Bachelor of Science Honours / Master of Environmental Management

Potential research projects

Updated 29/08/23

Course	*Project description*	*Supervisor(s)*
Honours or MEM	**Do the small mammals of the high-rainfall tropical savannas qualify as a Threatened Ecological Community under the EPBC Act?** Small mammals have undergone a dramatic decline in the high-rainfall savannas of northern Australia in recent decades. Many species that were once common and widespread have disappeared from much of their former ranges, and are now listed as threatened under Australia's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). In addition to listing individual species as threatened, the EPBC Act recognises Threatened Ecological Communities, however in the vast majority of cases these are plant-focussed communities; there are very few listed animal communities. The purpose of this desktop-based project is to assess whether the small mammals of the high-rainfall tropical savannas qualify as a Threatened Ecological Community under the EPBC Act. This will involve analysing existing datasets to assess the validity of the community itself, and to assess the extent to which the community is threatened. The outcomes of the research could potentially form the basis of a public nomination of the mammal community as a Threatened Ecological Community under the EPBC Act.	Brett Murphy (RIEL) brett.murphy@cdu.edu.au
Honours	**Using stable isotopes to assess the sources of tree water uptake** An important question in ecohydrology is related to the origin of water that is extracted by trees. In tropical regions subject to high rainfall seasonality, some trees may be reliant on perennial groundwater supplies during the dry season. But the prevalence and magnitude of groundwater uptake by trees is often unclear. Accurately assessing the use of groundwater by trees is essential for the evaluation of ecosystem health and vulnerability to water resource development. The aim of this project is to characterise and map the groundwater dependency of tree communities in different areas of the Roper River and Victoria River catchments, where remote sensing studies suggest that some trees are dependent on groundwater. However, a finer understanding of the sources of tree water uptake is lacking in these areas. The project will involve the use of stable isotopes of water as tracers of tree water sourcing. The isotopic composition of potential tree water sources (soil water at different depths, groundwater) will be determined and their contribution to xylem water will be assessed using numerical mixing models.	Clem Duvert (RIEL) clem.duvert@cdu.edu.au Lindsay Hutley (RIEL) lindsay.hutley@cdu.edu.au

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	The project will be supervised by Dr Clément Duvert, Prof Lindsay Hutley and will involve collaboration with Dr Tanya Doody and Dr Jodie Pritchard (CSIRO Environment).	
Honours	**Remote sensing for detection and surveillance of invasive weeds at a catchment scale** Siam weed invasion in northern Australia has substantially increased over the past 10 years. It has spread in Queensland, and was detected for the first time in the Northern Territory in 2019. The weed is poisonous to stock, smothers vegetation and is easily spread by humans, animals, wind and water. The weed has the potential to greatly affect the agriculture, pasture, and the tropical savanna biome of northern Australia. This project will acquire proximal (ground-based) and remote sensing (UAV and manned aircraft based) data which will include RGB, multispectral, and hyperspectral images along with ground reference spectral measurement. Several MEM/honours projects can be explored by students, such as: - Radiometric calibration and validation of the remotely sensed multispectral/hyperspectral images. - The use of calibrated multispectral imageries and object-based image analysis for weed detection. - Hyperspectral image classification for accurate mapping of the weed infestation in the natural ecosystem. - UAV-based high-resolution RGB images and machine-learning techniques for weed detection. The success of this project will enable us to better detect and manage high priority weeds, such as Siam weed, in northern Australia. *Note: The applicant should have completed ENV202/502 or ENV306/506.*	Deepak Gautam (RIEL) deepak.gautam@cdu.edu.au Louis Elliott (NT Department of Environment, Parks and Water Security) Natalie Rossiter-Rachor (RIEL)
Honours of MEM	**Runoff, water quality in the Keep River catchment (WA/NT)** The Keep River receives runoff from the 'Stage 2' farms from the Ord River Irrigation Area. The river is also the habitat of EPBC listed sawfish. Given the importance of the Keep River as a habitat, and the interest in developing the Ord River Irrigation Area, there is a strong interest in better understanding runoff and associated nutrient and chemical loads in order to ensure that the system is effectively managed. Project work can include (1) field work to collect water samples, (2) analyses of river flow, rainfall and river chemistry time series data, (3) collation of river pollution datasets from across Australia, and/or (4) investigations into water resources management. The ideal student would be open to conducting field work, learning basic computer programming/scripting (in Python).	Dylan Irvine (RIEL) dylan.irvine@cdu.edu.au

