une University of New England

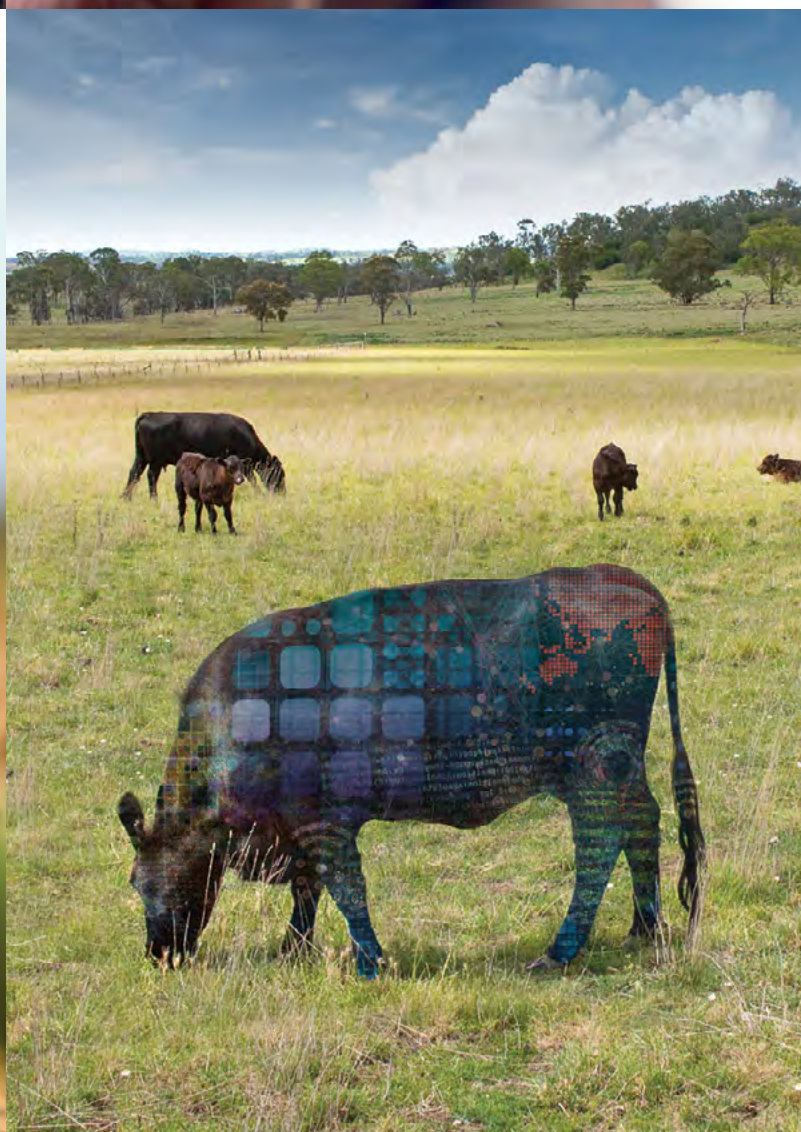
School of Environmental and Rural Science

School of Environmental and Rural Science

Projects 2026

Undergraduate, honours and coursework masters research projects

- Agronomy
- Animal Science
- Botany
- Ecology
- Environmental Education
- Environmental Science
- Population Genomics
- Palaeoscience
- Zoology
- Geoscience



University of New England

School of Environmental and Rural Science

Projects 2026

Contact: BSc Honours (SCI400)
Course Co-ordinator: Dr Eric Nordberg
Eric.Nordberg@une.edu.au

Contents

Projects are grouped broadly according to discipline. Many are collaborative across different research areas and there is flexibility in the Honours major used for enrolment. We encourage discussion of research ideas and student preferences across the disciplines.

ERS acknowledges that all our domestic projects are conducted on the traditional lands of the Aboriginal and Torres Strait Islander Peoples.

Agronomy encompasses both soil and plant sciences associated with field crops and pastures and is directly responsible for the production of most food and fibre consumed and utilised by people and livestock.

Agronomy

Discipline contact Chris Guppy: **cguppy@une.edu.au | 02 6773 3567**

Pasture Agronomy and Nutrition

Supervisor:
Dr Jonathan McLachlan: jmclach7@une.edu.au

There are a range of research projects available that focus on pasture agronomy, nutrition and quality, and grass/legume competition. Specific topics include germination/emergence requirements of legumes, root competition for nutrients and water, fertiliser placement at planting, tropical legume establishment and management, legume N-fix and N cycling, and many more. There are opportunities for either field or glasshouse-based research. I am also happy to discuss other topics based on your area of interest.

Pasture Weed Ecology and Management

Supervisors:
Prof Brian Sindel: bsindel@une.edu.au
Dr Jonathan McLachlan: jmclach7@une.edu.au

Students with an interest in pasture weed ecology and management can contact either of us for ideas, or if you have your own ideas we are happy to discuss those as well. We have a few topics about assessing the impact of weeds (e.g. thistles on pasture growth and composition), wick wiping herbicides onto pasture weeds (e.g. fireweed), the ecology of blue heliotrope (*Heliotropium amplexicaule*), assessing soil weed seed banks, and the effects of seed morphology on their movement in soils.

Vegetation and Soil Management on Solar Farms

Supervisors: A/Prof Paul Kristiansen: paul.kristiansen@une.edu.au (plant and soil dynamics)

Prof Brian Wilson: bwilson7@une.edu.au (soil fertility, carbon)

Dr Emma Doyle: edoyle3@une.edu.au (livestock production, grazing management)

Dr Onoriode Coast: ocoast@une.edu.au (plant physiology)

With the growth of the renewable energy systems globally, nationally and in the New England Renewable Energy Zone, there are many opportunities to understand the impacts of solar farms on soil, vegetation, livestock and energy generation. Contact us if you are interested the following topics. We are also keen to hear from you if you have other ideas.

- Pasture production and dynamics on solar farms (growth, species, physiology)
- Weed growth and management on solar farms (biology, ecology and management)
- Soil fertility on solar farms (nutrients, carbon, physical & biological factors)
- Optimising pasture utilisation by sheep on solar farms

Weed Management in Agricultural Systems

Supervisor: A/Prof Paul Kristiansen
paul.kristiansen@une.edu.au

Contact either of us if you are interested in exploring invasive weeds in agricultural systems or natural environments. We have a range of potential projects related to weed management in agriculture.

Topics include:

- Biology, ecology and management of specific weeds
- Weed seed bank assessment and management
- Herbicide resistance of weeds in vegetable farming systems
- Invasive plants in protected areas (e.g. National Parks)

Sub-Antarctic Weeds Projects

Supervisors:
Prof Brian Sindel: bsindel@une.edu.au

A/Prof Paul Kristiansen:
paul.kristiansen@une.edu.au

Several weed species such as *Poa annua* (winter grass), *Stellaria media* (chickweed) and *Cerastium fontanum* (mouse-ear chickweed) have invaded sub-Antarctic Islands (e.g. Macquarie Island), impacting on native biodiversity. These same and other weeds are now also threatening the Antarctic mainland. Given high conservation values, and threats from disturbance & climate change, the development of targeted control measures for invasive species is vital. A range of potential projects could be conducted, but one example is listed below. Can winter weeds germinate and grow in the Antarctic? While winter grass (*Poa annua*) has invaded the peninsula of the Antarctic mainland, little is known about the potential for a range of other cool season weeds to invade and survive in the Antarctic. This project will generate results of the resilience of a range of species to survive freezing temperatures and germinate and grow in Antarctic conditions utilising UNE's freezers and sub-Antarctic cool room facilities.

Horticulture Science and Technology

Supervisors:
A/Prof Paul Kristiansen:
paul.kristiansen@une.edu.au
(Production)

Dr Onoriode Coast: ocoast@une.edu.au
(Crop physiology)

Dr Priyakant Sinha: psinha2@une.edu.au
(Remote sensing)

We have a range of research projects based on basic crop science or on industry-based challenges related to horticultural production, including crop physiology, crop protection, breeding & genetics, and post-harvest management, as well as supply chain development and farmer capacity building. We have strong national industry links for a range of annual and perennial crops.

Food Systems & Rural Development

Supervisor:
A/Prof Paul Kristiansen
paul.kristiansen@une.edu.au
(Farming systems, rural development)

UNE staff contribute to a wide range of rural development projects nationally and internationally, especially in the Asia-Pacific region. These projects involve research, development and extension in diverse sectors including crop and livestock production, forestry, environmental management. Building on the strong technical expertise in ERS, these projects address critical aspects of adoption, training & extension, socio-economic impacts, gender studies, capacity building, governance and policy development. Please feel free to contact me if you would like to discuss what opportunities may be available.

Crop Science

Supervisor:
Dr Onoriode Coast: ocoast@une.edu.au
Dr Shamim Mia: smia@une.edu.au
Assoc. Prof. Paul Kristiansen: pkristi2@une.edu.au

An Honours year with us in Crop Science is not just about completing a project; it is about joining research teams working on the big questions of agriculture. How will crops cope with climate change-induced hotter days, warmer nights, droughts and rising CO2, and saline intrusion in coastal lands and deltas, due to sea-level rise and weaker river flows in dry seasons? How can we better manage crop production in protected and broadacre farming systems?

