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Exotic ant-homopteran associations: scaling invasions upward.

Ants are acknowledged as most potent invaders, and some repeatedly become pests of natural environments. Invasive ants form close associations with honeydew-producing homopterans which may be key to ant population build-up and impacts. Nowhere is this better illustrated than on Christmas Island where supercolony formation of the introduced yellow crazy ant (Anoplolepis gracilipes) is associated with increased populations of the cryptogenic scale insect (Tachardina aurantiaca). This mutualism is a forest-wide phenomenon, and both the study and analysis of this association at an appropriate spatial scale can be difficult but may be critical to understanding invasion dynamics and management options. I used a before-after, control-impact design to experimentally assess the effects of crazy ants on scale insect populations on a forest scale by dissolution of their association in canopy trees. Ants were eliminate from forest plots by broadcasting toxic bait on the forest floor. Within 11 weeks, baiting had reduced ant activity on ground and on trunks by 98-100%, while control plot ant activity remained unchanged. Following ant exclusion, adult scale insects declined by 62% in 11 weeks, and 100% in 12 months with no difference in control plot scale numbers. Furthermore, the elimination of ants reduced the dispersal of scale crawlers from the canopy by 98% in 11 weeks, and 100% in 12 months. Disruption to this mutualism between crazy ants and scale insects on Christmas Island is essential to prevent expansion of supercolonies into uninvaded rainforest, decimation of red crabs and further dieback of the rainforest canopy through the deleterious effects of scale insects.

Eligible for student award? **yes** *Presentation mode:* talk

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Amphibian declines in Australia: their history and possible causes

In 1991, it was thought that 23 species of Australian frogs were declining. Populations of additional species in the Wet Tropics collapsed in the early 1990s. Coordinated research led to rapid evaluation of possible threats, the elimination of many species from concern, and the identification of new species. By 1997, 12 of the species identified in 1991 as possibly declining had been removed from the list, but 16 new species had been added, for a total of 27. In early 2001 the IUCN status of all Australian frogs was reviewed; 22 species were listed as endangered or critically endangered, 3 as extinct, and 19 as near threatened or vulnerable. Populations of 21 listed species were thought to be decreasing, while the trends for 8 were unknown and 12 were stable. Declining species can be separated into two categories: one set for which likely proximate anthropogenic causes of declines are known, and a set, united by occurring at higher elevations in protected areas with relatively high but seasonal rainfall, for which causes have not yet been certainly identified. Recent work suggests that changes in the interactions of frogs with the organism causing chytridiomycosis are implicated in these declines.

Eligible for student award? **no** *Presentation mode:* talk

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Spatial assessment of risk to endangered vertebrates from fire ants, in South Carolina, USA.

Rare species are particularly at risk from fire ants due to population characteristics and natural history traits that increase their susceptibility to fire ant predation. Fire ants threaten the persistence and survival of many endangered species by directly causing mortality, and by indirectly affecting growth, survival, and habitat use. Several studies have been conducted to assess the effects of fire ants on individual species, but to individually assess the vulnerability of each endangered species would be time consuming and costly. We used statistical models and GIS to provide a relative, spatially based risk assessment for endangered species at risk from fire ant impacts. We built logistic and probabilistic models of fire ant distribution based on 4400 statewide samples. We built predictive spatial models of endangered species using Gap Analysis data, and quantified risk as a product of spatial overlap and hazard indices that focus on traits of the endangered species. Spatial overlap between fire ants and endangered species ranged from 0 to 100%, with rare ground-nesting, oviparous species restricted to savannahs at the highest relative risk. The quantification of relative risk among a large number of species allows scarce resources to be focused upon the most vulnerable species.

Eligible for student award? **no** *Presentation mode:* talk

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Monitoring landscape health in NSW Rangelands: Ants as bioindicators

Invertebrates are widely regarded as effective indicators of ecosystem health because of their exceptional abundance, diversity and ecological importance. Ants are an especially popular indicator group in Australia because of their numerical and ecological dominance, ease of sampling, and well-understood community dynamics. Here we describe the effectiveness of ant communities as indicators of rangeland health in the Cobar region of western NSW, from the results of a pilot invertebrate monitoring programme. The study involved 25 sites representing a range of habitats (grasslands, grassy shrublands and grassy woodlands) and land condition classes (varying with intensity of grazing by sheep, goats and kangaroos, and including five ungrazed reference sites). We specifically address the following questions (1) How predictably do ant communities vary with condition class in different habitats? (2) How do responses of ants compare with those of plants, other invertebrate groups, and birds? (3) What is the minimum subset of total ant species that can be used to reveal the responses of the entire ant community?

Eligible for student award? **no** *Presentation mode:* talk

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Skinks on the Edge - Avian Predation.

In Australia human activities have intensified the fragmentation of native landscapes. The consequences of these actions are that the remnants created develop two structurally and functionally different areas within them: edges and interiors. The proximity of such varying systems can cause abrupt changes to environmental conditions at the interface. These effects can determinately impact upon both abundance and diversity of native species. Many studies have been conducted on the impacts that edges have on endemic populations, few have addressed the impacts on reptiles. In a previous study we found that the abundance and diversity of small generalist skinks differed significantly between edge and interior areas of woodlands of the Cumberland Plain (Richmond N.S.W). The variation was not caused by differences in habitat characteristics. A new studied was undertaken to examine whether edges act as a conduit that allows an increase in avian predator activity on these skinks at the edge. Using skink 'decoys', predation was measured by counting the number of decoys attacked and the data were compared between the edge and interior of remnants. Preliminary results indicate that avian predator activity is increased at the edge than in interiors.

Eligible for student award? **yes** *Presentation mode:* talk

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The foraging dynamics of a New Zealand shorebird community, and its consequences in relation to long-term morphological changes.

Shorebird communities have received much attention due to their abilities to be used as models for understanding predator-prey interactions, population dynamics and migratory behaviours. However, there has been little research in New Zealand. In this study shorebird foraging behaviour was investigated at the southern Firth of Thames, a Ramsar site with a significant shorebird community of local and international value. The foraging strategies of key species was examined to determine the nature and extent of food resource partitioning. Foraging ecology was studied using observations of four ecologically significant species: the wrybill (Anarhynchus frontalis), the South Island pied oystercatcher (Haemotopus ostralegus finschi), the lesser or red knot (Calidris canutus) and the bar-tailed godwit (Limosa lapponica). This study entailed monthly observations (focal animal) of individuals of these species. Foraging behaviours, foraging location and microhabitat characteristics of foraging locations were recorded. Foraging behaviour was also compared to climatic data and morphological measurements. Implications for foraging strategies of the evolution of key shorebird morphological characteristics will also be examined using the analysis of a long term (15-year), detailed morphological data set.

Eligible for student award? **yes** *Presentation mode:* talk

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The importance of different woodland types for declining ground-foraging birds in the Victorian Riverina.

Clearing of temperate woodlands in south-eastern Australia has been well documented. Many species of woodland birds have been identified as threatened or in decline, and of these more than half forage on the ground. The ground-foraging assemblages in four woodland types (White Cypress-pine, Black Box, Grey Box, River Red Gum) in the Victorian Riverina were investigated and compared. The ground-foraging assemblage (nC species in total) comprised approximately 50% of all species but the composition differed significantly between woodland types. 'Declining' ground-foragers were most abundant in White Cypress-pine and Black Box woodlands, and sparse or absent within Grey Box and River Red Gum woodlands. The latter two woodlands supported lower densities and richness of ground-foraging species in the non-breeding season than during the breeding season, while assemblages in White Cypress-pine and Black Box showed little seasonal variation. Woodlands that support the richest communities (White Cypress-pine) are vastly depleted in Victoria while those that are depauperate in ground-foraging species (River Red Gum) are the most widespread. This difference highlights the need for conservation and restoration efforts in dryland, non-riparian woodlands in particular.

Eligible for student award? **yes** *Presentation mode:* talk

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History and ecology: a quantitative analysis of relationship between phylogeographic divergence and ecological attributes of avian species in the Wet Tropics

The Wet Tropics rainforests have experienced multiple range expansions and contractions during historical climate cycles. Restriction of rainforest to refugia during dry climatic cycles and a number of biogeographic barriers have promoted phylogenetic divergence between geographically isolated populations of vertebrates within the Wet Tropics. We surveyed phylogeographic diversity of endemic, other rainforest-restricted and more widespread birds within the Wet Tropics and found a mixed response to the effects of historical changes ir rainforest distribution and biogeographic barriers. This suggests that species-level differences in ecology have influenced their response. Here, we compare the phylogeographic divergence of multiple species of birds across the Wet Tropics with estimates of their individual ecological attributes to examine the role that species' ecology plays in mediating large-scale historical processes.

Eligible for student award? **no** *Presentation mode:* talk

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Provision of invertebrate habitat by coarse woody debris at fine spatial scales in river red gum Eucalyptus camaldulensis floodplain forest

Studies of utilization of coarse woody debris (CWD) by invertebrates typically have focused on specialized saproxylic insects with very specific habitat requirements, characteristic of species in stable environments. However, CWD in south-eastern Australian river red gum floodplain forests represent a highly variable habitat, subject to periodic inundation followed by extended dry periods. This study investigates patterns of CWD utilization by invertebrates to determine if the spatial complexity provided by logs promotes biodiversity given the background of high environmental variability and subsequent lack of specialist saproxylic fauna. The abundance, species richness and composition of CWD invertebrate assemblages were investigated by destructive sampling of logs and by pitfall trapping around logs. The invertebrate fauna in logs was found to be relatively depauperate. The character of faunal assemblages in logs differed between flood-prone and dry areas. Increasing decay and greater spatial complexity was associated with higher abundance and richness of invertebrates in logs. No relationships were found between proximity to CWD and richness or abundance of invertebrates. However, the composition of forest-floor invertebrate assemblages did vary with proximity to CWD in autumn 2001, but not in summer 2001. Disruption of the microhabitat around logs by flooding may account for this result. Structural components of the habitat mosaic play a role in maintaining biodiversity, even in a relatively generalized fauna and with disturbance due to flooding.

Eligible for student award? **yes** *Presentation mode:* talk

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Regulation revisited

The current entomological literature suggests that 'classical' population dynamic studies, in which the emphasis was often on the nature and causes of regulation, have given way to the ecologically interesting but quirky. There are signs that this may also be true for the vertebrate literature. Given that the ultimate goal of most population ecologists is to account for and predict the distribution and abundance of animals, with or without management, this seems surprising. Both abundance and distribution are the outcomes of the interaction between density-independent and density-dependent regulatory factors. So if studies on density-dependence and regulation are becoming less fashionable, why should this be? Is it a lack of funding for long-term studies, or boredom with semantic arguments about regulation and limitation? Or perhaps it is the daunting opaqueness of an increasing industry of new density-dependence tests and new criticisms of old tests. Yet the nature of population regulation remains one of ecology's most important questions, and this presentation offers some new perspectives on some old issues relating to it. Such issues include whether regulation is most commonly top-down, bottom-up or neither, the semantics and current consensus about them, hierarchies in regulatory processes, the nature and value of carrying capacity as a concept (what is it?), appropriate models for population regulation, and why simple density-dependence tests are valid after all.

Eligible for student award? **no** *Presentation mode:* talk

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How much of a problem does temporal variation in macroinvertebrate assemblages pose for rapid assessments of river "health in northern Australia?

The extent of intra- and inter-annual variation in the composition of macroinvertebrate communities varies considerably across the different biogeographic regions of Australia, with some wet-dry tropical and drought-prone temperatesystems displaying dramatic changes in response to natural but stochastic climatic events. Extracting long-term signals in response to climate change and other anthropogenic drivers from such potentially noisy data will prove challenging. Most of our knowledge about temporal variation comes from quantitative studies with relatively high taxonomic resolution. This paper explores the potential for rapid bioassessment methods (such as AusRivAS), which operate with coarser taxonomic resolution, to detect trends in macroinvertebrate communitycomposition. This issue is particularly problematic for predictive bioassessment systems which draw heavily on a comparison with a "reference" condition based upon a very limited and fixed reference sampling period, with little or no subsequent sampling of spatial reference sites. Irrespective of the sampling protocol used, we contend that effective programs to monitor for changes in response to climate change require rigorous procedures for site selection and the temporal allocation of sampling events relative to floods and droughts.

Eligible for student award? **no** *Presentation mode:* talk

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Geese, Hares, Rabbits and Maths: A plant-herbivore model where more grass means fewer grazers.

Classical theory has led us to believe that where more grazing is available, more herbivores will gather, inflicting more pressure on the grass and thus keeping its height low. Field data, in particular for a case of grazing geese, rabbits and hares in an island environment, contest this theory. In this paper, we briefly describe how models reflecting this difference are derived mathematically, and present a general picture of the dynamics of such systems.

Eligible for student award? **no** *Presentation mode:* talk

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Effect of seedling size on survival when competiting for light

Previous experimental work has shown that seedlings of larger-seeded species frequently out-compete those of smaller-seeded species when germinating simultaneously. Indeed, this result is assumed in models of species coexistence based on a 'seed size - number trade-off'. The advantage may be that larger seeds give rise to larger seedlings that subsequently deprive smaller-seeded species of light. Here we describe experiments using competing large- and small-seeded species, where the timing of germination and density of planting were manipulated in order to disentangle the effect of seedling-size from that of seed-size per se. 'Target' seedlings were grown among 'neighbour' seedlings with the expectation that larger neighbours would out-compete the smaller targets, irrespective of whether the target was the smaller- or larger-seeded species. This expected outcome was achieved in 84% of the pots. The exceptions tended to be smaller-seeded targets that escaped competition from their bigger neighbours by out-growing them. When targets and neighbours were similarly-sized at the onset of competition for light, the smaller-seeded species won much more often than did the larger-seeded species. The advantage of smaller-seeded species in these situations probably results from their higher relative growth rate compared with that of larger-seeded species.

