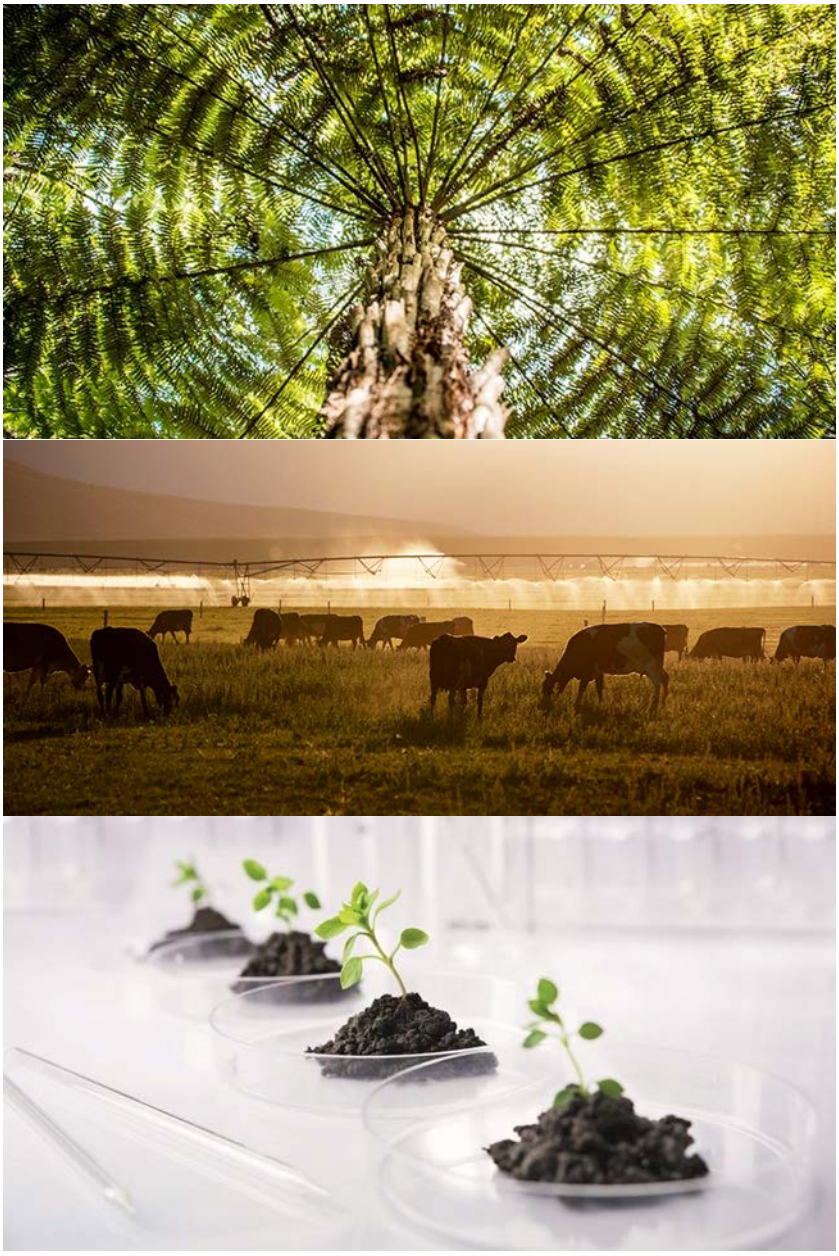
# Faculty of Agriculture and Life Sciences

# Honours Projects
# 2023



LINCOLN UNIVERSITY
TE WHARE WĀNAKA O AORAKI

# Contents

## Introduction

BAgrSc (Hons), BSc (Hons) and BV&O (Hons) students are required to complete a 40-credit project and write a dissertation at the 600-level. These dissertations are research-based and supervised by an academic staff member.

This booklet contains a list of some of the projects that are available in the coming year; it may be that other projects are also an option. Students are strongly advised to talk to potential supervisors as soon as possible.

Academic research staff have their own web-pages at:
https://researchers.lincoln.ac.nz/

## Aims

Dissertations are aimed towards individual research and study. Such an approach provides for student initiative in developing a research idea through the initial proposal, review of literature, design of experiments, conduct of experiments, analysis of results and their discussion. This will provide an assessment of the student's ability to conduct independent research and communicate results to other students and staff.

## Objectives

At the completion of a dissertation a student should be able to:

- break down a problem into key questions.
- develop those questions into a research proposal.
- read and critically assess literature on the chosen research topic.
- write a research proposal.
- plan and conduct appropriate research work.
- analyse results according to accepted statistical procedures.
- write up the results in a form that encompasses the above and discusses the significance of the results compared with other studies.
- communicate progress and results through written and verbal methods.

Dissertations are assessed by the supervisor and an independent examiner, who is normally an academic staff member of Lincoln University.

