THE UNIVERSITY OF MELBOURNE

School of Agriculture, Food and Ecosystem Sciences

Faculty of Science

Agriculture, Food and Ecosystem Sciences Research Prospectus

Contents

About the School

On 1 January 2023, the School of Agriculture and Food and the School of Ecosystem and Forest Sciences merged to form the School of Agriculture, Food and Ecosystem Sciences.

The School brings together a variety of discipline strengths and innovative solutions in ecosystem processes and management, food industries and systems, and agricultural practices and industry.

The School spans four campuses: Parkville, Burnley, Creswick and Dookie, which each have historical ties to specific disciplines. This reach provides a unique opportunity for students and researchers to collaborate on real-world issues and access a wide range of industry partnerships and internships.

The University of Melbourne's Faculty of Science acknowledges the Traditional Owners of the lands on which we work: the Wurundjeri Woi-Wurrung and Bunurong peoples (Burnley, Fishermans Bend, Parkville, Southbank and Werribee campuses), the Yorta Yorta Nation (Dookie and Shepparton campuses), and the Dja Dja Wurrung people (Creswick campus). We pay respect to their Elders, past and present. We also acknowledge and respect that Aboriginal and Torres Strait Islander people are this country's first scientists, with deep and enduring knowledge of the land, waters and skies.

Professor Giovanni Turchini

Head of the School of Agriculture, Food and Ecosystem Sciences

Professor Giovanni Turchini

- Aquaculture
- Omega-3 fatty acids
- Seafood quality and sustainability
- Aquafeed and resources utilisation
- Aquatic animal nutrition and physiology

giovanni.turchini@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/963768-giovanni-turchini

I contribute to aquaculture innovation and development to help meet growing global demand for a sustainable supply of nutritious, safe, healthy, and delicious food.

My interests include animal and human nutrition, aquaculture, food and feed technologies, fatty acid metabolism in cultured aquatic species, climate change adaptation of aquaculture, and sustainability and ethical concerns in fisheries and aquaculture. I am focused on lipid and fatty acid metabolism in cultured aquatic species and resource utilisation in aquaculture.

Lipid and fatty acid metabolism in cultured aquatic species

Health-promoting, long-chain omega-3 fatty acids including eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) are primarily found in seafood. I study the nutritional physiology of fish to increase the sustainability of cultured seafood abundant in these beneficial nutrients.

I aim to:

- minimise the use in aquafeed for cultured aquatic animals of unsustainably produced materials and ingredients that could be used directly as human food
- promote the use of resources from a circular economy
- develop innovative aquafeed formulations and feeding strategies to help the sector adapt to climate change impacts including rising water temperatures, reduced oxygen concentrations, and suboptimal environmental conditions.

Juvenile Atlantic salmon eating an experimental diet.

Fatty acid analysis of salmon fillet and aquafeed samples.

Fishing for Peruvian anchoveta in the Pacific, for fish meal and fish oil production.

Associate Professor Said Ajlouni

Associate Professor Said Ajlouni

- Food safety and quality
- Functional properties
- Probiotic and prebiotics

said@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/2382-said-ajlouni

I'm passionate about food safety, quality, functionality, and sustainability. I am especially interested in probiotics and prebiotics, minimally processed foods, recycling of food waste, nutritional ingredients, and improving human wellbeing by maintaining healthy microbiota.

Current research projects include:

- Improving quality and safety of fresh-cut produce using biomarker techniques
- Utilising some agro-industrial waste byproducts as prebiotics
- Developing legume-derived protein fractions to enhance bio accessibility of essential minerals
- Healthy chocolates enriched with microencapsulated probiotics.

Future research projects include:

- Pharmacological studies of Indigenous Australian plants to evaluate their therapeutic effects
- Functional food for the elderly containing bioactive peptides
- Impacts of single and multiple stains of probiotics on the bio- accessibility of curcuminoids
- Probiotic mechanisms in gut health (anti-allergen, anti-inflammation) and antibiotic resistance.

Associate Professor Margaret Ayre

Associate Professor Margaret Ayre

- Transitions in agriculture
- Cultural and natural resource management
- Adaptation and rural innovation
- Indigenous-led collaborative land and sea management

mayre@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/17296-margaret-ayre

I work with communities, industries and governments in agriculture and cultural and natural resource management to co-design and implement solutions to challenges in sustainability, rural innovation, and adaptation.

As a social scientist, I work collaboratively to create new insights, methods, and processes for governing change, and to support people and organisations to learn and improve situations. My research spans two main areas:

Innovation and adaptation in agricultural industries and communities

I produce and apply frameworks and tools for industry, communities, government, and researchers to address issues of drought resilience, climate change adaptation, water management and agricultural innovation, both nationally and internationally.

Indigenous, community based and led cultural and natural resource management (CNRM)

I develop insights and approaches to monitoring and evaluating Indigenous CNRM, curriculum development for Indigenous ranger training, and participatory planning for Indigenous estates.

Current projects include collaborative research on:

- Yolngu-led land and sea management in North East Arnhem Land with the Dhimurru Aboriginal Corporation and Yirralka Rangers
- Tiwi knowledge and governance for biodiversity conservation and economic development on the Tiwi Islands
- Challenges and opportunities for agricultural advisors related to digital transitions
- Adaptation pathways in the Australian livestock industries
- Supporting communities to lead initiatives enhancing their resilience to drought and other shocks
- Workforce and social dynamics of young people working in agriculture in Victoria.

Aerial view of Tiwi Islands, Northern Territory, Australia.

Professor Stefan Arndt

Professor Stefan Arndt

- Ecophysiology
- Ecosystem ecology
- Plant adaptation

sarndt@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/12104-stefan-arndt

Our research centres on the question of how plants and entire ecosystems cope with changes in environmental conditions and with climate extremes like drought or heat stress. We investigate plant performance under environmental stress, and this allows us to predict which plant species will be best suited to survive and thrive in a future climate in forests, revegetation projects or urban areas.

Ecophysiology and plant adaptation

The response of plants to environmental conditions will determine their chance of survival. In this research area, we study the mechanisms that plants employ to adjust and adapt to environmental stresses, especially drought and heat stress. Studying plants along environmental gradients and under stressful conditions to determine how they survive and why they fail, we consider plant responses on a whole plant level and relate expression of plant functional traits to mechanisms and processes. We also study to what degree plants can actively respond to a change in environmental conditions and to what degree their response is genetically determined. Our research identifies the variety of mechanisms that enable plants to grow and thrive in their environment.

Applied ecophysiology

Selection of plant species that can thrive and survive in future climates is a challenge. We develop and test novel approaches for plant selection in future forests, revegetation and urban areas, determining plant performance based on ecophysiological parameters and traits and testing plant performance in challenging conditions. Working in native forests, areas of revegetation and reforestation, in urban forests and in novel ecosystems such as green roofs or woody meadows, our research identifies plant species, provenances or cultivars that are best adapted to a future climate.

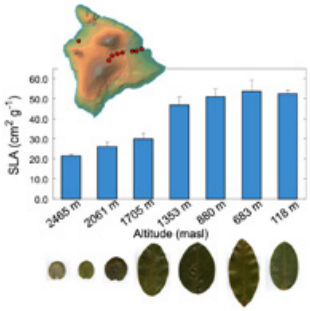
Ecosystem ecology

We investigate how entire ecosystems respond to changes in environmental conditions and how the cycling of carbon, nitrogen and water is influenced by climate. We measure how much carbon is absorbed by ecosystems and quantify, how climate variation influences ecosystem growth and the uptake or release of greenhouse gases. Key study areas are the Wombat Forest and the Whroo Nature Conservation Reserve in Victoria, where we operate eddy covariance flux towers and automated greenhouse gas measurement systems.

Our research leads to a better understanding of the impact that climate and climate change has on key ecosystem processes.

Measurement of tree transpiration on a dwarf eucalypt using a porometer.

Eddy covariance flux tower at the Whroo Nature Conservation Reserve in Victoria.



Variation of leaf shapes and leaf thickness of the tree Meterosideros polymorpha along an altitude gradient in Hawaii.

Professor Patrick Baker

Professor Patrick Baker

- Forest dynamics
- Silviculture
- Past climates
- Palaeoclimatology

patrick.baker@unimelb.edu.au

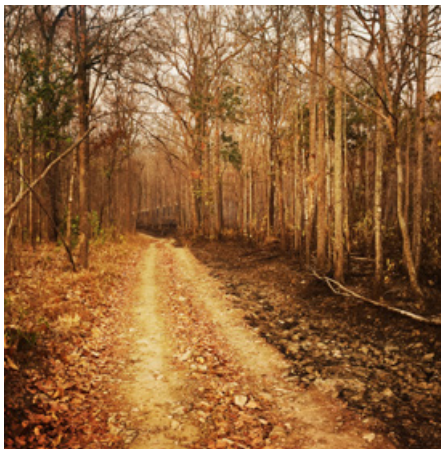
findanexpert.unimelb.edu.au/profile/451954-patrick-baker

The world needs forests – for biodiversity, for clean water, for wood and wood products, for mitigating climate change. My research is focused on understanding how best to manage today's forests, which have been shaped by yesterday's decisions, to meet tomorrow's needs.

My research focuses on understanding how native forests develop, how they change over time, how they respond to disturbances and climate, and how this knowledge can inform better forest management. I am particularly interested in the dynamics of mixed-species forests. My research is informed by large-scale, long-term forest inventory plots in continental South East Asia and in southeastern Australia, and by tree-ring data. These provide unique and complementary insights into long-term forest dynamics, the importance of rare events, and the influence of climate.

We are about to launch a five year project in Laos that is focused on forest restoration strategies that provide economic opportunities for local communities and will help Laos reach its target of 70% forest cover. The project integrates anthropology, economics, ecology, policy science, and silviculture to address the challenges of forest restoration in tropical landscapes where other land uses such as agriculture are often more profitable.

Trees in the Starvation Creek Forest Dynamics plot.



Impacts of dry season fire at Huai Kha Khaeng Wildlife Sanctuary, western Thailand.

Annual growth rings in Acacia dealbata.

Mr Christopher Barnes

Mr Christopher Barnes

- Wine technology
- Viticulture

barnesc@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/255254-chris-barnes

My work addresses challenges in the wine industry from climate, social and economic pressures.

I am a Senior Lecturer in Wine Technology and Viticulture. My research work addresses challenges in the wine industry, including climate, social and economic pressures.

Dookie College winery with Bertie the wine dog.

UoM students harvesting Shiraz grapes

Dr Benoit Belleville

Dr Benoit Belleville

- Forest products
- Agricultural by products
- Engineering
- Material characteristics
- Manufacturing

benoit.belleville@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/591094-benoit-belleville

I build knowledge, expertise and capability in the innovative uses of sustainably managed forest and agricultural byproduct resources for high-performance products.

Trees and plants that are cultivated sustainably sequester carbon from the atmosphere and form materials with excellent properties. These materials can be crafted into a wide variety of products using low-energy, advanced manufacturing techniques.

I aim to: (i) help the timber-processing sector adapt to increasing demand for materials suited to advanced timber-based construction and (ii) promote use of agricultural byproduct resources in environmentally friendly bio-composite products.

My research areas include:

- creating high-value engineered products from young plantation timbers and agricultural byproducts
- developing innovative processing and manufacturing technologies
- reducing and using waste
- evaluating product performance
- analysing value chains
- developing forestry industry models with local Indigenous communities.

Timber Mechanical Properties Testing Training in Papua New Guinea.

Environmentally friendly bio-based composite products.

Dr Helena Bender

Dr Helena Bender

- Kangaroo management
- Sustainability
- Social ecological systems
- Active hope
- Interdisciplinary practice

hbender@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/1929-helena-bender

The interdisciplinary research I undertake is motivated by a love of the more-than-human world and a desire to facilitate sustainability.

Kangaroo management

I investigate the use of sound to minimise conflict between kangaroos and humans in road and agricultural contexts that do not disadvantage kangaroos.

Sustainability

I research structural, conceptual and behavioural mechanisms that may empower and activate practices that facilitate sustainability. This has included establishing a database of sustainability-related experiences, and theorising the role of hope in producing action for sustainability.

Interdisciplinary practice

My research in this area involves exploring the practices and frameworks that work to integrate social and ecological knowledges, with the aim of more holistic analysis and management of social-ecological systems.

Future research projects include:

- Seeking to answer the question: how best can we support students experiencing eco-anxiety or distress related to social justice issues?
- Exploring how best to integrate the many factors involved in managing kangaroo-vehicle interactions on roadways.

The kangaroo in the background is part-way through a foot thump, a biologically significant alarm signal roos make when they sense danger and take flight.
Image credit: Helena Bender.

Making audio recordings at the side of the road.