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The role of artificial incubation in kiwi conservation.

Successful conservation management relies on the clear identification of threatening processes, the establishment of measurable goals and objectives, and the integration of ecological research and in situ management. The framework must be adaptive, so that as new information becomes available and management objectives are achieved, the program can be modified accordingly. Such a framework has been used in New Zealand to guide conservation actions for the northern brown kiwi. Kiwi populations on mainland New Zealand face a range of threats, of which predation on chicks by introduced predators is the most pressing. One short-term response to this has been to artificially incubate wild-laid kiwi eggs, and raise the chicks to 'stoat-proof' size in captivity, before re-release into the wild. Although the initial success of this technique was low, we have shown that hatching success can be increased to over 80% under artificial incubation conditions, and demonstrated that artificial incubation is not the rate limiting step in kiwi conservation. However, mortality of released chicks and wild birds is still excessive in some areas, and we highlight areas of research and management where attention should be focussed. Although captive rearing of kiwi is an effective short-term tool, longer term solutions are still required.

Eligible for student award? **no** *Presentation mode:* talk

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Neutral DNA markers fail to detect genetic divergence in an ecologically important trait

The development of strategies for in situ, ex situ conservation and reforestation of the monkey puzzle tree (Araucaria araucana), a vulnerable tree endemic to southern South America, has led to an interest in the level and distribution of the genetic diversity of the species. Neutral DNA markers (RAPDs) and quantitative genetic techniques were used to characterise genetic heterogeneity within and among populations from throughout the natural range of the species. Both the level and pattern of genetic variation estimated using the different techniques were essentially uncorrelated. An important discrepancy was found with the neutral markers failing to detect an important quantitative genetic divergence across the Andean Range relating to drought tolerance. This study clearly demonstrates the potential problems associated with making recommendations for conserving the genetic resource of threatened species based solely on neutral marker studies. Alternative approaches are discussed, including a stronger focus on ecologically important traits and the potential use of surrogate measures of genetic variability.

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Population Ecology of the Wollemi Pine

Seven years after the discovery of the Wollemi Pine (Wollemia nobilis) we know the following. There are 76 trees with 359 stems, averaging 4.5 stems/tree, in several populations within Wollemi National Park, west of Sydney. The tallest stem is 38.5 m and the widest diameter is 0.67 m. The Pines grow in warm temperate rainforest, mostly on steep slopes and ledges in sandstone canyons protected from desiccation and frequent fire. There is a strong binomial relationship between stem height and stem diameter and a weak positive relationship between stem diameter and number of coppices. The age of one 0.7 m diameter fallen coppice is 350+ years, however, the coppice clumps may be thousands of years old. There is no detectable genetic variation in the Pine, yet it has maintained fitness regarding sexual reproduction. All populations produce seed. Seedlings are present at all sites but grow slowly. In keeping with many rainforest tree species, light from canopy gaps is the key to seedling growth and recruitment. Most trees have coppiced as a response to disturbance - fire, rockfall or windstorm. This attribute may explain how the Pine survived the Pleistocene. An extensive root system may explain how the Wollemi Pine survives droughts

Eligible for student award? **no** *Presentation mode:* talk

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Effect of changing concentration of atmospheric carbon dioxide and land use on the Australian vegetation since the pre-industrial period.

The commencement of the industrial period and the upward trend in the concentration of CO2 in the atmosphere ([CO2]) 200 years ago coincided with the introduction of agriculture and pastoralism to Australia. Since then, the vegetation has been subjected to concurrent changes in [CO2] and land use and management. We predict how these factors have modified the vegetation at the continental scale by using a theoretical framework (the TMS scheme) that links leaf functional types to environmental conditions, satellite NDVI imagery, and published maps of the present 'modified' vegetation cover and the present 'natural' vegetation cover. According to our model the vegetation cover two centuries ago would have been more seasonal and more open. this was a consequence of the lower [CO2] at that time. These results highlight the need to incorporate the direct effects on increasing [CO2] on the vegetation into land management programs.

Eligible for student award? **yes** *Presentation mode:* talk

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Validating and Updating Regional Vegetation Mapping for Conservation Planning and Monitoring in South Eastern NSW.

NSW National Parks and Wildlife Service, with specialist contractors like Eco Logical Australia, are in year four of a five year program, validating 650,000ha of vegetation assemblage and eucalypt forest growth-stage mapping in the Eden RFA region, South East NSW. This presentation is on the mapping of endangered ecosystems by satellite analysis and isolated trees from orthophotography on private lands with a brief discussion about the consequences and opportunities created. The program will reduce the scale of existing maps from 1:100,00 to 1:25,000. Its focus is on assemblages of conservation priority; coastal and hinterland grassy eucalypt forests and secondary pastures; tableland grasslands; rainforest, heath, wetland, riparian and estuarine systems, rocky outcrops, and regrowth eucalypt forests. The methodology for updating the map follows that used by Keith and Bedward (1999). Key differences are; 800 new full floristic surveys sites now available for use in classification, hyper-spectral and multi-date satellite image mapping, the mapping of isolated paddock trees, new mapping of rare vegetation assemblages and a new API mapping of eucalypt canopy floristics and growth stage. The new map will improve; the accuracy of monitoring programs, endangered ecosystem recovery planning and conservation planning and management on public and private land.

Eligible for student award? **no** *Presentation mode:* talk

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Reconstructing pre-European vegetation pattern in the Fleurieu Peninsula, South Australia using archival records and potenti vegetation modelling.

Survey records from the AD 1840-80s provide data for the characterization of pre-European impact vegetation of the Fleurieu Peninsula in the Mount Lofty Ranges region of South Australia. Surveyors most commonly described the vegetation in terms of the dominant overstorey species and/or structural configuration. Records are locatable by (1) reference to original land units delineated and by (2) reference to landforms within land units and description of vegetation types associated with those landforms. These records only classify a portion of the region leaving a greater area unclassified. Former historical vegetation mapping studies typically have overlain records on topographic and soil maps and used "eyeballing" approaches, to extrapolate boundaries. This paper investigates potential vegetation modelling techniques to empirically examine the extent to which (1) the spatial distribution of historical vegetation records are correlate with environmental condition defined by attributes of climate, soils and topography and (2) can be used to predict the original distribution of historical vegetation. Results show that historical records of vegetation pattern are useful for determining former vegetation pattern and ecological relations where they can no longer be determined from remnant vegetation.

Eligible for student award? **no** *Presentation mode:* talk

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Information needs for the ecologically sustainable management of swim-with-dwarf minke whale ecotourism on the Great Barrier Reef.

A small but growing industry based on swimming with dwarf minke whales Balaenoptera acutorostrata occurs seasonally in the Cairns section of the Great Barrier Reef. Our biological studies have concentrated on recognition of individual whales, in order to address questions about the number of whales subject to swim-with-whales (sww) activities, exposure time to sww activities and the potential for cumulative effects. Additional biological information collected includes length, sex, group stability and behaviour of the whales. Given the truism that it is people rather than wildlife that are managed, we have conducted parallel studies gathering experiential data from passengers, crew and managers of the sww operations. These studies identified the importance of adequately preparing passengers before their sww activities, thus a range of interpretive material was developed for crew and passengers. Management of interactions has focused on development of a protocol to ensure that the duration and nature of the interactions are controlled as much as possible by the whales. The next step is to measure compliance with and effectiveness of the protocol, based on draft sustainability indicators incorporating data on industry management and a suite of biological characteristics of the whales.

Eligible for student award? **no** *Presentation mode:* talk

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An impending revolution: miniaturised global positioning devices and geographic information systems in the study of animal conservation ecology

Spatial and temporal information are two of the principal means researchers use to describe many, disparate aspects of animal ecology. For example, such data can be used to construct descriptions of animal activity patterns, home-range and territory sizes, habitat preferences, and predator-prey relationships. Current methods of obtaining spatial and temporal information, such as radio-telemetry, are often notoriously inaccurate, laborious, and can be considerably expensive in terms of both time and money. Obviously, a means of circumventing these limitations would greatly contribute to our abilities to quantify many of the patterns and processes in animal conservation ecology. Recent technological advances in the miniaturisation of global positioning devices (mGPDs) now permit the deployment of these units on small-to-moderately-sized animals (approximately 1kg). This innovation presents new opportunities to accurately reconstruct the movement and activity patterns of many animal species. With the certainty that this technology can only improve, the implications for conservation of endangered and threatened species are enormous. This presentation will describe, with examples, the use of coupling mGPDs with geographic information systems as a tool in animal conservation-ecology.

Eligible for student award? **yes** *Presentation mode:* talk

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Untouched research opportunities in Australasia: are we missing the exotic mammal boat?

Ecology is often criticised as a soft science that suffers from a lack of theoretical underpinning, predictive ability and empirical validation. Consequently, the synthesis of these components is a key imperative for the science. Several Australian and New Zealand ecologists have championed the role research on exotic mammals in their countries could play in this process, highlighting their potential as model systems within which to evaluate and advance contemporary ecological theory. We examined the focus of scientific articles published on exotic mammal ecology in Australia and New Zealand between 1990 and 2000, and investigated the degree to which Australasian ecologists have met this challenge. The majority of published studies surveyed focussed on the conservation impacts of exotic mammals and their management. Conversely, very few articles used exotic mammals to address broader ecological questions. We discuss reasons for this publishing trend, identify research fields in contemporary ecology in which the study of exotic Australasian mammals could prove insightful, and illustrate how this exotic fauna has and can be used to make advances in our ecological understanding.

Eligible for student award? **no** *Presentation mode:* talk

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Indigenous biodiversity outside public conservation lands in New Zealand: the role of nature-friendly farming

Many threatened habitats and species in New Zealand are dependent on areas outside public conservation lands for their continued survival. Many habitats and populations are continuing to degrade in extent and condition. Current policy work seeks to identify appropriate mechanisms to conserve indigenous biodiversity on private land. This paper examines the potential roles of nature-friendly-farming (NFF), i.e. the management of farmed land in a way that recognises or supports the needs of indigenous biodiversity. NFF is an important part of the spectrum of conservation management outside the public conservation estate, for three main reasons: · In order to protect and sustain indigenous biodiversity which occurs mainly within production environments, and whose natural range may never be able to be adequately represented in formally protected areas. · Because protection of patches may be ineffective if their surrounding matrix is not also managed with regard to biodiversity values. · As a mechanism for education and attitudinal change, i.e. that important biodiversity values are part of production environments and can often be successfully conserved within them. Currently, the most widespread NFF activities being undertaken in New Zealand are probably: patch ("remnant") protection through covenanting mechanisms, riparian planting and restoration, and animal pest control.

Eligible for student award? **no** *Presentation mode:* talk

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Realising your potential - tough luck if you're a microhylid frog.

Patterns of biodiversity are partly explained by processes that determine the distribution of species. Factors that influence species' distributions include the geographical history of an area, barriers to dispersal, species' tolerance of environmental conditions and biological interactions. Models can be used to explore and interpret the relative influence of these factors. We used BIOCLIM to predict the spatial distribution of 70 species of vertebrates endemic to the rainforests of the Australian Wet Tropics. For most species, distributions predicted by the models conform to the observed distributions. However, for 16 species, the predicted distributions exceed observed distributions, and those differences can be explained by the geographical history of the region and the ecological characteristics of the species. Those species are a non-random subset of the rainforest endemics, and largely include microhylid frogs and arboreal mammals - the least vagile of the fauna. Animals with low vagility are relatively poor at crossing barriers and, therefore, inefficient at colonising available habitat. Competition between closely related species might explain the absence of some species from parts of the distributions predicted by the model. Awareness of these biogeographical processes enhances our comprehension of patterns of biodiversity, which contributes to our understanding of macroecology in the Wet Tropics.

Eligible for student award? **no** *Presentation mode:* talk

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Family, visitors and the weather –patterns of flowering in tropical rainforests of northern Australia

Timing and seasonality of flowering and the associated biology of pollinators interact to influence plant reproductive success. The sheer scale of information in rainforests means that specialised knowledge is often limited to small proportions of the flora and fauna. We have databased the phenology of more than 2000 species of trees and shrubs from the Australian Wet Tropics. This database has been the resource against which we have tested hypothesis concerning pollinator competition, phylogenetic constraints and response to seasonal and biogeographic variation in abiotic factors. Patterns of flowering are more clumped than random, suggesting that seasonal or phylogenetic factors are more important than pollinator competition in influencing flowering patterns. Dividing data on flowering into smaller geographical units based on latitude and altitude shows that northern lowland rainforest are more or less aseasonal, and southern rainforests more seasonal. Seasonality is accentuated by altitude.

Eligible for student award? **no** *Presentation mode:* talk

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Seed fate and germination effects after cassowary gut passage

The southern cassowary is an important disperser of fleshy seeds in the wet tropics of Australia and New Guinea with approximately 220 species recorded in its diet in Australia. Thirty nine dungs were monitored in situ for a period of at least six months and the fate of each seed was recorded. Dungs were also collected and a glasshouse experiment was carried out to test gut passage germination effects of 12 plant species using both single and clumped seed treatments. Most seeds deposited in dungs were found to be predated or secondarily dispersed while some remained in situ and germinated or remained fertile. In the glasshouse experiment, there was no significant effect of treatment on the probability that a single seed of a species would germinate. There was no difference in the germination probabilities of conspecific and allospecific clumped treatments, both treatments showing lowered mean germination probabilities than the single dung fruits. This difference was significant in the alloscpecific case and nearly significant in the conspecific case. We suggest that the role that cassowaries play in the movement of seeds is more important than the effect of any process in the cassowary gut on germination

Eligible for student award? **no** *Presentation mode:* talk

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Behaviour and Space-Use by Notomys alexis in Roxby Downs, South Australia.