Course	*Project description*	*Supervisor(s)*
Honours of MEM	**Producing a drawdown and stream depletion estimator for groundwater extraction** Groundwater is the largest store of fresh, liquid water on Earth. It provides water for towns and industries, and provides important environmental services including providing baseflow to rivers and sustaining groundwater dependent ecosystems. When new developments are proposed, one of the challenges is typically determining suitable extraction limits. Often, this process utilises complex numerical groundwater flow models which do not always allow for an open and transparent process for those who are not familiar with groundwater modelling, or access to complex and potentially expensive computer codes. An alternative approach can come from the use of relatively simple analytical solutions. The goal is to produce a set of Python functions to demonstrate potential drawdown and/or the impact to rivers from groundwater extraction. The goal is to produce and demonstrate the use of Python tools to implement the Theis (1935) and Hunt (1999) analytical solutions to explore optimal approaches to design 'trigger level' management. This desktop-based project will focus on the use of Python to produce tools to demonstrate potential impacts of groundwater extraction in a totally open and reproducible way.	Dylan Irvine (RIEL) dylan.irvine@cdu.edu.au
Honours of MEM	**Big data/ big hydrology in northern Australia** Are you interested in working with big data? Interested in rivers? We are keen to work on a project to collate river hydrograph data (e.g., from the Bureau of Meteorology), catchment areas and properties (again, the Bureau of Meteorology), and rainfall and evapotranspiration time series (Queensland government SILO database). With these datasets, it will be possible to gap fill missing data in hydrographs, allowing analyses of baseflow (and how this may have changed through time), as well as the ability to study river 'flashiness', the timing and duration of no-flow periods of rivers, amongst many other questions. The goal is to study flows in Australia's rivers, and how it has changed over time. The ideal student should have some hydrological background, and either have solid computer scripting skills (i.e., Python, R, Matlab), or a strong willingness to learn, as well as some background in GIS.	Dylan Irvine (RIEL) dylan.irvine@cdu.edu.au Nicole Stromsoe (RIEL) nicola.stromsoe@cdu.edu.au
Honours of MEM	**Freshwater losses due to sea level rise** Access to fresh drinking water is vital to sustain life. While damage to coastal real estate is often considered when considering climate change, other impacts, including the loss of fresh (ground)water supplies receives far less attention. This project aims to utilise projections of sea level rise, costal slope data, and estimates of	Dylan Irvine (RIEL) dylan.irvine@cdu.edu.au

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	important hydrogeological variables (including groundwater recharge and hydraulic conductivity) to estimate the extent of seawater intrusion in coastal aquifers. By considering a range of sea level rise scenarios, and hydrogeological parameters, this desktop-based project seeks to understand the potential losses of freshwater across the Australian continent due to sea level rise. This project is best suited to someone with a background in mathematics or engineering, and/or with experience in computer coding/scripting.	
Honours of MEM	**Research projects on surface water, groundwater, water resources management and climate (general)** Both surface and groundwater provide a wide range of important services, from sustaining ecosystems, providing water for town water supplies, in industry and mining and to support agriculture (among many other services). With Australia being the driest inhabited continent on Earth, it is vital that we underestimate this critical resource. My research focuses on water resources, largely where groundwater is a factor, across the Northern Territory and northern Australia. The work includes a fieldwork and desktop-based projects. Potential projects could: • Utilise the collection and interpretation groundwater and/or river samples, • seeking to understand spring water sources, • the use of isotopes to understand various hydrological/hydrogeological processes, • the impact of groundwater extraction on springs and/or rivers, • questions relating to water resources management, • big data and groundwater science. If you're interested in any of these areas, please speak with me to discuss project options. Otherwise, more detailed projects from me are listed below.	Dylan Irvine (RIEL) dylan.irvine@cdu.edu.au
Honours or MEM	**Understanding the savanna ecosystem stress using remote sensing and eddy-covariance flux tower data** Canopy gas exchange is a powerful tool to understand the ecosystem stress and the response of an ecosystem to climate change and/or land-use change. Responses to slow change or pulse events of different intensity and duration e.g. drought or fire can be assessed. In this context, flux towers make direct measures of the exchange of energy, water and carbon at an ecosystem scale. However, these measures are at single points in space and to derive regional to global estimates of the ecosystem fluxes and stress, UAV and satellite remote sensing methods are needed.	Richard Crabbe (RIEL) richard.crabbe@cdu.edu.au Lindsay Hutley (RIEL) lindsay.hutley@cdu.edu.au