Associate Professor Lauren Bennett

Associate Professor Lauren Bennett

- Ecosystem processes
- Carbon
- Fire ecology
- Forest
- Restoration

ltb@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/14289-lauren-bennett

I am fascinated by Australia's native ecosystems. I'm particularly interested in the ecology of plants – what determines where they grow and how do they persist in our often harsh Australian environment? My research interests encompass a range of woody ecosystems and a diversity of fields from plant demography and fire ecology to soil science and carbon cycles. I'm focused on using our knowledge of native ecosystems to support their sustainable management and, where needed, their effective restoration.

Forest carbon

Most land carbon is stored in natural ecosystems, particularly forests. Maintaining the health and growth of natural ecosystems is critical to stabilising and reducing concentrations of carbon dioxide in the atmosphere. Our research group assesses where carbon is stored in forests and evaluates how those stores vary with forest type, soils, and climate. Our work has highlighted the importance of both biodiversity and climate to forest carbon patterns, and the importance of carbon stores in forest soils, which are often higher than previously estimated. Quantifying patterns in forest carbon stores helps with meeting international carbon reporting commitments, identifying those carbon stores that are most vulnerable under changing climate and fire regimes, and designing the best management options for conserving land carbon to mitigate climate change.

Wildfire environmental impacts

Fire can renew ecosystems, but too frequent and severe wildfires — like those in southeast Australia in recent years — can have negative environmental impacts. We are improving the ways to monitor fire impacts on ecosystems using a suite of integrated methods based on field and remotely sensed data. Our assessments include a diversity of ecosystems from mallee to tall forests, and a range of fire conditions, including planned burns, fires combined with drought, and multiple wildfires in quick succession. Our recent analyses confirm a trend of increasing wildfire severity in southeast Australia and provide evidence of persistent impacts of high-severity wildfires, particularly multiple severe fires, on the structure and composition of even the most fire-tolerant forests. We are using these understandings to develop complex landscape-scale models to better predict the effects of changing climate and fire regimes on ecosystem persistence, and to support decisions relating to effective forest management, including conserving species, communities, and carbon stores.

Fire changes carbon-cycle processes (photo by Cristina Aponte).

Trees are the backbone of forests (photo by Lauren Bennett).

Long-term prescribed fire trial in the Wombat Forest, Victoria (photo by Julio Najera).

Dr Matthew Burns

Dr Matthew Burns

- Hydrology
- Urban
- Rainwater
- Streams
- Water

matthew.burns@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/617561-matthew-burns

My aim is to improve the health of urban waterways through improved management of water.

I help to understand the impacts of urbanisation on waterways, with a particular focus on hydrology. I also help understand ways that urban impacts can be alleviated through the application of Water Sensitive Urban Design and better urban planning.

Rainwater tank with 'leaky' pipe for stream protection.

Headwater stream in Melbourne. What we should be protecting.

Dr Clayton Butterly

Dr Clayton Butterly

- Soil fertility
- Nutrient re-use and recycling
- Agricultural waste management

clayton.butterly@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/834821-clayton-butterly

I investigate how valuable resources in agricultural waste can be recovered and applied to improve sustainability of agriculture and remediate degraded land.

Agricultural waste management and re-use

Agricultural waste management is currently suboptimal. Materials regarded as waste are often valuable co-products and an important source of nutrients and organic matter.

I am primarily interested in:

- recovering, reusing, and recycling organic matter and nutrients from agricultural waste
- developing stable, pathogen-free soil conditioners from waste materials
- optimising soil acidity
- investigating soil-plant interactions
- improving soil fertility, and
- mitigating climate change impacts on agricultural systems.

Dr Rachel Carey

Dr Rachel Carey

- Food systems
- Food policy
- Food security
- Resilience

rachel.carey@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/608142-rachel-carey

I investigate and promote resilient, sustainable, healthy, and equitable food systems.

Foodprint Melbourne

Global food systems are under pressure from population growth, changing diets, climate change and declining natural resources. Cities are often located on fertile soil, close to water sources. As more people move into cities, housing and other urban uses tend to displace food production. But cities also generate wastewater and food waste that can be recycled to produce food.

I collaborate with policy makers, communities, and stakeholders in the Foodprint Melbourne research project, to help build a resilient, sustainable, local food system that can continue to feed Melbourne's growing population in the face of climate change, pandemics and other shocks.

Food policy

I analyse national and local food policies to understand who and what shapes our food systems and determines who eats what, where, when and how. This includes the governance of 'free range' and other higher animal welfare labelling, and how financial investment can shape healthy and sustainable food systems. I also co-develop integrated policy approaches that promote sustainable, resilient, healthy and equitable food systems.

Farming at Werribee on Melbourne's fringe.

A socially distanced farmers market during the COVID-19 pandemic.

Dr Jane Cawson

Dr Jane Cawson

- Fire behaviour
- Flammability
- Fire ecology
- Fire management

jane.cawson@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/144643-jane-cawson

Eucalypt forests are one of the most flammable vegetation types in the world. Fire is extremely important to their ecology but can also pose a threat. To better manage fire regimes in eucalypt forests we need to understand what drives their flammability. Through my research, I strive to provide this knowledge and thus help to improve fire management.

My research focuses on bushfire behaviour, particularly the role of vegetation as fuel in a bushfire and how it contributes to landscape-level flammability. Spanning multiple scales from leaves to whole forests and involving a combination of laboratory and field-based methods, I work closely with fire managers to design and implement field and laboratory research that contributes to improved fire management.

Field ignition experiments in eucalypt forests.

Measuring fuel after a mechanical fuel treatment at Healesville Sanctuary.

Associate Professor Surinder Singh Chauhan

Associate Professor Surinder Singh Chauhan

- Livestock genetics
- Livestock production and management
- Meat science

ss.chauhan@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/548394-surinder-singh-chauhan

I develop smart solutions to promote sustainable livestock production for a healthy planet.

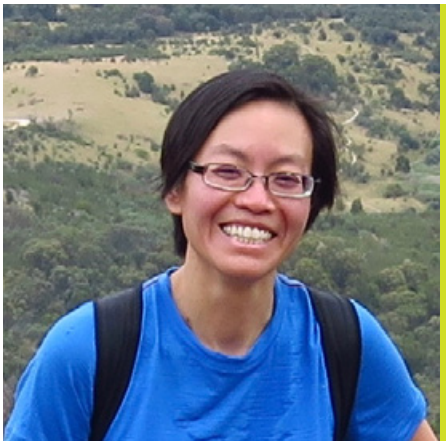
I focus on increasing sustainability, efficiency, and animal welfare in livestock production systems (cattle, sheep and goats) by:

- identifying molecular genetic markers to assist selection for thermotolerance
- applying a nutrigenomics approach to regulate metabolism and mitigate heat stress impacts
- elucidating the genetic, molecular and biochemical basis of meat quality and developing innovative tools to improve it.

In future, I hope to develop farm-ready feeding solutions for methane emissions reduction and productivity gains in livestock.

Dairy cattle behaviour on a hot summer day.

Dr Yung En Chee



Dr Yung En Chee

- Conservation science
- Ecological modelling
- Structured decision-making
- Waterways research
- Interdisiplinary research

yechee@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/10330-yung-en-chee

I apply expertise in ecology and decision analysis to develop tools and models for managing ecosystems, protecting biodiversity, and promoting healthy waterways.

Macroinvertebrate sampling in the upper Yarra catchment.

Ecological modelling and waterway management prioritisation in greater Melbourne

Freshwater biodiversity is more threatened and less studied than marine and terrestrial biota. Greater Melbourne includes over 20,000km of waterways threatened by urban growth and climate change. Melbourne's Healthy Waterways Strategy aims to protect our waterways for future generations.

To help achieve this, a long-term partnership between the University of Melbourne, Melbourne Water, the Waterway Ecosystem Research Group, and La Trobe University supports research-practice collaboration between freshwater, plant, restoration, and molecular ecologists, ecohydrologists, waterway and land managers. We have estimated biodiversity values for more than 8,000 stream reaches in varying catchments across the region, predicted changes under projected urban growth and climate change, and quantified expected benefits of various management actions.

Freshwater macroinvertebrates

Freshwater macroinvertebrates contribute water filtration and nutrient cycling essential to ecosystem health and are sensitive, informative indicators for biological monitoring. Despite this importance, species-level knowledge of their habitats, distributions, and responses to human activities is inadequate. I aim to reduce this knowledge gap.

Professor Deli Chen

Professor Deli Chen

- Soil fertility and biogeochemistry
- Carbon and nitrogen dynamics
- Greenhouse gases in agroecosystems
- Fertilisers technology and management
- Sustainable agriculture index

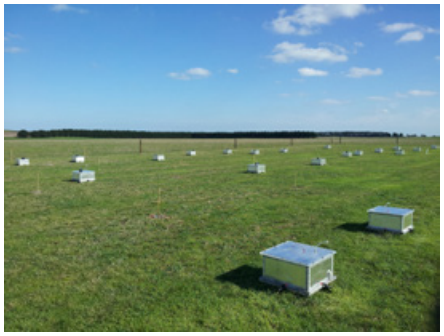
delichen@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/13219-deli-chen

I focus on increasing efficiency of nitrogen (N) fertiliser use and minimising N loss in agriculture, to enhance global food security, protect the environment and combat climate change.

Working with leaders in agricultural industries, my team applies state-of-the-art facilities and expertise to:

- quantify, simulate, and mitigate greenhouse gas emissions from crop and livestock systems in real-time at large scale
- develop techniques for measuring soil N transformations
- identify and quantify pathways of N loss in agriculture
- improve efficiencies of N fertilisers using micrometeorological methods and 15N techniques
- develop and apply agroecosystem models and decision systems for better fertiliser management
- mitigate N loss and odour from intensive animal production systems (cattle feedlots and poultry farms), particularly by using modified lignite and black coal to produce high-nutrient organic fertilisers and soil amendments
- develop sustainability indices for agriculture, including a framework for N footprint calculation, a N credit system, and societal cost-benefit models of N use, to share responsibility for agricultural pollution among farmers, suppliers, processors, retailers, consumers and governments.



Quantifying, simulating and mitigating greenhouse gas emissions from agroecosystems.

Evidence-based N indexes and N pricing for wheat flour to incentivise mitigation of N loss.

Dr Paul Cheng

Dr Paul Cheng

- Sustainable livestock production
- Grazing ecology

long.cheng@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/799665-paul-cheng

I develop methods for sustainable livestock production, to increase global food security, reduce environment pollution and improve animal welfare.

I focus on livestock nutrition, grazing ecology, precision agriculture, sustainable intensification, and greenhouse gas emission modelling.

My research projects include:

- using conserved forage to support more sustainable livestock production
- optimising robotic dairy systems to enhance productivity and efficiency
- reviewing greenhouse gas emission mitigation strategies in the livestock industry.

My future research plans include:

- exploring the use of dual-purpose crops to reduce carbon footprints
- investigating how shelter belts (tree and shrubs providing shade, wind breaks and habitats) can improve on-farm biodiversity, pasture, and livestock production
- developing protocols to validate greenhouse gas emission mitigation strategies in the livestock industry.

Sustainable development of dairy industry.

Trees on farmland enhance biodiversity, carbon storage and shelter for animals.

Use of dual purpose crops on farm.

Professor Ling Zhi Cheong

Professor Ling Zhi Cheong

- Early-life nutrition
- Functional foods
- Lipids
- Biosynthesis and bioprocessing
- Nutrition

lingzhi.cheong@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/976778-ling-zhi-cheong

I am passionate about sustainable food production and food waste reduction. I aim to understand the role of specific nutrients such as food lipids in health and disease.

Early-life nutrition

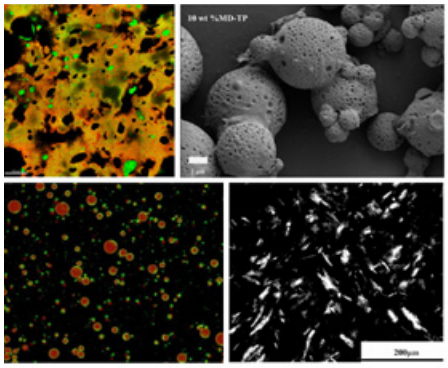
During the first 1000 days of a child's life (from conception to two years of age), good nutrition can positively influence lifelong health. My team elucidates the role of nutrients during infancy and toddlerhood in modulating the gut microbiome and priming the immune system. We aspire to provide innovative nutritional solutions for every phase of a child's growth and development.

Functional foods and ingredients

'Functional' foods and ingredients provide health benefits beyond basic nutrition by enhancing body functions and reducing disease risk. My team investigates the physicochemical, nutritional, and functional properties of food and ingredients. We then develop sustainable synthesis pathways to produce functional foods and ingredients at commercial scale. We are focused on functional food lipids (dairy, marine, plant and animal), which can also contribute structure, texture, aroma, and flavour to food.