Mark-recapture monitoring of a population of Notomys alexis inhabiting dune fields near the township of Roxby Downs, South Australia, was undertaken between April 2001 and February 2002. Fifty-five individuals were caught over three trapping sessions. Radio-tracking revealed twenty-one active burrows at four sites within the study area. Subsequent trapping at these burrows indicated that most burrows contained less than three individuals and frequently the radio-collared animal was the only apparent occupant of the burrows. Burrow monitoring suggests that burrow-use is intensive but short-lived, many burrows becoming inactive over the duration of the study. Telemetry data also supports the notion of a highly transient population. Ranges were aligned with the topography of the dune field and few movements between dunes were noted. Most animals ranged within areas of less than two hectares and seemed to favour particular areas of the range. However, this activity area appeared to shift within a short period of time and long-term recapture rates were extremely low. Impermanent ranges, low recapture rates and low rates of burrow occupancy suggest that this species is highly mobile, experiences high rates of immigration/emigration and does not form cohesive social units, although the population as a whole appears to be stable.

Eligible for student award? **yes** *Presentation mode:* talk

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Rarity in New Zealand Myosotis L.

Rarity is generally considered "the precursor to extinction" (Darwin, 1872). However, there are several different forms of rarity and not all rare species are threatened. I examined the different rarity patterns observed within New Zealand Myosotis. New Zealand Myosotis species are never common, all are rare in different ways and some species are threatened. Some species are known to occur at one locality where they may be locally common, others may occur in two or more widely disjunct geographic areas, while others may be widespread but never common where they occur. I compared the local abundance, disjunctions and distribution patterns of 33 taxa of Myosotis to aspects of their morphologies, including traits related to breeding system, dispersal and life-history. Taxa requiring pollinators to set seed had smaller range sizes and higher local population densities than those that were able to self-pollinate. Apparent adaptations for dispersal and life-history traits were not correlated with range size. The disjunct distributions exhibited by some taxa within the genus were not associated with any of the morphological traits.

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Burning, mining, & jarrah forest spiders: untangling the web of multiple disturbance effects during restoration in Western Australian jarrah forest

Factors causing animal communities to develop along different successional trajectories are important in theoretical and applied contexts (e.g. mine restoration). Few studies have considered the effects of multiple disturbances during succession in this regard. This study describes changes to post-mining spider succession in Western Australian jarrah forest caused by the additional disturbance of burning mine pits rehabilitated five and eight years previously using a BACI design. Post-mining spider succession in unburnt pits was found to involve highly deterministic changes in species composition, with a trajectory tracking towards, but had not yet reached, a state similar to unmined forest. Burning mine pits led to marked changes in species composition for both pit ages, and these differences were sustained for 16 months. Immediately following burning, the difference in composition between burnt and unburnt pits was greater within older pits than younger pits. At four months post-fire, the effect of burning mine pits differed between the younger and older pits, and within the older pits themselves. Burning caused a retrogression in post-mining spider succession for younger, and some older pits. In one older pit, burning had no effect. For other older pits, burning facilitated successional development towards a state more similar to forest sites burnt three years previously. Sixteen months after burning, most burnt mine pits had a taxonomic composition characteristic of a retrogression towards an earlier successional state. These pits, however, may have been moving towards a composition similar to unmined forest sites along a different successional trajectory than unburnt pits.

Eligible for student award? **yes** *Presentation mode:* talk

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Sourcing high genetic quality seed for revegetation – inbreeding effects on Acacia acinacea (Mimosaceae)

Acacia acinacea (Mimosaceae) is an important target species for revegetation within the Murray Darling Basin. Extensive phenotypic variation among populations of this species suggests that it is desirable to source seed locally where possible for revegetation to maintain local adaptation. However, anecdotal evidence indicates that seed production, germination and seedling survival in A. acinacea is highly variable across populations. This has been attributed to increased inbreeding in small, isolated or disturbed populations, which would have important implications for seed sourcing strategies, as such populations are often the only local seed source available. In this study we measured seed production, outcrossing rate and seedling fitness in five A. acinacea populations used as seed sources by GA NSW. Two populations were considered to be good seed source sites and three were considered poor sites. Results show that there were only marginal increases in inbreeding (approx 10%) in poor sites, reflecting a combination of selfing and biparental inbreeding, and this had no effects on seed production, seed quality or early seedling fitness. These data suggest that for self-incompatible species remnant populations may still represent good sources of locally-adapted germplasm.

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Landcover trends in the Wet Tropics Bioregion as derived from Landsat TM/ETM+ imagery, 1988-1999

Remote sensing can provide cost-effective, multi-temporal and multi-spatial datasets which are inherently suited to the mapping and monitoring of large areas. Data from the Landsat series of satellites have proven particularly useful for application to regional areas, particularly because of their spatial resolution and the existence of a dataset which spans 30 years. Landsat TM/ETM+ data from 1988, 1994 and 1999 and which cover the Wet Tropics region of northern Queensland, were processed and analysed to determine landcover for these three periods and compared to vegetation mapping from 1975. Landcover trends were determined and assessed. This talk presents these results and discusses the specific pre-processing and various classification methodologies which were derived and applied to the image dataset. Limitations on the use of Landsat TM/ETM+ in mountainous, tropical regions are also discussed.

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"Eco-civic" optimisation provides a nested regional framework for sustainable landscapes

The ecological sustainability of future landscapes and their capacity to support human communities depends on a range of institutions. An essential institution for regional resource management is civic engagement. Guided by two key principles, we have been developing techniques to explore how boundaries for resource management regions might be identified. The first is that the character of the landscape units within the region possess a high degree of homogeneity. The second consideration is that the choice of management region maximises the areal proportion of the region that is considered to be part of their 'community' by the residents. This should lead to greater commitment to civic engagement across planning, management, development and service needs important to the inhabitants for a sustainable future. Combined, these features provide an appropriate context for civic engagement for natural resource management. We have developed a method to delineate nested 'ecocivic' resource management regions. As a practical demonstration of these ideas, we have applied the methodology to northern New South Wales. The results are promising for the integration of human social and ecological system variables into design of multi-scale resource governance frameworks. Applied across the nation, such regions could serve as a common framework for Federal and State NRM programs.

Eligible for student award? **no** *Presentation mode:* talk

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Does controlling Chrysanthemoides monilifera (Bitou Bush)with metsulfuron methyl affect the litter invertebrate community

Chrysanthemoides monilifera ssp. rotundata (Bitou bush) was introduced as a dune stabilising plant, and since has rapidly developed into an environmental weed covering a large proportion of the N.S.W coastline. Metsulfuron methyl is one of the herbicides used to control bitou bush and although effective at low application rates the side effects of this chemical have not been considered. This is important as many herbicides are persistent in soil and leaf tissue. Soil and leaf litter invertebrates are highly involved in the nutrient cycling of organic matter, it is a concern that herbicide use may reduce species diversity and abundance, and modify population composition. Leaf litter invertebrates were sampled using pitfall traps in heavily bitou bush infested areas, on the south coast of NSW, both before and after the spraying application of metsulfuron methyl. Invertebrates from eight different orders were sorted to the lowest practical taxonomic level. Statistical analysis was performed to determine any differences in abundance and species richness between sampling periods and treatments. Patterns in invertebrate assemblage structure were also examined and significant differences were found between time periods, but not treatment types (control and sprayed). The results are discussed and explanations given for the evident changes in invertebrate abundance and composition. These results will have implications on the proposal to use metsulfuron methyl on a broader scale to control bitou bush.

Eligible for student award? **yes** *Presentation mode:* talk

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Microparasites of lizards, biodiversity, biogeography and ecological relevance

Would we stand in the way of a bulldozer if the only known population of a malarial parasite of lizards was at risk? Australia has an extraordinary diversity of microparasites in native vertebrate hosts that remains largely unexplored ecologically, with much taxonomic work still to be done. We have started to investigate some aspects of the ecology of apicomplexan (protozoan) blood parasites of large skinks in South Australia. The sleepy lizard, Tiliqua rugosa is host to the blood parasite Hemolivia mariae, which is transmitted far more effectively by one tick species than another, and thus which has a distributional boundary that coincides with the tick parapatry. The gidgee skink, Egernia stokesii, inhabits rocky outcrops in northern South Australia, where it is the host of at least six blood parasites, including two species of Plasmodium (malaria), but geographically adjacent lizard populations show dramatic differences in their parasite communities. We discuss how these biogeographic patterns may have developed, how the parasite infestations may affect the population dynamics and social organisation of the hosts, and the implications for conservation if blood parasites are included as a component of biodiversity.

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The impact of human visitation on Australasian gannets (Morus serrator) breeding at Point Danger.

Since 1995 a new colony of Australasian gannets (Morus serrator) has become established on the mainland at Point Danger in western Victoria and is the only mainland breeding locality for the species in Australia. Experimental controlled approaches by "simulated tourists" were used to investigate the effects of human disturbance on this large-ground nesting species. The effects of approach distance, time of day, and visitor group size on the behaviour and breeding success of the gannets throughout different stages of the breeding period were examined. This information will be used to generate management guidelines for human visitation at this site, and potentially other seabird breeding colonies.

Eligible for student award? **no** *Presentation mode:* talk

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The dynamics of a chytridiomycosis epidemic in Limnodynastes tasmaniensis

In late winter 1999 we observed an epidemic of chytridiomycosis in a population of Limndynastes tasmaniensis while sampling a frog assemblage in Western Sydney. Dead frogs were returned to the laboratory to confirm that the disease organism was Batrachochytrium dendrobatidis. In that season, apparently only Lim. tasmaniensis were affected by the disease despite a range of other frog species, including other Limndynastes, being present. Pitfall trapping was undertaken immediately before, and continued beyond the time of the epidemic. We were, therefore, able to investigate the dynamics of the assemblage and these data were compared with adjacent study sites that were not affected. In addition, local climatic conditions and other potential environmental impacts were investigated in an attempt to determine factors that may have influenced the sudden appearance of the disease in a relatively undisturbed wetland. While our observations are unlikely to provide definitive answers, there are a number

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Lessons from the past and future directions for the conservation of Australia's marsupial carnivores

Epoch-scale history shows that when continental faunas mix, the fauna from larger land-masses usually predominate and that eutherians usually predominate over marsupials. Recent history shows that in Australia, our marsupial carnivores have repeatedly been replaced by Eutherians. Today the marsupial carnivores are restricted to "islands" of productive habitat around the periphery of the Australian continent, while three species of recently introduced Eutherian carnivore occupy virtually the entire continent. Numerous biogeographical and phylogenetic explanations for the dominance of marsupial carnivores over eutherians may explain this pattern including; land-mass effects, isolation effects, fundamental differences in life-history strategy, differences in ontological processes between the two groups, and differences in behaviour. While there is a need for immediate conservation actions to conserve our remaining species of marsupial carnivore, these data suggest that the long-term future of the carnivorous marsupials is bleak. One avenue that may circumvent this is the development of a native animal pet industry, which would serve the dual purpose of ensuring that individuals of threatened species are conserved and of strengthening the relationship between humans, wildlife and their habitats.

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Investigating small mammal response to relocation: The interplay between habitat selection and successful relocation.

Density-dependent, territorial interactions are common in a variety of mammal species, including Peromyscus, and low quality habitat serves as a dispersal "sink" for behaviorally subordinate individuals. Little is known, however, about the importance of territorial interactions when individuals have been evicted from their native home ranges, especially when source habitats are disrupted. Peromyscus from two habitat types (oak-dominated and pine forest) were relocated to novel sites in northeast Connecticut and released along the transition zone between these two habitat types, both in the presence and absence of resident conspecifics. Short and long-term habitat selection and subsequent survival, reproduction and resource acquisition ability were assessed via live-trapping and PIT-tagging. Peromyscus selected oak over pine forest significantly more often, and survived longer in this habitat. Comparison of results between treatments with and without resident conspecifics provided evidence of dominance interactions influencing habitat selection. Resource acquisition data also indicated the influence of dominance structure in dictating habitat selection decisions. Understanding habitat selection and subsequent strategies will enable us to more precisely understand wildlife responses to habitat alteration, and to develop generalizeable predictions for the response of wildlife to removal of habitat in heterogeneous landscapes.

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Molecular insights into the evolutionary ecology of the mistletoe family Loranthaceae in Australia

Mistletoes are a prominent feature of the Australian flora which is recognised as being comprised of both Gondwanan and intrusive elements. There are Gondwanan groups of Australian Loranthaceae, some relictual others derived, in addition there is an intrusive element thought to have arrived when suitable continuous land surfaces with Malesia existed to the north. Consequently, the derived Australian lineages, which are predominantly tropical or arid radiations, appear to have arisen from these distinct origins. Other Australian genera may be easily recognised as ancestral, possibly remnants of a former paleoaustral flora, for example the southern temperate monotypic Atkinsonia and Nuytsia which share the terrestrial habit. Here the evolutionary and biogeographic trends among the Australian members of the Loranthaceae are examined using inferred phylogenetic relationships generated with 18S ribosomal DNA and trnL chloroplast DNA sequence data. There are ecologically significant arid radiations in the genera Amyema and Lysiana that have different biogeographic origins. Lysiana is associated with a primarily tropical lineage and has been successful in radiating into arid and saline habitats. The largest, most derived and genetically diverse Australian genus Amyema, occurs in most habitats, notably for its ubiquitous presence in mainland Australian woodlands.