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	This project will be conducted using TERN's Litchfield Savanna Supersite within Litchfield National Park that RIEL staff manage. Masters and Honours projects are available in this domain include: ➢ Calibration of UAV-based multispectral remote sensing with direct measures of energy, carbon and water use as measured by flux towers. ➢ The use of UAV-based multispectral remote sensing to estimate the vegetation stress. ➢ Use of historical weather and remote sensing data to estimate and link the ecosystem stress with long-term flux tower data. The success of this project will mean our ability to accurately map the ecosystem stress regionally using UAV and globally using satellite remote sensing. *Note: The applicant should have completed ENV202/502 and require some experience in scripting.*	
Honours or MEM	**Applying aerial drone systems in the ecological and environmental sciences** The application of aerial drone systems is transforming field data collection in the ecological and environmental sciences. These emerging technologies are being used across a broad range of vocations and sectors and their application is only going to grow into the future. Learning how to use aerial drone systems effectively is a must for any budding ecologist or environmental scientist. The North Australia Centre for Autonomous Systems (located at CDU's Casuarina campus) is engaged in the application of aerial drone systems into a broad range of projects in the environmental sciences. Rather than listing projects here we are looking for enthusiastic students to identify their own problems that could be solved using drone aerial systems. Potential projects could be monitoring animals population, identifying weeds, or undertaking landscape scale vegetation survey. You will work with our team of professionals to design a project suited to your interests, and learn how to undertake effective, compliant, and safe drone operations, as well as effectively analyse and synthesis these data. Students will require an RePL licence if they want to collect the data themselves, or the NACAS team can also collect the data for you. There is also opportunity for students to undertake a literature review in their chosen subject area.	Hamish Campbell (RIEL) hamish.campbell@cdu.edu.au (08) 8946 6017 http://nacas.net
Honours or MEM	**Ecosystem Services and Indigenous well-being** This project will explore and quantify links between ecosystem services (ES) and various constituents of human well-being. It will offer new skills to understand ES concepts, assess the values of ES, and to link the importance of managing natural resources with policy decision making.	Kamaljit Sangha (RIEL) kamaljit.sangha@cdu.edu.au

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	There is scope to focus on Indigenous well-being – understanding what well-being means to people and how country plays a role in enhancing people's well-being. This project can inform emerging nature repair or nature positive markets. Required skills: Bachelor's degree in environmental sciences or a related discipline.	
MEM	**Role of Indigenous peoples and local communities in conservation** This project will assess the involvement of Indigenous communities in formal conservation estate, often declared under national parks, wildlife sanctuaries, etc. If locals are involved, to what degree is their involvement and how their contributions shape the conservation strategies. This project could lead to Masters/PhD research. Requirement: Bachelor's in environmental sciences or a related discipline.	Kamaljit Sangha (RIEL) kamaljit.sangha@cdu.edu.au
Honours or MEM	**Impact of climate change on naturally occurring marine bacteria** This project seeks to shed light on the impact of environmental change on marine bacteria that occur naturally, but which under adverse conditions can become opportunistic pathogens. Our previous research studying bacterial communities and Vibrio bacteria specifically, suggests that temperature and salinity may have an impact on these Vibrio opportunistic pathogens. However microbial ecological studies can sometimes pose more questions than answers, so this project would establish culture trials to measure Vibrio species responses to temperature, salinity and algae (simulating blooms). Based on the literature and our own work, the student would develop hypotheses and identify lab-based approaches to address the hypotheses. Resources available would include lab facilities to support vibrio culture trials in response to temperature, salinity and algal treatments. There will be opportunity to measure responses using both conventional and molecular techniques, including identifying toxin or pathogen genes. Bacterial isolates would be sourced from a range of samples to ensure different bacterial strains were used in the trials. This research has implications for northern aquaculture, and interactions with NTG staff will be possible, thus increasing the student's network. The student will have ample opportunity to work within a supportive research team and develop a range of skills from the scientific method through to laboratory analysis and biostatistical skills.	Karen Gibb (RIEL) karen.gibb@cdu.edu.au (08) 8946 6705 0421 194 455
MEM (or possibly Honours)	**The seasonal use of nesting mounds by Orange-footed Scrub fowl** Camera traps have been deployed at three different scrub fowl mounds on or near CDU's Casuarina Campus for more than a year. A very large number of pictures are available for analysis to determine the extent to which the birds use the mounds at different times of the year, and for what purposes. A MEM project would be a desk-	Keith Christian (RIEL) keith.christian@cdu.edu.au