Food safety

Contaminants are biological, chemical and physical substances that are unintentionally added to food. Contamination can occur during food production, packaging, transport or holding. We develop sensors to detect contaminants in foods.



Microstructures of food products.

Designing pathways for commercial scale synthesis of functional foods.

Associate Professor Jeremy Cottrell

Associate Professor Jeremy Cottrell

- Gastrointestinal
- Muscle
- Developmental biology
- Pig
- Broiler

jcottrell@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/4524-jeremy-cottrell

I focus on efficient production of pigs and poultry, particularly how climate change and other stressors influence the growth and development of valuable livestock species.

Climate change is increasing the incidence and severity of heatwaves in Australia and abroad, placing strain on animal production systems involving stock blood-lines from temperate, European zones. I focus on the impacts of increased heat on livestock including changes in feeding patterns and growth rates, alterations in the endocrine system, and impairment in the function of organs such as the gastrointestinal tract or reproductive tract. I employ a range of investigative tools, including climate chamber or on-farm studies, organ baths and RNA sequencing.

Nutrition is a major overhead for animal production. For optimal growth, nutrition must be adapted to different production stages and challenges. For example, freshly weaned animals, lactating animals, or animals exposed to heat have different nutrient requirements. I investigate how nutritional additives such as micronutrients or phytochemicals can be tailored to assist livestock through challenging events or environments.

Seasonal (summertime) infertility is a major problem for animal production systems. My upcoming research will focus on how environmental changes influence non-coding RNAs in pig sperm, affecting the phenotype of offspring.

Associate Professor Brendan Cullen

Associate Professor Brendan Cullen

- Farm systems modelling
- Climate adaptation
- Mitigation of greenhouse gas emissions
- Pasture agronomy

bcullen@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/67075-brendan-cullen

Agricultural production systems must adapt to the changing climate while reducing their greenhouse gas emissions. I model farm systems to investigate opportunities for livestock producers (sheep, beef and dairy) to meet these challenges.

I lead multidisciplinary teams and work directly with farmers to ensure that our research is relevant to end users. We use farm systems analysis, farm economics and social research to find means for farmers to maintain profitability in hotter and drier conditions predicted for southern Australia, and analyse options to reduce greenhouse gas emissions and sequester carbon.

My pasture agronomic research includes an investigation of the production and feed quality of multi-species pasture mixtures compared to perennial ryegrass in the dairy industry, and the use of thermal imagery to detect water stress in plants.

Another research interest is understanding grazing behaviour of dairy cows in automatic milking systems.

Case study farm in East Gippsland.

Dr Kristy DiGiacomo

Dr Kristy DiGiacomo

- Animal nutrition
- Physiology
- Metabolism
- Efficiency
- Sustainable feed

kristyd@unimelb.edu.au

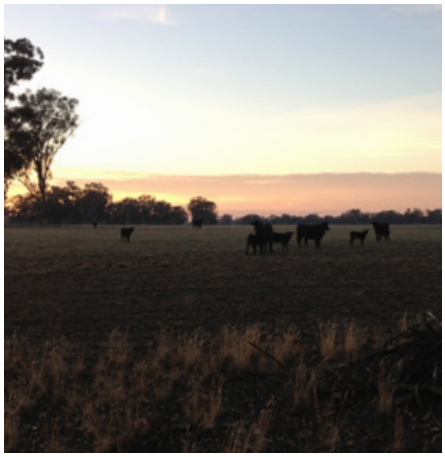
findanexpert.unimelb.edu.au/profile/136989-kristy-digiacomo

I aim to improve the sustainability of production animal industries under a changing climate by increasing our understanding of animal and feed interactions, physiology, and metabolism.

Optimal nutrition promotes animal growth, health and welfare, as well as production efficiency and sustainability. Manipulation of diet, including the use of novel feeds and nutritional supplements, can help manage animal growth and production under various physiological and environmental conditions.

I have partnered with industry, government, and academic institutions to achieve novel research objectives, including exploring the use of insect protein (reared on organic waste streams, such as supermarket waste and pork processing waste) as a protein feed source for ruminants.

Recent research in collaboration with Australia's largest goat dairy production system has provided insights into the drivers of milk productivity. Future research will examine methods to enhance lifetime productivity, efficiency, and health by improving early-life nutrition in dairy goats.



Cows at pasture.

Dairy goat kid.

Dairy cattle at Dookie.

Professor Richard Eckard

Professor Richard Eckard

- Climate change
- Carbon farming
- Carbon accounting
- Mitigation
- Methane

richard.eckard@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/2680-richard-eckard

I aim to help agricultural industries to not only reduce their carbon emissions but also to thrive under a changing climate.

My research focuses on carbon farming and accounting to support carbon neutral agriculture, enteric methane abatement, management of extreme climate events, and options for agriculture to respond to a changing climate.

In the future, I hope to develop a nationally coordinated, decadal research program to give Australian agriculture a globally competitive edge in low-emissions food production.

Methane being measured from Dairy cows using the SF6 technique.

Respiration chambers for measuring enteric methane

Methane chambers at ILRI, Nairobi measuring from Boran cattle and Red Maasai sheep.

Associate Professor Zhongxiang Fang

Associate Professor Zhongxiang Fang

- Food processing and preservation
- Food bioactive compounds
- Innovative food technology and packaging

zhongxiang.fang@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/773086-zhongxiang-fang

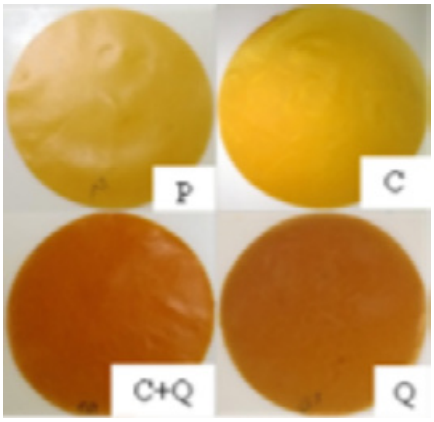
I aim to ensure that food is safe, nutritious, and pleasant to eat.

My primary research areas include:

- How different food ingredients interact under various processing methods, and how this affects food quality, safety, and shelf life.
- Function, metabolism, and microencapsulation of food bioactive compounds, and how they could improve human health and wellbeing.
- Edible coating and active packaging for food.
- Emerging processing technology including 3D printing of food and plant-protein-based meat analogues.

In future, I will focus on plant-protein-based foods and hybrid (meat/plant-based) foods. I am interested in developing sustainable and nutritious foods derived from Australian Indigenous and Asian cultures.

Indigenous food of bloodroot in new meat product development.



Edible packaging film made from sorghum protein with incorporating of natural preservatives.

Spray drying of food bioactive compounds.

Associate Professor Claire Farrell

Associate Professor Claire Farrell

- Green infrastructure
- Urban greening
- Drought tolerance
- Green roofs
- Woody meadow

c.farrell@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/340475-claire-farrell

My research involves working with plants to make cities more liveable for people, plants and animals. I research how urban greening can be used to manage stormwater, cool cities and improve the diversity of plants in the landscape.

Urban greening research is very applied and multidisciplinary and involves many partner organisations. My research has focused on developing green infrastructure, including green roofs, facades, rain gardens and woody meadows for Australian conditions. I use a holistic approach to researching how these technologies can make cities more liveable.

As a plant scientist, much of my research has evaluated plant tolerances to improve survival and stormwater retention in green roofs, walls and urban plantings. My green roof research on plant selection and substrates (engineered growing media) has overcome barriers to installation and created industry-ready green roofs. This has helped broaden plant selection worldwide beyond succulents while developing green roof substrates for hot and dry climates. Published internationally, key recommendations of this work have influenced policy and practice.

In recent years, my research has moved down from rooftops into streetscapes and parks. In the Woody Meadow Project, we are researching how naturalistic plantings of Australian shrubs can improve the appearance, resilience and function of low-maintenance landscapes, which generally lack diversity. Woody meadows are novel urban plantings that use natural shrublands as templates to create beautiful, diverse plantings which are maintained periodically through coppicing. This research draws on an ecological understanding of how Australian shrubland communities respond to disturbances such as fire and how plant traits relate to drought resistance strategies. We are also researching how woody meadows can be used in water-sensitive urban design applications, including rain gardens and swales. Recognised for their innovation, sustainability, and low cost, woody meadows are growing exponentially and are part of major landscape projects across Australia. This growing network of plantings enables us to use them as 'common garden' experiments to understand plant responses to different conditions and test their resilience.

The Burnley Campus Green Roof which demonstrates our research outcomes.

The Woody Meadow Pilot Planting at Birrarung Marr, Melbourne.

Professor Fiona Fidler

Professor Fiona Fidler

- Metascience
- Reproducibility
- Conservation science
- Integrity

fidlerfm@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/3224-fiona-fidler

We want evidence-based decisions, policy and practice to be based on the most reliable scientific evidence possible. Problems with reproducibility and publication bias and an underinvestment in error detection and peer review leave that evidence base vulnerable. My work is about building structures to ensure justified confidence in the scientific evidence base for end users and the public.

Science is often considered 'self-correcting', but what makes it so? Replication, error detection and systematic criticism are all important in maintaining self-correction mechanisms, but they are also undervalued activities. They typically don't win awards or attract lots of funding. I'm interested in ways to boost those activities through introducing new incentives and by improving existing structures like peer review. I'm interested in culture and norms in scientific practice and how methodological change happens. This research includes projects like evaluating how specific interventions (eg open data mandates, preregistration) impact scientific practice and the quality of related outputs.

I'm also interested in how statistics education can reduce the rate of questionable research practices (like p-hacking and selective reporting) in ecology and other fields. I am also interested in statistical controversies in science, for example, ongoing debates about null hypothesis significance testing and between frequentist and Bayesian inference frameworks. I'm also interested in applying social science methods to assist conservation decision making and have worked on several risk assessment and behaviour change projects.

repliCATS (Collaborative Assessments for Trustworthy Science). Workshop 2019.

Fiona, public lecture on the repliCATS (Collaborative Assessments for Trustworthy Science) project.

Dr Alex Filkov

Dr Alex Filkov

- Fire behaviour
- Extreme fires
- Wildland-Urban interface
- Communities
- Resilience

alexander.filkov@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/769157-alex-filkov

I investigate the fundamental physical mechanisms of extreme and dynamic fires, to improve our ability to predict wildfire behaviour and increase the fire resilience of structures and communities.

To mitigate wildfire risks, improve operational tools for fire management, and increase the fire resistance of structures, we need deeper understanding of the fundamental mechanisms behind wildland and structural fire behaviour.

In collaboration with industry partners, I study a wide range of fire behaviour and impacts through innovative laboratory experiments, field studies, and modelling. I have designed and built unique experimental apparatuses and cutting-edge measurement technologies such as a Variable Heat Flux Apparatus, Continuous Firebrand Generator, field-deployable Fire Behaviour Sensors, and Large-Scale Combustion Wind Tunnel.

My research includes:

- ignition and combustion of fuels and structural materials
- transition mechanisms of wildland fires to urban fringes
- generation, transport, and ignition potential of firebrands for short- and long-range spot fires
- dynamic fire effects and merging fires
- the impact of dynamic heat exposure on vegetation flammability and survival.

Testing fire resistance of facade materials.

Experimental investigation of junction fire in the field.

Dr Rebecca Ford

Dr Rebecca Ford

- Forest management
- Social values
- Climate change

fordr@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/23213-rebecca-ford

The ways people value, experience and act in forests are diverse and changing. Forests are also changing with climate change and increased fire frequency. Understanding these complex social ecological dynamics is important for enabling responsive and adaptative forest governance.

People and governance in forest systems

People, forests and governance agencies interrelate in complex dynamic systems. Our research group studies people's interactions with forests by examining their values, experiences and practices. We study relationships in forest governance among government and non-government organisations, researchers and communities by investigating institutions, decision making and representations of forest management.

Dr Sarah Frankland

Dr Sarah Frankland

- Self-regulated Learning
- Assessment

sarah.frankland@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/440357-sarah-frankland

I study how students transition from high school to university to inform strategies that can facilitate that transition. I also analyse how students interact with assessment tasks to develop more authentic assessment tools.

Self-regulated learning (SRL) encompasses the self-motivated behaviours that students use to monitor and control their learning, which impact the transition from high school to university. Part of SRL includes monitoring progress and this ties into assessment, which is another of my research interests. I focus on assessment literacy, exploring how an online grading tool can promote student development of evaluative judgement.