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Using historic (1850s-1920s) survey maps to determine pre-settlement distribution of Belah (Casuarina pauper) woodlands in northwest Victoria

During the first half of the 20th century Belah woodlands in northwest Victoria were preferentially cleared for agriculture. As a result, little evidence remains of their pre-settlement distribution. To determine the likely pre-settlement distribution of Belah woodland, historic survey maps and Parish plans (1850s-1920s) were used to create a geographical information system (GIS) database. Historic surveys of northwest Victoria were conducted principally to facilitate land selection and settlement, however, maps resulting from these surveys provide a wealth of historical vegetation information. Historic maps containing evidence of Belah woodland species were scanned and registered to enable use as a GIS layer. Relevant data from the maps was then entered into the GIS database. Scale of the historic maps ranged from 1:400,000 to 1:8,000. Use of a GIS database enabled information including; original surveyors notes, current scientific names, vegetation density, soil descriptions and precision of spatial information to be attached to each Belah woodland reference. Maps produced from this data indicate the likely extent of Belah woodlands in northwest Victoria prior to European settlement, data of great value for land management and restoration.

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The Effects of Herbivorous Amphipods on their Host Algae: New Methods for Amphipod Exclusion

The impact of small, herbivorous amphipods on their host algae is largely unknown. This impact may be positive (for example, the removal of epiphytes) or negative (through direct consumption of the host plant). Despite their high abundance, very few field studies have attampted to quantify the effects of amphipods on macroalgae. This is largely a result of methodological problems associated with observing and manipulating them in natural situations. To exclude amphipods using a cage (as is done for urchin and fish exclusion) requires a very small mesh size, which causes changes in water flow, light availability and other physical processes, confounding any results. New methods are presented here for the exclusion of amphipods from macroalgal surfaces without the use of cages. The insecticide carbaryl was incorporated into plaster blocks, which were attached adjacent to the brown macroalga Sargassum linearifolium in sydney Harbour. Preliminary results show that this method successfully deters amphipods from treated plants consistently for a period of four days. These new methods make possible new experiments aimed at quantifying the effects of these small herbivores on algae in situ (several of which are currently underway). The results of such experiments may have potential applications for fisheries, aquaculture and impact management.

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Monitoring protocols for ecosystem services / ecosystem condition in Victorian National Parks.

We are developing a framework for monitoring of ecosystem services and condition in parks and reserves for Parks Victoria, enhancing its ability to report on attributes of parks that are relevant to management goals, and are sensitive to changes considered to be ecologically important. The monitoring protocols will take a risk-based approach to ecosystem management, focussing on components of the ecosystem that are likely to change in response to environmental hazards or management actions. Protocols will report the likelihood that they can in fact detect important ecological changes and will answer key questions not directly addressed in most current systems. Monitoring effort will be tied to the likelihoods and consequences of adverse changes in ecosystem condition, with different levels of effort applied in accordance with the perceived level of risk. This tiering of monitoring strategies will focus the monitoring effort on attributes or values of most concern, and avoid the allocation of excessive resources to those of lesser concern. It will also facilitate an adaptive response to changes in condition. The framework will not replace the usual devices for collecting, interpreting and reporting evidence, but will provide an overall structure for the management of multiple monitoring systems.

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A proposed definition of Natural Temperate Grasslands for south-eastern Australia

Many natural (or 'native') grassy vegetation communities, although formerly widespread in temperate Australia, have become depleted in their extent, and may reasonably be considered rare and threatened. This project considered ecological communities that comprise 'Natural Temperate Grasslands' in southern Australia, for possible listing under the Environment Protection and Biodiversity (EPBC) Act 1999. The term 'Natural Temperate Grassland' is a label and is an imperfect summary of the vegetation community. The individual components of the label, ie. 'natural', 'temperate' and 'grassland', are each imprecise and open to individual interpretation. Therefore, an explicit working definition of 'Natural Temperate Grassland' is presented. The definition takes account of the social and legislative context in which it will be applied. It forms a basis for recognising and delimiting a coherent grassland vegetation community - as evidenced by its consistent physiognomy and functional relationships. Inclusion of derived or anthropogenic grasslands within the Natural Temperate Grassland definition are discussed. A dichotomous keys to enable recognition of the community is also presented, to further assist consistent agreement on the geographic delineation of Natural Temperate Grassland. Implications of the proposed nomination for grassland conservation are discussed.

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Assessing irreplaceability values for biodiversity; how do different methods compare?

Assessing the biodiversity significance of different parts of a landscape is a crucial prerequisite to effective conservation planning. We conducted one of the first systematic comparisons of two current system reserve design programs, Marxan and C-Plan, by investigating how each method predicted the irreplaceability of sites in the Brigalow Belt South bioregion, Queensland. Marxan uses an optimising algorithm to generate multiple reserve systems that meet set targets of species and ecosystem features with minimal costs. Irreplaceabili is then calculated as the proportion of solutions containing each site. In contrast, C-Plan generates direct estimates of irreplaceability by the likelihood that each site is needed to meet targets in all combinations of sites that satisfied the same feature targets. Sites were ranke consistently high by Marxan and C-Plan when they contained rare features. There were substantial differences for sites with more common features depending on their spatial location, which can be largely explained by different spatial design consideration rules of each method. Reserve compactness was the principle factor affecting variations in irreplaceability values between C-Plan and Marxan, and is a key consideration in conservation planning.

Eligible for student award? **yes** *Presentation mode:* talk

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Dispersal of the Mediterranean snails Cernuella virgata (da Costa) and Cochlicella acuta (Müller) on the southern Yorke Peninsula.

Mediterranean snails are introduced pests of pastures, grain crops and vineyards in southern Australia. The abundance of these snails and hence their pest status has increase recently as a result of a shift in agricultural practices towards soil conservation. Mediterranean snails cause significant feeding damage in winter and spring, and contaminate harvests in summer due to their aestivation on the ears and pods of cereals and legumes. Snails damage harvest machinery, and grain shipments are rejected overseas due to snail contamination. Determining the factors that influence the dispersal of the Mediterranean snails is important in determining appropriate control methods. Factors may include temperature, rainfall, human activities and competition for resources. Movement of individual adult Cernuella virgata (common white snail) and Cochlicella acuta (the pointed snail) has been measured in crops and pasture on the southern Yorke Peninsula. Integration of existing and new dispersal data with climatic data will be achieved with statistical and simulation models of snail population dynamics. If successful, these models should predict snail population trends and provide useful indicators of seasonal risk factors and optimal management measures.

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Ecosystem services and a risk-based approach to ecosystem management

This paper explores the utility of an ecosystem services perspective for supporting a risk-based approach to ecosystem management in Victoria's parks and reserves system. A critical issue for effective and accountable management is knowing exactly what it is we want to conserve and protect from risks. While this seems intuitive and obvious it is not often stated unambiguously. Adopting an ecosystem services perspective provides a natural focus for management and can aid in the tasks of formulating management objectives, delineating relevant spatial and temporal scales for key ecological processes, setting management targets, facilitating the process of hazard identification, developing assessment endpoints for ecological risk assessments, designing monitoring protocols, reporting on effectiveness of management actions and evaluating progress towards specified goals. An approach incorporating an ecosystem services perspective with principles of ecological risk assessment and management is illustrated using a case study on environmental flows for Lake Albacutya and terminal lakes in Wyperfeld National Park.

Eligible for student award? **yes** *Presentation mode:* talk

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Who's Eaten my Smalls? Insect-plant interactions in urban bushland fragments.

Avian predators are known to regulate populations of insect herbivores in numerous forest systems. Shifts in the composition of avian assemblages have been associated with the release of insect herbivores, often to outbreak levels. This project investigates insect herbivores in a fragmented urban environment and the extent to which insectivorous birds and invertebrate parasitoids regulate insect herbivory. We investigated the ecology of small urban remnants, large remnants and edges of large remnants in the Sydney Basin. We estimated levels of herbivory on Angophora costata at each of fifteen study sites (5 small, 5 large and 5 edges) and surveyed for invertebrate herbivores, insectivorous birds, and invertebrate parasitoids. Our results indicated that small urban sites suffer from higher rates of herbivory than edge and large sites and have fewer and less abundant insectivorous bird species than large remnants. We conclude that the loss of higher trophic levels within a fragmented urban environment has the potential to reduce predation pressures on lower trophic levels.

Eligible for student award? **yes** *Presentation mode:* talk

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How Does Powerline Right-Of-Way Management Influence Small Mammal Populations?

It has been emphasized that spatial heterogeneity is considered one of the foundations influencing the population dynamics, especially in human dominated landscapes. However, currently little research has focused on the ecological changes that occur due to long-term maintenance of a forest clearing, such as a powerline ROW. Broad research has investigated this worldwide, however the effects of ROW's on small mammals has barely been determined. Research in Australia, is especially lacking which investigates the effects of powerline ROW on all fauna and flora. Results from the current research suggest that the retention of heathy understorey vegetation within the ROW, may be an important factor in encouraging populations of early-successional species to colonise and utilize ROW habitat. This retention of vegetation may also be important in mitigating any potential detrimental impacts caused by the presence of the ROW. Preliminary data has further suggested that management of these areas is a critical component in determining how ROW will function for small mammal populations.

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Do nutrient levels determine the successional changes in New Zealand's restiad peat bogs?

Empodisma minus and Sporadanthus ferrugineus (family Restionaceae) dominate raised peat bogs in northern New Zealand. Empodisma, the main peat former, establishes early in wetland succession and initiates development of a raised bog. As bog development proceeds, nutrients - particularly total N and total P - decline. Sporadanthus is a late successional species, and establishes after Empodisma. We hypothesised that Sporadanthus would be more efficient than Empodisma at N and P uptake under low nutrient conditions typical of older raised bogs. We established experiments to test this hypothesis by determining the relative responses of the two species to differing levels of N and P. The results showed that overall, the biomass of both species increased with increasing nutrients, with Empodisma performing better than Sporadanthus at virtually all nutrient levels, including the lowest nutrient levels. Compared with Sporadanthus, Empodisma typically had greater shoot and root biomass production and lower root:shoot biomass ratio (except at the lowest N level), indicating it was better able to take advantage of increasing N and P levels by producing a higher proportion of shoot biomass. We concluded that successional change from Empodisma to Sporadanthus in these restiad peat bogs does not appear to be determined solely by nutrients.

Eligible for student award? **no** *Presentation mode:* talk

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Valuing Ecosystem Services with Scientific Goods and Services - the Influence Matrix

The aim of broadening the goals and values of conventional economics to include efficiency, fairness and sustainability has created a demand for new scientific goods and services! The challenge is to link community-based decision-making with conceptually rich economic and ecological models. Our aim is to link the explanatory and predictive power of science with societal understanding and decision-making that reaches the daily realities of modern urban and rural life. The influence matrix is a participatory modelling tool that delivers both goods and services to local communities. We characterise the services of the influence matrix in terms of opportunities to explore the logical system-wide consequences of individual and or group values through participation in a group -model building exercise. We characterise the goods of an influence matrix in terms of learning, measurement of progress toward long-term goals and model outcomes that help to guide collective research priorities.

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Global amphibian declines: Placing the suspected causes in perspective

Beginning in the late 1980s herpetologists increasingly found themselves in conversations where one or more colleagues described visiting a former field site only to find populations of frogs and salamanders reduced or extinct. Reports of declining populations persisted through the 1990s, engendering a call for research focused on the question: Is the threat of extinction increasing for amphibians? In the last five years workshops, conferences, symposia, and new research results have improved greatly our capacity to answer the question. There are four leading hypotheses to explain global amphibian declines, and they can be separated into two general classes. For hypotheses in class one, exotic species and habitat change, we have a good, and improving, understanding of the mechanisms underlying declines, but the magnitude of change in population size or even species numbers remains poorly understood. For class two hypotheses, global change and emerging infectious diseases, we have a poor, but improving, understanding of the suspected mechanisms causing declines, and the magnitude of change in population sizes is also poorly understood. I will summarize our understanding of the four proposed causes of amphibian declines with the goal of placing these studies and the general problem in perspective.

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The ecological importance of temporal patterns of rainfall to savanna vegetation

The climate of north Australia is marked by strongly seasonal rainfall. The temporal patterning of rains during the early and late phases of the wet season potentially influences plant growth markedly. This effect is probably far more than suggested by the relative contribution of these rains to the cumulative total rainfall for the whole wet season. Climate change scenarios often indicate changes to total amounts of rainfall, but at this stage lack the temporal resolution to comment on these relatively minor rainfall events. If they do have great ecological impacts then there is great incentive to better understanding these early and late rains. In this paper, we apply a modeling approach to examine the relative effects of the amount of rainfall and its timing to the growth of trees in savannas. We compare the effects of early and late onsets and ends to the wet seasons under varying total amounts of rainfall. The implications for understanding the impacts of climate change are discussed.

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Technological solutions for genetic conservation and recovery of rare and endangered plants in Australia and New Zealand.

Plant tissue culture techniques have developed for over half a century in the areas of domestic plant and agricultural crop production. The advent of techniques applicable to woody species has been relatively recent (partly driven by commercial forestry), as has their application in a conservation role. Significant conservation successes have been achieved in Australia and New Zealand with woody and non-woody species. The ability to apply tissue culture and cryo-preservation techniques to woody species allows: 1) propagation of those species not normally easy to propagate by conventional means due to a restricted genetic base and/or limited material of each sex for dioecious species (e.g. Fontainea oraria, Euphorbiaceae from Australia), 2) conservation and propagation of rare and endangered plants (e.g. Wollemi pine, Wollemia nobilis, Araucariaceae, from Australia and the Three Kings Tree, Pennantia baylisiana, Icacinaceae, from NZ), 3) conservation of individual historic trees (e.g. the Tree of Knowledge, Eucalyptus papuana and the Dig Tree, E. microtheca, Myrtaceae) and 4) propagation of species of commercial significance (e.g. Backhousia citriodora, Myrtaceae). These methods will aid Australia and New Zealand to contribute to global strategies for plant conservation.