## Enrolment

Please refer to the University website:
https://www.lincoln.ac.nz/study/study-programmes/

The regulations for the BSc (Hons), BAgrSc (Hons) and BV&O honours degrees and the entry processes differ, and detail is available here:

- BAgSc (Hons): https://www.lincoln.ac.nz/study/study-programmes/programme-search/bachelor-of-agricultural-science/
- BSc (Hons): https://www.lincoln.ac.nz/study/study-programmes/programme-search/bachelor-of-science-with-honours/
- BV&O (Hons): https://www.lincoln.ac.nz/study/study-programmes/programme-search/bachelor-of-viticulture-and-oenology-honours/

If you have any questions, then contact:

- BAgrSc (Hons) Professor Derrick Moot, Professor Leo Condron, Professor Jon Hickford
- BSc (Hons) Dr Carol Smith
- BV&O (Hons) Dr Olaf Schelezki

## Application checklist:

You need

- English as a first language or provide documentation of your English Language proficiency
- Birth certificate or passport, certified copies only
- Academic transcripts, official copies or certified copies of all tertiary education qualifications either completed or partially completed
- The name of the area you're applying for honours in (e.g. Ecology) and a statement of research interest

**To apply online go to:** https://www.lincoln.ac.nz/study/apply-and-enrol/

**Special note:** If after Bachelor degree study you receive a letter of invitation from Lincoln University to study Honours, **you are still required to complete an application form prior to registration.**

## List of Projects

| No. | Project Title | Supervisor and email |
|---|---|---|
| **1** | Acid soils and aluminium toxicity: Novel legumes for high country | Dr. Jim Moir<br>Jim.Moir@lincoln.ac.nz |
| **2** | Application of grape polysaccharides in food | Dr. Bin Tian<br>Bin.Tian@lincoln.ac.nz |
| **3** | Back to the roots – Towards a sustainable viticulture by understanding rootstock effects on vine growth, grape and wine quality and water use efficiency in a changing climate. | Dr. Olaf Schelezki<br>Olaf.Schelezki@lincoln.ac.nz |
| **4** | Behavioural responses of grazing dairy cows to increasing plantain (Plantago lanceolata L.) proportion in the diet | Dr. Omar Al-Marashdeh<br>Omar.Al-Marashdeh@lincoln.ac.nz |
| **5** | Big data approaches to measuring the value of biodiversity | Dr. Will Godsoe<br>William.Godsoe@lincoln.ac.nz |
| **6** | Biomarkers of disease progression in sheep models of Batten disease | Dr. Nadia Mitchell<br>Nadia.Mitchell@lincoln.ac.nz |
| **7** | Breeding solutions for cattle with reduced environmental impact | Dr. Omar Al-Marashdeh<br>Omar.Al-Marashdeh@lincoln.ac.nz |
| **8** | Can plant regulator treatments increase seed yield of Caucasian clover? | Dr. Alistair Black<br>alistair.black@lincoln.ac.nz |
| **9** | Can plantain-based pasture be used for more environmentally sustainable dairy systems? | Dr. Omar Al-Marashdeh<br>Omar.Al-Marashdeh@lincoln.ac.nz |
| **10** | Can we protect our native plants using fungal bioactive compounds? | Dr. Artemio Mendoza Mendoza<br>Artemio.Mendoza@lincoln.ac.nz |
| **11** | Comparison of plantain or annual ryegrass over-drilled into a six year old Caucasian clover sward in March. | Dr. Tom Maxwell<br>Tom.Maxwell@lincoln.ac.nz |
| **12** | Determining the vernalisation requirements for carrot flowering | Prof. Derrick Moot<br>Derrick.Moot@lincoln.ac.nz |

| No. | Project Title | Supervisor and email |
|---|---|---|
| **13** | Effect of a fungal bioactive compound on plant performance under abiotic stress | Prof. John Hampton john.hampton@lincoln.ac.nz |
| **14** | Effect of a fungal bioactive compound on two soil-borne plant pathogens. | Dr. Hossein Alizadeh Hossein.Alizadeh@lincoln.ac.nz |
| **15** | Effect of combining N mitigation strategies in dairy farm systems | Dr. Racheal Bryant Racheal.Bryant@lincoln.ac.nz |
| **16** | Effect of dietary biochemical diversity on welfare and environmental impact of grazing livestock | Prof. Pablo Gregorini pablo.gregorini@lincoln.ac.nz |
| **17** | Evaluating the diversity and distribution of plant-parasitic nematodes in New Zealand Kumara | Dr. Manjula Kularathna Manjula.Kularathna@lincoln.ac.nz |
| **18** | Gastrointestinal pathology in sheep models of Batten disease | Dr. Samantha Murray Samantha.murray@lincoln.ac.nz |
| **19** | Glow-worms | Dr. Andy Greer Andy.Greer@lincoln.ac.nz |
| **20** | How flammable is your farm? Measuring the flammability of crops and pastures to assess fire hazards on rural land | Assoc. Prof. Tim Curran Timothy.Curran@lincoln.ac.nz |
| **21** | Impact of breeding heat tolerance into the New Zealand dairy herd | Dr. Racheal Bryant Racheal.Bryant@lincoln.ac.nz |
| **22** | Impact of nematode on multi species pastures used in regenerative agriculture | Dr. Manjula Kularathna Manjula.Kularathna@lincoln.ac.nz |
| **23** | Lucerne response to phosphorus stress | Prof. Derrick Moot Derrick.Moot@lincoln.ac.nz |
| **24** | Pasture Persistence – determining factors that drive performance of perennial grass cultivars over time | Dr. Tom Maxwell Tom.Maxwell@lincoln.ac.nz |
| **25** | Phosphorus mobilisation from farm drains | Dr. Nik Lehto Niklas.Lehto@lincoln.ac.nz |
| **26** | Plant -based beverage fining agents | Dr. Leo Vanhanen Leo.Vanhanen@lincoln.ac.nz |

