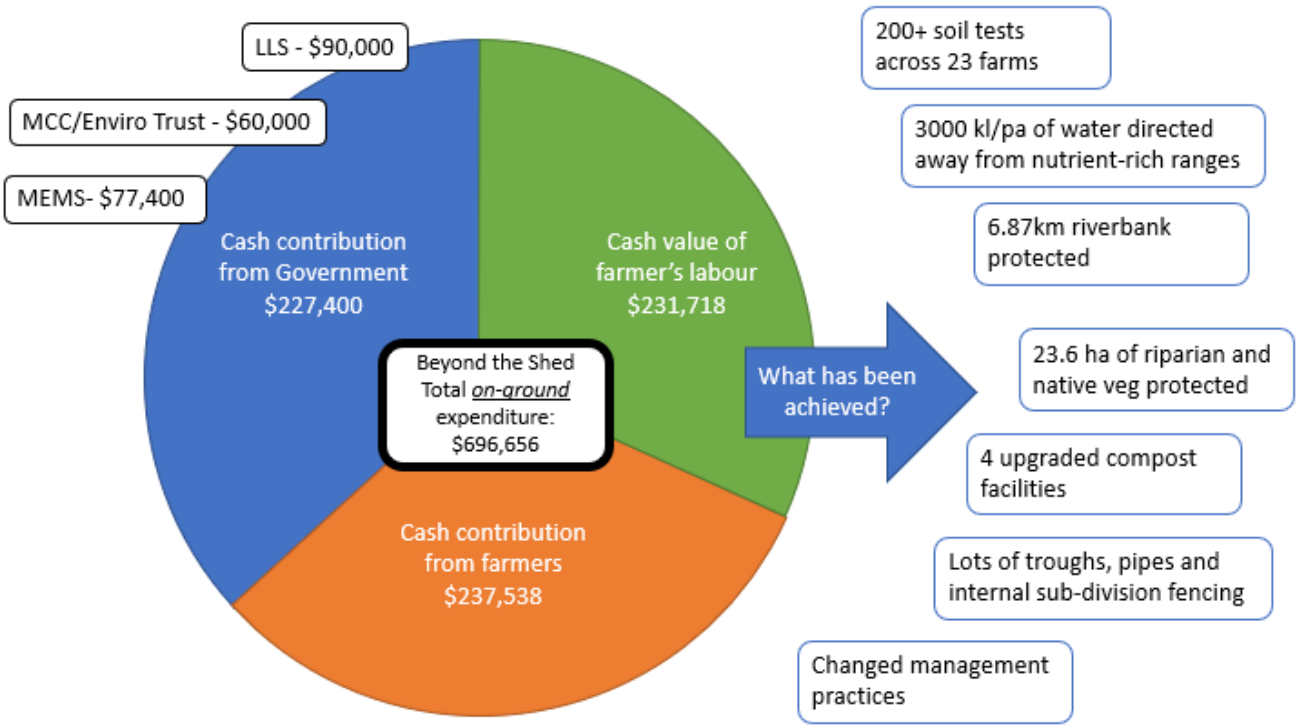
c. On ground funding

$10,000 for on ground works had been budgeted for each farm involved in the program. To receive funding farmers needed to demonstrate a 2:1 funding contribution. Works were targeted at improving nutrient management on farm, and a prioritization matrix of preferred works was developed to direct projects.

After the initial trial of 7 farmers, funding was received from the NSW Environmental Trust to expand the program to more farms in the catchment. Eighteen on-ground projects have now been completed or are in progress. Figure 5 below summarises the significant outcomes that have been achieved through this project. It should be noted that the nutrient mapping of farms and other engagement activities undertaken through the activity is not included in this total.

Almost $700,000 has been spent on-ground through this project, with $277,400 contributed by government, and $469,256 contributed by the famers themselves through their own cash and labour contributions.