For your Honours year you will be supported to design and conduct research on crops such as wheat, rice, or tomato, and learn how to use some of the latest and most advanced instruments to understand plant physiological performance. There will be opportunities for you to work closely with PhD students, technical assistants or industry collaborators, gaining experience that builds a pathway into both research and professional practice.

Projects are tailored to individual interests and may involve fieldwork, controlled environment or data-driven analysis. More importantly, they connect your study to global challenges in climate resilience, crop productivity and sustainable food systems. If you are motivated to make your Honours year count for more than just a degree, I invite you to explore how you can contribute to solving some of the most urgent problems facing agriculture today.

Soil water management in agricultural systems

Supervisors:
Dr Shamim Mia: smia@une.edu.au
(Soil water)

Dr Ivanah Oliver: ioliver4@une.edu.au
(Soil organic matter)

Dr Onoriode Coast: ocoast@une.edu.au
(Crop physiology)

Dr Priyakant Sinha: psinha2@une.edu.au
(Remote sensing)

A/Prof Lisa Lobry de Bruyn: llobryde@une.edu.au
(Policy analysis)

Water significantly affects agricultural productivity, particularly under the growing pressure of climate change and variability. Therefore, efficient utilization of water is critical in Australia and elsewhere in the world. Understanding the complex interactions between soil, water and plants will help us make informed agronomic decisions such as when to sow a crop, when and how much water to apply. It is also important how farmers use soil and weather information in relation to water management decisions. Our research addresses these critical areas. Specifically, we are interested in the following key research questions which can be addressed in an honour's thesis:

a. How does soil organic matter status, its quality and vertical distribution in the soil profile affect soil water availability and soil water supply in diverse soils?

b. How do crop management practices such as cover cropping, mulching, minimum tillage, crop rotation and choice of cultivars affect soil moisture balance and crop productivity?

c. Does remote sensing-based monitoring of soil moisture, crop water stress and health assessment facilitate agronomic decisions? When these data are integrated with ground-truth data (e.g., soil properties, crop growth stages, climatic data), to what extent is the water use efficiency improved across diverse cropping systems?

d. What are the key drivers (water allocation, rainfall, budget and market etc.) that influence the farmers' decisions in diverse agricultural systems?

To address these questions, we will measure soil properties (e.g., soil structure, pore distribution, and water holding capacity), plant parameters (e.g., root architecture, water uptake, and transpiration rate). We will use a range of techniques including soil spectroscopy, stable isotope tracing, high-resolution soil moisture sensing, UAV, and satellite remote sensing. Machine learning and AI-driven decision support models will be developed for optimising soil water management and improving water use efficiency across diverse Australian cropping systems. For understanding the farmers' decision-making process, we will combine soil properties, weather information, and model- based prediction data with social drivers (i.e., economics, perception and attitude) using advanced models.

The science of livestock production, wildlife management, or horses and dogs.

Animal Science

Discipline contact Sam Clark: **sam.clark@une.edu.au**

Improving the sustainability of poultry production

Supervisor:
Dr Amy Moss: amoss22@une.edu.au

I have a range of research projects on improving the sustainability of poultry production, including research in the areas of creating poultry feed from food waste, precision feeding of poultry, alternative feed ingredients, and various mineral nutrition studies. These projects are critical for the long-term sustainability of the poultry industry. There is opportunity for research projects and potentially industry experience and networking that may lead to job opportunities. Please get in touch to discuss potential opportunities further.

Broiler productivity

Supervisor:
Dr Kosar Gharib-Naseri: kosar.naseri@une.edu.au

This project will investigate the use of feed additives in broiler diets and measure the growth performance of broiler chickens under heat stress conditions. In addition to productivity outcomes, various aspects of bird health and welfare can also be assessed throughout the trial.

Other related projects in poultry nutrition are also available.

Please reach out for further information.

Animal Behaviour and Welfare

Livestock enrichment

Supervisors:
Dr Jessica Monk: jmonk5@une.edu.au,
Dr Amy Tait: amy.tait@une.edu.au

Projects are available focusing on goat and sheep enrichments in intensive systems. Interested students can analyse video footage from goat trials that have already been conducted or get involved with new work piloting enrichments for feedlot sheep. Projects using the goat videos may also focus on their learning ability or other behavioural testing.

Turkey husbandry

Supervisors:
Dr Dana Campbell: dana.campbell@csiro.au,
Dr Kosar Gharib-Naseri: kosar.naseri@une.edu.au

This project will use existing video footage to assess the behaviour of day-old turkeys following body alteration husbandry treatments such as beak-trimming and how behaviour may change following administration of pain relief. Analgesics following painful procedures can improve the welfare and performance of young animals. The student will develop an ethogram to decode archived video footage and analyse whether the administered drug can mitigate the behavioural response to pain.

We may have other projects in animal behaviour and welfare available across different livestock species, including collaborations with the CSIRO. We are also always keen to hear your ideas for new projects! If you are interested in animal behaviour and welfare research, please reach out to Jessica Monk for more information jmonk5@une.edu.au.

Anthelmintic Drug Discovery and One Health

Supervisors:
Dr Ali Raza: araza3@une.edu.au
Dr Alison Colvin: alison.colvin@une.edu.au

Parasitic worms (helminths) pose a significant threat to animal health and global food security, resulting in substantial economic losses in livestock industries and raising significant welfare concerns in both farm and companion animals. Control of these parasites relies heavily on synthetic anthelmintic drugs; however, the rapid and widespread development of resistance has compromised effective control. At the same time, antimicrobial resistance is also rising as a critical One Health challenge. To ensure sustainable control of parasites and pathogens, there is an urgent need to discover new treatment options and develop modern tools that can accelerate drug discovery.

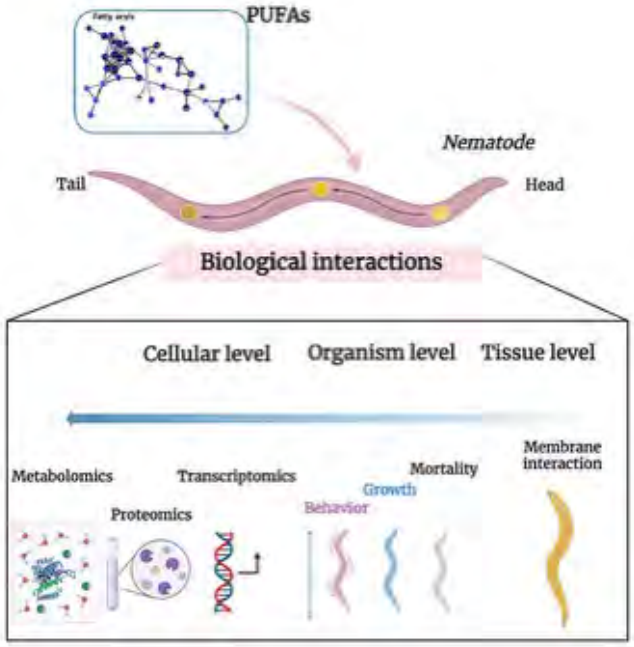
Our research program addresses this challenge by combining natural product pharmacology, molecular parasitology, and high-throughput screening technologies. We focus on bioactive compounds such as polyunsaturated fatty acids (PUFAs) derived from seaweeds, which show promise as natural alternatives to synthetic drugs. Using the model nematode Caenorhabditis elegans alongside parasitic nematodes, we explore both fundamental molecular mechanisms and translational applications. We also develop cutting-edge laboratory platforms to streamline anthelmintic and antimicrobial testing.

Available Honours Projects

1. **Polyunsaturated fatty acids (PUFAs) as novel anthelmintics**: Explore the efficacy and mechanisms of fatty acids against nematodes, integrating molecular, imaging, and transcriptomic approaches.
2. **Bioassay development for canine hookworms**: Develop and validate in vitro assays for drug discovery and resistance monitoring in dog hookworms.
3. **Establishing *C. elegans* as an infection model for antibiotic discovery**: Adapt nematode infection systems to test the activity of candidate antimicrobial compounds in vivo.
4. **High-throughput screening with WMicrotracker**: Standardise and optimise WMicrotracker-based assays for scalable, rapid screening of novel anthelmintic and antimicrobial candidates.

These projects provide students with hands-on training in **molecular biology, parasitology, pharmacology, and bioinformatics**, while contributing to innovative solutions for combating drug resistance in animal health.

Scanning electron micrograph of C. elegans



Understanding how plants have evolved, how they interact, how we can conserve them and how their genomes are structured.

Botany

Discipline contact David Perović: **dperovic@une.edu.au**

Plant evolution and conservation

Supervisor:
Rose Andrew: rose.andrew@une.edu.au
www.roseandrewlab.com

In the Molecular Ecology Lab, our research focuses on the following topics, typically in collaboration with UNE staff or experts elsewhere.

- Conservation genetics of threatened species
- Plant mating systems and pollination
- Hybridisation and speciation
- Eucalypt molecular ecology, including landscape genetics and genomics

Your project can focus on field studies, greenhouse work, population genetics or bioinformatics (see the Genetics major).