| No. | Project Title | Supervisor and email |
|---|---|---|
| **27** | Plantain pastures to reduce nitrogen losses from sheep grazing systems | Dr. Tom Maxwell<br>Tom.Maxwell@lincoln.ac.nz |
| **28** | Regenerative Agriculture Dryland Experiment | Dr. Alistair Black<br>alistair.black@lincoln.ac.nz |
| **29** | Regenerative agriculture on a commercial dairy farm | Dr. Racheal Bryant<br>Racheal.Bryant@lincoln.ac.nz |
| **30** | Role of fungal bioactive compounds on the rhizosphere microbiome from legumes and their impact on plant performance. | Dr. Artemio Mendoza Mendoza<br>Artemio.Mendoza@lincoln.ac.nz |
| **31** | Too much alluvium – how to bring soils back to productivity after a whopper of a flood. | Assoc. Prof. Peter Almond<br>Peter.Almond@lincoln.ac.nz |

# Details of Projects

## 1 Acid soils and aluminium toxicity: Novel legumes for high country

The productivity of South Island high country is typified by a short, often soil moisture limited growing season, and acid soils (pH < 5.5). Traditionally, white clover has been sown as the key pasture legume, but fails to persist. The use of alternative pasture species, such as deep rooting Lucerne, has been suggested to improve dryland pasture production. However, lucerne is known to be intolerant of acid soil conditions, and related aluminium (Al) toxicity issues. Nutrient (especially P) and trace element availability is also strongly influenced by soil pH. To offset increased soil acidity, lime must be applied, and where this cannot be done, soils may be too acidic for legumes and productivity declines sharply. Often the cost of lime is uneconomic in extensive high country, and the response to liming unknown. Although the relative Al tolerance of some forage legumes has been examined, information on many legumes is at best, vague. This study will examine a selection of novel pasture legume species grown in acidic / high aluminium soil conditions at Lincoln University. Soils will be adjusted to reflect a range of soil pH conditions and the establishment and growth rate will be used to determine the relative performance of the focus legumes. Other soil ameliorants will also be examined.

***Supervisor:*** ***Dr. Jim Moir***

***Email:*** **Jim.Moir@lincoln.ac.nz**

## 2 Application of grape polysaccharides in food

Grape is a good resource of polysaccharides that are widely present in grape skins and pulp. These polysaccharides mainly include polysaccharides rich in arabinose and galactose (PRAG) and rhamnogalacturonans (RG-I and RG-II). In wine industry, there are tons of grape pomace generated every year as production waste. There is a wide range of bioactive compounds in grape pomace (e.g. polyphenols) that can be utilized for various purposes. This study aims to characterize the polysaccharides in grape pomace and explore the potential application of grape derived polysaccharides in sustainable food system.

***Supervisor:*** ***Dr. Bin Tian, Dr. Lokesh Kumar, Dr. Leandro Dias Araujo***

***Email:*** **Bin.Tian@lincoln.ac.nz**

## 3 Back to the roots – Towards a sustainable viticulture by understanding rootstock effects on vine growth, grape and wine quality and water use efficiency in a changing climate.

Rootstocks are a key tool for adapting to climate change in the context of potential reduced water resources, extreme weather events such as flooding and from a sustainable water management perspective. Yet, the New Zealand Wine industry is yet to fully understand and exploit rootstock derived differences on vine growth behaviour and grape quality, particularly under water limiting conditions. Such information will directly support decision making of growers towards a more sustainable future, giving you the opportunity to directly make an impact with your research.

A chardonnay rootstock trial is available in our Lincoln Vineyard that has been established 20 years, and is therefore the ideal test field to assess rootstock borne effects.

The aim of this project is for the student to assess differences in phenology and growth and related grape and wine qualities in response to different rootstocks to develop a deeper understanding of their potential for use to adapt to climate change. This project will involve the student spending time in the Lincoln University vineyard to make these measurements, in the winery for winemaking as well as in the labs to analyse basic grape and wine quality parameters. The student will acquire a deeper understanding about plant physiology, grape and wine chemistry, project management and writing skills that are essential for a successful career in both the wine industry and in academia.