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	based project examining the photos and analysing the resulting data. However, the project could also be expanded into an Honours project by including field observations of the birds' behaviour as well as exploring the data from the wildlife cameras. *NOTE: There is no requirement for students to participate in fieldwork to undertake this project.*	
Honours or MEM	**Evaporative water loss and thermoregulation in invertebrate animals** Evaporative water loss (EWL) can be experimentally measured in controlled conditions that can be compared against environmental variables (such as temperature, season, etc.) or across species. Similarly, thermal selection can be measured in the laboratory and can be compared between species or evaluated against temperatures selected in the wild. Possible study animals include: hermit crabs; wolf spiders or other terrestrial spiders; scorpions; land snails; millipedes or centipedes; stag beetles.	Keith Christian (RIEL) keith.christian@cdu.edu.au
Honours or MEM	**How important is evaporative water loss from the eyes of reptiles and amphibians?** The eyes of most terrestrial animals are a measurable (and sometimes significant source of water loss because they are wet surfaces. As long as the eyes are open, they will be subject to evaporative water loss (EWL). For most lizards, which tend to have dry skins that have a high resistance to water loss, the eyes are a significant source of EWL. However, they have some control over this loss by having the ability to close their eyes, which greatly reduces the exposure of these wet surfaces. However, Geckos do not have eyelids and cannot close their eyes. They do, however, have scale over the eye called a "spectacle". It has been assumed that the spectacle has a resistance to EWL similar to that of the body scales. If that were true, then eyes would not be a particularly important source of EWL in geckos, and, we would expect the eye temperature of a gecko to be similar to the skin temperature of the gecko because they would both be evaporating at a similar rate. We have been studying EWL in geckos in a bigger project comparing genetic diversity with physiological flexibility. As part of that study, we have employed the use of high-resolution infrared photography to measure skin temperature, and we have found that, for geckos in an air stream, eye temperatures are lower than nearby skin temperature. This indicates that the spectacle is not as resistant to EWL as the body integument and scales. In retrospect, this is not surprising because work from the 1960s showed that the low EWL of reptile skin was primarily due to a lipid layer in the skin, not to the scales. It therefore seems that: (1) the eyes of geckos have water loss rates greater than the water loss across their skin, (2) but gecko eye EWL is probably less than that of the open eyes of lizards with eyelids; and (3) eye EWL in geckos may be a significant source of EWL relative to their total EWL. Given that EWL from gecko eyes will occur 24 h/day as opposed to other lizards that may have their eyes shut a significant part of 24 h day, it would be interesting to compare eye EWL in different types of lizards on both an instantaneous basis and integrated across a 24 h day.	Keith Christian (RIEL) keith.christian@cdu.edu.au

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	Two different projects could be developed from this: (1) The significance of evaporative water loss from the eyes of geckos. The data for this project have been collected, but not analysed. Thus, it would be a desktop study reducing the data, solving some equations for water loss from eyes and whole geckos and evaluating the relative contribution of eye water loss. Comparisons across species with different body sizes and habitats are also possible. (2) A comparison of the rates of evaporative water loss from the eyes of ectothermic vertebrates with different eye and skin characteristics, including: (1) geckos that do not have eyelids, but have a spectacle (eye scale) on their eyes, (2) lizards that do have eyelids but no spectacle, (3) frogs with low cutaneous resistance to water loss, and (4) frogs with high cutaneous resistance to water loss. The water loss of the eyes could be measured along with total water loss so that the contribution of eye water loss could be calculated and evaluated with respect to the different eye and skin characteristics. This project would require laboratory experiments, and animal ethics approval would have to be obtained before the data could be collected (except for the geckos, which have been measured). *NOTE: The applicant should have completed (or be currently enrolled in) ENV206 (or similar).*	
Honours	**The association of melioidosis with soil disturbance and the weather in Darwin** Melioidosis is a severe infectious disease affecting humans and animals in Northern Australia. It is caused by the soil bacterium *Burkholderia pseudomallei*. Cases mainly occur during the wet season and there is a strong association with rainfall. We hypothesize that large-scale soil disturbance and earthworks during large construction projects also increase the melioidosis incidence rate locally. This is a desktop-based project with RIEL and Menzies School of Health Research. There is a spatial data component where the student will extract spatiotemporal data from historical archives of satellite data and compute indices for changes in vegetation and earthworks followed by a biostatistical component performing timeseries analyses to assess whether melioidosis incidence rates are associated with soil disturbance and the weather. *NOTE: The applicant should have completed (or be currently enrolled in) ENV306/ENV506 ("Environmental Monitoring and Modelling") and ENV311/511 ("Real-World Statistics and Data Reasoning") (or similar). Interest in learning and using various biostatistical techniques in R is essential.*	Mirjam Kaestli (RIEL, Menzies) mirjam.kaestli@cdu.edu.au (08) 8946 7638 Richard Crabbe (RIEL) richard.crabbe@cdu.edu.au Bart Currie (Menzies) bart.currie@menzies.edu.au
Honours	**Toxic trace metals in Australia's cities and towns** Many people are unaware of just how ubiquitous toxic trace metals (lead and others) are in the environment. Emitted to the atmosphere by coal burning, metal smelting and transport, these metals travel large distances and have been found at greater than natural concentrations as far afield as Antarctica, the remote ocean and	Nicola Stromsoe (RIEL) nicola.stromsoe@cdu.edu.au (08) 8946 6527

