Bachelor of Science Honours / Master of Environmental Management

Potential research projects

Updated 9/11/21

Course	*Project description*	*Supervisor(s)*
Honours or MEM	**Darwin's biodiversity values** In Darwin, biodiversity and our natural assets are an important and underappreciated part of the City. The natural systems and species on Darwin's doorstep provide the backdrop to all aspects of life and biodiversity interacts with each component of the city's built environment. At the same time the impacts of climate change on the city's liveability (how enjoyable it is to live there) is uncertain. This project will look at Darwin's biodiversity, with a focus on the landscapes, habitats, species of significant value to the Darwin community (Larrakia traditional owners, scientific and wider community). It aims to highlight Darwin city as a biodiverse urban environment and foster a sense of pride of place that is globally unique. This research is part of the Darwin Living Lab project (https://research.csiro.au/darwinlivinglab), where a range of research organisations such as CSIRO join with three tiers of government (Darwin City Council, Northern Territory Government and Commonwealth Government) to provide research that aims to help develop a cool, liveable, thriving, tropical city into the future. This work would involve liaising with the various government employees to present your findings about the current state of the biodiversity of Darwin to a diverse audience. This could involve calculating the international biodiversity index[1] for Darwin, investigating the current understanding through a scientific literature review and exploring the grey literature and information held by various groups who value biodiversity around Darwin. [1] http://www.cbd.int/subnational/partners-and-initiatives/city-biodiversity-index	Adam Liedloff (CSIRO) adam.liedloff@csiro.au
Honours or MEM	**Darwin's biodiversity knowledge** Darwin is unique in Australia, being the only large city on the tropical north coast less than 15 degrees from the equator. This relatively isolated, coastal city has an amazing diversity of tropical plants and animals within its boundary and nearby providing an important and underappreciated part of the City. The natural systems and species on Darwin's doorstep provide the backdrop to all aspects of life with increasing threats from a growing population in a changing climate. This project will consider the current biodiversity knowledge of Darwin, whether traditional, scientific or from the wider community. It could involve getting a citizen-centric idea of favourite biodiversity aspects such as individual tree, natural landscape, species and why?	Adam Liedloff (CSIRO) adam.liedloff@csiro.au

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	This research is part of the Darwin Living Lab project (https://research.csiro.au/darwinlivinglab), where a range of research organisations such as CSIRO join with three tiers of government (Darwin City Council, Northern Territory Government and Commonwealth Government) to provide research that aims to help develop a cool, liveable, thriving, tropical city into the future. This work would involve liaising with the various government employees to present your findings about the current state of the biodiversity of Darwin to a diverse audience. This could develop online means of recording this knowledge, so it is available to the community and acknowledging those who hold valuable information about the past and change through time to be best prepared for the future. A measure of the involvement of citizens in biodiversity related activity and private scientific research will help understand community values.	
Honours	**Microbial processes in high-rate algal systems for wastewater remediation** Leanyer-Sanderson waste stabilisation ponds (LSWSP), Darwin's largest treatment ponds, use a natural, cost effective form of treatment which relies on sunlight. A small-scale set up of a new treatment technology involving a high-rate anaerobic digestor and high-rate algal ponds (HRAPs) will be fitted to LSWSP in 2020 and monitored for performance. The aim of this Honours project will be to use high throughput sequencing technology to identify microbial communities and key taxa within the anaerobic digesters and HRAPs and track how the communities change over space and time. The results from this work will identify key bacterial communities that are associated with each of the key process operations of the integrated system. Water chemistry parameters will also be undertaken at all microbial sampling points allowing the chemical remediation of the wastewater to be followed through the treatment process and to better understand the relationship between water chemistry and microbial communities. The CRC-P project 'transforming regional treatment in Australia with robust technology' aims to revolutionise rural and regional wastewater treatment in Australia. The integrated low-cost microalgae-based treatment solution will transform inefficient sewage treatment ponds into self-contained environmental assets benefitting regional communities. It has strong market potential worldwide due to the ability to retrofit existing assets. This integrated technology will recover water and valuable nutrients suitable for local agricultural uses, with minimal odour and greenhouse emissions. Necessary skills or knowledge: Molecular techniques (DNA extractions, gel electrophoresis, PCR, qPCR); understanding of and ability to work with biohazards; well-organized; ability to coordinate and communicate effectively with multiple organisations. ***This project comes with a $4,000 stipend from Power and Water Corporation.***	Anna Padovan (RIEL) anna.padovan@cdu.edu.au (08) 8946 6555