***Supervisor:*** ***Dr. Olaf Schelezki, Dr. Amber Parker***

***Email:*** **Olaf.Schelezki@lincoln.ac.nz**

## 4 Behavioural responses of grazing dairy cows to increasing plantain (Plantago lanceolata L.) proportion in the diet

Plantain (Plantago lanceolata L.) has been used as an alternative forage to ryegrass–white clover in dairy systems to reduce the environmental footprint of grazing dairy farms. Greater water content coupled with diuretic effect of plantain resulting in increased volume and reduced N concentration of urine from dairy cows compared with when consuming a ryegrass-white clover diet. Limited data is available on the effect of plantain on grazing and lying behaviour of cows at farm level and for the full production season. The project's objective is to measure the effect of increasing proportion of plantain in the diet on behaviour of dairy cows compared with ryegrass-white clover. Student will have the opportunity to

work with data from a range of sensors (CowManager, ICE Tags and Smaxtec) monitoring cow health (rumination, water intake) and activity (lying, standing, steps).

***Supervisor:*** ***Drs Omar Al-Marashdeh, and Dawn Dalley and Roshean Woods (DairyNZ)***

***Email:*** **Omar.Al-Marashdeh@lincoln.ac.nz**

## 5 Big data approaches to measuring the value of biodiversity

There is a need to see what makes biodiversity (the variety of living things) decline or increase over time. This project will teach you to measure the mechanisms which shift diversity using your choice of natural history observations from Canterbury or from datasets collected across the world.

***Supervisor:*** ***Dr. Will Godsoe, D. Jon Sullivan***

***Email:*** **William.Godsoe@lincoln.ac.nz**

## 6 Biomarkers of disease progression in sheep models of Batten disease

Batten disease is an inherited, fatal neurodegenerative disease primarily affecting children. Many other species carry the same disease-causing genetic mutations, including Borderdale and South Hampshire sheep. Our group works with both breeds, representing two different forms of Batten disease. Batten disease sheep show comparable clinical signs and neuropathology to patients, including extensive brain atrophy and increased inflammation in the brain. Biomarkers are measurable indicators of disease state which are useful for tracking disease progression and efficacy of treatments. The proposed project will involve testing clinically relevant biomarkers of disease progression in sheep blood, cerebrospinal fluid and brain tissue, with the aim of developing biomarkers to inform on efficacy of gene therapy in sheep. This project will provide an introduction to protein biochemistry and neuropathology and the use of large animal models to study human disease, as well as technical skills including Western blotting, brain tissue processing, immunohistochemistry, and microscopy.

***Supervisor:*** ***Dr. Nadia Mitchell and Dr. Samantha Murray***

***Email:*** **Nadia.Mitchell@lincoln.ac.nz**

## 7 Breeding solutions for cattle with reduced environmental impact

Reducing the environmental footprint from the farming sector has increasingly become a research focus in New Zealand. In an ongoing project, low nitrogen excreting animal has been genetically identified by using blood urea nitrogen (BUN) as an easily measured and moderately heritable trait. This project will compare heifers of divergent BUN breeding value (low vs high BUN breeding value) for performance and urinary nitrogen excretion. The student working on this project will be involved in collecting blood, urine and faecal samples of beef heifers with the aim of calculating total urinary nitrogen output per each of the treatment groups.

***Supervisor:*** ***Dr. Omar Al-Marashdeh***

***Email:*** **Omar.Al-Marashdeh@lincoln.ac.nz**

## 8 Can plant regulator treatments increase seed yield of Caucasian clover?

Recent large increases in the price of N fertilisers plus the mandated restrictions on N fertiliser application rates will encourage renewed interest in N fixation by pasture legumes. White clover is the main legume in New Zealand pastures, but Caucasian clover (Cc) can be more persistent and productive over a range of pastoral environments. Unfortunately, Cc seed has not been available for about 15 years and demand from hill and high country farmers has not been met. New seed production initiatives aim to meet this demand for Cc seed at an affordable price. This will only be possible if producers can increase their yields.

Three growth regulator treatments applied in late spring to a 2 ha second year crop will be monitored through summer to header harvesting in autumn 2023. Measurements of plant morphology including components of crop yield will indicate the responses to the growth regulator treatments. The effects of post-harvest management (e.g., grazing, irrigation, fertiliser, weed and pest control) will be measured in relation to the potential seed yield from a third seed harvest in 2024. The experimental crop is about 45 minutes from LU inland from Rakaia. Dr Phil Rolston and Dr Richard Chynoweth of the Foundation for Arable Research (FAR) will be advisors.

