

Future Regions Research Centre (FRRC)





Conserving, protecting and transforming our regions

The Future Regions Research Centre (FRRRC) aims to create new knowledge and innovative solutions to the grand challenges that impact both our natural and constructed environments.

FRRRC brings together expert research and local knowledge to tackle challenges ranging from the transition towards new energy to helping regional communities recover from bushfire and drought.

This expertise is embodied by our multidisciplinary teams who are working to develop new knowledge and innovative solutions to the challenges facing our environments.

These challenges include:

- managing land and water and its associated infrastructure and integration within the agricultural sector
- supporting and restoring ecosystems affected by primary industries and other activities (particularly mining)
- understanding the role of people at a time of significant societal and environmental change
- understanding the requirements to adapt to climate change and to more actively involve our First Peoples in the nation's future
- exploring options for circular economy and a carbon conscious future in agriculture and local industry

Understanding and managing the world we live in, from the constructed to the natural, is an emerging area of critical global concern. This requires a high level of continual research to facilitate solutions that balance the needs of society with the protection of the environment.

To address these concerns, the multidisciplinary FRRRC collaborates with local communities, government, industry partners and international collaborators. This includes the Centre's work with Indigenous communities to develop cross-culturally appropriate land and fire management strategies.

FRRC'S RESEARCH STREAMS

FRRC's objectives are aligned with its five research streams:

RESILIENT LANDSCAPES AND AQUATIC SYSTEMS

This stream evaluates the health of landscapes and aquatic systems and explores appropriate measures for their remediation.

STABLE LANDFORMS AND MINE REHABILITATION

This stream aims to stabilise landscapes and mining landforms through soil conditioning and revegetation programs to address further deterioration.

SOIL HEALTH, FOOD AND FIBRE

This stream explores the contribution of soils to the long-term stability of landforms and their role in capturing carbon and advancing agriculture.

CIRCULAR ECONOMY

This stream mobilises environmental engineering, advanced monitoring and modelling expertise to improve how we use and re-use products and waste.

SOCIETY AND HERITAGE

This stream explores how changes in society and the natural environment interact and seeks to integrate environmental values within social practices and policy.

Research with **real-world impact**

Our focus is on applied research that makes a difference in the communities we serve. The following case studies present just some examples of how this Centre's research is having a positive impact in the world.



Case study: **Researchers investigate impact of climate change on coal mine rehabilitation**

Our researchers are investigating how climate change could impact the stability of rehabilitated coal mines in Victoria's Latrobe Valley. Launched in 2021, the 18-month project is looking at the critical role of soil covers and vegetation in building safe, stable and sustainable landforms following mining.

Final rehabilitation of the mines will require at least part of the void slopes to be covered by earthen material and soil. Vegetation helps stabilise soil against downslope movement and regulate soil moisture, reducing the risk of erosion.

The research, led by Professor Thomas Baumgartl, will examine how changes in rainfall and increased drought will impact the soil and plant cover of rehabilitated mines.

It's the latest in a series of research projects Professor Baumgartl is undertaking on the rehabilitation of the Latrobe Valley's brown coal mines and will include laboratory and glass house experiments, as well as hydrological modelling.

Once completed, the project will highlight the potential impact of climate change on design requirements for ground covers in mine rehabilitation.

The \$450,000 research project is funded by the Victorian Government as part of the Cooperative Research Centre for Transformations in Mining Economies (CRC-TiME) – a national collaboration of universities, industry and governments.



Case study: **How maths is solving complex water quality issues**

Researchers are using complex mathematical modelling to improve the quality and distribution of water, a vital and precious resource that is often taken for granted because of its 'simple' journey from reservoir to tap.

Federation University Australia has a long-standing relationship with Grampians Wimmera Mallee Water (GWMWater), initially collaborating to improve the efficiency of the Wimmera Mallee Pipeline – a system well over 8,000 kilometres in length that supplies a large rural area of north-west Victoria and was built to replace an ageing and inefficient open channel water delivery system.

Professor Adil Baghirov said researchers developed new algorithms and optimisation techniques to reduce energy consumption and pumping costs, and to improve water quality to customers. The research contributed to a 20 per cent reduction in bills for households, businesses, industry and farmers. It also provided a more secure and efficient supply, with lower carbon emissions.

Key to the project was developing a mathematical model based on optimisation where water with varying degrees of quality was taken from different reservoirs in the Grampians region and mixed within the pipework to satisfy usage requirements for urban, farming and industrial use.

The project helped motivate a state-wide change in the Victorian water industry to implement 'intelligent water networks' and look for more efficient ways to operate pipeline systems.

Work continues, with the sector undertaking research on water grids, water resources and climate change, and optimisation of complex systems.



Case study: **Using dried biosolids to boost grain production**

Federation University Australia researchers are trialling the use of biosolids to improve soil fertility and increase crop productivity in Victorian grain-growing regions.

Biosolids are obtained from dried sewage and are freely available from state water corporations.