Course	*Project description*	*Supervisor(s)*
Honours	**Analysis of microbial biofloc communities used in the culture of the red-legged banana prawn** Seafood grown through aquaculture has grown by over 500% in the past 30 years and is now equivalent to seafood obtained through wild catch which has remained almost static since 1990. Done sustainably, aquaculture has great potential to continue to increase and provide valuable protein for the world's population. Approximately half the nutrient in feed is not assimilated by fish or crustaceans fed a formulated diet. The next big step in sustainable production is to expand on systems that can recapture and assimilate "waste" from cultured species. Biofloc is a culture system whereby unassimilated nutrients are recaptured in microbial biomass through the addition of a carbon source, such as sugar. The microbes create an aggregate, that becomes ecologically diverse including bacteria, fungi, protozoans and other zooplankton species that can be eaten by cultured prawns. This is an exciting process as it has the potential to dramatically reduce feed requirements, reduce the requirement for water exchange, reduce the need to discharge waste nutrient, and allows a move to intensive controlled indoor production system that can be situated close to consumer markets. These represent key improvements in sustainability. We are seeking interested candidates to study the composition of biofloc microbial communities through e-DNA technology, and investigate the nutritional value of biofloc at different time points used in the culture of the red-legged banana prawn.	Anna Padovan (RIEL) anna.padovan@cdu.edu.au (08) 8946 6555 Morris Pizzutto (Aquaculture) morris.pizzutto@cdu.edu.au
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

Course	*Project description*	*Supervisor(s)*
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 aquifer disturbance. The aim of this project is to characterise and map the groundwater dependency of tree communities around Elsey National Park, an area of significant groundwater discharge to the Roper River. Remote sensing studies suggest that the entire area is dependent on groundwater, with evapotranspiration rates in excess of rainfall. However, a finer understanding of the sources of tree water uptake is lacking. 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. The project will be supervised by Dr Clément Duvert, Prof Lindsay Hutley and will involve collaboration with Dr Sébastien Lamontagne (CSIRO Land & Water).	Clem Duvert (RIEL) clem.duvert@cdu.edu.au Lindsay Hutley (RIEL) lindsay.hutley@cdu.edu.au
Honours or MEM	**What drives the reoccurring algal bloom off Tiwi Islands?** Datacubes are ready and available. The student will be required to produce climatology and time-series analysis based on various parameters, such as fluorescence, chlorophyll, sea surface temperature, etc. *NOTE: David Blondeau-Patissier is a CDU adjunct, who works with CSIRO, Brisbane. For this reason David would supervise externally, unless a student is also based in Brisbane. Candidates will require knowledge/interest in biology and water quality, remote sensing, programming in e.g., MATLAB, IDL; statistical knowledge would be a bonus; desktop-based only.*	David Blondeau-Patissier (CSIRO/CDU) david.blondeau-patissier@cdu.edu.au
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.	Deepak Gautam (RIEL) deepak.gautam@cdu.edu.au Louis Elliott (NT Department of Environment, Parks and Water Security) Natalie Rossiter-Rachor (RIEL)

Course	*Project description*	*Supervisor(s)*
	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.*	
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. 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.	Deepak Gautam (RIEL) deepak.gautam@cdu.edu.au Lindsay Hutley (RIEL) lindsay.hutley@cdu.edu.au

Course	*Project description*	*Supervisor(s)*
	Note: The applicant should have completed ENV202/502 and require some experience in scripting.	
Honours	**Applying pest bird mitigation for horticultural crops in the Top End** The magpie goose aggregates in large numbers in mango orchards in the Darwin peri-agricultural area. They are considered a serious pest to the industry. Although a native species and keystone to the northern wetland ecosystems they are culled in large numbers during the mango harvest season. Repeated efforts of deterrent using visual, sound, and taste stimulus have proved to be ineffective in dispersing the birds. In this project, we will trial a novel technique that will use 'fear of the unknown 'as the driver for the bird scare response. The field work for this project will run over a 3-week period anytime from October through until December — depending on goose aggregations. This will provide the opportunity for the candidate to undertake the field work prior to commencing the Honours program. Honours is a short period of time and often students are not able to undertake intensive field studies and have sufficient time to undertake detailed ecological analysis. In this project the students will be able to do both. There is also the opportunity to have financial support during the field data collection. The student will learn ecological experimental design, camera trapping techniques, image analysis, ecological statistics and scientific report writing. The candidate will be expected to work independently and safely in the field.	Hamish Campbell (RIEL) hamish.campbell@cdu.edu.au (08) 8946 6017 www.mlelab.com
MEM	**Applying animal movement information into threatened Ecological Community assessments and listings** Under the EPBC Act, threatened ecological communities are matters of national environmental significance. This project will examine all current commonwealth government Ecological Community listings and tease out areas where animal movement information may assist in making better decisions around ecological community assessments and listing. Plus ascertain if and how the inclusion of archival movement can be better included into future assessments. This project will be a desktop exercise with no field work, and the student will learn skills around threatened species assessments, the EPBC Act and GIS. *NOTE: The student should have completed ENV508 and ENV518 (or similar).*	Hamish Campbell (RIEL) hamish.campbell@cdu.edu.au (08) 8946 6017 www.mlelab.com
MEM	**Assessing the use of Remotely Piloted Aircraft (drones) in conservation biology** Over the last decade there has been a huge uptake in the use of autonomous technologies for Conservation Biology. This smart and exciting technology is all the rage but is it actually enabling us to make better decisions in Conservation Science. This project will review the current literature in regards to the use of drone technologies in Conservation Biology, and assess the areas where it has been most effective, and map a pathway for future	Hamish Campbell (RIEL) hamish.campbell@cdu.edu.au (08) 8946 6017 www.mlelab.com