Figure 4 - Summary of on-ground works and expenditure undertaken through the Beyond the Shed project



3. Conclusion

a. Managing farmer fears and expectations

As MidCoast Council was a key player in this project, and Council also has a compliance role with regard to environmental issues associated with intensive farms, there were initial fears that the project's intent was to

use this baseline nutrient information to introduce restrictions on the farms and management of poultry litter. This fear was expected to significantly reduce farmer's uptake of the project.

Key steps taken to manage this included:

- Initial trial with 5 (expanded to 7) interested farmers before expansion to the remainder of the local industry
- Face-to-face meetings with Farmers on their property. The HLLS Extension Officer generally acting as the 'face' of the program rather than Council staff in the early stages of the program significantly assisted with managing these fears.
- The nutrient maps were developed for each farm by a consultant on behalf of MCC and HLLS, and while staff from these agencies could see the maps, the underlying data from each map was kept confidential from these staff to further reduce fears from the industry that this might just be a project to force them to change. Maps were labelled from 'highly productive' to 'poor' for the key nutrients that were tested to further reduce the potential negative connotations associated with the findings

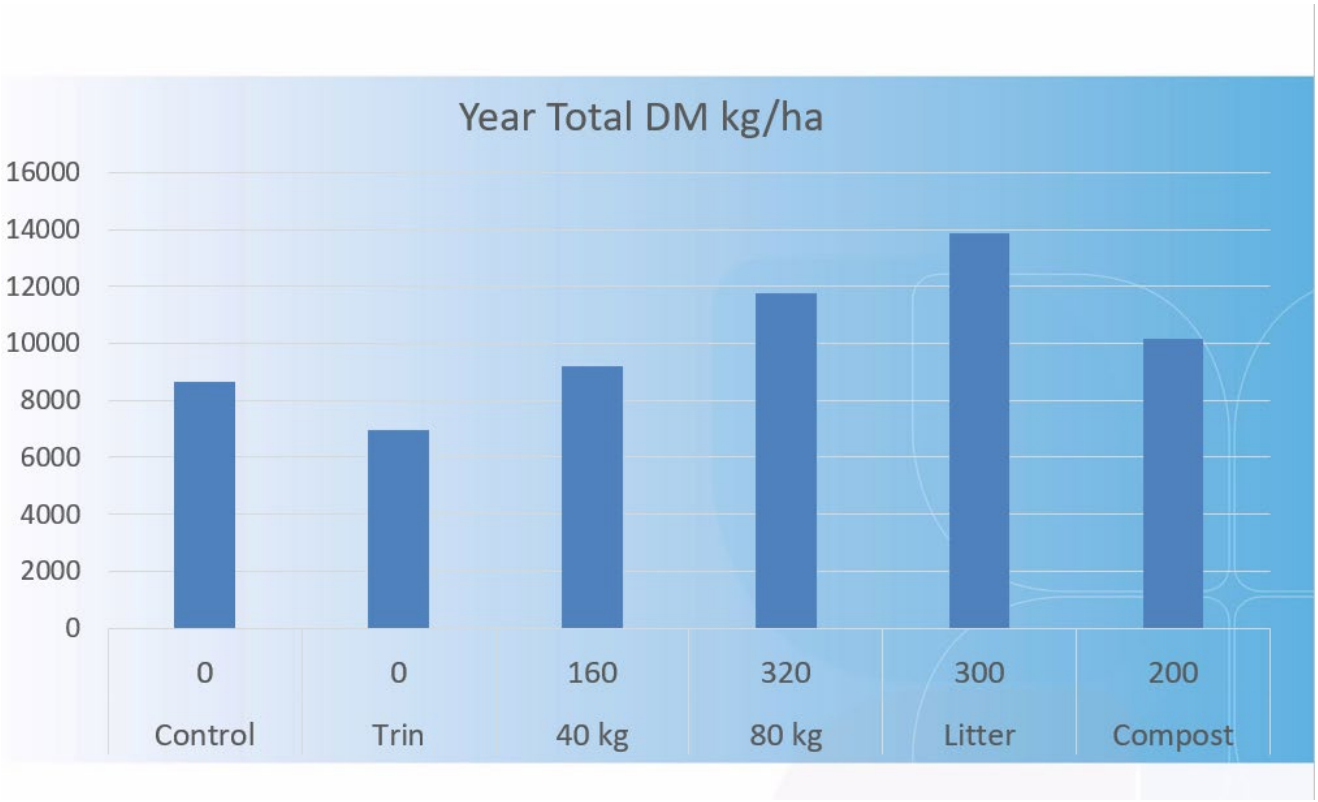
b. On-farm trial and locally testing a hypothesis