The research, funded by a Grain Research Development Corporation innovation fund, will help determine whether biosolids can be used as a possible solution to the significant subsoil issues hampering the Victorian grains industry.

Previous work shows that up to 80 per cent of soils in Victoria's grain-growing regions have major physical and chemical constraints that significantly reduce crop productivity. The use of biosolids aims to fix these issues and boost grain production.

Preliminary trials last year at Balliang in Victoria's medium rainfall zone showed plots that had deep subsoil manuring with biosolids yielded a 55 per cent increase in cereal grain production compared to untreated plots.

In a separate trial at Ballan in Victoria's high rainfall zone, deep placement of biosolids in the soil produced a 65 per cent yield increase in cereal grains compared to the untreated control treatment.

Dr Fernando said it was clear from the trials that re-engineering poor Victorian subsoils with biosolids substantially changed the soil's physicochemical properties and soil water dynamics.

The research is also backed by the Intelligent Water Network, with the biosolids supplied by Central Highlands Water.

Centre Leadership

FRRC has three centre co-directors as well as leadership teams for each of its research streams.



Professor Thomas Baumgartl

CO-DIRECTOR
FUTURE REGIONS
RESEARCH CENTRE

Professor Thomas Baumgartl is an internationally renowned environmental scientist specialising in soil physics and soil mechanics, with a degree in geoecology from the University of Bayreuth, Germany.

Professor Baumgartl is leading the Geotechnical and Hydrogeological Engineering and Research Group (GHERG). The group of local and international experts works closely with the Victorian Government and mining partners to guide the safe rehabilitation of open-cut brown coal mines in the Latrobe Valley.

Professor Baumgartl has many years of experience working nationally and internationally on industry and government funded projects and has worked previously at the Centre for Mined Land Rehabilitation at the University of Queensland. His research interests focus on mine closure and solutions for construction of stable landforms. Of specific interest are water balance parameters (such as evaporation, run-off, infiltration, vegetation, deep drainage) and understanding the evolution of constructed landforms and risks of failure. He is associate editor and editorial board member of several international journals and has organised and presented at international conferences on mine rehabilitation and land restoration.



Professor Singarayer Florentine

CO-DIRECTOR
FUTURE REGIONS
RESEARCH CENTRE

Professor Singarayer Florentine ('Florry') is a restoration and invasive species ecologist with more than 25 years of experience in research and higher education teaching. Professor Florentine specialises in ecologically diverse habitats, with experience in three different countries.

Professor Florentine established a powerful invasive species and restoration research group based upon understandings of complex and urgent ecological restoration issues. He has led the development of strong collaborative research partnerships with over 20 natural-resource management groups across Australia and with high profile researchers from Spain and Sweden. Professor Florentine has attracted significant competitive research grant funding, bringing over \$10 million to the University.

Professor Florentine has published over 100 research papers, and supervised several PhD, MSc and Honours students. He established the Biodiversity Across the Borders Conference, which significantly enhanced the research culture within his discipline.

Professor Florentine has been appointed as a Deputy Chair of the Biodiversity Advisory Committee at the Glenelg-Hopkins Catchment Management Authority.



Professor Keir Reeves

CO-DIRECTOR
FUTURE REGIONS
RESEARCH CENTRE

Professor Keir Reeves' research expertise exists at the intersection of history, heritage, regional studies and cultural tourism, including travel in Asia, Australia and the Pacific.

Professor Reeves has been a Chief Investigator on three ARC Discovery and four ARC Linkage projects. Professor Reeves was ARC funded Post-Doctoral Industry Fellow and contributed to Anzac Journeys: Returning to the Battlefields of World War Two (Cambridge, 2013) – shortlisted for the 2014 AHA Ernest Scott prize.

Professor Reeves is a Life Fellow at Clare Hall Cambridge and was a Visiting Researcher at both the University of Cambridge and Ghent University, and a Senior Rydon Fellow and Bicentennial Fellow at King's College London. In 2019, Professor Reeves was a Visiting Fellow at the Centre for the Humanities and Public History Lab at Utrecht University, and in 2020 he was a Visiting Researcher at Wakayama University, Japan.

Professor Reeves completed his MA and PhD at the University of Melbourne.

Research Stream Leaders

RESILIENT LANDSCAPES AND AQUATIC SYSTEMS

- Dr Jessica Reeves
- Associate Professor Andrew Barton

STABLE LANDFORMS AND MINE REHABILITATION

- Larissa Koroznikova
- Professor Thomas Baumgartl

SOIL HEALTH, FOOD AND FIBRE

- Associate Professor Kim Dowling
- Professor Andrew O'Loughlin

CIRCULAR ECONOMY

- Associate Professor Ean Ooi
- Associate Professor Vincent Verheyen

SOCIETY AND HERITAGE

- Professor Jennifer Martin
- Professor Erik Eklund
- Dr Cathy Tischler
- Dr Kelsey McDonald



Find out more

For research queries and to find out more about FRRC's research, visit the Centre website: federation.edu.au/frrc

Federation.edu.au

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