***Supervisor:*** ***Dr. Alistair Black, Dr. Phil Rolston (FAR), Dr. Richard Chynoweth (FAR)***

***Email:*** **alistair.black@lincoln.ac.nz**

## 9 Can plantain-based pasture be used for more environmentally sustainable dairy systems?

Plantain (Plantago lanceolata L.) has been used as an alternative forage to ryegrass–white clover sward to reduce the environmental footprint of grazing dairy farms. However, effectiveness of plantain in reducing nitrate leaching at farm level is yet to be confirmed. Farmlet study including increasing level of plantain in the ryegrass-white clover mixed sward (nill, 30% or 50% in the total pasture DM) has been established at the Lincoln University Research Dairy Farm. The long-term farm system study aims to evaluate the effect of increasing dietary level of plantain on dairy farm performance and environmental footprint over multiple production seasons. The student working on this project will have a chance to use modelling tools such as Farmax and Overseer to simulate treatment effect on farm financial and environmental outputs.

***Supervisor:*** ***Dr. Omar Al-Marashdeh***

***Email:*** **Omar.Al-Marashdeh@lincoln.ac.nz**

## 10 Can we protect our native plants using fungal bioactive compounds?

Climate change is a double blow for native plants; first, because of temperature increases and increased drought events, and second, the increasing threat of plant pathogens to the poles. This project aims to evaluate the role of a specific fungal bioactive compound in plant protection. The project will assess the plant protection ability of seed application of fungal bioactive compounds against pathogen attack in native plants by assessing seedling emergence and survival and establishment after transplanting in controlled conditions and a nursery. The student will work in a multidisciplinary and international team, including researchers from Scion and Ngai Tahu Farming and Forestry.

***Supervisor:*** ***Dr. Artemio Mendoza Mendoza***

***Email:*** **Artemio.Mendoza@lincoln.ac.nz**

## 11 Comparison of plantain or annual ryegrass over-drilled into a six year old Caucasian clover sward in March.

It is difficult to maintain a high clover content in perennial pastures. Grasses such as perennial ryegrass usually dominate white clover after a few years. Nitrogen fertilisers hasten this grass dominance. Plantain is a less aggressive companion for clovers so that the pasture nutritive value is improved with increased clover in the pasture. But plantain and / or white clover may not persist more than three or four years. In contrast, annual ryegrass will dominate during the winter but managing the transition to other species in spring is challenging.

Caucasian clover may offer a more persistent legume option. In contrast to white clover's short lived taproot and stolons which are vulnerable to drought, Caucasian clover has a deep perennial tap root and a dense mat of rhizomes. It may be possible to manage Caucasian clover as a persistent source of biologically fixed N and nutritious forage when compatible species such as plantain or annual ryegrass are direct-drilled into established Caucasian swards in autumn. This could provide either a winter active grass, or a herb which is less aggressive than a perennial grass. An Honours student would be involved in designing the experiment prior to drilling in March and monitoring the pasture treatments through to early spring.

***Supervisor:*** ***Dr. Tom Maxwell***

***Email:*** **Tom.Maxwell@lincoln.ac.nz**

## 12 Determining the vernalisation requirements for carrot flowering

New Zealand is one of the major producers of carrot seed globally with most of the seed being produced in Canterbury. This project will determine the vernalisation requirements for carrot flowering. The experiment will be conducted in controlled environment chambers and measurements will include dissection of the apical meristem to track reproductive development and leaf appearance rate. The aim is to determine if we can artificially induce flowering and allow seeds crops to be produced within one season.

***Supervisor:*** ***Prof. Derrick Moot***

***Email:*** **Derrick.Moot@lincoln.ac.nz**

## 13 Effect of a fungal bioactive compound on plant performance under abiotic stress

Climate change induced drought and heat stress will have a negative impact on plant growth. We have discovered that a bioactive chemical compound produced by a soil inhabiting fungus can interact with plants through chemical signalling which upregulates the plant's defence pathways, thus allowing it to more strongly resist abiotic stress. This project will aim to assess the impact of the fungal bioactive compound applied within a seed coating on (1) the performance of plants (pasture or wheat or potatoes) under controlled conditions of drought and heat stress, and (2) the accumulation of oxidants and the antioxidant response in stressed plants.

***Supervisor:*** ***Prof. John Hampton, Dr. Hossein Alizadeh***

***Email:*** **john.hampton@lincoln.ac.nz**

## 14 Effect of a fungal bioactive compound on two soil-borne plant pathogens.

Soil-borne pathogens are an increasing problem for agricultural production. We will be investigating the ability of a bioactive chemical compound produced by a soil inhabiting fungus to control two soil-borne pathogens in pasture, wheat, and potatoes. The effect of the compound on the pathogens will be first investigated in vitro. The project will aim to assess the impact of the compound applied as a seed coating on the two soil-borne pathogens in a glasshouse study to determine: (1) disease severity and plant mortality in the presence and absence of the compound (2) plant production in the presence and absence of the compound.