The project has included an ongoing trial of various treatments for pasture on a poultry farm with high nutrient loads. The intent of this trial was to demonstrate the hypothesis of exchanging an N-based fertilizer for the continued application of poultry litter. Urea was trialed at an application rate of 40 and 80kg per hectare as an alternative. Application of composted bird mortalities was also included as this was something that many farms have onsite but are unable to remove or sell from their property.

As shown in Figure 6, over the first year it was found that poultry litter was still the most successful fertilizer. 80kg of N was useful, but not as good as poultry litter and 40kg of N showed minimal benefit. Due to the already highly productive nature of the soils, the 'do nothing' approach of the control was likely the most attractive of all since there are significant labour and material costs to apply urea and poultry litter.

The compost trial was also quite positive, and as this is something that all farmers have on site and are generally unable to sell, it presents an argument for further improving onsite composting of bird mortalities for farmers. The trial will continue into a second year to further assess the benefits of improving soil health through the addition of compost, using alternative pasture mixes with low bloat legumes, liming of soils and other ameliorants that improve N uptake of grasses. In this area the added nitrogen is only needed on winter pastures. Naturalized Kikuyu pasture dominate paddocks in the summer and thrive on the warmer conditions with available moisture.

Figure 5 - Results of pasture trial on nutrient rich soils (slide provided courtesy HLLS)



c. Composting and dead-bird disposal

There has been significant interest in this component of the project. Large poultry farms produce varying numbers of daily bird mortalities. There are limited options for disposing of these birds in an efficient and environmentally friendly manner. Some farms freeze and transport birds to landfill, some farms use an incinerator and some farms compost their birds. All these options require inputs to manage successfully and are also accompanied by multiple risks.

Composting of daily bird mortalities is seen as a preferred option in our area. The focus of this component of the project has not been to produce commercial grade compost, but to break-down birds as quickly and efficiently as possible.

Through the on-ground funding component of the program several farms have upgraded their compost facilities. Due to the significant demand to improve these structures, Council is now investigating the development of standard designs to streamline the planning and construction of these facilities on farm.

Demonstrating the benefits of applying compost to pasture (as opposed to raw litter) in the trial discussed above will potentially add another reason for improving on-farm composting systems.

d. Sale of litter, undervaluing of poultry litter and changed management practices

Most farms found that their paddocks were highly productive, and the addition of more nutrients in the form of chicken litter for pasture production was not needed. Some of the management activities they have switched to as a consequence of the program to improve nutrient management are: rotational grazing, river and creek fencing, prescribed fertiliser applications to meet nutrient deficits, selling all litter off-farm, reduction of runoff, fodder conservation and new pasture mixes. Improving summer and winter pasture management with saleable stock – through rotational grazing which will increase beef produced per hectare and export nutrients off farm.

Many farms are now taking silage from paddocks, particularly those downhill of free ranges rather than grazing them. This will have the bonus of maintaining buffer strips around any nutrient hotspots to reduce the overland flow of nutrients from these sites reaching waterways, while also mining the high-nutrient soils and exporting nutrients off farm. The example in Figure 7 shows one such farm implementing actions to reduce nutrient flows from free-range areas to nearby waterways. The historic placement of the sheds near a waterway cannot be changed (and is a relatively common occurrence in the region), but the use of the paddocks below the range for silage production mines the soil for nutrients and exports them off farm through sale of silage or feeding out bales on lower nutrient paddocks. The grassed paddock also serves as a buffer strip between the nutrient rich range area and the waterway.