Some potential projects with a field, lab or greenhouse focus:

- **Reproductive biology and speciation mechanisms in *Xerochrysum* paper daisies**: A recent plant taxonomy project with Prof. Jeremy Bruhl and others has identified several new species. We are now looking for a student who likes greenhouse work to identify which reproductive barriers have evolved between these species. On-campus preferred.
- **Recruitment and regeneration of dominant eucalypts in Threatened Ecological Communities**: What are the barriers to recruitment and establishment of eucalypts in agricultural landscapes? This project uses a combination of experimental plantings and field observations to study the success of early growth in three eucalypts of conservation significance. On-campus preferred.
- **Phytochemical variation in native plants**: Eucalypts and many other native plants pack their leaves and flowers with a range of smelly and bitter compounds. These 'phytochemicals' shape many ecological interactions, such as herbivory, pollination and competition, yet they often vary dramatically across the range of a species or between species. Several opportunities exist for projects with a taxonomic or ecological focus. Visits to UNE required.

Fungal and plant ecology

Supervisor:
Dr Saphire McMullan-Fisher

Topics are listed below, usually working collaboratively with UNE staff or experts elsewhere. Open to student ideas.

- Fungal-plant-animal interactions, with particular emphasis on biotrophic relationships
- Fungal ecology employing trophic and trait-based research approaches, including the establishment of baseline data for fungal communities across vegetation types and bioregions
- Ecological processes mediated by fungi and cryptogams (algae, bryophytes, cyanobacteria, biological soil crusts, and associated microbiomes), including decomposition dynamics
- Fungal DNA barcoding and environmental DNA (eDNA) applications for understanding fungal ecology, including ecological and biogeographic pattern interpretation
- Fungal conservation implementation within International Union for Conservation of Nature (IUCN) frameworks at global, national, and state levels
- Interactions between fungal weeds and invasive species
- Cryptogam ecology (algae, bryophytes, cyanobacteria, biological soil crusts, and microbiomes) and their significance for biodiversity and microclimate regulation
- Native nitrogen contributions to ecosystems, including nitrogen fixation by cryptogamic organisms such as cyanolichens

Rader Community Ecology Lab

Supervisors:
Dr Lena Alice Schmidt: lschmidt@une.edu.au
www.raderlab.com

We explore how pollinators interact with each other, other insects and their environments to understand their behaviour, habitat use and contributions to ecosystem services.

Our research spans a range of topics, including (but not limited to):

- Life cycle-based pollinator support
- Ground-nesting bees and soil habitat use
- Pollinator behaviour in novel landscapes
- Pollinator networks in urban gardens
- Interactions between pollinators (and non-pollinator insects)
- Ant-mediated ecosystem services in cropping systems

If you are interested in pollinator ecology and conservation, we welcome students to get in touch to discuss potential project ideas.

The interrelationships between organisms and their environments.

Ecology

Discipline contact Manu Saunders: **manu.saunders@une.edu.au**

Reptile Ecology and Environmental Disturbance (REED) Lab

Supervisor: Dr Eric Nordberg:
Eric.Nordberg@une.edu.au
sites.google.com/view/ericjnordberg/updates
Follow us on instagram: @nordberg_reed_lab

People in the REED lab are interested in how wildlife populations, particularly reptiles, respond to natural and human-mediated disturbances. Both natural (e.g., wildfires, severe storms) and human-induced disturbances (e.g., agriculture, urbanization, habitat fragmentation) have impacts on wildlife communities. Our lab works at the intersection of disturbance ecology, resource use, and wildlife conservation.

The research in our lab aims to identify win-win strategies among industries to enhance anthropogenic outputs as well as promoting wildlife conservation. We use community ecology, species interactions, predator-prey dynamics, competition, and behavioural ecology to answer ecological questions. Successful honours projects are often associated with existing HDR projects which give you someone to work with in the lab and field and who can provide guidance with data collection, analyses, and writing.

We are looking for students to join the lab with an interest in collecting AND ANALYSING data. Familiarity with R is a bonus :-)

Possible research projects:

Ecology, conservation, and behaviour of reptiles

Projects may include field or lab studies on a variety of topics, species, or systems including but not limited to Western saw-shelled turtles, Eastern long-neck turtles, leaf-tail geckos, red-bellied black snakes, or other local species. Projects may be related to conservation, spatial ecology, behavioural ecology, or thermal ecology. Project ideas are always evolving so please contact me with your ideas and interests.

Assessing impacts of renewable energy projects

Projects could investigate many different things, including but not limited to:

- developing photo-drift fences to monitor wildlife
- perimeter fences – what uses gaps and holes
- comparing the community composition of wildlife between solar farms and adjacent farmland
- improving landscape management practices (mowing, spraying, grazing; using artificial habitats) to increase suitable habitat on renewable energy sites
- AI to map solar facilities and habitat features (desktop project)
- thermal ecology of microclimates under solar panels

These projects could take place at the UNE Solar Farm (and potentially others) and involve a lot of field work, conducting fauna surveys (birds, bats, mammals, amphibians, reptiles, inverts), conducting vegetation surveys, and processing data. Strong identification skills would be beneficial. Many of these projects could be co-supervised in cross disciplinary groups (Animal Science, Botany, Zoology, Agronomy, etc.)

Projects associated with current HDR projects

Often one of the best ways to do an honours is to be attached to an existing project and paired with an HDR student. Many of my students have on-going projects involving lab and field data collection. We could discuss if there is a side project or complimentary project that could be done in concert with their project. Some of our existing projects include:

- wildlife and biodiversity on solar farms
- impacts of fire on shelter sites and microclimates for arid reptiles
- ecology, conservation, and management of giant geckos on Christmas Island
- cold water pollution and it's impacts on freshwater turtle movement and basking behaviour

Open to student ideas as well!

Please contact me to discuss your own ideas!

Fungal and plant ecology

Supervisor:
Dr Saphire McMullan-Fisher

Topics are listed below, usually working collaboratively with UNE staff or experts elsewhere. Open to student ideas.

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- Native nitrogen contributions to ecosystems, including nitrogen fixation by cryptogamic organisms such as cyanolichens

Wildlife Management and Natural History

Supervisor:
Dr Heidi Kolkert: Hkolker2@une.edu.au
Lecturer and Collections Manager of the UNE Natural History Museum

I am a fauna ecologist specialising in the management of threatened species, ecosystem interactions, and natural history. My research spans a range of topics, including insectivorous bats and the acoustic analysis of bat echolocation and other fauna sounds.

Currently, I am engaged in several projects involving bats, gliders with larger projects on wind energy and fauna road crossings

Potential research areas for students include:

- Multiple koala projects in collaboration with Dr Amy Tait
- Bat echolocation / tracking projects in agroecosystems in collaboration with Dr Zenon Czenze
- Glider related projects
- Museum-related projects
- Insectivorous bat related projects
- School fauna biodiversity projects – evaluating and conducting research on fauna with school kids.

I encourage students to explore their own research interests and discuss potential project ideas with me

Practical Ecology, Science and Technology (PEST Research)

Research Group Leader:

A/Prof Guy Ballard, W055, UNE.

Potential supervisors for 2025/2026:

Dr Hugh Davies: hdavie27@une.edu.au
Dr Deane Smith: dsmith@une.edu.au
Dr Paul Meek: paul.meek@dpi.nsw.gov.au

Our research interests:

We focus on monitoring and managing vertebrate wildlife for real-world benefits.

Most of our students are interested in a research career or working in practical wildlife management.

Example projects for 2025/2026

For those interested in fieldwork to collect data:

- Does the routine maintenance of camera traps affect macropod detectability?
- Dingo diets on the Tiwi Islands
- For those who would prefer a desktop-focused project:
- How does lure degradation affect mammal species detection by camera traps?
- Who's on the take-away menu? Which prey species do predators carry around?

We are happy to discuss other ideas in the areas of: invasive species management, animal ecology, wildlife management, camera monitoring, population genetics and more.

Saunders Ecology Lab: Biodiversity, Community Ecology and Conservation

Supervisors:

Dr Manu Saunders: manu.saunders@une.edu.au
saundersecologylab.com

Research topics:

- **Community ecology** (species interactions and networks; effects of landscape factors, habitat condition and disturbance on communities and interactions; plant-insect communities; pollination ecology)
- **Threatened Ecological Communities** (ecology, conservation and policy)
- **Insect ecology and conservation** (insect community ecology; effects of habitat, landscape and disturbance factors on insect diversity and population dynamics; insect monitoring techniques)
- **Biodiversity and Ecosystem Function** (quantifying how biodiversity and ecological interactions contribute to ecosystem function and services)
- **Science communication and citizen science** (media framing, policy, scicomm evaluation, citizen science approaches)

Potential project options:

- **Wetland soil microbes**: quantify soil microbial diversity in threatened wetland communities of the Northern Tablelands and identify conservation implications. (Co-supervisor: Dr Christina Birnbaum, USQ)
- **Plant-insect community ecology**: links between plant floral traits and insect diversity
- **Urban pollinators in the country**: Plant-pollinator communities in regional/rural urban areas and surrounds
- **Mistletoe**: Mistletoe diversity and ecology in urban and rural areas around the Armidale region. What environmental factors influence mistletoe distribution? (Co-supervisor: Prof David Watson, Charles Sturt Uni)
- **New England Mozzies**: What mosquito species are found in different habitats of the New England region? We don't know much about New England mozzies, and diversity and distribution studies will have important ecological and public health implications (Co-supervisor: A/Prof Cameron Webb, NSW Health/USyd)

Get in touch with me to chat about any other relevant ideas.