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	Australia's iconic Snowy Mountains. In terms of impacts on humans it is the concentration of these metals in the environments we are exposed to everyday – our homes, gardens, workplaces and playgrounds – that is probably of most interest. We have found surprisingly high levels of toxic trace metals in children's playgrounds in urban environments. Previous studies have documented elevated levels of lead on playgrounds in industrial centres with a known history of metal pollution – such as former mining or smelting towns. However, we don't fully understand the distribution and concentration of metal pollutants in urban environments more generally – in the cities and towns where we live. This project aims to quantify the concentration of metal pollutants on children's playgrounds in urban environments. This project forms part of a larger project building an Australia wide data base of metal concentrations – this honours project will preferably focus on Darwin and it's surroundings but there is potential to undertake this project externally in the students home town. Necessary skills or knowledge: Basic (1st year) university chemistry knowledge, the ability to work independently (with guidance) to develop a robust sampling strategy, the ability to collect samples from a range of urban environments, the ability to follow protocol to collect and maintain 'clean' samples, basic maths skills, skills in excel or R and GIS or the ability to learn them. Methodological approach: Develop a sampling strategy to reliably quantify trace metal concentrations on children's playgrounds in Darwin and its surroundings (or other towns and cities), undertake a literature review to develop a database of comparable measurements, analyse data to determine concentrations, spatial patterns and potential for harm of toxic trace metals in urban environments.	
Honours	**Drivers of water variability in Australia's wet–dry tropics** The variability of water presence and quantity in the rivers, wetlands and aquifers of Australia's wet-dry tropics has a profound effect on the plants, animals and people that rely on them for survival. It is often assumed that the wet-dry tropics are buffered from the effects of dry periods experienced elsewhere in Australia by the annual tropical wet-season – which replenishes environmental water stores. However, recent dryer than usual wet seasons have highlighted the fact that the wet season may not be as reliable as is often assumed – which could impact the availability of water through the dry season and even into subsequent years. While we understand the link between larger scale climate drivers (such as the El Niño–Southern Oscillation) and the year to year variability rainfall in the top end, we don't really know how variability in these systems impacts the presence and quantity of surface water – that is water in wetlands and stream habitats important to plants and animals. The amount of rainfall which appears in these surface habitats is likely to be modulated by the impacts of catchment configuration and connectivity between groundwater and surface water stores. The aim of this project is to understand long term, year-to-year variability of surface water variability in the wet dry tropics and its climatic controls.	Nicola Stromsoe (RIEL) nicola.stromsoe@cdu.edu.au (08) 8946 6527

Course	*Project description*	*Supervisor(s)*
	Necessary skills or knowledge: Some understanding of climate and hydrology. Basic maths skills. The capacity to learn new statistical techniques and implement them in the relevant software. Methodological approach: Undertake a literature review to identify suitable statistical techniques to analyse streamflow variability and its relationship with relevant climate drivers (e.g. the El Niño–Southern Oscillation, Indian Ocean Dipole), Identify and obtain data on streamflow and climate driver indices, using publicly accessible data, Use statistical analysis to determine relationships between streamflow and climate drivers.	
MEM	**What do we know about changes to water availability and ecosystems in northern Australia prior to the instrumental record (anytime between 100 and 71 000 years ago)?** Variability in water presence and quantity has a profound effect on Australia's plants and animals. Over the long term, patterns of water availability drive changes in the distribution and abundance of the living organisms and result in local and regional vegetation shifts. Scientists use a variety of proxies to reconstruct these changes from times prior to the development instrumental rainfall databases and ecosystem monitoring. So far however, there have been fewer reconstructions undertaken for northern Australia than for other parts of the continent. This project will search the scientific literature for evidence of past change in northern Australia's hydroclimate and associated ecological responses to construct a picture of how our environment has changed through time and to better understand the potential for future change.	Nicola Stromsoe (RIEL) nicola.stromsoe@cdu.edu.au (08) 8946 6527
Honours or MEM	**Quantifying taxonomic bias in the northern Australia fauna** Why are some animals more studied than others? Our knowledge of Australia's wildlife ecology is very uneven, which has significant consequences for their conservation. This desktop-based project aims to unravel what makes a species popular for research using text-mining and functional-trait approaches combined. Importantly, this project will quantify the gaps of knowledge between the well- and poorly-known species that will help set up priorities for future research. This study is taxa specific (e.g. either mammals, birds, fish, or another group of the student's choice). It will focus primarily on Northern Australia, with the potential to expand Australia-wide.	Osmar Luiz (RIEL) osmar.luizjunior@cdu.edu.au
Honours	**Assemblage structure of Darwin's urban coral reefs using drones** Some of Darwin's urban beaches, such as Nightcliff, East Point, and others, bear shallow coastal coral reefs that are very little studied because it is dangerous to dive, and the water is relatively turbid most of the time. By taking advantage of Darwin's broad tidal range, this study aims to use drone generated imagery at the short time windows when extreme low spring tides expose these reefs out of the water to study the species composition and spatial structure of their coral colonies.	Osmar Luiz (RIEL) osmar.luizjunior@cdu.edu.au Deepak Gautam (RIEL) deepak.gautam@cdu.edu.au