- Australian Council of Deans of Science funded project: Improving Assessment Literacy Skills in Undergraduate Students
- Post-Pandemic Learning and Teaching Initiatives funded project: Student Wrap-up: Increasing student engagement with participation feedback and guided reflection

Associate Professor Sigfredo Fuentes

Associate Professor Sigfredo Fuentes

- Digital agriculture
- Artificial intelligence
- Precision agriculture
- Agriculture and food in space
- Remote sensing

sigfredo.fuentes@unimelb.edu.au

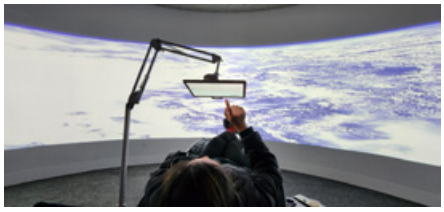
findanexpert.unimelb.edu.au/profile/551189-sigfredo-augusto-fuentes-jara

I focus on the intersection of climate change, agriculture, and advanced technologies (machine learning, artificial intelligence (AI), and emerging sensor technology) to develop sustainable solutions for food production and security on Earth and for long-term space exploration – the latter through the newly funded ARC Centre of Excellence for Plants in Space.

Digital Agriculture Food and Wine (DAFW) for Earth and Space

The cross-disciplinary DAFW research group seeks to harness the power of AI and sensor technology to enhance decision-making in agriculture, enabling more efficient crop irrigation, resource use, growth monitoring and disease detection, thereby boosting productivity. A key focus is the development of edible plants suitable for long-term space exploration. By examining plants' sensory appeal, nutritional composition, growth patterns, and physiological effects on astronauts, we aim to enhance the sustainability and resilience of food production during space missions and contribute to the development of self-sufficient space habitats.

By integrating machine/deep learning and AI techniques, we aim to revolutionise the assessment of sensory attributes in plants and plant-based products, from food and beverages to materials and pharmaceuticals. Our ARC Centre of Excellence for Plants in Space boasts a collaborative network of 38 national and international partners, including NASA and Axiom. By 2030, our research will drive transformative advancements in sustainable food production on Earth and beyond.



Sensory analysis in space-immersed environments for pick-and-eat leaf vegetables to test how simulated zero gravity affects sensory perception.

Robotic farming systems in Parkville to produce pick-and-eat leaf vegetables implementing digital sensors, AI and digital twins.

Dr Joe Greet

Dr Joe Greet

- Wetland restoration
- Riparian Vegetation
- Environmental flows
- Deer impacts

greetj@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/360700-joe-greet

I am a wetland ecologist and really enjoy being a researcher and working with plants and people. My hope is that my research will help land and water managers to better maintain and protect our native vegetation and heal Country.

I am a wetland ecologist and lover of plants. A member of the Waterway Ecosystem Research Group within the School of Agriculture, Food and Ecosystem Sciences at the University of Melbourne, I like working in partnership with Traditional Owners, Melbourne Water, DELWP, Parks Victoria and other land and water management agencies to protect and restore our wetland environments.

My current research activities are focused on four main projects:

1. The restoration of the wetland forests at Yellingbo, the last refuge of the critically endangered Helmeted Honeyeater and lowland Leadbeater's Possum
2. Determining appropriate environmental watering of Birrarung's (the Yarra's) billabongs in partnership with Traditional Owners, the Wurundjeri Woi Wurrung's Narrap ('Country') Team
3. Making Rivers Great Again. I'm working with the Arthur Rylah Institute and others to further our understanding of the relationships between plant life histories and water regimes to inform environmental flow management and restoration of our waterways
4. Understanding, mapping and mitigating the impacts of feral deer on our native vegetation.

Surveying billabong vegetation at Bolin Bolin.

Surveying deer impacts in the Yarra Ranges National Park.

Associate Professor Dorin Gupta

Associate Professor Dorin Gupta

- Abiotic (drought and heat) stress
- Biotic (legume fungal diseases) stress
- Resource use efficiency
- Crop genetics and genomics
- Diversified crop production

dorin.gupta@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/233665-dorin-gupta

I aim to build climate-change-resilient food systems and promote biodiversity in agricultural landscapes to conserve plant genetic resources and enhance ecological sustainability.

Sustaining crop production under uncertain, challenging conditions

I focus on optimising resource use, evaluating and enhancing crop genetics (exploring varieties, wild relatives, breeding, and nutrition), and managing biotic (fungal) and abiotic (drought/heat) stresses in crop production systems, including broadacre, horticulture, native crops, and mixed farming.

I am designing diversified crop production systems that are more resilient to climate change, including drought and heat, by integrating legumes, dual-purpose and native crops, silicon-mediated stress tolerance, and conservation agricultural practices. By fostering national and international research collaborations, I facilitate the exchange of knowledge, expertise, and resources to accelerate the development and adoption of innovative solutions for sustainable food production.

Evaluating the integration of legumes and dual-purpose crops for diversified crop production: enhancing drought resilience and sustainability.

Crop wild and distant relatives, and silicon supplementation: enhancing drought/heat tolerance and vital traits in legumes and cereal crops.

Unlocking the potential of native crops: towards diversified cropping, and climate change adaptation.

Dr Amy Hahs

Dr Amy Hahs

- Urban ecology
- Spatial analysis
- Biodiversity
- Interdisciplinary research

amy.hahs@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/947-amy-hahs

My research focuses on the knowledge gaps and barriers that constrain our ability to create cities that support biodiversity for the benefits to both people and nature.

Impacts of urbanisation on biodiversity

Cities and towns represent challenging environments for biodiversity, yet they also support a high diversity of plants, animals and microorganisms. My research group seeks to understand how different organisms respond to urban impacts such as chemical and sensory pollution (light, temperature, noise), altered disturbance regimes, human activities and altered habitats. We use a combination of methodological approaches, including remote sensing and spatial data, gradient analyses and field surveys to understand biodiversity responses in terms of taxonomic, phylogenetic and functional assemblages and traits. This research has revealed three key pathways of response to urbanisation: species that are pre-adapted to urban conditions and persist in urban landscapes, species that are maladapted to urban conditions and become locally extinct, and species that display an eco-evolutionary adaptive response, such as a change in behaviour or strategy. Understanding the ecological impacts of urbanisation is a critical step in identifying how cities can be designed and managed for people and nature.

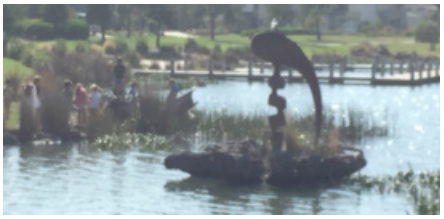
Urban landscapes for people and nature

Cities and towns are complex systems of ecological, social, cultural, technical and constructed elements. My research group has a heavy emphasis on providing an urban ecology and biodiversity voice to a diverse range of projects through interdisciplinary and cross-sectoral projects. Examples of projects include collaborating with landscape architects, planners and other professionals to develop best practice guidelines and other resources for practitioners; providing evidence to help prioritise urban forest and landscape connectivity actions across metropolitan Melbourne and Singapore; co-designing biodiversity interventions in urban green spaces and evaluating their effectiveness; understanding the relationships between biodiversity and human health and wellbeing; and using an evidence-based approach to identify urban-nature indicators that can be used to connect local actions with global frameworks, such as the Sustainable Development Goals and the Post-2020 Global Biodiversity Framework.

Disentangling local and global contexts using a comparative approach

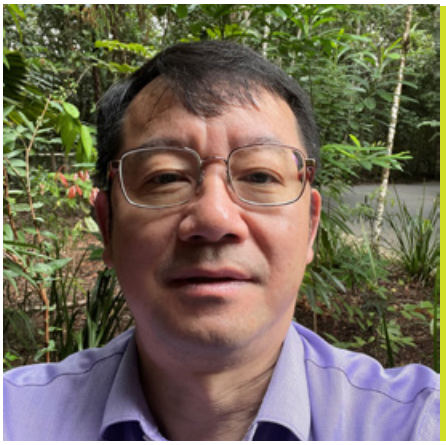
Every city or town reflects its unique history, culture and tradition, as well as the biogeographic region, climate, and social and economic contexts they exist within. My research employs a comparative approach to help disentangle these complex influences and begin identifying general principles that apply to most cities around the world. This will also help us to understand the unique factors at the local scale that need to be considered to ensure that the understanding of impacts on biodiversity and efforts to ensure urban landscapes can support people and nature are sensitive and responsive to that particular place. I have a large network of collaborators from around the world. In particular, I am interested in flipping the dominant paradigm and finding out what the Global North can learn from researchers and practitioners in the Global South.

Magpie and sulfur-crested cockatoos in Melbourne.



Wetlands, sculpture, children, nature.

Professor Jim He



Professor Jim He

- Soil microbial ecology
- Soil fauna and food web
- Transmission of antibiotic resistance genes
- Soil health

jizheng.he@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/642022-jim-he

Focusing on soil microbial communities, I develop biological approaches and food-web manipulation strategies to increase soil health and nutrient use efficiency in agricultural and natural ecosystems.

Soil microbial ecology

I study the distribution patterns, community structure, and functional contributions of soil microorganisms in nutrient cycling, carbon sequestration and soil health, using omics-based molecular technologies, culture-dependent isolation techniques, and stable-isotope tracing approaches. My research has revealed the niche differentiation of nitrification microorganisms and their manipulation mechanisms in improving soil nitrogen use efficiency.

Soil fauna and food webs

I use morphology and molecular technologies to develop standardised methods for soil fauna identification and soil biodiversity monitoring and study the interactions of soil fauna and microorganisms. I aim to increase understanding of the soil food web and its resilience to human disturbances including climate change.

Transmission of antibiotic resistance genes (ARGs)

I explore the transmission of ARGs from bacteria in feedlot manure to agricultural soil fauna and crops to evaluate the potential risks of manure applications to ecosystem and human health.

Field trials of nitrogen fertilisers and nitrification microorganisms.

Agricultural soils rich in organisms.

Associate Professor Kate Howell

Associate Professor Kate Howell

- Microbial ecology
- Food composition
- Yeast and bacteria
- Fermentation
- Plant foods

khowell@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/192335-kate-howell

I'm passionate about making flavoursome, attractive, and healthy foods accessible to all. My research uses a wide range of tools from microbiology, chemistry, bioinformatics, and engineering.

Design of plant-based and fermented foods for optimal human health

I aim to increase understanding of how microbial activities and interactions in fermentation impact plant-based food structures, aromas, nutritional contributions, digestion, and human microbiomes (oral and gut).

The Dookie Bread Lab

This research collaboration is revitalising the knowledge of Australian heritage wheat varieties and expanding the vocabulary of grain quality to include nutritional and flavour characteristics. We plan to mill flour from the grains grown at Dookie campus and bake bread (and other products) for the local community and beyond.

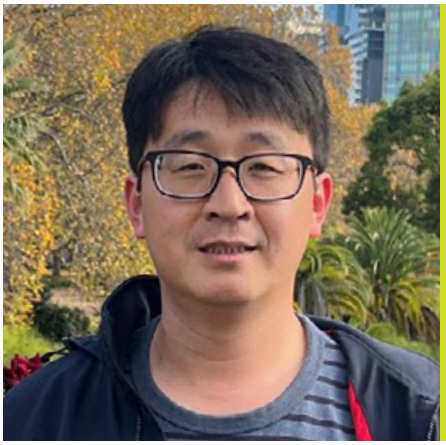
Yeast biology and human nutrition

I study diverse yeasts in sourdough bread to generate insights into lipid biochemistry, phylogenomics and microbial ecology, and unlock potential nutrition in staple foods with profound implications for human health.

Sourdough breads are delicious and nutritious.

Test bakes in the laboratory.

Dr Hangwei Hu



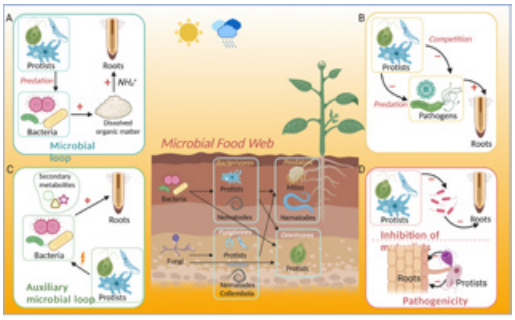
Dr Hangwei Hu

- Soil biology
- Soil health
- Plant-soil microbiome interactions
- Environmental microbiology
- Antimicrobial resistance
- Microbial biotechnology

hang-wei.hu@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/660206-hang-wei-hu

I aim to increase understanding of how biotic and abiotic factors impact soil organism diversity, community structures, and functions – including organic matter decomposition, nutrient cycling, and pathogen control – across a range of terrestrial and agricultural ecosystems.



Understanding the roles of protists in plant-soil microbiomes.

The role of soil biodiversity in ecosystem processes

I apply molecular techniques, stable isotope tracing, and advanced bioinformatic and modelling methods to study soil fauna and microbes. I have found positive correlations between the diversity of bacteria, fungi, protists, and invertebrates and multiple ecosystem functions, and explored various biotic interactions within the soil food web, above and below ground.