Course	*Project description*	*Supervisor(s)*
	research and development. The student will learn how to effectively interrogate scientific literature, data analysis and synthesis and how to better undertake scientific writing. *NOTE: The applicant should have completed ENV508 and ENV518 (or similar).*	
Honours or MEM	**Assessing environmental change in the NT using remote sensing** Changes in environmental practices have resulted in large changes to rivers in the NT. This project will use satellite (Landsat) imagery gathered over the past 40 years to assess differences in riparian vegetation.	Hamish Campbell (RIEL) hamish.campbell@cdu.edu.au (08) 8946 6017 www.mlelab.com
Honours or MEM	**Unmanned aerial vehicles: drone applications in the environmental sciences** The Movement and Landscape Ecology lab (www.mlelab.com) has a large fleet of unmanned aerial vehicles (UAVs / drones) and students can design any project in the usage of UAVs for environmental management.	Hamish Campbell (RIEL) hamish.campbell@cdu.edu.au (08) 8946 6017 www.mlelab.com
Honours or MEM	**Management of feral species in the NT** This could be lab, desktop or field-based depending on the student, but will look into current management practices around feral pigs in the NT.	Hamish Campbell (RIEL) hamish.campbell@cdu.edu.au (08) 8946 6017 www.mlelab.com
MEM	**Tropical crops and plant pathology** There are opportunities to work in the plant pathology team at NT Department of Industry, Tourism and Trade, using both classical and genetic techniques. Projects available include: • Identification and pathogenicity of Botryosphaeriaceae species associated with dieback on mango trees and stem-end rot on mango fruits in Northern Australia. • Aetiology of Mango malformation disease in the Northern Territory. • Taxonomy and identification of plant pathogenic fungi: microscopy, morphometry, photomicrography, phylogenetics.	Jose Liberato (NT Department of Industry, Tourism and Trade) jose.liberato@nt.gov.au (08) 8999 2264
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 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
Honours or MEM	**Darwin Harbour water quality**	Karen Gibb (RIEL) karen.gibb@cdu.edu.au

Course	*Project description*	*Supervisor(s)*
	The tropical, macro-tidal estuary of Darwin Harbour is in good condition and supports a rich biodiversity. However, urban and industrial development pressures are increasing in many parts of the catchment. In 2010 and 2011, local beaches were closed on multiple occasions in the dry season due to elevated counts of E. coli and entero- cocci. There were concerns about sewage discharges and other suspected inputs, such as urban rivers and drains. The contamination may have originated from a point source, such as a waste treatment plant, or a diffuse, intermittent and indirect route, that is, contamination from surrounding urban areas and agricultural land that may include faeces from humans and other animals. Furthermore, environmental strains may have contributed to elevated counts. Identifying pollution hotspots will allow a more targeted approach to harbour water quality monitoring. This project will use existing bacterial and nutrient data from the 2010-2011 beach closure event to explore water quality in Darwin Harbour, identify pollution hotspots, critically analyse the use of E. coli and enterococci for water quality assessment and compare to other harbours. The student will be responsible for understanding and analysing the data within the broader context of harbour-scale water quality assessment. Critical analysis will be a key part of this project which will require an extensive analysis of relevant literature and a willingness to pose questions and hypotheses. *NOTE: There is no requirement for students to participate in fieldwork to undertake this project.*	(08) 8946 6705 0421 194 455
Honours or MEM	**The thermal ecology of three species of geckos** CDU's Casuarina Campus is home to three common species of gecko that inhabit different microclimates. This project will explore the thermal options and preferences of these nocturnal lizards by using a combination of field (CDU Casuarina Campus) and laboratory measurements and experiments. The project's scope is flexible and could be changed to accommodate either an Honours project or a shorter MEM project. It would involve a willingness to spend some time collecting data at night as well as spending some whole days in the laboratory.	Keith Christian (RIEL) keith.christian@cdu.edu.au
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-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.*	Keith Christian (RIEL) keith.christian@cdu.edu.au