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Honours	**Understanding the diet of freshwater fishes through stomach content analysis** Northern Australia hosts the highest diversity of freshwater fishes that are, at the same time, the least known in the whole country. This project aims to use legacy frozen fish stomachs from a previous project to shed light on the diet patterns of some of the most iconic fishes in the Northern Territory, such as the barramundi, the archerfish, catfishes and fifteen other species. These fishes were sampled across five rivers basins and all seasons, making it possible to determine potential changes in diet that might be related to distinct river flow conditions and wet-dry seasonal variability.	Osmar Luiz (RIEL) osmar.luizjunior@cdu.edu.au
Honours or MEM	**Research trends, knowledge gaps and future directions in feral cat research** Domestic cats (*Felis catus*) are among the most abundant carnivores on earth. The impacts of free-roaming cats, both owned and feral, on wildlife and policies trying to tackle the problem have been well-documented in hundreds of papers. Those papers cover various subjects published in journals specialized in diverse topics such as biological conservation, applied ecology, environmental management, public health, ethics, veterinary medicine, animal welfare, and others. The quantity of papers published associated with the broad thematic range threatens researchers capacity to keep up with the research field, a phenomenon known as 'information overload'. This desktop-based project aims to make sense of the disparate scientific literature about feral cats using a machine-learning approach called 'topic modelling'. Topic modelling is a bottom-up approach to literature reviews that automatically uncover hidden thematic structures from collections of texts. Topic modelling help elucidate the key ideas within a set of articles. It provides insight into the development of a scientific field, detects gaps in knowledge and suggests changes in research priorities with greater speed and quantitative rigour than would otherwise be possible through traditional narrative reviews.	Osmar Luiz (RIEL) osmar.luizjunior@cdu.edu.au Brett Murphy (RIEL) brett.murphy@cdu.edu.au
Honours or MEM	**Synthetic aperture radar remote sensing for aboveground pasture biomass** Aboveground pasture (including crops) biomass monitoring is crucial to improving profitability in the livestock industry as the information is useful for feed budgeting and grazing management. Manual, destructive measurement of pasture biomass is highly accurate but not sustainable at large scale; thus, satellite-based optical imagery has been immensely utilised. Meanwhile, the application of the optical satellite remote sensing is limited by cloud cover, making it unreliable for pasture biomass estimation in regions with persistent cloud cover. Synthetic aperture radar remote sensing surmounts the problems associated with the optical-based systems and is responsive to the structural attributes of vegetation. Nonetheless, SAR remote sensing is under-utilised in pasture/crop biomass studies due to insufficient knowledge regarding the availability, preprocessing and interpretation of SAR data. This will be a desktop study, student will conduct a literature review of SAR remote sensing of pasture/crop biomass, and will retrieve and validate polarimetric parameters useful for pasture/crop biomass. The project will use a multitemporal field measured biomass data from a CSIRO experiment site.	Richard Crabbe (RIEL) Richard.crabbe@cdu.edu.au

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	Note: Best for students who have completed ENV202/502 and ENV306/506	
Honours or MEM	**Weed detection using UAV and satellite remote sensing data** Environmental weeds are a big problem in Australia as it costs federal and state governments a lot of money to control. In NSW, bitou bush (*Chrysanthemoides monilifera* subsp. *rotundata*) is a major threat to coastal biodiversity while African lovegrass (*Eragrostis curvula*) smothers native pasture plants. Field visits approach for the detection and control of weeds can be highly subjective, labour and time expensive while the visits can be skewed in favour of physically accessible locations. UAV and satellite remote sensing provides an objective and cost-efficient method for weed monitoring. This project will explore UAV and satellite imagery and machine learning/AI techniques for the detection/classification of bitou bush and African lovegrass in NSW. Data for this project is already available. *Note: Best for students who have completed ENV202/502 and ENV306/506 and willing to learn scripting*	Richard Crabbe (RIEL) richard.crabbe@cdu.edu.au
Honours	**Conservation genetics of rock-rats** Australia's rock-rats (*Zyzomys*) are a fantastic genus of native rodents found through rocky country in northern and central Australia. This project will use genetic data to understand evolutionary relationships among species and genetic diversity within populations of rock-rat species. This can help us understand the importance of particular locations for conservation of genetic diversity in declining mammals and also provide insights into whether populations in certain areas are more resilient to environmental threats (genetic data can be used to understand changes in population size). The project will be supervised by Prof. Sam Banks, Dr Brenton von Takach Dukai and involve collaboration with external scientists. There will be opportunities for field work, laboratory work and data analysis.	Sam Banks (RIEL) sam.banks@cdu.edu.au
Honours or MEM	**Native rice transpiration and photosynthesis evaluation under different environmental conditions** Stomatal conductance is the key factor regulating transpiration and subsequently water use in agricultural ecosystems. The objectives of this study are to evaluate the dependency of stomatal conductance on phenological and environmental factors considered most important in determining stomatal aperture, viz. leaf ageing, photosynthetic active radiation, temperature, vapour pressure deficit, soil water potential and time of day. Gas exchange measurements will be collected using an Infrared Gas Analyser (IRGA) under a wide range of phenological and environmental conditions. This would be a on a field trial at Coastal Plains and cosupervised by Dr Alireza Houshmandfar, Cropping Group Leader, Department of Industry, Tourism and Trade. Operational funding is supported by a Future Food Systems, Cooperative Research Centre grant to CDU.	Sean Bellairs (RIEL) Sean.bellairs@cdu.edu.au; 08 8946 6070
MEM	**Pest management for Australian native rice under cultivation** Australian native rices are abundant and widespread across northern Australia, particularly in the NT. There are three native species in northern Australia, *Oryza meridionals*, *O. rufipogon* and *O. australiensis*. These wild	Sean Bellairs (RIEL) Sean.bellairs@cdu.edu.au; 08 8946 6070 Penny Wurm (RIEL)