Enhancing farm productivity and food security

My work includes developing controlled-release fertilisers that leverage the symbiotic interactions between rhizosphere microbes and plant signalling molecules to enhance nutrient acquisition, and optimising beneficial biomes for sustainable agriculture.

Antibiotic resistance genes (ARGs)

My research has shown how: (i) long-term heavy metal contamination significantly increases the abundance and diversity of ARGs in agricultural soils; (ii) irrigation of urban parks with treated wastewater increases the abundance and diversity of ARGs but does not enhance their potential for horizontal gene transfer; and (iii) manure-derived ARGs can transfer to the edible parts of vegetables, with potential risk to human health.

Professor James Hunt

Professor James Hunt

- Agronomy
- Crop physiology
- Farming systems

james.hunt@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/2124-james-hunt

I aim to increase the profitability, productivity, and sustainability of grain-based farming systems.

The cross-disciplinary Crop Agronomy Group works closely with farmers and commercial agronomists to understand constraints to farming systems' productivity and profitability, and develop and test solutions. Test stages are: (i) crop simulation models, (ii) small research plots, and (iii) commercial-scale trials on farms. Our collaborative process facilitates adoption and integration of solutions and new technology into farming systems.

Our projects funded by the Grains Research and Development Corporation have focused on: improving grower decisions around sowing time and crop cultivar phenology choice; integrating long coleoptile wheat cultivars into Australian farming systems; and re-framing risks and rewards of long-term nitrogen fertiliser strategies.

We are supporting the Dja Dja Wurrung Aboriginal Corporation in a National Landcare Project to collect basic agronomic information on kangaroo grass (Themeda triandra) to support its reintroduction as a high-value seed crop.

Dr Arjun Pandey compares growth of canola in different long-term nitrogen strategy treatments at Dookie Campus.

Plots of early sown quick winter wheat at Birchip Cropping Group's main field day site near Curyo in northwest Victoria.

Sowing research plots at Dookie Campus.

Dr Moss Imberger

Dr Moss Imberger

- Freshwater ecology
- Land use impacts
- Urbanisation
- Organic matter dynamics
- Nutrient processing

moss.imberger@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/428312-moss-imberger

The health of our streams is being rapidly degraded by land use change, including agriculture and urbanisation. The ecosystem services provided by streams and the health of future generations is thus being put at risk. My research aims to identify, understand and measure land use impacts on streams, with the aim of finding new management approaches and policies that support the restoration and protection of streams into the future.

Structure, function and hydrology of small ephemeral headwater streams around Melbourne

Headwater streams represent a dominant part of the river network by length. These small streams are primary sources of streamflow, important sources of organic matter to downstream waters, and act as 'hot spots' for retention and transformation of nutrients such as nitrogen and carbon. While small headwater streams are likely to be extremely important for maintaining downstream river and bay health, they are particularly vulnerable to degradation or loss in rapidly urbanising cities such as Melbourne. Despite this recognition, we still lack a clear understanding of their ecological structure and function, and their hydrologic behaviour.

Linkages between flow, sediment, organic matter and instream vegetation

Research has shown that urbanisation alters stream hydrology, increasing coarse sediment export and reducing organic matter storage, diversity and abundance of instream vegetation. Despite these broad scale patterns, we still lack a clear understanding of which components of the flow regime are most significant at influencing sediment and organic matter dynamics, and how they interact to influence instream vegetation retention, germination, emergence and persistence.

Potential for integrated water management to protect streams from urban development

Urbanisation degrades stream health. However, recent research has shown that retrofitting peri-urban catchments using water-sensitive urban design (WSUD) can restore some elements of stream ecosystem structure and function. The success of these WSUD approaches is dependent on sufficient space for larger systems and demand for captured water — requirements that are difficult to meet in existing urban areas but far simpler when designed into new greenfield developments. This research investigates the potential to protect urban stream structure and function in the face of new urban developments.

Factors driving and limiting the restoration of peri-urban streams using stormwater control measures

Research has shown that stormwater control measures (SCM) (such as biofilters and rainwater tanks can improve water quality and reduce and slow flows at system outlets. However, the effectiveness of newer SCMs designed specifically to treat, retain and use stormwater when applied at a catchment scale remains unknown. This research aims to test if the application of catchment-scale SCMs in peri-urban environments can restore the structure and function of small streams already degraded by urban development.

See more here: **urbanstreams.unimelb.edu.au.**

Monitoring and assessing healthy streams in the Dandenong Ranges, Victoria.

Associate Professor Sabine Kasel

Associate Professor Sabine Kasel

- Forest community dynamics
- Ecosystem processes
- Climate change
- Disturbance
- Threatened species

skasel@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/14351-sabine-kasel

My mission is to provide the empirical, peer-reviewed evidence that underpins the conservation and management of Victoria's forest ecosystems and the biodiversity these forests support.

Forest biodiversity and community dynamics

Key risks to Australia's forested ecosystems are changes in fire regimes (natural and managed) and climate change. These changes can translate to changes in forest productivity, changes in forest regeneration, increased drought stress and changes in fire frequency and intensity. Bush fire, forest management practices (including planned burning, timber harvesting and reserve design) and changing climate may interact to affect forest biodiversity, leading to significant impacts on the distribution of forest dependent species, changes in the composition and structure of forest communities and the disruption of ecosystem services. My work is focused on empirical research that lays the foundations for improved understanding of the key ecological processes responsible for the response of forest biodiversity, such as threatened species and plant community composition to compounded disturbances, including altered fire regimes, changing climate and forest management practices. This work is critical to the management of forested ecosystems for improved biodiversity outcomes and the ecosystem services they deliver.

Recruitment and growth dynamics of Persoonia arborea (Tree Geebung)

Persoonia arborea is an endangered tree species endemic to the Central Highlands of Victoria. The species is fire sensitive and grows widely in the Black Friday 1939 regrowth Wet Sclerophyll Forest that is the primary resource for the timber forest industry in Victoria. My work aims to understand the response of this species to disturbance from timber harvesting and bush fire. Size-age relationships using tree rings and radiocarbon dating are being developed to establishing response to disturbance and age to reproductive maturity.

Work to date suggests the species regenerates prolifically following mechanical disturbance and that established trees can withstand low intensity bushfire. Further work is focussed on assessing the size of the soil seed bank following disturbance, and advancing our understanding of the seed biology of this species. Together this information will provide for improved management and conservation outcomes for this iconic species.

Associate Professor Luke Kelly

Associate Professor Luke Kelly

- Conservation biology
- Ecology
- Evolution
- Fire science
- Global change

ltkelly@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/140333-luke-kelly

I aim to transform understanding of ecological and evolutionary dynamics under global environmental change – including shifting fire patterns, landscape modification and climate change – and to stop species going extinct.

I lead the Biodiversity Dynamics Research Group. We primarily use field data and experiments to explore links between biodiversity and environmental change, build models to forecast changes in animal and plant populations, and develop strategies to conserve biodiversity. We integrate data and models with participatory approaches (such as scenario planning), involving local communities, stakeholders and policy makers throughout environmental decision making, to improve outcomes.

We focus on three main areas of research:

- Plant evolution and global change – We work in Mediterranean-type ecosystems in Australia and Spain to determine whether plant populations can successfully evolve through key traits to keep up with the rate of environmental change.
- Fire ecology and management – We aim to determine the mix of fire-driven variation (pyrodiversity) that will best promote biodiversity and how we can achieve that mix.
- Animal ecology and conservation – We undertake field studies of mammals, birds and reptiles in southern Australia, to develop and test ecological theory, monitor biodiversity identify critical habitat and determine the best management strategies (including for invasive predators) under possible future scenarios.

Some trees release seeds into the resource-rich ash covering the ground after fire.

The Mallee Ningaui shelters in spinifex clumps in semi-arid Australia.

We incorporate genetics and glasshouse experiments into our work on contemporary evolution, climate change and novel fire regimes

Professor Tom Kompas

Professor Tom Kompas

- Biosecurity
- Applied economics
- Environmental economics
- Computational modelling

tom.kompas@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/695719-tom-kompas

I do research designed to have impact, to change government policy on various biosecurity measures, such as effective border quarantine and post-border surveillance measures, as well as policy responses to climate change.

My research specialises in biosecurity, large-scale computational modelling, climate change, and natural resource and environmental economics. I work on estimates of the potential economic damages from climate change across different temperature settings for over 120 different countries and over 50 commodity sectors, as well as emissions reductions pathways. I also do work on the economics of biosecurity for plant, animal and human health. This involves work on optimal post-border surveillance for the early and cost-effective detection of pests and diseases to protect agriculture and the environment.

Along with 'flattening the curve' for COVID-19, there's an urgent need to address potential damages from climate change.

Associate Professor Shu Kee (Raymond) Lam

Associate Professor Shu Kee (Raymond) Lam

- Agricultural data science
- Fertiliser management and technology
- Greenhouse gas measurement and mitigation
- Climate change impacts on agroecosystems

shukee.lam@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/326600-shu-kee-lam

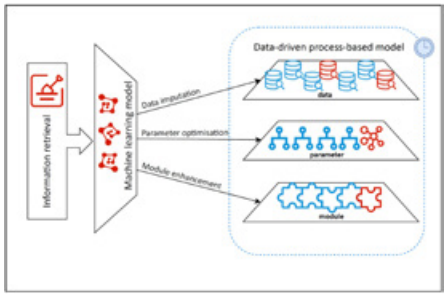
I aim to improve fertiliser management and mitigate nitrogen pollution and greenhouse gas emissions from agricultural systems.

I help to develop enhanced-efficiency fertilisers tailored to different soils, crops, and climates, and decision-support tools that facilitate optimal nitrogen use with minimal losses to the environment.

My research group employs a wide range of techniques, including static chambers, passive samplers, and open-path lasers and Fourier transform infrared spectrometers, to measure greenhouse gas emissions from diverse agricultural systems such as cereals, vegetables, and pastures. We utilise process-based agroecosystem models to simulate, predict, and assess the effects of management practices on nitrogen losses through various pathways.

We integrate big data with machine learning techniques to improve the reliability of model predictions regarding nitrogen processes. We also employ meta-analytic techniques to analyse extensive national and international datasets on soil-plant carbon and nitrogen dynamics in agricultural systems, gaining valuable insights into potential climate change mitigation and adaptation strategies.

Intensive fertiliser use in vegetable systems.



Using data-driven machine learning approaches to improve process-based models.

Professor Patrick Lane

Professor Patrick Lane

- Ecohydrology
- Fire
- Forest management
- Water resources

patrickl@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/98261-patrick-lane

At the Forests and Water Research Group, we seek to improve our ability to understand and predict the hydrologic impact of climate variability, forest growth dynamics and forest disturbances. This research is aimed at improving water resource planning in Australia by researching the biophysical processes driving hydrologic change to underpin the development of models for real-world application to forest and catchment management problems.

We are living in a changing environment. A more variable climate is producing extremes in low and high rainfall, as evidenced by the recent large-scale floods, drought and fire. The effects of climate and climate-related disturbances are particularly important for the health of forests and the ecosystem services they provide. Water is a highly significant ecosystem value, and forests are the source of much of our water. We need to understand and predict how forests will respond to the climate and disturbance drivers. However, it is not only the quantity and quality of water that forested landscapes provide that is important; equally critical is their intrinsic water status. That is, how do the forests themselves respond to drought and fire? Will they continue to be healthy and productive, or will drought and fire cause significant harm? My research interests include the impact of forest growth dynamics and disturbance on evapotranspiration and streamflow, the impact of fire on erosion and water quality and the biophysical processes underlying the catchment responses. The effects of fire and climate change is a particular focus.

Current research projects include:

- The development of models to understand how forests will respond to repeated fire and to a varying climate and what that means for streamflows
- How much water do forest of varying density and age use?
- A new remote-sensing method to quantify forest conditions and hydrology
- Drought proofing plantations
- Prediction of fire impacts on erosion and water quality.

Measuring tree water use.

Measuring forest streamflow.

Dr Robyn Larsen

Dr Robyn Larsen

- Diabetes management
- Sedentary behaviour
- Dietary interventions

robyn.larsen@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/850685-robyn-larsen

I aim to better understand the interactive effects of physical activity and diet on glucose metabolism, to inform new strategies for diabetes prevention and management.

Type 2 diabetes and cardiovascular disease are increasing worldwide, driven by poor diets, physical inactivity and sedentary behaviour (too much sitting as distinct from too little exercise). We need better understanding of how these behavioural risk factors interact to inform lifestyle interventions for prevention and treatment.

Sedentary behaviour is associated with elevations in postprandial glucose, insulin concentrations and other cardiometabolic risk markers (hypertension, endothelial dysfunction). In collaboration with colleagues at Baker Heart and Diabetes Institute, I have shown that breaking up prolonged sitting with regular, short bouts of light- or moderate-intensity physical activity (i.e., walking, or simple bodyweight resistance exercises) attenuates postprandial glucose and insulin responses in adults with obesity or type 2 diabetes. These studies have informed sedentary behaviour guidelines of the American Diabetes Association and the National Heart Foundation.