Course	*Project description*	*Supervisor(s)*
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. 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.	Keith Christian (RIEL) keith.christian@cdu.edu.au

Course	*Project description*	*Supervisor(s)*
	(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 or MEM	**Remotely sensing an ecological tipping point: mass mangrove tree dieback in the Gulf of Carpentaria, causality and recovery** While mangroves are superbly adapted to the intertidal zone, there was an unprecedented mangrove dieback event stretching 1000 km across the Gulf of Carpentaria in 2015/2016 due to climate change. This project will use historical and current remote sensing data to examine the spatial and temporal nature of cover change following this event. The extent of dieback has been investigated already and now attention needs to focus on the rate and spatial distribution of recovery that will inform us of the resilience of this coastal system following major ecosystem failure due to climate change. *NOTE: Experience in managing and analysis of remote sensing imagery essential.*	Lindsay Hutley (RIEL) lindsay.hutley@cdu.edu.au Deepak Gautam (RIEL) deepak.gautam@cdu.edu.au
Honours or MEM	**Sensitivity of riparian tree flora to magnesium sulphate associated with the Ranger Uranium mine closure, Kakadu National Park** Current understanding of ecohydrological properties of Top End vegetation suggests spring-feed monsoon vine forests and riparian vegetation have a high groundwater dependence. Contamination of surface groundwater post-rehabilitation of the Ranger site could therefore have significant impact on riparian vegetation and thus impact stream health. Environmental isotopes and tritium analysis will be used to quantify groundwater dependence of riparian vegetation in the Magela Creek catchment, Kakadu NP / Ranger Project Area. This knowledge will be coupled with sensitivity testing of common riparian woody species to $MgSO_4$ to provide a risk assessment of impact from surface and/or groundwater egress of mine-related contaminants. *NOTE: Experience in managing and analysing data essential.*	Lindsay Hutley (RIEL) lindsay.hutley@cdu.edu.au
MEM	**Native stingless bee ecology: can they be effective pollinators in rambutan?**	Mary Finlay-Doney

Course	*Project description*	*Supervisor(s)*
	Native stingless bees (*Tetragonula* spp.) are abundant in Top End environments. Locally they are also known as sugar bag or sweat bees and they can regularly be found nesting wall cavities and upturned containers as well as trees and termite mounds. To date, ecological research has focused on stingless bee species restricted to the east coast of Australia where they are cultivated in home gardens and used commercially in the pollination of macadamias and other crops. Our research program is investigating stingless bee ecology of NT endemics, flowering phenology of rambutans and developing apiculture techniques to build stingless bee numbers for managed pollination in rambutan orchards. If you're interested in learning to identify stingless bees, measuring hive activity, learning apiculture practices or monitoring flower receptivity and fruit set please get in touch. Student projects can be tailored to interests and time available.	(NT Department of Industry, Tourism and Trade) mary.finlay-doney@nt.gov.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 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.	Nicola Stromsoe (RIEL) nicola.stromsoe@cdu.edu.au (08) 8946 6527
Honours	**Drivers of water variability in Australia's wet–dry tropics**	Nicola Stromsoe (RIEL)

Course	*Project description*	*Supervisor(s)*
	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 im pacts 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. 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.	nicola.stromsoe@cdu.edu.au (08) 8946 6527
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	**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	Sam Banks (RIEL) sam.banks@cdu.edu.au

Course	*Project description*	*Supervisor(s)*
	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.	
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 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.	Sean Bellairs (RIEL) Sean.bellairs@cdu.edu.au; 08 8946 6070 Penny Wurm (RIEL) 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

Course	*Project description*	*Supervisor(s)*
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 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.	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. 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.	Stephen Garnett (RIEL) stephen.garnett@cdu.edu.au

Course	*Project description*	*Supervisor(s)*
	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.	
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, 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
MEM	**Natural oil analysis from Australian native plants** Analytical organic chemistry.	Vinuthaa Murthy (RIEL) vinutha.murthy@cdu.edu.au