Course	*Project description*	*Supervisor(s)*
	relatives of cultigen rice comprise a globally significant source of new genes for breeding *O. sativa* (cultigen rice). They also have economic potential as a high-value, low-volume and culturally-identified specialty food product. This project is part of a larger project investigating the commercialisation of Australian native rice. Pilot studies indicate that in order to be commercialised, cultivation will be required, because supply from wild harvesting is not reliable. For this reason, RIEL is conducting nursery trials to learn more about native rice performance under nursery and field trial conditions. Under nursery conditions we have found a number of invertebrate pests in rice grown in our preliminary trials. This MEM project will investigate pest management for cultivation of Australian native rice. It is expected that native rice will be tolerant of some level of predation by native "pests". It may be that native rice is a preferred host for other pests. The research will involve the collection and identification of pests, creation of an invertebrate pest library, a review of pest management options for the pests identified, and trials of these management options, focusing on integrated pest management (IPM), under nursey conditions. Thes student must be located in Darwin.	Penny.wurm@cdu.edu.au; 08 8946 6355 The project will also involve collaboration with entomologists and agronomists in NT Department of Industry, Tourism and Trade. For more information visit the project website at https://www.cdu.edu.au/riel/research/australian-native-rice-commercialisation
Honours or MEM	**Agronomy and commercialisation of Australian native rice** This project is currently focussing on the agronomy of Australian native rice, via a series of nursery experiments focussing on soil properties and agronomic performance, seedling establishment, etc. There is also scope for other projects focussing on supply chain development, markets etc.	Sean Bellairs (RIEL) sean.bellairs@cdu.edu.au Penny Wurm (RIEL) penny.wurm@cdu.edu.au
Honours or MEM	**Trends in magnetic termite abundance in the Greater Darwin region** This project will draw on an historical dataset of magnetic termite mounds to determine trends in growth and abundance. Magnetic termite mounds are icons of the Top End savannas. Some evidence suggests that individual mounds may stand for at least centuries, possibly millennia, and that recruitment of new mounds is incredibly infrequent. A dataset of measured mounds from the mid-2000s will be used to assess changes in the last 17 years that will allow some of these hypotheses to be tested, and whether the population of magnetic mounds is being sustained.	Stephen Garnett (RIEL) stephen.garnett@cdu.edu.au
Honours or MEM	**Global trends in the legal protection of wildlife** This project draws on a global dataset of wildlife protection legislation to understand the coverage and biases of legislative instruments designed to protect wildlife	Stephen Garnett (RIEL) stephen.garnett@cdu.edu.au