Environmental Education

Discipline contact Dr Adrienne Burns: **aburns@une.edu.au**

BELONG in STEM: Building Equity, Learning, and Opportunities in Next-Gen STEM

Supervisor:

Dr Adrienne Burns: aburns@une.edu.au
Senior Lecturer in Biological sand Environmental Sciences; Leader of Learning Science Learning Hub.

Research Focus

My research explores equity and transition in STEM higher education, with a particular emphasis on the diverse needs of school leavers and mature students in a rapidly changing world. Students entering STEM and Environmental Science programs encounter a range of challenges, including maths anxiety, digital literacy gaps, and the shift to online and blended learning environments, while mature-age students often juggle study with work and family responsibilities. At the same time, school leavers must adapt to new expectations of independence and critical thinking in a global context of environmental and technological change. My work seeks to understand these experiences and develop innovative, evidence-based approaches that foster belonging, build confidence, and support academic success. Projects in this area give Honours students the opportunity to contribute to practical solutions that improve access, engagement, and outcomes for diverse cohorts in STEM and environmental and allied sciences.

Potential research areas for students include:

STEM Education Projects

1. Maths Anxiety and Confidence in STEM Students – Investigating how maths anxiety and self-efficacy influence the transition into university study.
2. Digital Literacy Gaps in Transitioning STEM Students – Exploring the impact of digital literacy on equity and success in online STEM programs.
3. The Role of Online Learning Technologies in Supporting Transition – Examining how adaptive and AI-assisted tools can enhance engagement and support STEM learners.

Environmental Science Learning Projects

4. Sustainability Competencies in the Curriculum – Mapping how Environmental Science units embed sustainability and SDG-related competencies, and how students perceive their relevance to real-world careers.
5. Information and Digital Literacy in Environmental Science – Investigating how students develop scientific literacy and the barriers faced by mature-age and school-leaver cohorts.

Tackling some of the major world environmental challenges such as food security, pollution, climate change and conserving threatened species.

Environmental Science

Discipline contact Susan Wilson: **swilso24@une.edu.au**

Soil Governance and Soil Information for Sustainable Land Management

Supervisor:

A/Prof Lisa Lobry de Bruyn: llobryde@une.edu.au

In order for farmers to maintain or improve natural capital through their management they need to access and use good quality, local information, including identification of soil types and their soil health status (here using available soil testing as a proxy). Tracking of soil health status, at the local level, largely falls to farmers. Despite recurrent language, in policy and other documents, suggesting farmers' monitoring of soil health is necessary to guide decision-making and land management practices, the reality of their practice, is relatively unknown.

It appears that we have assumed what motivates farmers to monitor natural capital or soil test but have not asked them. A research project would work with landholders undertaking natural capital assessment, and examine what they do with the data they collect and how it influences their land management decisions.

Skills: Analysing surveys, undertaking a qualitative analysis and follow-up interviews. Human Research Ethics application required.

Pollution Science Research Group

Supervisors:

Dr Susan Wilson: swilso24@une.edu.au
Dr Matt Tighe: mtighe2@une.edu.au
une.edu.au/pollutionscience

Pollution has been prioritised in the United Nations Environment Program as one of the main threats to our planet. Environmental pollution results in lost productivity and hazards to humans and the environment. In the New England area, we have over 3000 contaminated derelict mine sites dispersing metal pollutants to the wider environment. Water can't be used for drinking in many areas of Australia because of contamination with persistent PFAS "forever" chemicals". In agricultural areas pesticides can affect ecosystem service organisms and food security, and microplastics are turning up everywhere. These are just some of the issues our group is working on. Our research informs how pollutants can be measured, how pollutants move and behave in the environment to develop guidelines and regulation, how pollution can be remediated, and how we can prevent pollution in the first place.

If a student has an interest in a particular area this can be discussed but alternatively, the project areas in which we are working are described below:

- Biogeochemical cycling of mining derived pollutants in the environment
  – How does climate change influence risk from pollutants in ecosystems: wildfires, drought and floods.
- Rehabilitation strategies at mine sites: managing leaching, phytoremediation, plant-based management to remove risks.
- Solar farms and pollution. Is this a concern?
  – Towards a circular economy – reusing our wastes - municipal waste composts, biochars, solar panels – researching the constraints and benefits to safe reuse
- Fate, persistence and effects of pesticides
- Microplastics - where do they go and what do they effect? Current research projects are based in Christmas Island and Sri Lanka
- Archaeological contamination and the timeline of bioavailability
- Contaminant monitoring and analysis
- Bioavailability and risk – PAHs and other organic pollutants
- Remediation strategies for contaminated soils

Research projects:

1. **Rehabilitation of Sb and As contamination in the Hillgrove Mine**
   In this field and lab-based project you will examine remedial options for contaminated soil at the Hillgrove Mine including phytoremediation options.
2. **Raging fires, wild storms: Metalloid contamination in fire impacted landscapes**
   In this field and lab-based project you will examine how metalloid contaminants move and behave in fire effected soil . Do they become more or less mobile? Do they volatilize.? What are the drivers?
3. **Microplastics in soils**
   A range of projects exist in this area. The microplastic load to terrestrial systems is significant yet almost nothing is understood about the consequences for soils, for the organisms that live in it or for us. We are considering microplastic movement in soils, influence on soil water dynamics, uptake in plants, as well as ecotoxicity to terrestrial organisms. We have a new project starting on Christmas Island for 2026.

4. **Microplastics in NSW estuaries**
This project will be based in estuary systems of northern NSW and will explore inputs, type and load of microplastics detected through longitudinal study and extend this to impacts on estuary oyster fisheries.

5. **Reusing organic wastes for beneficial outcomes in soils as part of a circular economy**
This project, undertaken with an industry partner, will examine options for reusing organic wastes as soil amendments. The student will characterise the wastes as fit for purpose and examine options for soil application (rates/ methods) for optimal soil improvement and plant production. CRC Future Food Systems scholarships may be available.

6. **Can plants be used to clean up contaminated soil?**
The role of Australian native plants for soil rehabilitation. In this trial the student will grow a range of Australia native plants in mine site contaminated soils to assess efficacy for soil remediation and rehabilitation.

7. **Is our sushi harming us?**
The role of seaweed in foodchain exposure to metals and metalloids. Seaweed and algae can accumulate high contaminant concentrations depending on the quality of the growth medium. This project will examine metal concentrations in a range of different seaweed species, understand the contaminant concentrations, the bioavailability and risk for foodchain transfer.

8. **Predicting antimony and arsenic movement across catchments in a changing climate world**
Armidale sits in a Renewable Energy Zone. Many new renewables projects are approved or in the making, in particular extensive solar farms. In this project the student will examine soils beneath solar panels and assess changes in soil quality, including trace elements, carbon, nutrients and biodiversity. Almost no work is available on this topic which hinders our knowledge of any adverse or beneficial effects for informed environmental assessment.

9. **The uptake of metalloids by homegrown vegetables**
In this trial the student will grow a range of important vegetables in metalloid contaminated soils and assess the risk for foodchain accumulation and exposed populations.

10. **Domestic water filters and metal contamination**
Thousands of domestic water filters are used in homes across Australia. However, little is known about efficacy for different water sources and contaminant breakthrough, nor the loading of metals on the filter media which are disposed to landfill. In this project the student will collect water filters and test metal breakthrough for different water sources to gather the data to support safe water supply and filter disposal.

11. **Trace element contaminants in household items**
Exposure assessment usually assumes negligible contaminant exposures from many items people use daily. This project will use rapid elemental analysis techniques to screen a range of household items and consumables for trace element signatures to assess potential under-evaluation of these sources.

12. **Microplastics for 'biodegradable' sources**
Many plastic components of everyday life have been rebadged as 'biodegradable'. This project will examine the degradation of such products in the soil environment via waste and composting and compare with standards of degradatio.

Terrestrial Carbon Research Group

Supervisors:

Prof Brian Wilson: brian.wilson@une.edu.au
Dr Ivanah Oliver: ioliver4@une.edu.au
Visit our webpage

1. Impact of "ecosystem engineering" by seabird colonies on soil physical properties on offshore islands of NSW

The offshore islands of NSW are a unique environment with distinctive ecological processes operating. Seabirds, particularly shearwaters, are burrowing birds that displace large quantities of soil on these islands as part of their annual breeding cycle. This has the effect of "ecologically engineering" the landscape on a regular basis. This project will investigate the quantities of soil displaced annually and the effect of this on soil carbon, physical, chemical and biological properties, nutrient cycling and interactions with vegetation to inform NPWS regarding ongoing management of the island ecosystem.

Collaborators: NSW Department of Climate Change, Energy, the Environment and Water, NSW NPWS

Location: Broughton Island Group, NSW

2. The nature and function of soils in the Australian Alps (Kosciuszko National Park) and their vulnerability to climate change

The Australian Alps represent an environment that is unique on the Australian continent and the region contains an assemblage of soil types that is unique on the Australian continent. Although the above-ground ecosystems of the Australian Alps have received considerable scientific attention, research relating to the nature of their soils has been much more limited. Soils are the foundation of all terrestrial ecosystems and the soils of the Alpine region are uniquely high in organic matter and biota by comparison with the remainder of the continent. A fuller understanding of the nature, role and vulnerability of soils in these ecosystems is required to inform effective management strategies.