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The need for an expanded set of theory behind ecosystem services

The concept of ecosystem services has become increasingly popular over the past several decades as a way to acknowledge human dependence on nature. A complete theoretical framework for this relationship should consider both the supply and receipt of services. Or the supply side, a broad range of ecological theory has been considered, including that relating to the interrelationships among ecological processes that provide services, the relationships between biodiversity and ecosystem functions, equilibrium versus persistence of populations and communities, and self organising and complex-adaptive systems. On the receipt side, only economic theory has been applied. In our work in the Ecosystem Services Project (www.ecosystemservicesproject.org), in partnership with community level decision makers, we have realised there is a need for greater attention to theory and research into the human needs that ecosystem services might meet, the processes by which people learn about their part in ecological-social systems, and the ways in which the outputs of scientific research can be presented to be accepted into the world-views of the broader community, which votes and makes choices that influence the relative value given to ecosystems in decisions about land-use change. This paper considers how this breadth of theory can be brought together to address some of the key environmental challenges currently facing Australia and the world.

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Interaction of salinity and fine-scale variability in WA wheatbelt remnants

Shallow saline water tables currently pose the greatest threat to plant diversity and ecosystem function in the WA wheatbelt, an area which is recognized as one of the world's 25 biodiversity hotspots. Broad-scale hydrological modelling of the Upper Blackwood Catchment suggests that 34% of the catchment will be affected by shallow water tables (<2 m depth), including 37,368 ha of native vegetation, most particularly those vegetation communities occurring in low-landscape positions. In two remnants on the western side of the catchment where groundwater has reached, or is close to, equilibrium, there is good agreement between the prediction of the model and the on-site presence of shallow water tables. However, fine-scale variability in microtopography and soil texture reduces the spatial impact of a shallow water table in these remnants and hence may buffer the impacts of shallow water tables to some extent, creating a mosaic of affected and unaffected areas. Yet such fine-scale variability in edaphic factors is also reflected in plant species distributions, with distinct understorey and ground cover communities associated with soil type and topographic location. The communities located in the lowest landscape positions are at extreme risk from salinity and waterlogging, and require urgent hydrological management.

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Logging a National Park for biodiversity - restoration of hardwood plantations in Bongil Bongil, Coffs Harbour NSW

Bongil Bongil National Park is a new 1200 ha coastal park on the NSW mid-north coast containing over 200 ha of eucalypt plantations. The NSW National Parks and Wildlife Service wants to restore plantation sites to more natural and biodiverse self-sustaining communities. Our research aimed to determine the best techniques for initiating succession towards natural communities within Lantana camara infested Eucalyptus grandis plantations. Across three 1.5 ha plots, canopy and understorey restoration treatments were implemented in a split-plot design in 2000. Canopy treatments included clear-felling, thinning or plantation tree retention. Within these canopy treatments, understorey planting of wet sclerophyll and rainforest seedlings and post-planting weed control were conducted in factorial combination. Abiotic and biotic ecosystem attributes were monitored throughout the study. Plant functional groups were delineated and analysed using mixed-effects modelling. We report the success of various restoration treatments and outline some quantitative goals for restoring these hardwood plantations. Ecosystem functioning was maintained above abiotic thresholds, meaning vegetation management remains the key to achieving NPWS' long-term restoration goals. Given the large area of disturbed land managed by NPWS and the prospect of establishing hardwood plantations on degraded parts of their estate, this research provides a model for future restoration of such sites.

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Insect diversity in Eucalyptus globulus plantations compared to nearby native forest in south-western Australia

Eucalyptus dominates the native forest of Australia, and so Eucalyptus plantations in Australia might be expected to harbour a significant fauna of native insects. In this study we compared the fauna of beetles and moths in Eucalyptus globulus plantations and compared it to that in nearby native forest in south-western Australia. We surveyed spatially paired plantation and native forest sites in four locations. Here we discuss four different samples of the insect fauna: light trapped moths (295 species) light trapped beetles (103 species) malaise trapped beetles (126 species) and canopy knockdown beetles (307 species). For all groups species richness was higher in native forest. There was considerable overlap in composition: most species recorded in plantations were also recorded in native vegetation. Compared with samples from native forest, plantation samples were relatively more dominated by a few abundant species. The most common beetle in both habitats (with very large populations in plantations) was the leaf-feeding weevil Gonipterus scutellatus. This pest species, native to east coast Australia, appears to have recently migrated from plantations into remnant forest, where it is a potentially harmful invader. Thus, while Eucalyptus plantations can host native fauna, they can also encourage outbreaks of pest species that can cross into native forest.

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Valuing Ecosystem Services in the Wet Tropics of Queensland World Heritage Area

The primary aim of the research is to develop a new or modified approach to the economic conundrum of valuing non-market (unpriced) goods, typically environmental goods and services. The approach adopted must be practical, encourage accounting and investment in natural assets, and have application with respect to methods by which acquisition of ecosystem services, preservation of current conservation values and rehabilitation can be financed. The economic theory of value is the study of market phenomena, which attempts to analyse and explain price triggers a posteriori under a variety of hypothetical market situations. Conversely the theory of valuation is concerned with a priori interplays in actual market situations. The surrogate market based on revealed preferences for this study is therefore the property market. The surrogate market will enable shadow prices for individual ecosystem services to be derived. The value of land at any point in time is dependent on the benefits or benefits stream that it is estimated can be derived from it in the future. The unimproved or rateable value of a local government area will take into consideration all of the legal uses to which land is put, or for which it is suitable. As some ecosystems services are essential to life, it follows that unrateable land, ie land held in the public domain (conservation areas) must be worth at least as much for the ecosystem services that it provides ie. the benefits stream, as rateable land put to its highest and best use. Following Hotelling's Rule, the surrogate capital value for the areal component of a region that produces ecosystem services can then be used to determine an annual flow (stream of benefits), known as the Usus Fructus per annum. The shadow prices of individual ecosystem services have been derived by way of a multi-model multiple criteria analysis, with expert consensus on weightings and sensitivities provided through the shared reality of a Delphi panel. National Parks and other conservation areas, as well as private properties, can then be assessed as to the absence or presence (% intact) of individual ecosystem services.

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Spatio-temporal modelling of biomass: a statistical modelling analysis indicates the usefulness of the 2D Topo-climate model f biomass assessment and prediction.

Spatio-temporal biomass data are important for catchment monitoring, management and environmental modelling of biological, atmospheric and hydrological processes. Models for spatio-temporal biomass representation can be developed using a range of data sources and calculated parameters. Some models capture the spatial component of biomass distribution, others reflect the temporal component of biomass accumulation and growth. Few models however, incorporate the spatio-temporal components of biomass. This paper considers available biomass related data, how accurate the data, and what data sets or combination of parameters can best model spatially distributed biomass through time. The low relief experimental catchment (27 km2), in SE Australia, consists of grass/pasture (70%) and woodlands over a duplex soil. Over a 100 biomass sites were sampled at three time periods. In this paper ten models are developed and classified into three groups: sub-catchment, satellite and topo-climate models. Using statistical analysis (the square root generalised cross validation RTGCV) the ten models are compared to determine the most accurate representation of biomass. The 2D Topo-climate model produced the most statistically accurate (RTGCV 27.9) and effective (using 11 parameters) spatio-temporal model for biomass assessment and prediction. Topo-climate models are useful for biomass management, further model development and research purposes.

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A ten-year study of the effects of tourism on Little Penguins Eudyptula minor on Phillip Island

Tourists have been watching Little Penguins Eudyptula minor come ashore at Summerland Beach on Phillip Island in southern Victoria since 1928. This nightly event, known as the "Penguin Parade", currently attracts 522,000 visitors each year. Sixty percent of visitors come from overseas and it is the most important component of international tourism in the region. Approximately 10% of the 26,000 breeding penguins on Phillip Island are involved with tourism at the Parade. Numbers of penguins have fluctuated extensively over the past two decades and potential causes, including tourism, have been examined. A long-term study has shown that demographic parameters are the same for penguins breeding at the Parade as for those breeding away from the tourism area, indicating that factors other than tourism are responsible for the fluctuations in numbers. Between 1991-2000, overall breeding success (chicks produced per breeding pair per year) was almost identical in the tourism and control areas. Adult mortality at the Penguin Parade was within the range of adult mortality at the control sites but at the higher end. Recruitment patterns were similar between sites also. Measures employed to mitigate potential visitor disturbance to penguins will be discussed.

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Trial regeneration burns of the nationally endangered mound spring endemic Eriocaulon carsonii (Eriocaulaceae)

Eriocaulon carsonii is a nationally endangered plant that is endemic to mound springs at the edge of the Great Artesian Basin. While drawdown is the greatest threat to the species, grazing and trampling by stock is also a threat, at least in South Australia. However, previous research in this state found the removal of stock to result in a significant overall decrease in the distribution and abundance of E. carsonii associated with a significant increase in Phragmites density. These researchers (Fatchen & Fatchen 1993) recommended the trial burning of such springs, to suppress Phragmites and to enable E. carsonii to recolonise spring vents from their presently highly vulnerable position on the spring tails. These researchers cited an Aboriginal elder as saying that these springs were burnt previous to European settlement. In August 2000, three mound springs containing E. carsonii in the Hermit Hill Spring Complex were subject to a trial burn by an Arabunna elder. Associated with this burn was intensive pre- and post-fire quantitative monitoring of all plant species in these burnt springs as well as in three comparable unburnt control springs. This paper will present the outcomes of this monitoring and associated research.

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Ecological and evolutionary implications of variation in pollinator assemblages on Trachymene incisa subsp. incisa (Apiaceae)

Disruption of natural pollination systems is occurring worldwide; in Australia, a major cause is the introduction of the European honeybee. Honeybees have the potential to reduce pollen supplies, displace native pollinators and alter pollen flow between plants, however, most previous studies have looked at effects of honeybees on plant fitness in terms of seed set only. In addition, natural variation in pollinator assemblages at a range of spatial and temporal scales has been documented, but the effects on plant mating have rarely been studied. This project will address the reproductive and evolutionary implications of variation in pollinator assemblages on Trachymene incisa subsp. incisa, a common perennial herb. Variation in floral display (inflorescence size and number), pollinator assemblage composition (abundance, dominance of species), pollinator behaviour (pollen removal and deposition rates) and genetic diversity (gene flow, outcrossing rates), and how these relate will be investigated over several populations spanning the geographical range from south-east Queensland to the south coast of NSW. Controlled pollination experiments will be implemented to compare the effects of honeybee and native insect pollination on plant reproductive success. Fitness of seeds (germination, survival, growth and fecundity) will be recorded and related to pollinator (native/introduced) and genetic identity (heterozygote/homozygote).

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Impacts of alien ant invasion on endemic land-birds on Christmas Island, Indian Ocean.

Social insects are among the most devastating of alien invaders. The yellow crazy ant Anoplolepis gracilipes, a keystone invader on many tropical, oceanic islands, causes a "state change" in rainforest on Christmas Island, Indian Ocean (CI), altering forest structure, composition and process. We evaluated impacts of crazy ant invasion on four species of critically endangered, endemic land-birds by comparing their abundance, reproductive success, behaviour and potential seed dispersal services in ant-invaded and uninvaded forest. Abundance of the emerald dove was halved in ant-invaded forest; however, overall abundance of the island thrush, CI white-eye and CI imperial pigeon did not differ from that in uninvaded forest. Fewer juvenile thrushes were found in ant-invaded forest and fledging success was nil (0/8), compared to 60% (6/10) in uninvaded forest. Behavioural repertoires of the thrush, white-eye and dove were altered by crazy ant invasion. Thrushes and white-eyes handled fewer artificial fruits in ant-invaded forest than in forest indirectly influenced by invasion. Our findings suggest that crazy ant invasion alters the land-bird community on Christmas Island, resulting in decline in some species and interference with the services they provide. These impacts are likely to be complex, involving direct predation and changes in resource availability and habitat structure.

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Impacts of habitat fragmentation on the metapopulation dynamics of a West Australian frog, Heleioporus albopunctatus.

Heleioporus albopunctatus is a widespread species with a range encompassing south-west Western Australia (WA). Main (1990) suggested that H. albopunctatus has declined or become extinct in parts of the WA wheatbelt due to increases in salinity. I investigated the metapopulation ecology and genetic structuring of populations of adults and larvae of this species in the WA wheatbelt. 45 populations were monitored over a three year period. This species has terrestrial egg deposition in burrows.When burrows flood, eggs hatch into tadpoles. Of 45 populations, 12 (27%), recruited tadpoles from egg masses. From zero to six of these 12 populations recruited metamorphs over the three years. Thus only a small number of breeding sites regularly recruit, and only during years of good rainfall. Recruitment failure is linked to salinisation and reduced water-holding capacities of the mostly man-made breeding sites. Allozyme analysis indicates a significant degree of subdivision (Fst082, p

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Differential response of sprouting and non-sprouting chaparral to increased fire frequency in southern California, USA

We examined the influence of increased fire frequency on two species of post-fire sprouters (Malosma laurina and Ceanothus spinosus) and one non-sprouter (C. megacarpus), growing in a mixed stand of chaparral shrubs over a 15-year period. The non-sprouting species was most resistant to summer drought and exploited dry microsites and canopy gaps. An increase in fire frequency from a mean of 12.5 years to 5.5 years led to localized extinction of the non-sprouter, followed by significant reduction in population numbers of only one of the sprouting species, C. spinosus. Post-fire seedlings of all three species were eliminated. Exotic weeds, primarily Eurasian grasses and forbs, now occupy these microsites. Thus the former chaparral stand has undergone vegetation-type conversion to a grassland savannah with clumped resprouts of M. laurina. Because the exotic weeds are highly flammable, this type-conversion will probably persist and further enhance frequent fires.

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Soil macroinvertebrates and landscape function in North Australian savannas.