Course	*Project description*	*Supervisor(s)*
	Almost every country has a list of species protected under its legislation. Commonly, however, such lists are out of date taxonomically and in terms of the risk posed to the species that are listed. They also tend to be biased towards mammals and birds and ignore many of the most threatened taxa in other animal classes, or plants. A dataset is available on almost all the world's wildlife legislation that has never been analysed. Identifying legislative shortfalls will help countries improve their lists, and, through that, the species that are listed.	
Honours or MEM	**Population trends of a grassland migratory shorebird in northern Australia** The aim of this project is to examine the trends in Little Curlew (*Numenius minutus*) populations across northern Australia using records from online databases, atlases and counts from historical literature. There are grave concerns for the species, with many close relatives declining rapidly in abundance in flyways across the world, but without robust monitoring data it is difficult to confirm any trend predictions. Like other migratory shorebirds, the species faces many threats: effects from climate change, alteration of habitat on breeding grounds, reduction in the availability of food resources, development of habitat on core staging grounds in the Yellow Sea region, pesticides and fertilisers on agricultural grounds where birds feed, and hunting. Grassland shorebirds such as the Little Curlew are difficult to monitor because of their nomadic movements across the non-breeding grounds in response to rainfall events and food availability; consequently these shorebirds have received less monitoring attention. Because of this and the lack of knowledge on this species, using records from online databases, bird atlases and historic literature allows an inexpensive method of assessing the species' trends over time.	Stephen Garnett (RIEL) stephen.garnett@cdu.edu.au
Honours or MEM	**Population trends of a grassland migratory shorebird in northern Australia** The aim of this project is to examine the trends in Little Curlew (*Numenius minutus*) populations across northern Australia using records from online databases, atlases and counts from historical literature. The global population estimate for the Little Curlew is currently 141,000, with some suggestion that the species may be declining. However without robust monitoring data it is difficult to confirm any trend predictions. Like other migratory shorebirds, the species faces many threats: effects from climate change, alteration of habitat on breeding grounds, reduction in the availability of food resources, development of habitat on core staging grounds in the Yellow Sea region, pesticides and fertilisers on agricultural grounds where birds feed, and hunting. Grassland shorebirds such as the Little Curlew are difficult to monitor because of their nomadic movements across the non-breeding grounds in response to rainfall events and food availability; consequently these shorebirds have received less monitoring attention. Because of this and the lack of knowledge on this species,	Stephen Garnett (RIEL) stephen.garnett@cdu.edu.au

Course	*Project description*	*Supervisor(s)*
	using records from online databases, bird atlases and historic literature allows an inexpensive method of assessing the species' trends over time.	
MEM	**Natural oil analysis from Australian native plants** Analytical organic chemistry.	Vinuthaa Murthy (RIEL) vinutha.murthy@cdu.edu.au
Honours or MEM	**Assessing the environmental footprint of aquafeeds for farmed barramundi** Barramundi (*Lates calcarifer*) farming is Australia's fourth largest aquaculture sector by volume and is expected to expand considerably as Australia diversifies its farmed seafood sector. To support the sustainable growth of barramundi aquaculture, we require knowledge on how to best minimise environmental impacts associated with its production. Feed accounts for the majority of embedded environmental impacts in the life-cycle of most farmed fish, thus represents a critical lever for improving environmental performance. The environmental impacts from feed production can be minimised in two ways - through reducing feed demand or through manipulating how feeds are formulated. This project will compare and contrast how changes to feed efficiency or feed formulation can minimise the environmental footprint of aquafeeds for farmed barramundi through: Estimating the net habitat disturbance, greenhouse gas emissions, nutrient pollution, and water consumption from feed production for Australian barramundi production. Conduct sensitivity analyses of the influence of changing feed conversion ratios or feed composition on the net environmental impacts of barramundi aquafeeds. In doing so, the results of this project can provide policy-relevant guidance on priorities for sustainable expansion of Australian barramundi farming. Skills students will develop through this project (they don't need to have these before commencing): Competence in R statistical programming language and collaboration using Github. Gain experience in spatial analysis and data synthesis. Expertise in aquaculture sustainability research Strong potential for peer-reviewed publication This project is associated with ARC Linkage Project: *Optimising feeds to support ecosystem-based aquaculture*	Beth Penrose beth.penrose@cdu.edu.au Dr Richard Cottrell (IMAS, University of Tasmania) richardstuart.cottrell@utas.edu.au

Course	*Project description*	*Supervisor(s)*
Honours or MEM	**Detection of invasive aquatic weeds in natural waterways using environmental DNA** Aquatic weeds pose significant threat to the quality of the Darwin region's drinking water, tourism, recreation and the aquatic ecology of the iconic rivers and billabongs of the Northern Territory. Cabomba (Cabomba caroliniana Gray), a submerged aquatic plant from the southern United States, is one of the world's most serious aquatic weed species and recognised in Australia as Weed of National Significance (WoNS). In 2004 cabomba was located in the Darwin River with an eradication program initiated in 2004 with significant reduction of the size of the infestation. Methods that can detect invasive aquatic plants at low levels in the environment are required. Environmental DNA is shed by all living organisms in the environment and is a powerful tracking too especially for species detection especially at low abundance. This project will develop and apply environmental DNA (eDNA) and environmental RNA (eRNA) methods to assess eradication efforts for Cabomba in the Darwin River. The question of whether detections from live or dead plants is occurring will be assessed by comparing eDNA to eRNA results, as eRNA should only be expressed by live plants. The project will also assess distance eDNA travels and assess how eDNA corroborates with visual results. The project will involve collaboration with external scientists and staff in the Weed Management Branch, Northern Territory Government. There will be opportunities for field work, laboratory work and data analysis.	**Maxine Piggott** maxine.piggott@cdu.edu.au