Working with the Terrestrial Carbon Research Group in this unique environment along with a range of research partners including State Government, and National Parks and Wildlife Service, you will join an established team working on a long-term project in Kosciuszko National Park to evaluate the nature and functions of soils and to assess their vulnerability to climate change. The work is varied and can accommodate all soil science disciplines including soil carbon, soil condition and health, nutrient cycling, soil water relationships, soil biology etc. The work will inform the current and future management of this iconic environment.

Collaborators: NSW Department of Climate Change, Energy, the Environment and Water, NSW NPWS, NSW LLS

Location: Kosciuszko National Park, NSW

3. Native vegetation for carbon storage

Soil and biomass carbon are now recognised internationally as a key component of our response to climate change. Methods to store additional carbon are therefore being sought. Native grasses and shrubs offer unique opportunities in the Australian landscape to store additional carbon in biomass and soils within a diverse managed landscapes. This project seeks to quantify the potential of these methods for carbon storage and sustained production.

Collaborators: NSW Department of Climate Change, Energy, the Environment and Water, NSW LLS

Location: Northwest NSW

4. Dynamics of pyrogenic carbon in soils subject to fire

Soils of many environments are subject to the Influence of fire but the Impact on carbon dynamics and storage remain unclear. This project aims to Investigate the impacts of fire on soils, how carbon (charcoal) Is added to, and stored, in the soil. The work has considerable significance to the behaviour and management of soils, particularly in protected environments, and how these impacts might relate to climate change Mitigation.

Collaborators: NSW Department of Climate Change, Energy, the Environment and Water, NSW NPWS, NSW LLS

Location: Northwest NSW

5. Vulnerability of alpine, sub-alpine and montane forest soils in NSW to climate change

Ecosystems of the alpine and sub-alpine zones of NSW are the most vulnerable to projected climate change with progressive warming and drying of these environments leading to likely significant change in these systems. Although much work has been conducted to examine and model the effects of climate change on above-ground ecosystems, limited work has considered the effect of climate change on the soil resource. This project will utilise a range of alpine, sub-alpine and montane forest sites to examine the vulnerability of soils and particularly the soil organic matter cycle, to climate change. The impacts of climate change on the nature and extent of these soils and their character will be assessed to guide planning and management of these ecosystems into the future.

Collaborators: NSW NPWS

Location: New England National Park, Kosciuszko National Park, Mt Kaputar National Park, NSW

Anthrozoology and Indigenous Knowledge Lab

Supervisor:
Dr Brooke Kennedy: bkenne27@une.edu.au

TThe Anthrozoology and Indigenous Knowledge Lab uses a multidisciplinary approach to research, where animal, human and environmental factors are collectively observed to gain a whole picture. Our One Health approach ensures all stakeholders are involved from the beginning and that we are addressing root causes rather than symptoms.

Anthrozoology centres around animal-human interactions. Our lab focusses on owned dogs and cats, particularly the ecology of those that are free roaming and their impacts on wildlife.

We are working in Urban areas; Greater Sydney (Blue Mountains, Campbelltown and Northern Beaches), Northern NSW (Tweed and Byron), and remote areas; Central NSW (Walgett and Brewarrina) and the remote Indigenous community of the Tiwi Islands in the Northern Territory.

Indigenous Knowledge is built in everything the lab does. Not only to make sure Indigenous stakeholders are involved, but to ensure we are utilising both Western and Indigenous sciences to improve how we plan, act, monitor and revise our research.

Potential Project Areas:

- Pet ownership
- Dog or cat (domestic)
  - Ecology
  - Roaming behaviours
  - Impacts on wildlife
- Indigenous Communities
  - social science
  - Indigenous Knowledge i.e. cultural burning

Or any combinations of the above. If you are interested in researching in any of these topics, or have an idea of our own, please get in touch.

UNE Earth Observation Laboratory

Supervisor:
A/Prof Bradley John Evans
bradley.evans@une.edu.au
eolab.au/

At the UNE Earth Observation Laboratory, we explore our planet from the ground, from drones and aircraft, and all the way from space. Using state-of-the-art sensors, we capture information about the condition, composition, and rates of change of ecosystems, from individual plants and animals to rivers, wetlands, and global landscapes. These observations help us estimate environmental state, flux, and change over time, delivering critical insights for biodiversity, agriculture, and climate resilience.

We combine fieldwork, airborne campaigns, and global satellite data to answer pressing environmental questions. Our research informs conservation, land management, and food production while ensuring the health of rivers, lakes, and wetlands. Through projects such as CSIRO's AquaWatch Australia Mission, we are advancing real-time water quality monitoring for inland and coastal systems, supporting community, industry, and government decision-making across Australia and beyond.

Research Strengths

- We specialise in collaborative research across:
- Remote Sensing and Earth Observation
- Water Quality including CSIRO AquaWatch projects
- Precision Agriculture and Crop Physiology
- Environmental Informatics

Applications include:

- Vegetation species mapping and change detection
- Agricultural environmental monitoring and assessment
- Land use change analysis and prediction modelling
- Landscape characterisation
- Airborne hyperspectral and terrestrial LiDAR-based 3D image analysis
- Hyperspectral imaging spectroscopy
- Crop and native vegetation physiology
- Environmental modelling

If you are passionate about the environment, wildlife, water, and the synergy between ecosystems and agriculture and want to make a real-world impact with cutting-edge imagery and data, then Earth Observation at UNE is the place for your Honours journey.

Spatial Science Research Lab

Supervisor:
Dr Priyakant Sinha: psinha2@une.edu.au

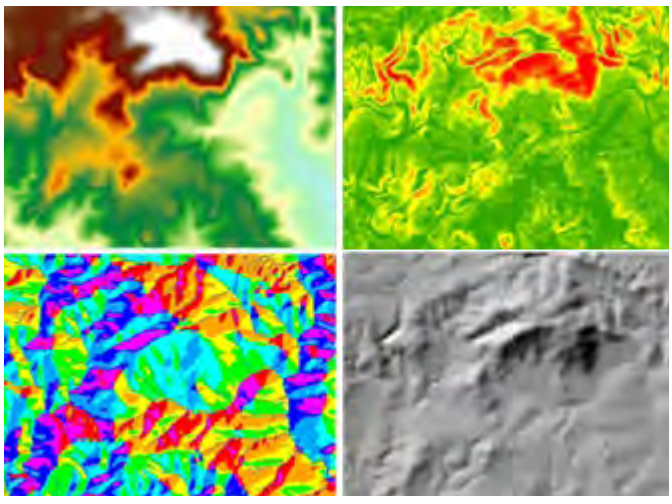
My Lab focuses on Spatial Science applications in solving real-world problems and support decision making, with broad theoretical skills in GIS and spatial statistics and practical skills for analysing, visualising and synthesising spatial data. Applications for GIS are diverse, and it is commonly and widely used tool in climate change, agriculture, ecology, wildlife management, geology, environmental planning, resource modelling, urban and regional planning, archaeology, and any other applications with spatial component.

Software: ArcGIS Pro, ArcGIS Online and freely available QGIS.

Data: Govt Portal Services and other online resources, project-based data.

Potential project areas:

- Spatial modelling: species habitat and biodiversity conservations, future site developments and planning
- Spatial Statistics including Hotspots and Cluster analysis for pattern detection
- Landuse change and vegetation condition
- Agriculture system management, crop health monitoring and yield forecast
- Climate change modelling
- Forest fire management
- Environmental monitoring and impact assessment
- Hydrological modelling Drought and Flood monitoring and impacts
- Site suitability modelling
- Any other topic of interests.



Aquatic Ecology and Restoration Laboratory

Aquatic Ecology and Restoration Laboratory Aquatic ecosystems are complex, beautiful, fascinating and absolutely necessary for human survival. Managing these systems effectively for long term ecosystem health requires an understanding of the biotic and abiotic processes driving biodiversity and ecosystem function in them. The Aquatic Ecology Lab at UNE comprises eight researchers who specialise in aquatic plants, invertebrates, fish and biogeochemistry:

- Dr Sarah Mika (biogeochemistry and basal resources in aquatic food webs)
- Dr Ivor Growns (invertebrate ecology)
- Dr Adrienne Burns (aquatic botany and algal dynamics)
- Dr Rob Rolls (fish ecology)
- Dr Leah McIntosh (fish ecology and basal resources)
- Dr Manisha Shakaya (aquatic ecotoxicology)
- Dr David Mackay (plant ecology)
- Dr Munique Reid (hydrogeomorphology)

The lab is offering several HDR projects aligned with our major research projects:

1. Vegetation community dynamics in the Gwydir Wetlands

The Gwydir Wetlands are a biodiverse, highly fertile inland floodplain wetland system located west of Moree in northern central NSW. The wetlands are dynamic ecosystems driven by inundation and support substantial areas of floodplain and wetland vegetation communities that are floristically and functionally diverse and poorly conserved in NSW, including; water couch - marsh - grasslands. Maintaining and improving the condition of vegetation communities in these systems is an ongoing aim of the Commonwealth Environmental Water Office through the provision of water for the environment (e-water).

- Vegetation condition can be used to assess the effectiveness of a management activity, such as e-water delivery, by comparing vegetation against reference sites or 'benchmarks'. While some areas of the dominant water couch – marsh – grassland wetland community are inundated frequently, other areas remain dry for long periods. This project will compare existing benchmark data against seven years of collected data to gain a better understanding of the vegetation condition response to differing watering regimes over time. Findings can assist land and water managers in making future decisions surrounding implementation of future watering regimes in this floodplain system.