However, the magnitude of the glucose-lowering effect depends on the type of break in sitting, the underlying degree of insulin resistance and the amount and type of carbohydrate consumed, suggesting that opportunities exist to further refine this approach regarding the timing and nature of meals and sitting breaks.

Blood glucose lowering effect of different types of activity breaks in sitting.

Dr Stephanie Lavau

Dr Stephanie Lavau

- Environmental sociology
- Sociology of science

stephanie.lavau@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/23855-stephanie-lavau

I study the role of citizens in caring for local ecosystems and species, to: (i) support management agencies and other environmental organisations in developing and reviewing strategies for working with communities; and (ii) recognise the important contributions of citizen action.

I extend understanding of the practices through which people care for nature, and how these practices connect people, technologies, objects, places, and ideas. My recent research focuses on the protection of urban waterways and biodiversity conservation, including: citizen science and biodiversity monitoring; domestic water practices for private and public benefit; craftivism and wildlife rescue; and environmental volunteering in urban waterway management. Collaboration in environmental knowledge and practice is core to my research, as a method and a topic of enquiry.

Dr Anita Lawrence

Dr Anita Lawrence

- Human nutrition
- Public health nutrition
- Dietary recommendations
- Dietary modelling

anita.lawrence@unimelb.edu.au

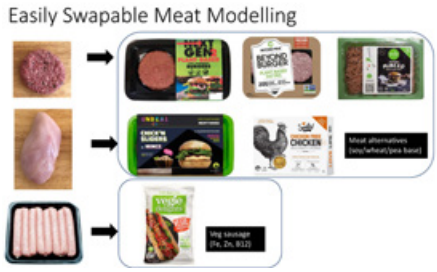
findanexpert.unimelb.edu.au/profile/847021-anita-lawrence

I apply extensive experience in public health and nutrition research, policy, regulation, and communication to help guide Australia's transition to healthy and more environmentally sustainable diets.

Food for healthy people and a healthy planet

Our dietary intake not only determines our risk of heart disease, cancer, diabetes and other chronic diseases, but it is also an important determinant of planetary health. Today's global food systems are major contributors to greenhouse gas emissions, water scarcity, and biodiversity loss.

I am combining state-of-the-art modelling techniques and data sources to build a dietary modelling tool that can better predict the nutritional implications of policies and public health messages aimed at encouraging the Australian population to transition to a more environmentally sustainable diet.



A recent scenario we modelled where animal-source meat and milk were swapped for plant-based 'meat' and 'milk'.

Plant-based 'milk'.

Plant-based 'meat'.

Professor Stephen Livesley

Professor Stephen Livesley

- Urban ecology
- Urban trees
- Green infrastructure
- Urban microclimate
- Soil science

sjlive@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/21449-stephen-livesley

I study how vegetation and soil systems in towns and cities can support microclimate cooling, catchment hydrology, biodiversity habitat and our own wellbeing, to help us adapt to climate change and extreme weather events.

I analyse and quantify many of the ecosystem functions and benefits that the urban forest (trees, shrubs, and treed green spaces) provides in different contexts and scenarios. I aim to understand where trade-offs and compromise may occur, to help better design and manage urban, green (vegetation) and blue (water) infrastructure systems. My research involves direct measurement of soil, water, vegetation, and climate interactions, as well as mechanistic modelling of urban ecological processes, combined with a social dimension to better understand preferences, values and opinions of the public and professionals and enable more inclusive and informed decisions.

Tagging elm trees in University Square to understand insect predation by birds, possums and wasps.

Measuring the microclimate and energy balance on a green roof in Docklands, Melbourne.

Where are all the trees in our new outer suburbs?

Professor Michael McCarthy

Professor Michael McCarthy

- Quantitative ecology
- Statistical ecology
- Environmental management
- Ecological modelling

mamcca@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/13490-michael-mccarthy

I am motivated to develop methods that can make our environment better for both humans and the natural world. I enjoy my research because it combines two primary interests: ecology and mathematics, a combination of abilities and interests that seems relatively rare, so I seek to assist better environmental management through novel insights and the development of useful methods.

Quantitative and applied ecology

I am interested in developing, evaluating and applying models to assist ecological management. My research spans many areas, including detection of invasive and rare species, population dynamics, fire ecology, synthesis of ecological data and environmental risk assessment. The common theme is using quantitative methods such as mathematical analysis, simulation modelling and statistical analysis to help synthesize information so as to inform ecological management.

Combining quantitative methods with ecology can provide insights that might otherwise be overlooked. Much of my research involves the development of novel quantitative methods, leading to an expanding program focused on the evaluation of models. I work across numerous ecological systems and with a range of species, including plants, vertebrates, invertebrates and micro-organisms. I have worked on projects related to marine, freshwater and terrestrial environments, from arid regions to tall forests.

Eucalypt tree. Hollows in eucalypt trees are a key resource, but how do we detect them (and the species that occupy them) most reliably? My research on imperfect detection in ecology addresses this question.

The mountain ash forests of Victoria. The mountain ash forests of Victoria provide much of Melbourne's water, they are harvested for wood and have extremely high environmental values. They also burn at unpredictable intervals. My research aims to help predict the impacts of unplanned fires on the range of values of these and other forests.

Dr Gayathri Devi Mekala

Dr Gayathri Devi Mekala

- Gender in agriculture
- Institutional analysis
- Livelihoods and food security
- Social aspects of climate resilience and water management

gayathri.mekala@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/352880-gayathri-mekala

I contribute to building a more inclusive, equitable and resilient society through my research in gender, agriculture and water management.

As a social scientist and gender-in-agriculture specialist, my research interests include: gender aspects of food production systems and water management; institutional and policy analysis; livelihoods and food security. I have worked in India, Pakistan, Pacific islands, Ghana, and South Africa. Social institutions and resource management policies that are gender-sensitive can transform our production systems, make them more resilient to climate change, and help meet the United Nations' Millennium Development Goals.

A women farmer walking through a rice field irrigated with wastewater in Andhra Pradesh, India.

Farm labour getting a ride on a truck loaded with fodder grass to the market in Hyderabad, India.

Ms Maddison Miller

Ms Maddison Miller

- Indigenous knowledge
- Cultural-ecological connections
- Healthy Country

maddison.miller@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/836772-maddison-miller

Aboriginal peoples have been caring for and nurturing this place for tens of thousands of years. There exists a deeply reciprocal relationship between Aboriginal peoples and country that nourishes not only the natural world, but provides for complex cultural practice and rich community relationships. As a Darug researcher, my aim is to respectfully work alongside community to embed Aboriginal country care into contemporary applied ecology.

Ecological knowledge of Country

The interconnectedness of Country, culture and community for Aboriginal and Torres Strait Islander peoples is at the centre of our world views. The health of any one of these elements relies on the health of the others. As Aboriginal people, we share a kinship with Country and nature expressed through our continued cultural practice. This relational ontology dictates that Country is to be cared for and loved and is capable of caring and loving in return. My research seeks to bring together ways of knowing Country in land management.

Bringing together ways of knowing Country through story

Stories are the oldest knowledge devices in the world and have been passed down on this continent for thousands of years. On Gunditjmara Country, stories of Budj Bim relate back to a cultural and geological event that happened more than 30,000 years ago. My research seeks to understand how stories can be used in bringing together different ways of knowing. I work with ecologists and Traditional Owner groups from across Victoria to create new stories that weave Indigenous worldviews and knowledges together with Western science.

Healthy Country

Healthy Country is a term often used to describe. As deputy lead, I am working with Traditional Owner groups in Victoria to have a baseline understanding of what Healthy Country means from an Indigenous viewpoint and how we can start to build a research agenda that works towards Healthy Country outcomes.

Global Indigenous perspectives of energy transition and climate change in cities

Working with Indigenous women from Canada, Australia, Peru and Bolivia, this project aims to explore Indigenous perspectives on cities. Cities are often found on Indigenous homelands but are often treated as Terra Nullius in research, governance and practice. This research sets a foundation for understanding the Indigenous City.

Yilabara Ngara by Maddison Miller - storytelling installation at Emu Sky.

Uncle Badger Bates sharing plant knowledge.

Bindjali Braided Tree.

Associate Professor Craig Nitschke

Associate Professor Craig Nitschke

- Landscape ecology
- Forest ecology
- Biodiversity conservation
- Climate change
- Social-ecological systems

craign@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/184007-craig-nitschke

I aim to help solve the wicked problem of conserving forests while meeting demand for forest resources under a changing climate. I seek to foster landscape-scale ecosystem management that is climate-smart, socially acceptable, and sustainable.

I focus on forest and landscape ecology. The latter is a multi-disciplinary field involving field-based ecological studies, genetics, species and landscape modelling, remote sensing, and social research methods. My research areas overlap with the disciplines of botany, silviculture, wildlife biology, conservation biology, phenology, plant physiology, climatology, hydrology, and dendrochronology, across urban, agricultural and forest domains. I explore the relationship between forest ecosystems, and forest-dependent species, and the biotic and abiotic factors that shape their patterns of distribution and abundance over space and time.

Impact of changing fire regimes on forest landscapes in the Victorian Alps (photo by Craig Nitschke).

Changing landscapes: recent impacts are evident, but the future is uncertain (photo by Craig Nitschke).

Mapping old trees and forests is a key research theme (photo by Craig Nitschke).

Professor Trent Penman

Professor Trent Penman

- Fire risk
- Landscape fire
- Fire behaviour
- Fire management
- Decision science

trent.penman@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/669873-trent-penman

I quantify risks to environmental and human assets from wildfires, using models incorporating theoretical and applied bushfire behaviour and management strategies to determine actions to reduce risks.

Fire risk modelling

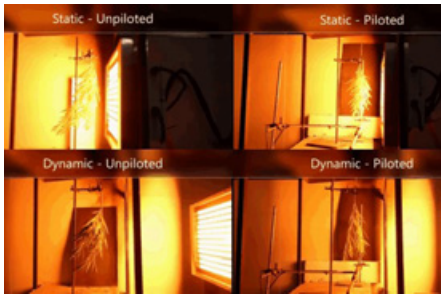
My team and I are international leaders in fire-risk methodologies over short (5-year) and long (100-year) time frames. We collaborate with government, industry and expert hydrologists, ecologists, engineers, social scientists and economists to capture the complexity of fire risk and ensure our methods have practical applications.

Fire behaviour measurement

We examine a range of fire measurements during and after fire events to determine fire drivers and behaviours, and the impact of management actions. We undertake small to medium fire behaviour experiments in our research laboratory at Creswick, and use aerial drones to measure fire behaviour during prescribed fires and small wildfires in grasslands, heath shrublands and forests. For large wildfires, we use remote sensing to measure fire spread and severity.

We are developing a large combustion wind tunnel for the Creswick campus for better analysis of fire ecology and sustainable building design. Bringing together expertise from our team and across Australia, we seek to develop a national standard for fire risk analysis.

A prescribed burn in Victoria



Laboratory fire research

Dr Mohammad Pourkheirandish

Dr Mohammad Pourkheirandish

- Crop genetics
- Molecular evolution

mohammad.p@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/830516-mohammad-pourkheirandish

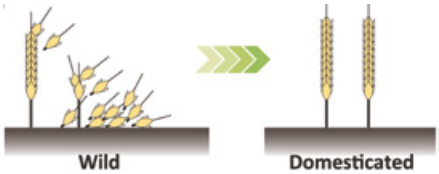
I aim to improve crop plants, particularly wheat, barley, and oat, by identifying and exploiting novel genetic resources and genes for beneficial traits such as yield, nutrient usage, and stress tolerance

Cereal improvement

My team studies the genetics of beneficial plant traits including resilience to drought and saline soils, efficient uptake of nutrients, high yield, and retention of the cereal head under dry wind conditions (a major cause of yield loss in Australian barley), and develops molecular tools to enable plant breeders to select these traits efficiently. We undertake field and greenhouse experiments, employing traditional Mendelian crossbreeding as well as sophisticated genomic technologies and measurement platforms. We isolate the causal genes, and scan different gene pools for novel variants of these genes that can contribute to the genetic improvement of cultivated varieties.

Crop re-domestication

Our modern crops originated from a small number of wild relatives selected by ancient farmers. This limits the adaptability of cultivated crops to changes in the environment and climate. By breeding key genes into wild forms of cereal, we can produce more easily cultivated forms with increased genetic diversity. To this end, we investigate the gene complexes that cause a cultivated cereal's seeds to remain attached to the head as the plant matures. This is arguably the most important trait of a cultivated variety, as it allows the seed to be collected and consumed or replanted.



Grain dispersal mechanism in wild relative of wheat and barley.