***Supervisor:*** ***Dr. Hossein Alizadeh, Professor John Hampton***

***Email:*** **Hossein.Alizadeh@lincoln.ac.nz**

## 15 Effect of combining N mitigation strategies in dairy farm systems

In order to make an sizeable impact on reducing N loss from intensive farming systems, farmers will be required to adopt multiple mitigation practises to reduce nitrate leaching and green house gas emissions. Two farmlets at LURDF have been established to investigate the effect of combining N mitigations on production, profit and environment. This honours project would be part of a wider Low N project and The Living Laboratory which brings together the skills and expertise from DairyNZ, AgResearch, Fonterra and CRV. Depending on the interests of the honours student there is scope to generate targeted research questions regarding pasture management (plantain diverse pastures, high and low N fertiliser) or animal production and N partitioning, or whole farm system (Farmax and Overseer modelling).

***Supervisor:*** ***Dr. Racheal Bryant***

***Email:*** **Racheal.Bryant@lincoln.ac.nz**

## 16 Effect of dietary biochemical diversity on welfare and environmental impact of grazing livestock

This project will be focused on : 1) the effect of dietary functional diversity on specific markers of animal welfare and nutrient (carbon and nitrogen) use efficiency of grazing livestock 2) Evaluated the concept of foetal programming and the role of functional biochemistry of diverse diets as a tool to reduce fawning /calving/lambing stress and stress of foetus and new progeny. All of which will contribute to enhance welfare and production while reducing environmental impact of pastoral livestock production systems in New Zealand.

***Supervisor:*** ***Prof. Pablo Gregorini***

***Email:*** **pablo.gregorini@lincoln.ac.nz**

## 17 Evaluating the diversity and distribution of plant-parasitic nematodes in New Zealand Kumara

Plant-parasitic nematodes (PPNs) cause significant losses to the global sweet potato (Kumara) industry. Previous reports had indicated these losses to be around 10-11% in susceptible sweet potato varieties. Even though there have been reports indicating the association of nematodes with sweet potatoes, for almost two decades, no research had been done to understand their detrimental effects on the NZ sweet potato industry.

Therefore, this honours project will be conducted to evaluate the current nematode status and the potential threat they pose to the sweet potato industry in NZ. The findings from this research would be extremely important to develop strategies to mitigate existing nematode related problems. The research would enable us to develop sustainable, environmentally friendly management strategies to minimize nematode damage in the future.

***Supervisor:*** ***Dr. Manjula Kularathna, Prof. Nick Roskruge (Massey University)***

***Email:*** **Manjula.Kularathna@lincoln.ac.nz**

## 18 Gastrointestinal pathology in sheep models of Batten disease

Batten disease is an inherited, fatal neurodegenerative disease primarily affecting children. Many other species carry the same disease-causing genetic mutations, including Borderdale and South Hampshire sheep. Our group works with both breeds, representing two different forms of Batten disease. As well as affecting the central nervous system, it is suspected that Batten disease also affects the nervous system in the gut (enteric nervous system). The proposed project will investigate gut health in Batten disease affected sheep by assessing gastrointestinal (GI) transit time in vivo and studying post-mortem GI tissue to look for neuron loss and other pathological abnormalities. This project will provide an overview of pathology in the enteric nervous system as well as the use of sheep to model human diseases. Technical skills gained will include immunohistochemistry, histopathology, and microscopy.

***Supervisor:*** ***Dr. Samantha Murray and Dr. Nadia Mitchell***

***Email:*** **Samantha.murray@lincoln.ac.nz**

## 19 Glow-worms

Gastro-intestinal nematodes are a major cause of ill-thrift for grazing livestock. However, one of the major constraints to be able to effectively manage the impact of infection is our inability to rapidly enumerate the number of larvae on pasture. Recently we have obtained preliminary data showing that under the right light conditions (filters) larvae can auto-fluoresce. The objectives of this project are to expand on these preliminary findings and identify the optimum conditions under which larvae may auto-fluoresce and the limits of this possibility to determine the suitability of this approach to enable rapid quantification of gastro-intestinal nematode eggs or larvae on pasture.

***Supervisor:*** ***Dr. Andy Greer***

***Email:*** **Andy.Greer@lincoln.ac.nz**

## 20 How flammable is your farm? Measuring the flammability of crops and pastures to assess fire hazards on rural land

Destructive wildfires are becoming more common in many parts of the world, including New Zealand. A key driver of fire behaviour is fuel and in wildfires the main fuel is vegetation. This means that there is a clear need to assess the flammability of different plant species and vegetation types, including those that occur on rural lands. This project will measure the shoot flammability of a range of plant species commonly found on rural land, particularly crops and pastures, to identify those species with high flammability (representing a high fire hazard) and those with low flammability, which might be strategically planted to reduce fire spread (green firebreaks). This project will involve collaboration with other postgrad students and comprise plant species identification, field work to collect samples (potentially during summer, though this is negotiable) and laboratory work to burn samples and measure their flammability (on a plant BBQ!). It is part of a wider project (Farming and Nature Conservation) which is aimed at better managing plants and animals on farms, and using them to provide nature-based solutions to pressing problems (such as wildfire).