Aquatic Ecology and Restoration

2. Aquatic food webs in the northern Murray Darling Basin

This project is focused on understanding how long- and short-term hydrological regimes, including management with environmental water, influences energy transfer through aquatic food webs. This includes understanding links between aquatic food web structure and function, and plant, soil microbe, and terrestrial communities.

- It is well understood that food resources of poor quality inhibit growth in consumers, but is there a link between a consumer's diet quality and how valuable they then become as a resource? Following on from current labbased mesocosm trials, this project would comprise a field experiment to investigate the effects of diets of varying quality on zooplankton growth, reproduction and value as a food resource for higher order consumers, including investigating whether there is a link between diet quality and energy density of consumer biomass.
- Long-term hydrological regimes (including drying cycles) influence the structure and function of different types of habitat patches in wetlands. In areas that remain permanently or near permanently saturated, anoxic soil conditions promote the formation of highly organic soils or peats, that promote biogenic production of methane which can act as a food resource for aquatic consumers. Patches in wetlands naturally change over time, and the distribution of peaty soils and their associated plant communities change in response to changes in hydrology, such as through patterns of environmental watering. Can we determine recent changes by investigating the soil organic matter composition of wetland soils? This project would involve some fun field work plus laboratory work.

3. Strengthening the use of non-lethal methods to facilitate the inclusion of fish in stable isotope studies of food webs

Fish are an important component of aquatic food webs as they often represent the highest trophic levels. Stable isotopes are widely used to understand food web structure. However, standard methods for the collection of samples from fish require the animal to be killed. In river systems with naturally small populations that are frequently under stress, invasive or lethal sample collection methods are undesirable. The use of non-lethal sample collection methods will allow us to include fish in food web studies with minimal impact to the ecosystem.

- This project will build upon existing research that establishes the isotopic relationship between fish muscle tissue and fin tissue. This research will focus on species present in the northern Murray-Darling Basin and will likely include field work to collect tissue samples, and lab work to prepare samples for isotopic analysis.

4. Developing biological indicators of estuary health using invertebrates

Estuaries and estuarine lagoons are under significant anthropogenic stress. Many indicators of estuary or lagoon health use the physical and chemical indicators of water quality, or the biological indicator of phytoplankton biomass. However, these physical and chemical indicators change rapidly and do not directly monitor impacts on estuarine biota. Two projects will focus on developing biological indicators.

- Benthic macroinvertebrates are exposed to sediment conditions and integrate water quality impacts over longer time periods than would be measured in regular water sampling. This project will examine benthic macroinvertebrate communities in estuaries and estuarine lagoons covering a range of anthropogenic disturbance to determine whether they can be used to develop a reliable biological indicator of estuarine health. This project involves fieldwork and labwork.
- Estuarine zooplankton fluctuate in response to water quality and phytoplankton abundance. This project will examine estuarine zooplankton communities in estuaries and estuarine lagoons covering a range of anthropogenic disturbance and salinity gradients to determine whether they can be used to develop a reliable biological indicator of estuarine health. This project involves fieldwork and labwork.

Nutrient colimitation in aquatic ecosystems

Carbon, nitrogen and phosphorus are the three key macronutrients in aquatic ecosystems and together they drive aquatic primary productivity. Water managers have national and state guidelines for nitrogen and phosphorus, above which concentrations are predicted to negatively impact the health of aquatic ecosystems, often in the form of harmful algal blooms. However, many of our freshwater and estuarine systems regularly exceed these concentrations without suffering from harmful algal blooms.

- A project will examine the concept of nutrient colimitation as a means of understanding why high individual nutrient concentrations may not be leading to excessive aquatic primary production. The project will involve a field experiment using nutrient-amended diffusing substrates to determine the limiting macronutrients in northern NSW catchments, and whether these relationships change temporally.
- A second project will investigate the threshold concentrations of the macronutrients required to trigger excessive algal growth, and whether these thresholds change with increasing water temperatures. This project will involve fieldwork and a lab experiment using nutrient-amended diffusing substrates to identify critical nutrient concentrations in northern NSW catchments.

Making the most of genomic technologies to tackle applied and blue-sky questions for agriculture, evolution and conservation.

Population genomics

Discipline contact Rose Andrew: **rose.andrew@une.edu.au**

Molecular Ecology Laboratory

Supervisor:
Rose Andrew: rose.andrew@une.edu.au
roseandrewlab.com

In the Molecular Ecology Lab, we undertake genome-focused research in addition to ecological and conservation genetics. For these projects, a strong background in genetics, bioinformatics or computational biology is recommended.

Examples of potential projects:

- **Modeling of *Eucalyptus* diversification using genomic data:** We have a wealth of sequence data that is ripe for demographic modelling of speciation and adaptation. *On or off-campus.*
- **Speciation genomics in native plants:** Building on recent taxonomy projects, we can now study the process of genome divergence in native plant genera such as *Eucalyptus, Homoranthus* (Myrtaceae), *Phebalium, Cyanothamnus/Boronia* (Rutaceae), *Chrysocephalum* and *Xerochrysum* (Asteraceae). Disentangling the roles of natural selection, hybridisation and introgression can help us to understand speciation, the fundamental process that produces biodiversity. *On or off-campus.*
- **Genome evolution in Rutaceae:** With new reference genomes built using the latest long-read sequencing (also called third-generation sequencing), we can investigate the divergence of genome structure at long and short timescales, and how this influences adaptation and speciation. *On or off-campus.*

Understanding the prehistoric life forms (or fossils) preserved in rocks and ancient sediments and the evolution of life on Earth.

Palaeoscience

Discipline contact Phil Bell: **pbell23@une.edu.au** or supervisor

Betts Lab and TRILO Lab @UNE (Timing, Record and Inception of Life Origins)

Supervisors:

Prof John Paterson: jpater20@une.edu.au
Dr James Holmes: jholme28@une.edu.au
Dr Marissa Betts: marissa.betts@une.edu.au

The Betts Lab and TRILO Lab focus on the early evolution of animals, particularly Cambrian (ca. 539 to 485 million-year-old) marine faunas of Gondwana, and using these important fossils to answer major questions relating to their evolutionary history, biogeography and palaeoecology during the biggest animal radiation in the history of life – the Cambrian 'Explosion'. Research programs also include the use of fossils in the relative dating and correlation of strata around the globe in order to refine the geologic timescale, as well as understanding the mechanisms behind exceptional fossil preservation (e.g. soft tissues). Projects can be tailored to accommodate more geological or palaeobiological interests.

1. **Cambrian trilobites and other shelly fossils from allochthonous limestone blocks in the Murrawong Creek Formation, Gamilaroi Terrane, southern New England Orogen**
   Fossiliferous limestone clasts within the Murrawong Creek Formation appear to have been derived from a carbonate platform fringing an island arc, outboard of the East Gondwanan coastline during Cambrian times. The shelly fossils from these clasts, including a diverse trilobite assemblage, are rather unusual and, in some cases, endemic, likely due to this exotic palaeogeography. This project will document the trilobites and other shelly fossils from a locality near Tamworth, NSW, with the aim of better understanding the diversity and biogeographic signature of this distinctive fauna.

   Prof John Paterson: jpater20@une.edu.au
   Dr Marissa Betts: marissa.betts@une.edu.au

2. **Taphonomy and palaeoecology of a deep-water early Cambrian trilobite assemblage from the Elder-Chace Range area of the Flinders Ranges, South Australia**
   The Mernmerna Formation is a widespread stratigraphic unit in the Flinders Ranges and hosts a huge diversity of early Cambrian shelly fossils from a range of palaeoenvironments. In the Elder-Chace Range area, the Mernmerna Formation is particularly thick and contains a deep-water trilobite assemblage in the upper part of the unit. This project will document the diversity, taphonomy and palaeoecology of this trilobite assemblage and its implications regarding specific environmental conditions (e.g. water depth and light levels) at the time of deposition.

   Prof John Paterson: jpater20@une.edu.au
   Dr Marissa Betts: marissa.betts@une.edu.au

3. **Trilobites and other shelly fossils from the lower Cambrian Aroona Creek and Wirrealpa limestones, Flinders Ranges, South Australia**
   The Aroona Creek and Wirrealpa limestones in the Arrowie Basin of South Australia contain fossil assemblages that are important for stratigraphic correlation with other Australian sedimentary basins and may prove critical for defining important boundaries of the Cambrian timescale. This project will document trilobites and 'small shelly fossils' from these formations at various sites in the Flinders Ranges, South Australia to provide a better temporal constraint on this unit and resolve taxonomic issues surrounding key index fossils.

   John Paterson: jpater20@une.edu.au
   Marissa Betts: marissa.betts@une.edu.au
   James Holmes: jholme28@une.edu.au

4. **Cambro-Ordovician trilobites from Mt Arrowsmith, western New South Wales**
   Early Palaeozoic strata in western New South Wales are highly fossiliferous, yet poorly documented. The Cambrian and Early Ordovician successions at Mt Arrowsmith are no exception. This project will focus on the diverse trilobite assemblages from this area, including the description of new species, and will place these important faunas in biostratigraphic and biogeographic contexts. (This project will be co-supervised by Dr Patrick Smith, Australian Museum, Sydney).