Termites are the dominant invertebrates in tropical soils and play a critical role in landscape functioning. We are investigating the critical role of termites and other soil macroinvertebrates on the basic functioning of savanna systems in northern Australia, in particular on the soil water relations and nutrient cycling. By understanding the role of soil macroinvertebrates in maintaining landscape function we hope to develop ways to hasten recovery of degraded systems and improve resilience of healthy systems. This paper (i) presents a brief overview of the importance of soil macroinvertebrates to soil functioning, in particular the role of termites in water capture and retention and (ii) discusses preliminary results from three case studies that show variation in macroinvertebrate activity, abundance and/or diversity with variation in land condition.

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A palynological record of human impact on vegetation at Whagapoua Estuary, Great Barrier Island, New Zealand.

Pollen and sediment in ten cores taken from mangrove to salt marsh and swamp forest indicate a sequence of vegetation changes and environmental disturbance since c. 3500 cal. yr B.P. From 3500 to 1500 cal. yr B.P., the local estuary was a tidal flat area surrounded undisturbed regional conifer-hardwood forest (Dacrydium, Agathis, Libocedrus, Metrosideros, Phyllocladus, and Prumnopitys). Sub-canopy species included Cyathea dealbata tree ferns, and Rhopalostylis palms. After 1700 cal. yr B.P. Phyllocladus and Agathis, started increasing and some shrubs such as Griselinia and Myrsine appeared in the sub-canopy, which may suggest that the climate was becoming drier. By c. 1500 cal. yr B.P., the appearance of Avicennia pollen marks the start of the successional sequence, and coincides with the start of charcoal fragments, which could be caused by natural fires in the drier climate. The initial small scale of anthropogenic deforestation occurred c.1000 cal. yr B.P. in Whangapou Estuary, leading to increased sedimentation, and Juncus kraussii, Leptocarpus similis invading Avicennia marina sites. The most extensive deforestation by Polynesian is represented by a sharp and sustained rise of Pteridium spores, accompanied by a considerable increase in charcoal accumulation rates in pollen profiles from c. 800 to 600 cal. yr B.P. Increased rates of erosion are indicated by the much higher sedimentation rates in the Polynesian period. The human impact triggered plant succession from salt marsh to freshwater swamp, which was shown by a sharp decrease in Leptocarpus similis pollen and increase in Baumea type pollen since c. 350 cal. yr B.P. European disturbance (c. AD 1840) speeded up soil erosion dramatically, causing further succession from Baumea to Leptospermum and Gleichenia shrubland. As a result, the upper tidal limits of the Whangapoua Estuary shifted further east c.1000 m and further south c. 2000 m within c. 400 years. The driving factor for the plant succession appears to have been siltation caused by human impact. Key words: Palynology, Polynesian, European, forest clearance, succession, charcoal.

Eligible for student award? **yes** *Presentation mode:* talk

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Secondary seed dispersal, predation and landscape structure: Does context make a difference in Tropical Australia.

The distribution of animals is effected by landscape change, which is in turn likely to effect animal-mediated ecological processes. In this paper we examine how changes in the distribution and abundance of granivores and frugivores may affect the processes of seed predation and secondary dispersal and how this might affect the long-term community structure of plants in Australia's Wet Tropical landscapes. We demonstrate that granivorous rodents are predatory on seeds of all structural types and display only weak tendencies in preferring large, hard-coated seeds. We also demonstrate that the distribution patterns of three of the key scatter-hoarding and seed predatory mammals are affected by changes in landscape structure. We then go on to analyse seed predation and seed caching rates for a range of plant species in different landscape contexts and dispersion patterns and demonstrate that location and dispersion effects are generally weak and are over-ridden by species effects. We go on to predict the potential effects on seedling recruitment and hence the long-term community structure of the forests in the context of the entire seed dispersing community.

Eligible for student award? **no** *Presentation mode:* talk

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The Global Positioning System: Recent Innovations in Animal Tracking Technology

Methods of tracking the locations of animals are important tools in the study of ecology and related disciplines. In open environments with little signal obstruction, one effective means of obtaining position information is by satellite telemetry, of which there are two distinct types. The ARGOS system uses instruments carried aboard U.S. NOAA weather satellites to detect signals emitted from transmitters (PPTs) when the satellites pass overhead. Although certainly a useful animal-tracking tool, the ARGOS system is unfortunately expensive to operate, provides few position fixes (6-24/day), and is relatively inaccurate (approximately 150-1000 m). If recapture of the subject animal(s) is likely, the Global Positioning System (GPS) provides an outstanding alternative to ARGOS. The GPS uses a constellation of satellites operated by the U.S. Department of Defence. Extremely accurate (better than 2 m with differential correction), the sampling frequency of position fixes using GPS can be as high as one observation/second, while the cost of obtaining these data is only a fraction of that of ARGOS. In this presentation I discuss the state-of-the-art technological developments, particularly in miniaturisation, for using GPS as a means of acquiring high-resolution descriptions of animal movement patterns and suggest some applications in the study of animal ecology.

Eligible for student award? **no** *Presentation mode:* talk

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A confidence interval approach to data analysis

In the majority of ecological research, P-values are used to define the importance of observed treatment effects. At best, however, P-values do not provide the information required to assess the true ecological importance of observed effects, and at worst they can lead to erroneous conclusions. It is argued that in most cases, the primary reason for doing experiments is to (a) estimate the size of treatment effects (b) estimate the degree of uncertainty associated with treatment effects and (c) determine whether and the size of observed treatment effects is important in the context of a particular investigation. An example is used to demonstrate that using confidence intervals is often the best way to achieve these objectives.

Eligible for student award? **no** *Presentation mode:* talk

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Habitat disturbance and invertebrate biodiversity: lessons from non-forest ecosystems

Although 30% of New Zealand's land area is formally protected, there is poor representation of many communities and ecosystems particularly outside of high mountain areas. Currently, a major land status change is occurring in New Zealand's pastoral lands (c.20% South Island), with land allocated either to the Crown for conservation purposes, or to private uses. Higher altitude areas are generally being conserved whilst low to mid altitudes are being privatised. The latter altitudes tend to be modified and disturbed, and generally poorly protected. However, biodiversity values may still be high particularly amongst invertebrates. Knowledge of plant-invertebrate relationships in these largely non-forest ecosystems is generally poor. Biodiversity studies are often limited by unavailability or inaccessibility of invertebrate taxonomic expertise. In keeping with other initiatives, and to progress ecological and biodiversity studies, the separation of organisms into recognisable taxonomic units or morphospecies' has sometimes been adopted. However, community studies of invertebrates are time-consuming and incomplete. Scientifically robust shortcuts are needed to assess biodiversity in these systems. Our data from a range of non-forest ecosystems in southern New Zealand allow some conclusions to be drawn on the use of assessment approaches such as using higher taxonomic levels and functional groups, with a particular focus on Coleoptera which are speciose and trophically diverse.

Eligible for student award? **no** *Presentation mode:* talk

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Direct Seeding: An Alternative Revegetation Technique for the Wet Tropics

In tropical and subtropical regions attempts to rehabilitate degraded areas have predominantly involved the establishment of monoculture plantations over large areas or species rich restoration plantings over smaller areas. Despite the merits of both these approaches they are very costly to establish and are not suitable for broad-scale reforestation with biodiversity recovery as the primary objective. Direct seeding is an alternative revegetation technique that has been widely adapted for broad-scale tree establishment, particularly for mine-site rehabilitation in many parts of Australia and overseas, but remains very much under utilised in wet tropical and sub-tropical regions. Further investigation into how direct seeding can be applied to wet tropical and sub-tropical environments is necessary before the benefits and limitations of this technique can be fully understood. This presentation will summarise results from a series of experimental trials which aimed to elucidate the factors (environmental and ecological) most important for determining the success or failure of this method of restoration in the wet tropics and how barriers to plant establishment in early successions may be more successfully overcome It is hoped that this research along with other experimental work from my PhD will help to establish guidelines for direct seeding of rainforest species under varying conditions and provide greater insight into ways in which costs may be reduced when attempting to restore rainforest to degraded areas.

Eligible for student award? **yes** *Presentation mode:* talk

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Bird assemblages and the role of Travelling Stock Routes in the central-Lachlan region of New South Wales.

It has become increasingly important to understand the ecological function and conservation value of linear strips of vegetation connecting patches of remnant vegetation that would otherwise be isolated. To date there are few publications dealing with the conservation value of such strips of potentially valuable habitat in Australia. This study aims to investigate the conservation value of strips of roadside vegetation (Travelling Stock Routes) for woodland birds in the sheep/wheat belt in the central Lachlan region of New South Wales. Within this region such roadside strips are often the dominant form of natural vegetation. The relationships between habitat complexity, habitat width, bird species diversity and abundance will be investigated along with examining how selected bird species use the roadside reserves. To facilitate this project a pilot study, investigating spatial and temporal variation of bird species diversity in roadside vegetation was conducted. Preliminary results show little variation in the number of bird species along a series of six, one-hectare plots spaced at one-kilometre intervals in complex and wide roadside vegetation. However, variation in bird species composition between plots along the six-kilometre strip of vegetation is high. Data on temporal variation in bird species diversity suggests sites of poor habitat complexity require a minimum of four twenty-minute surveys to record the majority of species present, during a one-week period. New species were still being detected even after six surveys in three of four sites of high habitat complexity.

Eligible for student award? **yes** *Presentation mode:* talk

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How to not catch beetles in Tasmanian Rainforest. Confidently determining species absence for a given search effort.

Which species are really absent? The answers to this deceptively simple question are essential for investigating metapopulation theory and for many aspects of conservation biology. In this study I examined the probability of detecting beetle, snail and reptile species in temperate rainforest in Tasmania, to determine which species could be reliably sampled using a realistic sampling effort. I sampled three rainforest locations over five months using pitfall traps. At each location I sampled one large grid (50-64 trapping stations, 25m spacing), and three small grids (4x4 trapping stations, 5m spacing) to examine whether intense localised sampling was as effective as widespread, low intensity sampling. An initial screening was based on a sample effort of 30 traps. Using a criteria of 95% confidence of detection at all three locations, the species that could potentially be sampled effectively included only ten beetles, two snails and one lizard. I then applied probability curves with bootstrapped confidence limits to estimate the probability of detection for a range of sampling strategies. I found that the probability of detecting a species was influenced by trap arrangement (random vs linear vs square), grid size and whether the species had a clumped or uniform distribution.

Eligible for student award? **no** *Presentation mode:* talk

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Critical isolation thresholds for pollen movement in Dianella revoluta (Phormiaceae)

Fragmentation of habitat may alter floral neighbourhood and potential mate densities of native plant species' populations. Where isolated plants or subpopulations fail to attract sufficient quantity or quality of pollination service reproductive failure or inbreeding depression may result. Here we present data on Dianella revoluta, a common, buzz-pollinated, perennial plant in the understorey of mallee vegetation in NSW. In order to determine if a critical isolation threshold could be identified beyond which pollen movement occurred only rarely, cut inflorescences were placed in roadside vegetation with increasing intervening distance to a conspecific pollen source. Flowers were collected after one day and the amount of conspecific pollen, and that of all other species (heterospecific pollen), was counted. Conspecific outcross pollen load was found to decrease with distance to nearest pollen donor, particularly beyond distances of approximately 100m. However, amounts of pollen from other plant species did not decrease suggesting that visitation remained constant. We believe that this is caused by loss of Dianella pollen to more abundant co-pollinated species. This work demonstrates the manner in which this and other plant species may be at risk in increasingly fragmented landscapes.

Eligible for student award? **yes** *Presentation mode:* talk

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A review of mechanisms linking NPP and catchment water balance in Australian landscapes

Australia is the driest of all permanently inhabited continents. It also has a very low NPP and presumably these features are linked. However, the mechanisms by which catchment water balance determines NPP are complex, interactive and poorly understood for Australian vegetation. Furthermore, quantifying a catchment's water status remains problematic. This paper will discuss different measures of catchment water status and review some of the major mechanisms linking this to NPP. The review will cover leaf, canopy and whole-tree scale mechanisms, including stomatal control, changes in specific leaf area and hydraulic architecture. A simple regression model to predict CO2 flux to a canopy is presented for Australian sites.

Eligible for student award? **no** *Presentation mode:* talk

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(The many) sources of uncertainty in habitat maps

Maps of the predicted distribution of a species (often loosely called habitat maps) are commonly used to assist in biodiversity management and decision making. Habitat maps based on statistical modelling have been used widely for this purpose in Australia including their use in the RFA process. In all cases the final map will have some uncertainty associated with it. Various forms of uncertainty including random and systematic error in the input data, subjective judgement, model uncertainty and vague concepts, affect the accuracy and utility of habitat maps. This talk will briefly outline and explain some of these, and will suggest methods that may be useful in investigating and communicating the resulting map uncertainty. A case study will focus on the extent of model uncertainty in habitat maps based on logistic regression, and its impact on the resulting habitat maps and the decisions reliant on them.

Eligible for student award? **no** *Presentation mode:* talk

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The importance of the spatial structure of environmental correlates in habitat prediction models.

There is an increase in the number of studies that model species distributions with environmental correlates. From a methodological point of view, current emphasis in this field seems to be on comparison of different types of models and rigorous evaluation of model output using data partitioning. In this study we apply 3 different types of distribution prediction models using selected South African bird distribution data and 3 climate variables, which are known from previous work to be important bird richness predictors. Evaluating the output using receiver operating characteristic analysis (ROC), we find little variation in the accuracy of predictions in a between-model comparison for all species. However, in a species-by-species pairwise model comparison, we find that models disagree consistently for certain species. The distributions of these species tend to overlap in a significant spatially homogenous area. Using generalised indicators of local spatial association, we show that this homogenous area of high model disagreement is a significant climate transition zone between a run-off dominated- and evaporation dominated water availability regime. We propose that an investigation into the spatial nature of environmental predictor variables prior to a distribution modelling exercise can yield valuable insight into model performance, the potential advantages of geographical database partitioning prior to modelling, and spawn alternative hypotheses on distribution predictor variables.