***Supervisor:*** ***Assoc. Prof. Tim Curran, Dr. Tom Maxwell, Dr. Azhar Alam***

***Email:*** **Timothy.Curran@lincoln.ac.nz**

## 21 Impact of breeding heat tolerance into the New Zealand dairy herd

Lincoln University is collaborating with Livestock Improvement Corporation (LIC) to investigate the effect of breeding dairy cows carrying the SLICK gene on heat and cold tolerance. A population of SLICK carrier calves are being established at ADRDS to investigate the impact of breeding for improved welfare in a changing climate. There are several research questions which can be addressed in one or more honours projects under the supervision of Prof Jon Hickford, and/or Dr's. Racheal Bryant, Omar Al-Marashdeh or Sandy Slow. In this research, calves born in August 2022 with or without the SLICK gene will be compared in their growth rate, grazing behaviour and body temperature when exposed to South Island winter conditions. The research will be carried out on the university's research dairy farms. Temperature and activity sensors will be attached to calves and visual observations of their behaviour, will be carried out to determine whether animal genetics affects behaviour of young stock. Additional measurements for physiological or molecular research questions are available depending on the interests of the student who are encouraged to approach any of the listed academics to talk more about project options.

***Supervisor:*** ***Dr. Racheal Bryant***

***Email:*** **Racheal.Bryant@lincoln.ac.nz**

## 22 Impact of nematode on multi species pastures used in regenerative agriculture

Literature had indicated regenerative agriculture (RA) contributing to a significant improvement in soil, plant and animal outcomes. Multispecies pastures to improve soil, plant, and animal components, is considered to be effective to increase the efficacy of a RA system. Out of a variety of abiotic and biotic agents, plant pathogenic nematodes are known to cause severe damage to pasture species. Therefore, presence of certain types of nematodes could have a negative impact on multispecies pastures used in RA systems in the initial stages. On the other hand, a few studies had demonstrated the use of nematode diversity as a bio indicator of soil health. In this honours project, we will be looking at nematode diversity in fields assigned for RA practices at Lincoln University to evaluate their impact on pasture species as well to understand their contribution to soil health. The findings from this research would be extremely important to understand the performance of multispecies pastures with nematode in a RA setting.

***Supervisor:*** ***Dr. Manjula Kularathna, Dr. Alistair Black***

***Email:*** **Manjula.Kularathna@lincoln.ac.nz**

## 23 Lucerne response to phosphorus stress

Lucerne response to phosphorus stress will be assessed in this established field experiment. The student will monitor shoot and root growth, and crop development to understand the physiological basis of the yield response.

***Supervisor:*** ***Prof. Derrick Moot***

***Email:*** **Derrick.Moot@lincoln.ac.nz**

## 24 Pasture Persistence – determining factors that drive performance of perennial grass cultivars over time

Unravelling the complex interacting biotic and abiotic factors that drive pasture community change is important to develop the appropriate pasture management to improve persistence. Identifying primary driving factors (soil type, summer rainfall, plant N status, population survival mechanisms) and secondary driving factors (invertebrate pest pressure, diseases, weed ingress and high intensity grazing) which act and/or interact to determine productive sown pasture longevity are critical to understanding and therefore managing for pasture persistence. To address this need, and provide the DairyNZ Forage Value Index with persistence trait data for perennial pasture grass species, a long-term pasture persistence trial, consisting of repeated annual sowings, commenced in Canterbury in 2015 and is planned to continue until 2024. This project measures DM yield, botanical composition, grass morphology and density of ten grass cultivars from pasture plots continuously stocked with sheep.

***Supervisor:*** ***Dr. Tom Maxwell***

***Email:*** **Tom.Maxwell@lincoln.ac.nz**

## 25 Phosphorus mobilisation from farm drains

Eutrophication of freshwater ecosystems is a major environmental challenge in New Zealand’s agricultural landscapes. Massive phytoplankton growth under eutrophic conditions impacts on the recreational, ecological and cultural values of freshwater resources. Phosphorus (P) is a critical nutrient in regulating phytoplankton growth in aquatic ecosystems, so understanding the factors that drive P release into rivers is critical for helping to mitigate its impacts on local ecosystems. Sediments in farm drains and ditches often contain large amounts of fixed P, and this can be mobilised into local rivers under specific conditions. In lowland areas, the sediment-bound P can make a significant contribution to bioavailable P

loads that are deposited into end-of-river environments (lakes, estuaries, wetlands, etc.). The extent to which can happen in Canterbury is currently unknown. In this project you will survey farm drains around the LII/Ārarira river catchment and measure P mobilisation fluxes from the drains under a range environmental conditions to estimate their contribution to the overall P loading in the LII river, and ultimately to Lake Ellesmere/Te Waihora. This project will involve extensive work in the field (a driver's licence is a must) and you will develop expertise in a wide range of novel laboratory analyses.

***Supervisor:*** ***Dr. Nik Lehto***

***Email:*** **Niklas.Lehto@lincoln.ac.nz**

## 26 Plant -based beverage fining agents

Alcoholic beverages, like beer and wine are often fined to clarify physically, stabilise biochemically, or modify flavour and aroma.