   Prof John Paterson: jpater20@une.edu.au

5. **Morphological trends in Cambrian trilobites**
Trilobites are one of the most diverse and morphologically complex animal groups that lived during the Cambrian. For decades, trilobite experts have noted various morphological trends in their exoskeletons over time, such as reducing the number of thoracic segments and an increase in the size of the pygidium. However, very few studies have tried to quantify these supposed evolutionary patterns. This project aims to test these ideas and assess whether certain biological "rules" (e.g. Cope's Rule and Williston's Law) apply to the macroevolutionary trends in trilobites. The project will utilise a previously generated morphological and phylogenetic dataset of Cambrian trilobites and apply a combination of phylogenetic comparative and time-series analyses (e.g., macroevolutionary model fitting, ancestral state estimation, and autoregressive linear models). The ideal applicant may have some experience with programming languages but, at minimum, should be interested in learning them and their application to analytical palaeobiology. (This project will be co-supervised by Dr James Holmes).

Prof John Paterson: jpater20@une.edu.au
Dr James Holmes: jholme28@une.edu.au

6. **Early Cambrian chronostratigraphy of South Australia**
This interdisciplinary project will primarily use small shelly fossils to determine the ages of key lower Cambrian successions in the Flinders Ranges, South Australia. Build your palaeontological knowledge of early Cambrian fossil fauna and their biostratigraphic applications. Complement this work with stable isotope chemostratigraphy and lithologic data. This is a great opportunity to contribute to building the geological timescale, and regionally and globally correlate rocks from South Australia during the Cambrian Explosion of life. Skills acquired via this project are widely used in both academia and industry.

Dr Marissa Betts: marissa.betts@une.edu.au
Prof John Paterson: jpater20@une.edu.au
Dr James Holmes: jholme28@une.edu.au

7. **Reconstructing the skeletons of some of the earliest armoured animals**
Use cutting-edge 3D scanning technologies to reconstruct the oldest complex skeletons in the fossil record and resolve the functional morphology, palaeoecology and evolutionary relationships of the enigmatic animals who made them.

Dr Marissa Betts: marissa.betts@une.edu.au
Prof John Paterson: jpater20@une.edu.au

8. **Carbonate microfacies and early Cambrian palaeoenvironmental reconstructions**
This project aims to reconstruct the kinds of ancient marine environments in which early animals evolved and diversified. This includes the world's oldest animal-built reefs and the palaeoenvironments that flanked them. This work is key for understanding the interplay between ancient marine environments and the evolution of early animals. This multi-faceted project will also incorporate investigation of how fossils are preserved in carbonates, and the effects preservation style has on fossil recovery and ecosystem reconstructions.

Dr Marissa Betts: marissa.betts@une.edu.au
Prof John Paterson: jpater20@une.edu.au

The science of animals living on land, in freshwater or in the sea.

Zoology

Discipline contact Tommy Leung: **tleung6@une.edu.au**

Entomology

Supervisor:

Dr Anna Probert: anna.probert@une.edu.au

I am an entomologist and invasion scientist with a special interest in social insects. I am part of a large international collaborative effort understanding economic impacts of nonnative species and a member of the IUCN's EICAT authority, which is responsible for assessing the global impacts of non-native taxa to native biodiversity. I aim to create inclusive and equitable research opportunities so projects can be developed around whether you want to conduct research with a larger emphasis on field-, lab-, or desk-based activities.

Opportunities where potential research projects could be developed are outlined below; however, I welcome students to identify their own research interests and come and discuss project ideas.

Areas of research for potential students include:

- The legacy effects of fipronil to invertebrate communities on Christmas Island. This project comes with the potential opportunity for field work in T2. Opportunities to work on the project in the lab also exist
- Fire ant management and biosecurity
- How do ant communities (or other insect communities) respond to wildfire and other environmental disturbances
- The trophic ecology of ants in mallee ecosystems
- Paper wasp diet and behavioural ecology
- Invasive species and their parasites (desktop project, in collaboration with Tommy Leung)
- The impacts (ecological, social or economic) of pest insects at local, regional, national and/or international scales. These can include impacts to native biodiversity, cultural activities and ways of life, human health and wellbeing, and economic activities (desktop project)

Behavioural Ecophysiology

Supervisor:

Dr Zenon Czenze: zczenze@une.edu.au

My Lab focus on behavioural/physiological ecology of mammals and birds. Broadly, we are interested in how aspects of a species natural history and ecology (i.e., roost preferences, drinking behaviour, and diet) influence thermoregulation and quantifying this using physiology. Specifically, we are interested whole-organism thermal physiology and energy budgets of small endotherms. Research Questions Our research is divided into three themes. Our projects mainly involve bats, birds, gliders, and other small terrestrial marsupials, and take place in the field or in the lab. We collaborate with Local Land Services, Indigenous groups, Government, Industry, and other members of ERS. There are potential projects available in each theme so, if you're interested, contact Zenon to discuss opportunities.

Impacts of heatwaves:

Radio tracking in the field and open-flow respirometry in the lab to record the physiological responses of birds and bats to high temperatures and heatwaves.

- Evaporative cooling capacity of birds and mammals
- Foraging and thermal biology of free-ranging mammals, birds, and reptiles
- Hyperthermic torpor in native mammals and marsupials
- Thermal roost preferences in captive and free-ranging mammals

Bats and Industry (Agriculture, Silviculture):

Acoustic identification, radio tracking, and molecular diet analysis of insectivorous bats and birds in agroecosystems.

- Insectivorous bat diversity diet and pest-control in agriculture
- Insectivorous bat conservation in degraded ecosystems

Climate change predictions:

Biophysical models and dynamic energy budgets in R using NicheMapR to identify vulnerable populations and mitigate the effects of climate change.

- Modelling the direct effects of climate change on mammals and birds
- Designing artificial roosts to prevent overheating

Animal Behaviour and Ecology Lab

Supervisor:

Prof Paul McDonald: paul.mcdonald@une.edu.au

Some potential projects outlined below, but happy to discuss different ideas based on student's interests and desired skillsets. I am interested in supervising projects that cover a range of topics from the lab to fieldwork, and these can include the full spectrum of either focusing on one specific species or group, through to projects that more broadly cover biodiversity as a whole.

Potential project areas:

- **Woodland birds:** options exist for conservation-based projects looking at interactions between Noisy Miners and threatened species (e.g., Regent Honeyeater, small birds).
- **Bioacoustics:** examining a range of topics from identifying presence/absence of key species in an area, through to behavioural budgets, or utilising acoustic recordings to monitor site biodiversity broadly.
- **Animal behaviour in a broad context:** projects seeking to understand why species behave the way that they do, when they do, particularly those focused on acoustic signalling.

Example Projects:

1. **What factors limit reproductive success of birds of prey (raptors) on the New England Tablelands?** Our region is home to three threatened species, and information on the importance of factors such as diet, weather or competition on success is currently lacking.
2. **When should we manage miners?** Despite being native species, Noisy Miners have a negative impact on biodiversity in areas that they occupy. Understanding the most effective way/s to limit miner populations is a key area of management concern. This could be investigated through field observation and also some lab-based work examining molecular data.
3. **Can passive acoustic monitoring (PAM) generate the same information as on-ground, visual surveys?** Whilst setting up an automated recording unit is easier than finding a skilled expert to sample vertebrates at a site of interest, considerable uncertainty remains over exactly how acoustic data can be reliably used. This project would examine these relationships by focusing on local habitats to determine if newly developed acoustic techniques can offer a reliable alternative to traditional surveys for at least some taxa.

Laboratory of Applied Zoology and Ecological Restoration (LAZER)

Supervisor:

A/Prof Deb Bower: dbower3@une.edu.au

The research completed by the Laboratory of Applied Zoology and Ecological Restoration (LAZER) strives to understand and mitigate threats to wildlife through experimental and empirical ecology, and community engagement. Our research helps manage land and water for biodiversity and enable ecosystem function in a state of continuing environmental change. Our study systems occur within the New England Tablelands, Murray-Darling Basin and Tropical Australia and we focus on vertebrates, particularly reptiles and amphibians, as our models.

Available research topics:

1. **Freshwater turtle behaviour**
   Explore the cognition, personality, or sociality of freshwater turtles to learn more about their preferences and needs (Lab or field).
2. **Reproductive methods for freshwater turtles**
   Explore turtle sperm and help improve conservation methods in artificial reproduction (Lab-based).
3. **Developing methods for turtle conservation**
   Explore the effect of inundation on developing turtle embryos to understand climate-related threats to turtle populations.

Come along to a lab meeting, volunteer with our Masters and Doctoral students, or make a meeting with Deb to learn more about the research in our lab. We often work in partnership with NSW Government Local Land Services and Department of Planning and Environment, or Qld Government Department of Environment and Science, so opportunities for inter-agency collaboration are high.

Follow us on @lazer_une on instagram for the latest fun.

Morphological diversity and evolution

Supervisor:

Dr James Holmes: jholme28@une.edu.au

Are you interested in how animals evolved across the history of life? My research focuses on morphological diversity and variation in fossil animals at different scales; from studies of growth and development in individual fossil species, to macroevolutionary questions about the rise and fall of morphological diversity across evolutionary radiations and mass extinction events in deep time. I mainly use trilobites—extinct marine arthropods similar to modern crustaceans—as a model group in my research, but I am also interested in applying similar methods to extant animals like birds.