Eligible for student award? **yes** *Presentation mode:* talk

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Rehabilitation of degraded tropical forests

There are a variety of ways to rehabilitate forests on degraded tropical lands. These include assisted natural regeneration, direct seeding, monoculture plantings and mixed species plantings. Generally, the more interventionist the method, the more expensive it will be. However, the exact goals of a rehabilitation scheme will also determine its success and its overall cost. We have examined two approaches to forest rehabilitation: · The first approach is aimed at accelerating the rate of biodiversity restoration without necessarily obtaining a commercial return. We have focussed our studies on highly species rich plantings, that were expensive to create but appear to be successful. · The second approach is to develop methods of farm forestry that provide for timber production and biodiversity by establishing plantations of high-value rainforest trees in mixtures. We have focussed particularly on assembling species mixtures that are complementary and stable over time. The goals of these two approaches are somewhat different but both intend to increase the diversity and structure of degraded lands. We have attempted to monitor some of the ecological and functional outcomes of these approaches at individual sites and across landscapes.

Eligible for student award? **no** *Presentation mode:* talk

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Possible tradeoffs between xylem conductive efficiency and resistance to drought/salinity induced embolism in Mexican mangroves.

Three species of mangrove trees were studied at La Mancha Lagoon, Veracruz, along the Gulf of Mexico, to determine their xylem specific conductivity (ks) and resistance to drought and salinity induced embolism. Avicennia germinans occurred in the most saline soils where it had midday xylem water potentials (f) of -6.2 to -7.5 MPa during the height of the dry season, with an experimentally determined 50% loss in conductivity (PLC50) of - 6.2 MPa. In contrast, Laguncularia racemosa had f values ranging from -2.2 to -4.6 MPa with a PLC50 value of -3.7 MPa and Conocarpus erectus had f values of -1.7 to -6.4 with a PLC50 value of -3.78 MPa. Conocarpus was facultatively deciduous at the more saline sites. Avicennia, which was tolerant of the greatest salinity, had the lowest ks values at 1.24 (SE 0.18) kg m MPa-1 s-1 m-2 for 8.5 mm diameter stems, versus values of 2.38 (SE 0.29) and 3.62 (SE 0.50) for Lagunularia and Conocarpus, respectively. The water potential features correlated with the banded distribution of these species within the lagoon, suggestive of possible tradeoffs between conductive efficiency and tolerance of salinity. However, within species variation between sites in the minimum water potentials experienced was considerable.

Eligible for student award? **no** *Presentation mode:* talk

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Forest fragmentation and disjunct core areas in New Zealand

We examined the extent of forest loss in New Zealand and quantified the remaining habitat unaffected by edge effects (core area). Unexpectedly, most fragments contain multiple, disjunct cores. We model responses of animal populations under the traditional assumption of a single, continuous core area per fragment and compare the results to the empirical distribution of disjunct cores in fragments in complex landscapes. One quarter of New Zealand's land area remains in native forest, spread amongst 120,000 fragments. However, the five largest fragments represent fully 40% of the total forested area! Even though the North and South Islands have equal percent forest cover, the North has more than twice as many fragments as the South, with mean fragment size 1/3 that of the South. Larger fragments were more irregularly shaped than small fragments and thus have proportionally greater amounts of edge-affected areas. Using ArcInfo GIS software, we used theoretical edge penetration distances of 10, 100 and 1000 m to quantify the degree to which core areas are broken into multiple, small core areas. The real landscape supports significantly lower population sizes than a landscape with continuous cores of same total area. Many fragments that would sustain local populations with a single core are unable to when the disjunct nature of their cores is taken into account.

Eligible for student award? **yes** *Presentation mode:* talk

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Effects of topography, woody plant cover, and grazing on nutrient patchiness in chenopod shrublands of South Australia.

Heterogeneous distribution of nutrients is an important functional property of arid lands. Because of non-linear responses of plants to resources availability, resource patchiness can increase productivity. Accumulation of materials in depressions and around perennial plants are deemed to produce this patchiness. I measured top-soil concentration of nitrogen (N), phosphorus (P) and organic mater (OM) along a topographic gradient to assess the relative contribution of topography and perennial plant cover to patchiness. Transects were placed across a fence separating a lightly and a heavily grazed area to evaluate the impact of grazing on resource patchiness. None of the variables measured were associated with topographic position, nor with microtopographic features. The concentrations of N and OM were weakly associated with distance to the nearest shrub. The concentrations of N, P and OM were strongly correlated with distance to trees. Nutrient concentration under shrub and tree canopies were unaffected by grazing, but there were lower levels in open spaces in the heavily grazed paddock. The results indicate that in this system perennial plant cover is the main determinant of nutrient heterogeneity, suggesting that retention of trees is critical to maintain the resource base of the system, in particular under intensive grazing pressure.

Eligible for student award? **no** *Presentation mode:* talk

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Fledging, Behaviour and Natal Dispersal in Kakapo, Strigops habroptilus

The kakapo (Strigops habroptilus) is a critically endangered, flightless parrot, endemic to New Zealand. In 2002, after the most successful breeding year in recorded history, the kakapo population received a 37% increase, to 86 individuals. This successful breeding season allowed the fledging, behaviour, movement and dispersal of kakapo juveniles to be studied for the first time. In total 24 chicks were studied on Codfish Island / Whenua Hou, using radio tracking and triangulation to locate each individual chick and its nest mother . A considerable difference was found between the fledging age of chicks from nests with a clutch of one, compared to that from clutches of two. However, no difference in growth rate was found between individuals from clutches of different size. According to Greenwood's dispersal hypothesis, it is predicted that there will be a sex bias in dispersal from the natal range, with females dispersing away from the natal area while males stay close by. Results of the timing and magnitude of dispersal will be discussed.

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Making the Connections: Use of theoretical expectations for management and monitoring

Conservation management has moved from species-focused approaches to integrated approaches such as ecosystem management. However, in most instances these approaches compliment each other. Both these approaches share common factors. For instance in many instances explicit theoretical expectations have not been developed. This often result in either unexpected outcomes in instances where outcomes have been monitored, or limited evaluation of successes of management projects. I present a brief conceptual approach to conservation management directed at maximising biological diversity within the modern day constraints using theoretical expectations affecting diversity. I suggest that ecological stability maybe the only attainable conservation outcome and develop expectations within this framework and how to evaluate resilience, resistance and persistence using selected case studies. I conclude that theoretical frameworks should be the key starting point in the management of threatened species and ecosystems.

Eligible for student award? **no** *Presentation mode:* talk

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Misinterpretations of Null Hypothesis Significance Tests in Conservation Biology journals

The use of Null Hypothesis Testing (or Null Hypothesis Significance Testing, NHST) has been severely criticised for several decades. Yet it remains the dominant statistical procedure in a number of disciplines, including ecology. In this paper I will report results from a survey of statistical reporting practices in two journals: Biological Conservation and Conservation Biology. Typical problems associated with NHST use include: 1. interpreting statistically non-significant results as "no effect" or "no impact" without reference to statistical power or precision and 2. lack of effect size measures (and estimates of error such as confidence intervals or standard error) accompanying tests of hypothesis. Recommendations for better practice include more emphasis on effect size measures and associated confidence intervals, and graphical displays of these measures.

Eligible for student award? **yes** *Presentation mode:* talk

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Characteristics of key feeding habitat for Eastern Curlew at two spatial scales in subtropical eastern Australia.

Broadscale habitat use of Eastern Curlew was assessed using low tide surveys on feeding grounds, where 60 skilled volunteers counted 160 intertidal flats during summer 1998-99. The area surveyed covered around 40 % (9,500 ha) of the intertidal habitat within Moreton Bay. Data from adjacent, physically similar, flats were pooled, giving 32 broader-scale sites for analysis, of roughly equal area (mostly between 200 and 400 ha), which varied greatly in their curlew density and also in substrate and other environmental features. Of ten environmental characteristics measured for each site, substrate penetrability was the best predictor of curlew density. Characteristics that were poor predictors included distance to the nearest roost, amount of seagrass and level of human disturbance. For a finer-scale assessment, the microhabitat use and feeding behaviour of curlew were recorded at 12 intertidal flats, during summer 1999-2000. These flats varied in size (23-97 ha), substrate, topography, and other features. Across all the flats, curlew preferred to feed on sand and between 0 and 50 m from the low water mark. Other substrates (including sandy mud, mud and seagrass) were used in roughly the same proportions as they occurred. These results suggest that curlews select habitat most strongly at a between-flat rather than within-flat scale

Eligible for student award? **yes** *Presentation mode:* talk

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Monitoring biodiversity health in tropical savannas

There is increasing demand for robust methods of assessing biodiversity status as a component of landscape health in Australian rangelands, including the tropical savannas. A number of indicators for biodiversity health have been proposed, but the utility of these indicators remains largely unvalidated. We are investigating the value of a range of indicators or surrogates for biodiversity health in tropical savannas. Sites in a range of land condition states have been sampled in major rangeland types in two pastoral regions in northern Australia - Dalrymple Shire (Queensland) and Victoria River District (Northern Territory). Sampled biota includes vertebrates, vascular plants, ants and termites. The condition of the sites is also assessed using landscape function analysis, indices derived from satellite imagery and conventional plot-based methods used by existing pastoral monitoring programs. Initial results from the project are presented here and the implications for an effective, landscape-scale scheme for monitoring biodiversity health are considered

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The ecological basis of convergent maternal care strategies in ungulates and macropods

Among ungulates, there is a dichotomy between species in which offspring follow the mother ("following" strategy) versus species in which offspring remain concealed ("hiding" strategy). In this study we reveal that the same dichotomy exists among macropods. We tested three traditional explanations: that a "following" strategy is associated with (1) open habitat, (2) large mothers, and (3) gregariousness. We also proposed a new hypothesis, that a "following strategy" is associated with delayed weaning, and thus with the "slow" end of the slow-fast mammalian life history continuum, because offspring devote resources to locomotion rather than rapid growth. Our comparative test strongly supports the habitat structure hypothesis and provides some support for this new delayed weaning hypothesis for both ungulates and macropods. We suggest that in both clades, differences between species in the form of parental care are due to a similar interaction between habitat, social behavior and life history.

Eligible for student award? **no** *Presentation mode:* talk

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Biosphere Reserves or Conservation Management Networks: a comparison of two types of mixed ownership conservation networks

The onground development of the Biosphere Reserve concept in Australia has largely been dormant since its inception in 1977. With the exception of two, Bookmark and Fitzgerald River, the remaining biosphere reserves have been restricted to existing public protected areas. However, a number of recent proposals for new biosphere reserves are intending to encompass land managed for conservation and sustainability on a variety of tenures. Likewise, models such as Conservation Management Networks (CMNs) have more recently been proposed to improve protection, management, information, and accounting for ecosystems managed for conservation across a range of tenures in fragmented landscapes. Are these two models essentially attempting to achieve similar outcomes under different names? Various attributes of three mixed-ownership conservation networks - the Bookmark Biosphere Reserve (SA), the Grassy Box Woodland CMN (NSW) and the Gippsland Plains CMN (VIC) were measured and analysed. Goals and measures of success for biosphere reserves and mixed-ownership networks need to be clearly identified before any indication of success can be measured. One such measure may be the contribution of such areas to a comprehensive, adequate and representative reserve system. This measure is analysed and discussed for the three aforementioned networks.

Eligible for student award? **yes** *Presentation mode:* talk

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A lesson after 10 years of restoration in a 30 year old abandoned pasture land in the edge of Tropical Rainforest, NE Queensland

Artificial restoration techniques have been employed to accelerate natural recruitment in abandoned pastureland. We investigated the survival of planted tropical rainforest seedlings after ten years, natural recruitment over this period and compared selected soil physico-chemical properties with rainforest. The study was conducted as a randomised block design involving five treatments. Mortality of planted seedlings, new recruits, canopy closure and weed density were assessed. Soil samples, from 0-15 cm depth, were analysed for soil physico-chemical properties. Across the four treatments 68% of planted seedlings survived. Natural recruitment ranged from 10-23 in the treatments compared to 13 in the control. The canopy cover increased and weed cover decreased with increasing species diversity. Nitrogen and Carbon levels were significantly lower but exchangeable Al and bulk density was significantly higher under abandoned pasture or planted forest compared to natural rainforest. Results show that species diversity in artificial planting has more influence than soil physico-chemical properties on the success of artificial restoration. Tropical soils have a poor capacity to recover from degradation in soil properties caused by deforestation and cultivation.

Eligible for student award? **no** *Presentation mode:* talk

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From biome to backyard: The role of map data in ecological management.

Tropical savannas occur across northern Australia and are part of a global biome. In a joint project, the Queensland Herbarium and the CRC for Tropical Savannas produced a map of Australian tropical savanna vegetation. The mapped area fits into a hierarchy of ecological units including biomes, ecoregions, bioregions, provinces and ecosystems. This hierarchy plays a role in understanding and planning for management of ecological function at the global, continental, regional and local scales. The Australian savannas mapping project brought together botanists from northern Australia to produce a 1:1 000 000 scale seamless vegetation map for 22 of the 88 recognised Australian biogeographic regions. The map project used GIS to assist in re-interpreting existing datasets and for relating vegetation units to the broader landscape by adding geology, landform and soil data to map units. GIS was also used when interpreting satellite imagery as a new vegetation map was produced for areas where vegetation had not previously mapped to this scale. Project outputs include a technical report, hard copy map and 1:1 000 000 scale digital coverage that provide an overview of the diversity of Australian savanna landscapes. This enables more localised research and management practices to be seen in context.