Wild Hordeum in Philip Island

Barley head loss.

Associate Professor Senaka Ranadheera

Associate Professor Senaka Ranadheera

- Food microbiology
- Probiotics
- Prebiotics
- Fermentation
- Food safety

senaka.ranadheera@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/800524-senaka-ranadheera

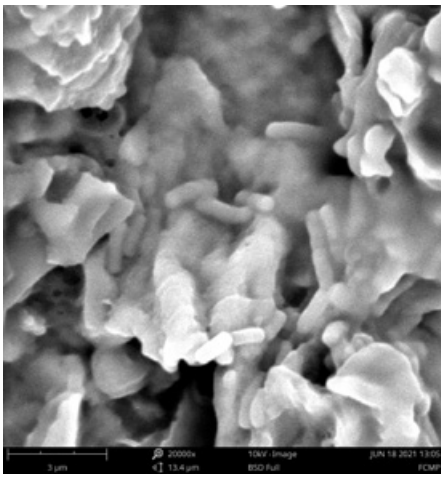
To achieve better health outcomes, I focus on maintaining the therapeutic potential of prebiotics and probiotics through food processing, long-term storage, and gastrointestinal transit.

Probiotics, prebiotics and gut health

Probiotics are live microorganisms in food, which support gut health. Prebiotics are non-digestible compounds in food, which foster growth and activity of probiotics and beneficial gut microbiota.

To deliver health benefits to the human host, probiotics must survive food processing, storage, and digestion in sufficient numbers, tolerating acid, bile and enzymes in the gastrointestinal tract, and colonising the intestinal epithelium. I use in vitro models to provide solutions to these challenges, maximising probiotic efficiency and benefits.

Teaching students laboratory techniques in probiotic research.



SEM view of encapsulation of probiotics with food matrices, a proven method in improving probiotic efficiency in food.

Associate Professor John Rayner

Associate Professor John Rayner

- Urban horticulture
- Plant selection
- Green roofs
- Green walls
- Woody meadows

jrayner@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/2467-john-rayner

I am passionate about plants and horticulture. My mission is to make cities greener by developing more functional, resilient, engaging and visually attractive vegetation. While plants should be the core of the 'greening cities' movement, there are significant gaps among built environment and landscape professionals in planning, designing and sustaining plants successfully. Reducing these knowledge gaps, particularly within and across disciplines, is at the heart of my work.

My primary research area is in green infrastructure, specifically green roofs, green walls and woody meadows. For the last 15 years, this has focused on three key areas: plant evaluation and selection, the analysis and development of urban substrates and soils and the maintenance and management of urban vegetation. I have a side interest in the design and management of therapeutic and children's landscapes. I am very active in industry engagement and outreach activities, particularly in the translation of research to practice, including the development of best practice guides and contracted research and consulting for major landscape projects. My work also includes curriculum development and the delivery of professional education and training.

Inspecting green roof plants in Maryland, USA.

Woody Meadow in Birrarung Marr City of Melbourne.

The Highline in New York City.

Dr Michael Santhanam-Martin

Dr Michael Santhanam-Martin

- Agricultural innovation studies
- Sustainable agriculture
- Farm work
- Climate change adaptation

mpmartin@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/374263-michael-santhanam-martin

I help farmers, industry bodies and policy-makers to better understand the process of change, supporting their adaptation to shifts and opportunities in the environment, technology, resources, and stakeholder expectations.

I analyse changes and driving factors impacting farm jobs, agricultural careers, and regional and sectoral workforces, to help agricultural industries meet their current and future workforce needs, and create jobs that are rewarding and worthwhile.

As part of the Rural Innovation Research Group, I have commenced an ARC Linkage project entitled “Securing the next generation in farming and food careers”. Working with academic colleagues in youth studies and labour market economics, and with industry and community partners across Victoria, this project will investigate how and why young people (aged 15-35 years) enter, sustain or leave jobs and careers in the agri-food sector, including farming, farm services and food processing.

Investigating work structures in Victorian orchards.

What is a “middle manager”? Investigating work organisation in Victorian orchards

Associate Professor Gyorgy Scrinis

Associate Professor Gyorgy Scrinis

- Food politics and policy
- Philosophy of nutrition science
- Ultra-processed foods
- Corporate power
- Food insecurity

gyorgys@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/1628-gyorgy-scrinis

Combining politics, economics, sociology and philosophy, I study how global food systems contribute to food insecurity and poor nutrition, severe ecological and animal welfare impacts, and inequalities in wealth and power along the supply chain in order to inform policies and strategies to address these issues.

Ultra-processed foods (UPFs) and food corporations

UPFs are industrially manufactured, packaged, and fast foods that contain reconstituted ingredients and additives, and are primarily produced by large food corporations. High proportions of UPFs in the diet are associated with poor health. I analyse the commercial and corporate drivers of UPF production and consumption, to inform policy proposals for regulating producers and reducing consumption.

Nutrition science and dietary guidelines

Nutrition research and dietary advice are shaped by scientific paradigms and assumptions – for example, a reductive focus on nutrients – and social, philosophical, political and commercial contexts. I explore alternative ways of understanding nutrients, foods and the body, and the influence of corporate funding on nutrition science and expert advice.

Food insecurity of university students

Food insecurity affects a large proportion of university students in Australia, ranging in severity from poor quality diets to regularly skipping meals. I examine university students' experiences of food insecurity in Australia, how campus environments are failing to provide affordable food for all, and how students are contributing to policies and initiatives to address this issue.

Ultra-Processed Foods.

Food insecurity of university students.

Associate Professor Gary Sheridan

Associate Professor Gary Sheridan

- Hydrology
- Soils
- Erosion
- Water quality
- Modelling

sheridan@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/98266-gary-sheridan

I develop biophysical models that help land and water planners, managers, and policy makers assess risks and make decisions to better manage bushfires and forest and water resources.

I study the long-term, co-evolution of forests, soils, and fire regimes, to help predict future trajectories of forest systems under climate change. I focus on the hydrology, water balance, and soil erosion processes of fire-prone upland forests in southeast Australia, including:

- improving models of surface fuel moisture
- identifying transitions in forest systems that may alter fire behaviours, and
- developing risk models for post-fire flash floods, debris flows, and water contamination.

Installing runoff monitoring equipment on hillslopes after a bushfire.

Using “instrumented catchments” to understand how rainfall, forests, and runoff interact.

As forests change, so do their microclimates and fire regimes.

Professor Kevin Smith

Professor Kevin Smith

- Phenomics
- Plant breeding
- Pastures
- Forages
- Agronomy

kfsmith@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/393320-kevin-smith

I focus on solutions to improve the productivity and resilience of pastures and forage crops.

Farmers grow forage crops for fresh grazing by livestock or for conservation as hay or silage, for later feeding. I work in multidisciplinary teams to develop productive, perennial forage species that are resilient to climate change, and related innovations fit for farm applications. This work includes genomic, phenomic, economic and agronomic aspects.

Driverless ground vehicle measuring pasture growth.

Screening ryegrass for nitrogen use efficiency.

Associate Professor Helen Suter

Associate Professor Helen Suter

- Soil science
- Nitrogen cycling
- Sustainable production systems
- Greenhouse gas emissions
- Soil health

helencs@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/16560-helen-suter

To help meet the challenge of achieving long-term global food security under increasing population pressure and climate variability, without causing environmental harm, I investigate nitrogen and carbon cycles in soils, crops, pastures and the atmosphere, including agricultural greenhouse gas emissions, options for soil carbon storage, and strategies for more efficient nitrogen use in food production.

Novel technologies for environmentally friendly fertilisers

I research strategies to improve nitrogen use efficiency in fertilisers, including additives that slow loss of nitrogen to waterways and the atmosphere, reducing the environmental impact of nitrogen fertilisers and enabling farmers to reduce nitrogen application rates.

Multispecies dairy pastures to improve climate resilience and sustainability

I assess whether dairy pastures that use a variety of pasture species will provide better climate resilience and environmental outcomes than traditional pastures dominated by one species. I investigate how species composition impacts pasture quality, productivity, soil ecological biodiversity, the efficiency of water and nutrient use, potential for carbon storage, and rates of nitrogen cycling, to determine the short and long-term implications of pasture species choice.

Dairy cows enjoying high quality pastures

Measuring nitrous oxide emissions from vegetable farms.

Rice production in southeast Asia.

Dr Matthew Swan

Dr Matthew Swan

- Fire ecology
- Fire management
- Animal behaviour

swanm@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/161519-matthew-swan

Wildfires are a key ecological process that have shaped global biodiversity for millennia. Despite the evolution of plants and animals with fire, fire regimes are changing during rapid anthropogenic change. There is an urgent need to understand how fire can be managed to help conserve biodiversity.

My research is focused on understanding how fires (both wildfires and planned fires) affect the distribution and abundance of animals. In particular, I'm interested in how properties of fire regimes such as size, intensity and frequency vary in different ecosystems and what the implications of this are for biodiversity. I study the effects of fire regimes on important ecological processes such as animal movement, habitat use and species interactions.

Additionally, I am interested in determining how fire interacts with other threats such as land-use change, invasive predators and climate change. I work with a range of animal groups, including birds, mammals and reptiles and conduct primarily field-based research across a range of ecosystems in south-eastern Australia, including heathlands, woodlands and tall forests.

Dr Chris Szota

Dr Chris Szota

- Green infrastructure
- Urban forestry
- Urban ecohydrology
- Plant ecophysiology

cszota@unimelb.edu.au

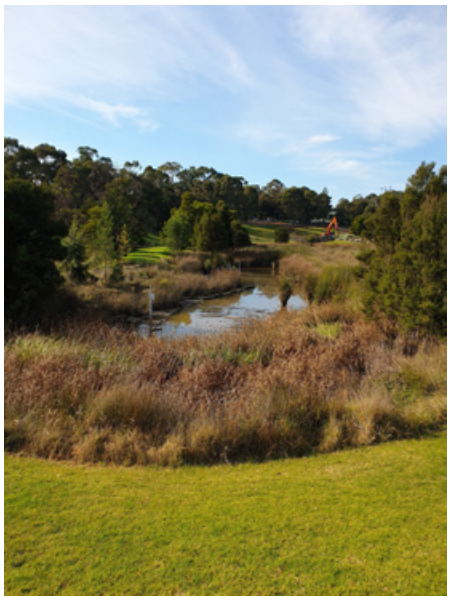
findanexpert.unimelb.edu.au/profile/415560-chris-szota

My aim is to develop solutions to the suite of environmental problems created by urbanisation. Green infrastructure can mitigate the negative impacts of development on our waterways and improve the quality of life for people. I hope to build the evidence base required to make the major changes necessary to achieve sustainable development.

Cities generate substantial volumes of polluted runoff, carried by highly efficient drainage networks to our creeks and rivers. As a result, we waste precious water resources and degrade waterway ecosystems. I work on green infrastructure, which aims to reduce the volume of polluted stormwater urban entering waterways and provide other ecosystem services for residents.

My background is in plant ecophysiology, studying nutrient uptake mechanisms and drought tolerance in vegetation far from the city: at restored mine sites and eucalypt plantations. Urban environments provide a fantastic opportunity for plant ecophysiologists to contribute to mitigating the impact of cities on the environment and make them better places to live. I work on improving the performance of green infrastructure through plant selection, substrate development and engineering design for green roofs, street tree systems, constructed wetlands and biofiltration systems.

Constructing a system to irrigate street trees with stormwater generated by roads.



A constructed wetland that filters pollutants from stormwater before it enters an urban stream.

Dr Peta Taylor

Dr Peta Taylor

- Behaviour
- Welfare
- Poultry
- Free-range
- Enrichment

peta.taylor@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/677558-peta-taylor

I collaborate with diverse animal welfare stakeholders to undertake high-quality, animal-centric research into practical and cost-effective means of better meeting captive animals' wants and needs.

Applying methods from ethology, physiology, and neurophysiology, I focus on agricultural species, especially poultry, investigating free-range systems, maternal environments, and environmental enrichment, to improve animal welfare in the meat chicken industry.

Peta holding a laying hen.

Free-range meat chickens.

Clicker training a laying hen.

Dr Niloofar Vaghefi

Dr Niloofar Vaghefi

- Plant pathology
- Evolutionary mycology
- Population genetics
- Plant pathogen genomics

vaghefin@unimelb.du.au

findanexpert.unimelb.edu.au/profile/510993-niloofar-vaghefi

I advance understanding of phytopathogen (plant pathogen) biology and adaptive evolution, and plant disease epidemiology, to develop more effective and sustainable disease management strategies for natural and agricultural ecosystems.