Projects with me can be tailored to your specific interests and situation. These can involve doing remote fieldwork to collect fossils for analysis back in our labs at UNE. Alternatively, you can do a more theoretical project that can be done entirely on your computer—or anything in between! While I prefer students to be on campus for at least part of their project, I can also facilitate more "online" options if you wish.

Potential projects:

1. **Cambrian shape-shifting arthropods**. The Cambrian Period was when many of the first animal groups appeared on Earth, including the first arthropods (the group containing crustaceans, spiders and scorpions). Artiopodans are an ancient group of fossil arthropods that includes trilobites and their soft-bodied relatives. In this project, you would explore how morphological diversity ("disparity") evolved across this group by measuring and comparing different artiopodan species, and examining how disparity evolved through time and across phylogenetic trees.
2. **High-resolution evolution**. Over 150 years since Darwin published the Origin of Species, the origin of species is still much discussed, and direct evidence of how speciation occurs is rare in the fossil record. In this project, you would use geometric morphometrics (statistical shape analysis) to quantify how the morphology of fossil species changes through time across high-resolution Cambrian rock sections, to reveal patterns of speciation in some of the earliest animals (e.g. brachiopods, trilobites).
3. **Getting to the "core" of the Cambrian Period in northern Australia**. This project will focus on extracting and describing some of Earth's oldest fossils from drill cores from QLD/NT. You will learn how to: (a) collect drill core samples (in Mt Isa, Brisbane or Canberra); (b) extract fossils from these using different methods; (c) image and describe fossils; and (d) place these in the context of the geological timescale.
4. **Other projects. Interested in more traditional palaeontology?** I have a range of possible projects involving fossil collection, preparation, photography and description. These include projects focused on biological questions (e.g. exploring how fossil animals grew) and geological applications (e.g. using the biostratigraphic distributions of fossils to tell geological time).

Parasitology

Supervisor:

Dr Tommy Leung: tleung6@une.edu.au

Parasitism is by far the most common way of life on this planet - all types of organisms are infected with parasites of some sort at some stage of their lives, and parasitism has independently evolved multiple times in many different lineages of life. Parasites also play key (but hidden) roles in shaping the ecology and evolution of their hosts as well as how they interact with their environment.

The research projects we conduct in this lab seek to understand how parasites live and what effects they have on their hosts. If you have a research/project idea about evolutionary ecology of parasitism that you are interested in exploring, feel free to contact me.

Potential projects:

1. **Parasite fauna of commercial and recreational fish species:** Australia is a continent surrounded by coastlines and the many fish species which are found in its waters form an important part of this country's ecology, culture, and economy. Like other wild animals, many of these fish are host to a wide variety of parasites, some of which are potential pest or zoonotic species which pose a concern to fisheries or public health. Additionally, the composition of parasite communities can also provide insights into the ecology of their fish host. If you are interested in a project on fish parasites, you can contact me and we can discuss potential fish species which can be the focus of such a project.
2. **Parasite fauna of freshwater invertebrates:** Freshwater invertebrates are host to a wide range of parasites, some of which have complex life cycles that involve multiple different host animals, including larger vertebrates such as birds as the definitive hosts. This project will be focused on documenting the diversity and prevalence of parasites in invertebrates such as molluscs and arthropods in the freshwater habitats around the New England region.

Koala Reproductive Health

Supervisor:

Dr Amy Tait: amy.tait@une.edu.au and
Dr Heidi Kolkert: hkolker2@une.edu.au

Aoin UNE's groundbreaking koala conservation initiative! We're establishing a comprehensive reproductive health research program for our regional koala populations, combining cutting-edge reproductive technologies with practical conservation outcomes.

This multidisciplinary project offers Honours students the opportunity to contribute to:

- Reproductive health assessments and disease surveillance
- Linkage between reproductive health and stress physiology
- Population genetics and genomic sampling for national databases

You'll work alongside leading researchers from UQ and the Australian Museum, and develop skills in wildlife laboratory diagnostics, and conservation biology. Your research will directly inform local koala management strategies and contribute to national conservation efforts.

We're seeking enthusiastic students with backgrounds in animal science, zoology, or biological sciences who are passionate about wildlife conservation and reproductive physiology and ready to make a real difference for this iconic species.

Understanding our planet's geological and prehistoric past and the cataclysmic processes that shaped the earth.

Geoscience

Discipline contact Luke Milan: **lmilan@une.edu.au**

Why do honours in Geology?

There could be many reasons why you might want to do honours, but the commons ones are (1) part of the journey to enable you to go on to do a PhD or (2) to gain significant additional experience before entering the workforce to help land that job. Honours is highly regarded in industry as it shows you can project manage, write and have a mature and higher level of scientific understanding in geology. Honours can give you a competitive edge when going for your first job as you will stand out in comparison to students with undergraduate degrees. Employers constantly tell us that they value honours students highly. Honours in geology will help you stand out - there are significant amounts of jobs in geology for example, If you look on Seek.com.au, at the moment there are over 1000.

Geology Scholarships: There are numerous bodies that offer competitive bursarys for prospective geology honours students to apply every year. Students are UNE are highly competitive and have been very successful in recent years. This can help defray your costs for research, relocation, or enable you to concentrate on your honours instead of working. Some projects come with funding as well.

Contact UNE staff to learn more.

A mafic enclave (in the shape of Australia!) hosted within a granite from the New England region.

Great Serpentinite Belt (multiple projects) ARC funded

Supervisors:

Dr Luke Milan: luke.milan@une.edu.au
Dr Tim Chapman: timothy.chapman@une.edu.au
Dr Nicholas Tailby: ntailby@une.edu.au
Dr Ria Mukherjee: rmukherj@une.edu.au

The Great Serpentinite Belt is a unique belt of interesting rocks that are known as ophiolites. Ophiolites represent rare segments of oceanic crust that have been thrust onto a continent. This ancient ocean is poorly understood, and we would like to know the size, age and tectonic setting of this ancient ocean. These research projects represent a unique chance to work on fragments oceanic crust outcropping on land. The serpentinite belt is also the host to high-pressure fragments of subduction zone complexes such as eclogites, blueschist that can provide a detailed record of subduction and give a broader tectonic history of the region. Little detailed mapping of the Great Serpentinite Belt has been undertaken in recent decades. These rocks also host metal deposits of 'critical metal' interest. We have a variety of projects available to investigate the serpentinite belt, including a focus on the timing and processes that formed the oceanic crust (ophiolite) blocks or high-pressure metamorphism. We can tailor a project to suit you – typical aspects may include field mapping, petrology, rock and mineral geochemistry, geochronology, and isotope geochemistry.

We have numerous project opportunities, and this is part of ongoing research project with The Australian Research Council and Universities of UQ, QUT and Geological Survey of NSW and QLD.

Keywords: Field mapping, petrology, whole rock geochemistry, geochronology, tectonic discrimination, critical metals mineralisation

Late Permian magmatism and super eruptions (multiple projects)

Supervisors:
Dr Nicholas Tailby: ntailby@une.edu.au
Dr Luke Milan: luke.milan@une.edu.au
Dr Tim Chapman: timothy.chapman@une.edu.au

The late Permian period in the New England Orogen experienced a significant spike in magma production. The local region is now host to large tracts of granite plutons and thick sequences of volcanics and calderas. These catastrophic eruptions produced air fall spread as far as central Queensland and Wollongong. Several projects exist in exploring the processes that produced the heightened magma production and super-eruptions. These include mapping out poorly understood volcanics and plutons, establishing the timing, extent, drivers, and linking the volcanics to the batholith and related tin tungsten and “critical metal” deposits. The projects can involve geological mapping and geophysical interpretation, petrography, geochronology, and geochemistry.

Opportunities to work with NSW Geological Survey.

We can tailor a project to you! We have numerous opportunities.

Keywords: Field mapping; geochemistry, petrography, airborne geophysics, geochronology, volcanology, igneous petrology.

Tracking the evolution of a hidden magmatic arc

Supervisors:
Dr Luke Milan: luke.milan@une.edu.au
Dr Tim Chapman: timothy.chapman@une.edu.au
Dr Nicholas Tailby: ntailby@une.edu.au

Does tracking the evolution of an ancient exotic arc over time sound exciting? These projects will refine and re-evaluate the evolution of the Tamworth belt of rocks and related Gamilaroi formation. This belt preserves a diverse suite of strata shedding off volcanic arcs. The preserved lithologies and facies outcropping change over time reflecting the changing tectonic setting. There is controversy over their provenance and traditional methods of studying these rocks in the past have led to confusion. This project will utilise state of the art analytical techniques to refine key periods in the belts history to reveal and resolve the geological processes that have been ascribed to the belt. There are multiple projects available, and they typically involve a multifaceted approach that starts with field mapping, sampling, and a wide variety of laboratory work.

Keywords: Field mapping; geochemistry, petrography, geochronology, volcanology, igneous petrology.

Other projects

Supervisors:
Dr Luke Milan: luke.milan@une.edu.au
Dr Tim Chapman: timothy.chapman@une.edu.au
Dr Nicholas Tailby: ntailby@une.edu.au
Dr Ria Mukherjee: rmukherj@une.edu.au
Dr Ross Jenkins: rjenkins@une.edu.au

We have numerous projects not listed here and can tailor a project to suit. Join in on our ongoing research projects in diverse specialities including field geology, igneous and metamorphic petrology, structural geology, geochemistry, mineralisation, and environmental aspects. Some of these can be industry supported.

Please reach out to the staff to discuss possibilities.

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