Figure 6 - Example of paddock below free-range area being managed for silage production to export nutrients off farm (image displayed with permission)

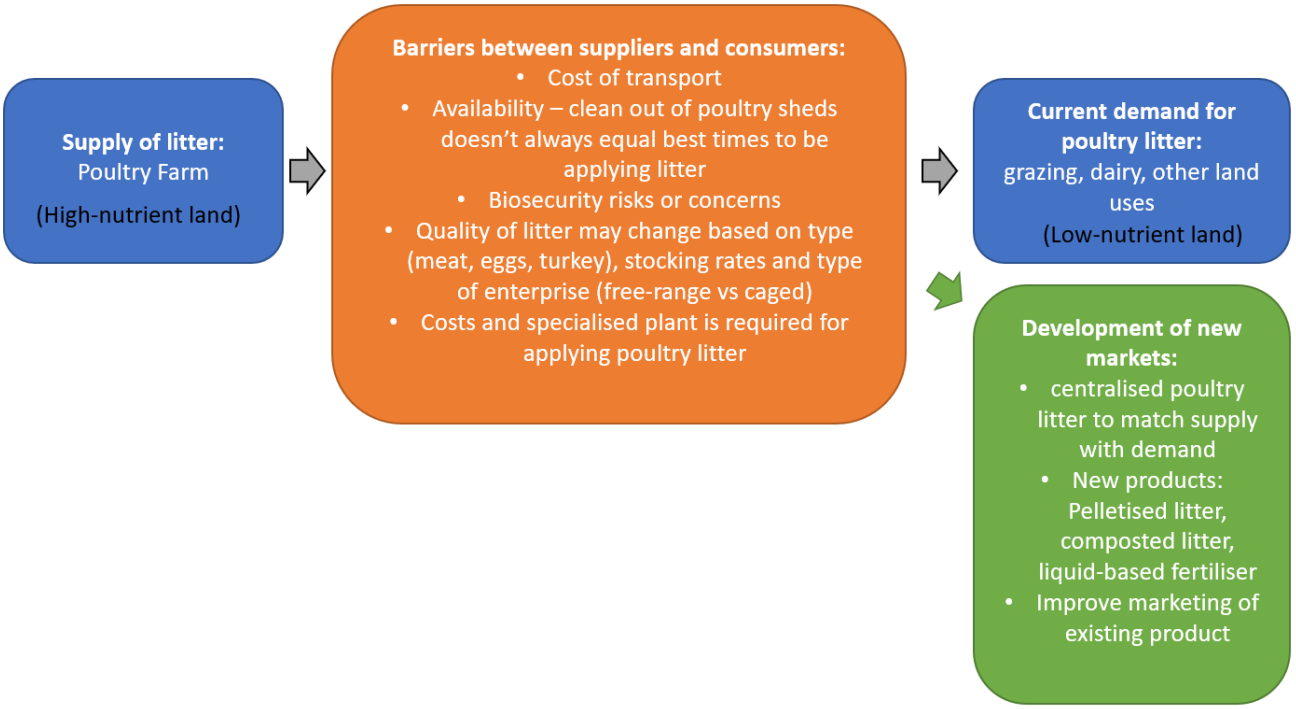
Most farms involved in the program are now selling the bulk of their litter off-farm. This removes it from a site that is very high in nutrients and (theoretically) is applying it to another site where these nutrients will improve pasture components and production and will therefore be taken up by plants rather than wash into waterways. In practice this is not always the case.

The undervaluing of poultry litter is a key issue that has arisen through this project. While litter can be an excellent fertilizer when used in the right circumstances, it is bulky and expensive to transport, and when the

poultry farmers want to sell it isn't necessarily when customers want to buy it. This leads to an undervaluing of this product (Fig 8).

Improving systems to add value, knowledge and application of litter to promulgate the transfer of litter from high-nutrient areas to those areas which require it or where it will have a reduced impact on receiving waters will be a key focus of the project going forward. Increasing awareness of the value of poultry litter by other rural land users as well as how/when to apply it will be part of this.

Figure 7 - Poultry litter is an undervalued resource with significant barriers between suppliers and the market



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