Pathogen evolution and management

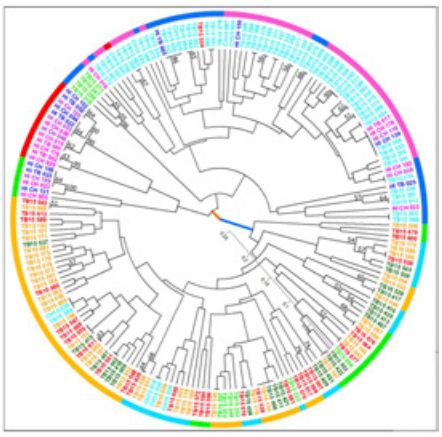
I use traditional and molecular techniques, novel genomic tools, and bioinformatics to characterise genetic and phenotypic variation in bacterial and fungal pathogen populations and understand how highly adapted and aggressive pathogen populations emerge and disseminate. This informs strategies for plant disease management including identifying and eliminating sources of infection, limiting pathogen dispersal and survival, and managing development of resistance to fungicides and host cultivars.

Fungi and oomycetes taxonomy and evolutionary mycology

I use whole-genome and multi-locus sequencing to develop a classification system for fungi and pseudofungi by reconstructing phylogenetic relationships. This is not only critical to understanding the evolutionary divergence and speciation of these organisms, but also for effective plant disease management.

A Victorian tomato crop suffering yield decline due to soilborne diseases

Plants are inoculated with plant pathogens to assess their aggressiveness and host responses



A genetic distance tree showing genetic diversity in a fungal pathogen population and association of pathogen genotypes with the collection site

Professor Peter Vesk

Professor Peter Vesk

- Functional ecology
- Plant traits
- Ecological models
- Vegetation management

pvesk@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/100084-peter-vesk

There are roughly 300,000 plant species. We know a lot about some, but not others. Effective conservation and management require good ecological knowledge. I aim to speed the development of that knowledge through measurable plant traits and quantitative models.

I am a quantitative ecologist who integrates fundamental and applied research, working mainly with plants. A clear challenge in plant ecology is how to generalise understanding: how to move beyond treating every study and every species as a special case.

Research in my group mainly falls in two fields:

1. The analysis of plant functional traits and types and their generality
2. Predicting, planning and measuring the outcomes of vegetation conservation, management and landscape restoration.

Most of the work includes developing and applying conceptual and quantitative ecological models appropriate to the problem at hand.

The use of functional traits provides a means to transfer knowledge from well-studied species to less well-studied species. That can be about where plant species occur or how they grow or respond to fire.

On the topic of vegetation management, our work on Eucalypt woodlands spans conducting experiments on tree regeneration, providing models of vegetation change and the provision of animal habitat, and we monitor the outcomes of management for plant and animal communities.

Teaching students sampling methods in the Bogong High Plains. Image credit: Peter Vesk.

Standing at the base of a large Eucalyptus regnans. Image credit: Angela Stock.

Associate Professor Tony Weatherley

Associate Professor Tony Weatherley

- Organic wastes
- Phosphorus
- Soils
- Closing the loop

ajw1@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/475-tony-weatherley

I seek appropriate applications of agricultural waste materials that contain useful nutrients to reduce environmental damage and economic loss.

Closing the nutrient loop

Global reserves of phosphorus (P) – an essential plant nutrient – are declining. I examine the potential to divert and process organic waste streams from industry and residences to return valuable P to farm systems and reduce the environmental impact of P in landfill or waterways. These waste streams can be composted or processed through pyrolysis to form biochar.

In plant glasshouse experiments, I apply advanced, solid-state, spectroscopic methods to analyse how organic acids, alone or in combination, affect availability and efficient use of P. I aim to improve evaluation of organic waste materials' suitability for application to land, and even formulate new products to increase the availability of applied or existing P for agricultural systems

Fast composting of food waste from a residential dining hall.

Measuring water movement in paddy soils of the central dry zone of Myanmar. Measuring water movement in paddy soils of the central dry zone of Myanmar.

Associate Professor Christopher Weston

Associate Professor Christopher Weston

- Forests
- Ecosystems
- Ecology
- Fire
- Soil

weston@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/1681-christopher-weston

I am to provide an empirical basis for better understanding relationships between forest management and fuel hazard. I also investigate Indigenous cultural burning practices in relation to forest carbon balance, greenhouse gas emissions, forest resilience and fuel hazard.

I am a forest ecologist with expertise in soil science and forest ecosystem ecology. My interests include the ecology of Australian forests and nutrient cycling in forest soils. My research focuses on the biogeochemistry of forest ecosystems, the productivity of forests, carbon and nutrient cycling in forests, greenhouse gas fluxes from forests and bushfire fuels science. Current projects include recovery of bushfire fuels after wildfire, recovery of tropical forests following fire and management of tropical plantations for sustained productivity.

Professor Kathryn Williams

Professor Kathryn Williams

- Environmental psychology
- Conservation psychology
- Forests
- Urban greening

kjhw@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/2324-kathryn-williams

My mission is understanding people and how they connect with nature — social science to help protect, restore and manage ecosystems.

My research extends knowledge of human-environment relationships and applies this to issues of environmental management. My work is grounded in environmental psychology, but I often work in teams of academics from other disciplines to address challenges associated with ecosystems in urban and wider landscapes.

Human-nature connections

My research explores human relationships with natural environments, ecosystems, plants and animals, and with 'nature' more broadly. Much of this work is concerned with nature in cities: plants, urban greening, and ecosystems that support urban populations. My interest is in understanding the psychological dimensions of these connections. One aspect of this work examines how environments influence psychological function and experience, such as changes in mood, attention and creativity. A second aspect is concerned with factors that underpin environmentally significant behaviour, such as social values, understanding, and emotional affiliation with the natural world.

Social expectations and environmental policy and practice

Much of my work has been with forest and fire management agencies, helping them to understand psychological factors that are relevant to their decision-making. For example, I have worked with colleagues to better understand why people support or oppose different ways of managing forests or using land. Increasingly, this work has focused on understanding how knowledge from social research can be integrated into environmental planning and management.

Nature in the city.

People and nature. Image credit: Michael Coghlan/ Flickr.

Professor Nicholas Williams

Professor Nicholas Williams

- Urban ecology
- Green infrastructure
- Green roofs
- Plant traits
- Native grasslands

nicholas.williams@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/837104-nicholas-williams

I work predominantly in urban areas because although they are the cause of many of the world's environmental problems, cities also offer humanity great hope for a sustainable future. I seek to understand urban biodiversity patterns and ecosystem processes and then develop applied solutions to reduce the negative impacts of urbanisation such as biodiversity loss, excess urban heat, stormwater runoff and CO2 emissions. I am passionate about demonstrating how native plants can be used more widely in cities to provide ecosystem services such as cooling and stormwater adsorption, biodiversity habitat and greater connection to country for all Australians.

Urban Ecology

I am interested in how urbanisation affects the assembly of plant and animal communities, their distribution and what characteristics or traits of species mediate this. My research in this area has included sampling local and regional vegetation and insect communities, quantification of plant traits, and international collaborations, which have developed influential syntheses and conceptual frameworks.

Green Roofs

Over the past 12 years, I have led green roof research in Australia, working with other Green Infrastructure Research Group members to create a collaborative, cross-disciplinary network of researchers, government agencies and industry partners. We conduct high-quality research encompassing green roof substrate design, plant palette selection and testing, and quantifying green roof stormwater, energy and social benefits. This work has provided the evidence base for state and local government policy and planning schemes and was integrated into the award-winning Growing Green Guide. More recently, we have been researching how to increase the uptake of green roofs in Australian cities.

Native grassland and grassy woodland ecology conservation, restoration and management

Southeastern Australia's native grasslands and grassy woodland are critically endangered ecosystems threatened by urbanisation and land-use intensification. My research has sought to better understand their ecology and develop effective management and restoration techniques. It builds on work done in my PhD and decades of research at the University's Burnley Campus and includes herbivory, seed ecology, nutrient manipulation and direct seeding techniques for restoration. I have also edited a book on the ecology, restoration and management of native grasslands and developed an app to increase awareness and help species identification.

The Pixel Building Green Roof in Carlton used green roof plant palettes and substrates based on our research. It was designed to reflect the pre-European vegetation at the site and provide biodiversity habitat.

Surveying native grassland on Melbourne's urban fringe.

Professor Brendan Wintle

Professor Brendan Wintle

- Conservation
- Monitoring
- Cost-effectiveness
- Modelling

b.wintle@unimelb.edu.au

findanexpert.unimelb.edu.au/profile/261-brendan-wintle

I am motivated by the conservation of species because I have been so lucky to experience the awe and wonder of nature and wildlife. I want future generations to have that opportunity. When we allow species to go extinct, we steal something precious from future generations.

Australia's biodiversity is unique and rich. Australia is one of the world's 'megadiverse' nations, with more species than any other developed nation and the highest levels of endemism (uniqueness). Eighty-seven per cent of our mammals, 93% of our reptiles and 94% of our frogs are found nowhere else on the planet. Yet Australia is at the forefront of extinctions driven by dramatic land-use change (habitat clearing and degradation) and the proliferation of invasive species following European invasion. We have the highest rate of biodiversity loss of any developed nation and the second highest rate of loss on the planet. We are responsible for 35% of all mammal extinctions globally since 1700. On average, our threatened bird populations have declined in abundance by 50% since 1985.

I will engage in any research anywhere on the planet that can help stem the tide of extinctions, but I do most of my work in Australia. I currently lead work in several key areas of conservation research: on-ground trials of conservation actions, design of monitoring to understand the state and trends of species and the effectiveness of conservation actions and policy, the costs of conservation, prioritisation of conservation investment and ongoing conservation policy failure.

Setting up a light trap to count Bogong moths on Mt Wills.

Professor Ian Woodrow

Professor Ian Woodrow

- Natural products
- Flavonoids
- Terpenoids
- Eucalyptus

i.woodrow@unimelb.edu.au

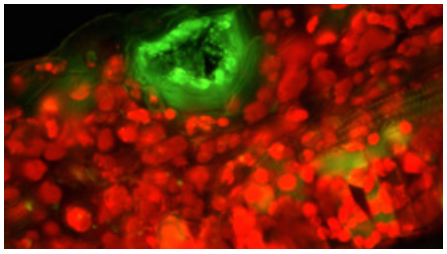
findanexpert.unimelb.edu.au/profile/119-ian-woodrow

Australia has a large amount of land that is marginal for cropping. I would like to develop sizeable areas of highly water-use efficient mallee eucalypt plantations for natural product and biomass production.

Plants produce a huge array of chemicals (natural products), many of which are of commercial value as pharmaceuticals. My research involves identifying valuable plant natural products, mapping their biosynthetic pathways, and developing methods for large scale production using plantations.

Future projects involve the establishment of eucalypt plantations for the production of essential oil, flavonoids and phloroglucinol compounds.

Plantation of blue mallees (Eucalyptus polybractea), which have been bred for their exceptionally high levels of pharmaceutical grade eucalyptus oil. The oil is harvested by steam distillation of foliage.



A cross-section of a eucalypt leaf showing the photosynthetic cells (red) and an embedded secretory cavity (green). These cavities (glands) contain relatively large amounts of natural products, including terpenoids, flavonoids and polyketides.

Collecting rare but chemically interesting eucalypts in southern Australia.

Professor Pablo Zarco-Tejada

Professor Pablo Zarco-Tejada

- Remote sensing
- Hyperspectral imaging
- Vegetation stress detection
- Chlorophyll fluorescence
- Radiative transfer modelling

pablo.zarco@unimelb.edu.au

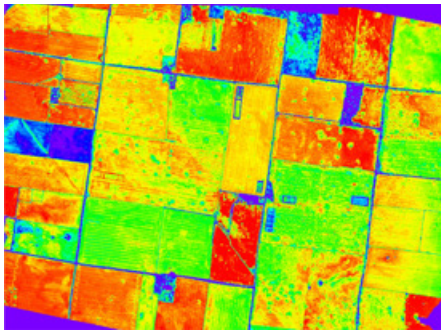
findanexpert.unimelb.edu.au/profile/835498-pablo-zarco-tejada

My research is focused on quantitative methods for vegetation stress detection and physiological condition, primarily water and nutrient stress assessment, and the early detection of harmful plant diseases.

I lead the HyperSens Laboratory in research and industry services and advisory activities that support precision agriculture and ecosystem management. These include:

- large-scale imaging of farms and forests using piloted and uncrewed aircraft with hyper/multispectral scanners and thermal sensors
- detecting water and nutrient stress in vegetation
- monitoring plant traits and health indicators such as leaf and canopy levels and chlorophyll fluorescence emissions
- assessing biochemical and biophysical parameters through physical modelling
- developing innovative algorithms and adapting imaging software to meet the needs of industry partners.

Aircraft for remote sensing.



Hyperspectral image for vegetation stress detection.

THE UNIVERSITY OF
MELBOURNE

UniMelb on-demand

Get to know us better
in your own time

SciMelb

CRICOS Provider Code: 00116K

RFQ08492