Fining agents are made or sourced from a variety of raw materials, some relatively unprocessed to products that extracted and modified to achieve a specific goal.

The raw materials used for fining agents are sourced from animal processing by-products, mining (earth), bacteria and fungi extracts, and some plant-based sources.

With increasing consumer preference towards sustainable, full-circle and natural food products, the use of fining agents in beverages that fulfils these requirements is of interest.

This project will evaluate potential new and novel plant based fining agents and compare them to more traditional and commonly used products.

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## 27 Plantain pastures to reduce nitrogen losses from sheep grazing systems

Reducing the environmental footprint from the dairy farming sector has increasingly become a research focus in New Zealand. Reducing the environmental impact from the sheep grazing sector is a neglected area. The nitrogen (N) deposited in urine patches of ruminants grazing perennial ryegrass-white clover pasture can be a major contributor to on-farm N pollution, due to these swards delivering N in excess of animal requirements. Recently, alternative forages such as plantain (Plantago lanceolata L.) and Italian ryegrass (Lolium multiflorum L.) have been identified as having a reduction effect on nitrogen loss. However, testing the implementation of plantain and Italian ryegrass under grazing in farm systems is required. The study monitors nitrogen losses of weaned lambs grazing on a plantain-Italian ryegrass-red clover pasture or a perennial ryegrass pasture-white clover pasture in a farmlet system at Ashley Dene Research and Development Station. The project will compare animal (liveweight, blood and urine), pasture (production and botanical composition) and soil (N availability) data from the plantain-based versus perennial ryegrass-white clover pasture.

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## 28 Regenerative Agriculture Dryland Experiment

Regenerative agriculture is a practice of farming that claims to provide food and fibre while revitalising the land and the environment. This project aims to test “regen ag” against a current best farming practice for sheep production in low rainfed (350-700 mm) regions of New Zealand. The two agriculture systems are compared in a new long-term farmlet experiment at Lincoln University. The regen ag system incorporates multispecies pastures, rotational grazing at low intensity and high frequency, multispecies winter forage crops, pasture-crop rotation, and minimal tillage practices to provide meat, wool and other ecosystem services. The standard ag system uses lucerne monoculture and sub clover/cocksfoot pastures, rotational grazing at higher intensity and lower frequency than the regen ag system, monoculture winter forage crops, pasture-crop rotation, and mechanical tillage methods. The two systems are replicated across soils of two fertility levels (Olsen P 10 versus 20) to determine their resource use efficiency. The four treatment combinations are laid out randomly across 80 plots that average 0.1 ha, and 20 plots of the same

treatment comprise a 2 ha farmlet. The prospective student/s will measure soil, plant and/or animal components of each system.

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## 29 Regenerative agriculture on a commercial dairy farm

Align farms has split their 1000-cow herd and 296 ha property into two farms representing either conventional or regenerative farming. In 2023/24 they will be commencing their third season as full regenerative farming comparison. Information about their farm and goals is available on their website. This honours project will provide a student an opportunity to collect data from a commercial dairy farm, the design of the honours project and research questions will be determined following discussions with the farmers and the interests of all parties.

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## 30 Role of fungal bioactive compounds on the rhizosphere microbiome from legumes and their impact on plant performance.

Plants release more than 40 per cent of their photosynthetic products into the roots to support the microbial consortium of bacteria, fungi and oomycetes in the rhizosphere. Fungal bioactive compounds have been recently suggested as essential mechanisms to protect plants against biotic and abiotic stress. However, very little is known about how these bioactive compounds affect the microbiome. This project will assess the role of fungal bioactive compounds (1) in the establishment of the microbiome in the rhizosphere on legumes (common bean or lotus or clover), and (2) how these bioactives affect the formation of nodules and their microbiome. The student will be able to work with a multidisciplinary and international team.

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## 31 Too much alluvium – how to bring soils back to productivity after a whopper of a flood.

On 30 May 2021, Canterbury went into a region-wide state of emergency as substantial areas of land were inundated with water and alluvial sediment. Damage was significant, especially for farmers, with significant areas of land covered by a layer of alluvium that could exceed 30 cm in depth; this resulted in damaged or destroyed crops and pasture (example photos below). The alluvium lacked structure, organic matter and had low plant available nutrients (nitrogen, sulphur and phosphate). A major issue faced by farmers was how to bring soils buried by this alluvium back into productivity to meet feed demand. However, little research addressing flood recovery currently exists, meaning management decisions after the flooding may not have been optimal. Considering climate change is expected to make weather events like these more frequent, the research gap in flood recovery is a significant oversight that must be addressed.

In collaboration with Manaaki Whenua – Landcare Research and Ravensdown, this project will be aimed at investigating which management practices could be used to efficiently bring soils back into productivity after being buried by alluvium. The Honours project would involve experiments that would quantify the effects of management practices (such as cultivation, soil amendments and plant species) on plant yield, plant quality and soil physical/chemical properties.

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