Eligible for student award? **no** *Presentation mode:* talk

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The effects of Tropical Cyclone Waka on the structure of lowland tropical rain forest in Vava'u, Tonga

On New Years Eve, 2001, Tropical Cyclone Waka passed directly over the Vava`u island group, Kingdom of Tonga with sustained and maximum wind speeds of 185 km hr-1 of 230 km hr-1 respectively. During a prior study of forest secondary succession, 44 600-m2 forest plots on 13 islands had been surveyed in 1995 and their locations marked. This provided an opportunity for the only post -cyclone assessment of established lowland tropical forest plots in any of the western Pacific islands east of the Solomon Islands. Twenty-one of the plots were relocated in June 2002. Tree mortality averaged 6%, varied from 0-7% for lowland late successional species, and tended to be higher for early successional plots (8-16%) and species (up to 19%). Severe damage (uprooting, snapped stems) affected 25% of the 2030 stems measured. The proportion of snapped stems was disproportionately high in the 10-15 cm diameter class. Uprooting was more prevalent than expected by chance among large trees (>20 cm dbh). The greatest mortality and severe damage combined (>39% of stems) occurred in plots that were early successional and/or in exposed topographic positions. In spite of the cyclone damage the basal area and density of the plots actually increased from 1995-2002 in eleven and six of 21 plots, respectively. Net forest growth from 1995-2001 outweighed hurricane mortality in all but the most damaged plots.

Eligible for student award? **no** *Presentation mode:* talk

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Sex in a fragmented landscape: Developing a general framework of rare plant population responses to habitat fragmentation.

To effectively manage plant populations for conservation, there is a need to provide reliable information on the conditions required for maintaining viable populations. This is particularly true for rare taxa occurring in a fragmented landscape, such as that of south-west Western Australia. Western Australia contains over 45% of Australia's gazetted threatened flora, 80% of which are found within the south-west region. Resources do not exist to undertake comprehensive studies of population dynamics for every rare plant species of this region. By assigning rare plant taxa into functional groups, based on their floral architecture and putative pollinator, their fire life history (sprouter versus non-sprouter) and germination requirements, models will be developed for each functional group. Representative taxa will be chosen from each functional group for detailed investigation on how rates of pollination, seed production, genetic diversity and seed fitness are affected by population size and landscape context. The information gained from these models will be extrapolated to other taxa within each functional group thereby providing guidelines for flora conservation, threatened ecological communities, and restoration/revegetation programs. Here we present findings on our preliminary allocation of the 230 endangered and vulnerable plant taxa of Western Australia into floral architecture functional groups and which species will be utilised for the next stage of the project.

Eligible for student award? **yes** *Presentation mode:* talk

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Life history characteristics for an urban lifestyle: cross continental comparisons in birds.

Urban environments represent highly disturbed habitats for birds. Life history characteristics are likely to play an important role in determining which species are able to live within these areas.. Using datasets from USA and Australia, we have compiled a list of birds from each continent that are more abundant in urban areas than in native forests and woodlands. W have also identified species that are more frequently seen in forests and a final group that are in equal abundance in both habitats. We investigated whether any life history or morphological characteristics are more commonly seen within the species that favour urban areas compared with species that are found in greater frequency in forests. The attributes we investigated included body mass, diet, clutch size, nest height and nest type. Several attributes, particulalrly body mass, differed significantly between birds that thrive in urban areas, compared with those that are negatively affected by urbanisation. The similarlity between North American and Australian birds in the association of attributes with different habitats, indicates some predictive power in determining species response to urbanisation.

Eligible for student award? **no** *Presentation mode:* talk

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Scenario Building: the use of GIS to visualise revegetation thresholds & guidelines

During the past 4 years we have worked with a large number of Landcare Groups and Greening Australia to develop revegetation guidelines based on the habitat requirements of woodland birds threatened by loss of habitat extent and structure using a focal species approach. Bird surveys were stratified by woodland remnant patch size, isolation and internal structural complexity and at least 50 remnants were surveyed. Patterns of bird species occurrence were used by ourselves and collaborating farmers to identify revegetation and management guidelines such as: enlarge small remnants to at least 10 ha in size; protect all remnants from continuous grazing; and construct 10 ha "stepping stones" so that all remnants are no more than 1 km from other sizeable remnants. Each guideline was then mapped as individual themes in a GIS with a high resolution SPOT satellite image as the base theme. The tabular capability of the GIS was then used to calculate basic costs such as fencing and area revegetated, as well the cumulative area under woodland cover (sub-catchment threshold). We have found this visualisation (mapping) of vegetation enhancement guidelines to be an effective analytical and communication tool.

Eligible for student award? **no** *Presentation mode:* talk

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Potential for an urban biosphere reserve in Auckland, New Zealand.

Despite recognition at a UNESCO Man in the Biosphere (MAB) regional workshop in 1977 that there was “ merit” in New Zealand’s participation in the Biosphere Reserves Programme, New Zealand has yet to utilise biosphere reserves as a mechanism of environmental management. While substantial areas of wilderness are protected under existing legislation, the development by MAB of an ‘urban biosphere reserves strategy’ may offer a useful, and perhaps more appropriate, application of the biosphere reserves concept in New Zealand. Auckland is New Zealand’s most densely populated region, with degraded ecological services and fragmented ecosystems typical of human production environments. Despite this, environmentally significant sites in the urban and peri-urban matrix still exist, managed by a range of territorial land authorities. A groundswell of community-initiated ecological restoration projects, accommodated and encouraged by territorial land authorities, are enhancing environmental values and increasing the level of environmental awareness. The promotion and demonstration of a balanced relationship between people and nature can be maximised in the urban context. Applying the Biosphere Reserve concept to the Auckland region would link areas with environmental value, and offer astrategy to integrate existing environmental management mechanisms and a range of sustainability initiatives from both government agencies and local communities.

Eligible for student award? **no** *Presentation mode:* talk

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Why are there so many heteroblastic plants in the New Zealand flora: Shade-tolerance or shade-avoidance?

Leaf heteroblasty (plants that have juveniles and adults markedly differing in leaf size, shape and growth habit) is remarkably common in New Zealand. We hypothesized that seedlings of heteroblastic species are not plastic in their response to light and are more shade-tolerant while homoblastic species are more plastic but shade-intolerant. We compared seedling leaf physiology and growth performance of two pairs of heteroblastic and homoblastic endemic species grown under different light qualities (R: FR-Red: Far red ratio) and quantities simulating deep shade and full sun. For both genera, heteroblastic seedlings had much lower plasticity in leaf morphology than homoblastic seedlings. In full sun, heteroblastic Aristotelia fruticosa was 56% higher in leaf photosynthesis and 65% higher in stomatal conductance than homoblastic A. serrata. Stomatal conductance was 64% higher in heteroblastic H. sexstylosa than homoblastic H. lyalii. In the deep shade, seedling survival and the rate of photosynthesis were higher for A. serrata than A. fruticosa. Hoheria lyalii was higher in stomatal conductance than H. sexstylosa while there was no significance difference in leaf photosynthesis. Our results demonstrated that homoblastic species survive and grow better in the shade than heteroblastic congeners do suggesting heteroblasty is not an adaptation to shade-tolerance.

Eligible for student award? **yes** *Presentation mode:* talk

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Effects of a dominant ant associated with anthropogenic disturbance on ant assemblages on rock outcrops

Competition in ant communities is thought to result in hierarchies of dominance with dominant species regulating species composition and assemblage structure. The meat ant, Iridomyrmex purpureus, is a dominant ant on sandstone outcrops near Sydney, Australia. It is active and aggressive, and in our initial surveys outnumbered other ant species 4:1. We conducted an exclusion experiment to determine the effect of meat ants on the resource use and foraging activity of co-occurring ant species. Cages excluded over 95% of meat ants from outcrops. We examined ant activity, responses to mealworm baits, and habitat characteristics at each of 16 sites. Functionally similar ants, particularly other species of Iridomyrmex, were less abundant in the presence of meat ants, however no effects were detected for other species. Baits were removed more rapidly at sites with meat ants than at exclusion and control sites, but only on rock where meat ants were the most successful foragers. Outcrops with meat ants were closer to fire trails than those without, suggesting that open areas created through anthropogenic disturbance facilitate meat ant invasion. The success of meat ants is due not only to their ability to dominate a substrate that is under-utilized in their absence, but also to their effective exploitation of resources at the expense of functionally similar species. Changes in meat ant distribution due to anthropogenic disturbance may thus cause changes within hierarchical levels in ant assemblages.

Eligible for student award? **yes** *Presentation mode:* talk

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Habitat suitability models of small ground-dwelling fauna in coastal heathlands: incorporating vegetation structure

In recent years, the development of wildlife habitat models, by integrating statistical techniques with Geographic Information Systems (GIS) and remote-sensing applications, has increased. The selection of habitat variables in the formulation of these models is constrained by the availability of digital data layers that approximate the ecological requirements of the species under investigation. Layers of land cover and vegetation health indices can be derived from satellite imagery, however vegetation layers containing structural attributes are difficult to obtain. Moreover, the spatial resolution obtained from satellite imagery is generally sufficient for regional applications, but not local applications (e.g. home range of a small mammal). In this study, a habitat suitability model that incorporated a spatial measure of vegetation structure was developed for a small dasyurid, the Swamp Antechinus (Antechinus minimus). Like most ground-dwelling fauna, vegetation structure is a vital attribute of this species' habitat, and any measure of it will substantially improve the predictive power of a habitat suitability model. To derive this layer we used the technique of Coops and Catling (1997a, b) based on Airborne Multi-Spectral Imagery and the relationship between local variance of the near infrared spectral band and vegetation structure. The steps involved in building the habitat model and the resultant model are presented. Coops, N. C. and Catling, P. C. (1997a). Predicting forest structure from airborne videography for wildlife management. International Journal of Remote Sensing 18, 2677-2682. Coops, N. C. and Catling, P. C. (1997b). Utilising airborne multispectral videography to predict habitat complexity in eucalypt forests for wildlife management. Wildlife Research 24, 691-703.

Eligible for student award? **no** *Presentation mode:* talk

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Multiple scale remote sensing analysis of canopy dieback and thinning in rainforests of tropical North Queensland

The availability of high resolution multispectral data over the Wet Tropics World Heritage area provided an opportunity to test the effects of varying spatial and spectral resolution on the quality of data regarding rainforest canopy thinning an dieback. Dieback patches were mapped from aerial photography and transformed to vector polygons. These polygons were then used to extract multiple band pixel data from each of Landsat ETM+ (25m), Ikonos (4m), Specterra (2m) and ADAR (1m) imagery. The spectral signatures of dieback patches were then compared to an exclusive, random sample of equivalent area. In addition, vegetation and leaf pigmentation indices based on green, red, near infra-red and near thermal infrared bands were constructed and evaluated for their ability to reliably discriminate areas of canopy decline. The results of this study provide a methodology for broad scale monitoring of rainforest canopy change and targeting of intensive field sampling

Eligible for student award? **no** *Presentation mode:* talk

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The influence of habitat structure on bird assemblage structure in tropical forests

This study examined the influence of habitat structure on bird assemblage structure across a vegetation gradient from closed rainforest to open woodland. By restricting the study to a well-defined biogeographic region within the Wet Tropics we were able to determine the influence of habitat structure independent of the confounding effects of regional processes such as climate and biogeography. Increases in vertical complexity and spatial heterogeneity of a habitat are hypothesised to increase faunal diversity and abundance by providing a greater number of potential niches. Vegetation structure was characterised by indices of vertical complexity and spatial heterogeneity in each of four habitat types. The results showed that both habitat structure and bird assemblage structure underwent marked changes along the vegetation gradient. Examination of the relationship between habitat structure and bird assemblage structure revealed that vertical complexity was an important positive influence on bird species richness and abundance. Spatial heterogeneity was also an important factor but to a lesser extent than vertical complexity. Therefore, vertical complexity of the vegetation imposes a strong influence on bird community structure.

Eligible for student award? **no** *Presentation mode:* talk

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Estimating animal dispersal and abundance using genetics: Conservation and pest management applications.

Genetic data is increasingly being used to determine a wide variety of wildlife population parameters. This talk will present results from two projects that have used microsatellite DNA markers to generate empirical estimates of dispersal and population density with results contributing to the management of each of the species concerned. We have investigated the impact of habitat modification on lizard dispersal. In this case, small populations of the endangered grand skink, Oligosoma grande, inhabit rock outcrops amongst a matrix of indigenous tussock grassland or modified pasture in southern New Zealand. Results from this study have shown that dispersal is highest in tussock and that it is possible to accurately determine the origin of dispersers using genetic assignment tests. We have also used a genetic approach to test the efficacy and value of non-invasive DNA-based analysis for monitoring the distribution and abundance of stoats, Mustela ermina, and a serious mammalian pest in New Zealand. We have successfully developed a field-based hair collection system, and used the system for obtaining mark-recapture estimates of stoat abundance. This technology will be particularly useful in order to quickly, cheaply, and accurately monitor cryptic species at low population densities.

Eligible for student award? **no** *Presentation mode:* talk

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Ecological Risk Assessment of Genetically Modified Subterranean Clover Expressing a Sunflower Seed Albumin Gene

Recently, much debate has surrounded the ecological risks associated with transgenic plants both in Australia and around the world. One area that has received considerable attention is the risk of transgenic plants becoming "superweeds" since the direct economic and environmental costs of invasive plants can be large. However, very few studies have investigated the ecological risk associated with genetically modified pasture plants, despite the prevalence of pasture plants in natural and agricultural systems in Australia and elsewhere. We investigated the risk of invasion of remnant grassland communities by genetically modified Trifolium subterraneum (subterranean clover) expressing a sunflower seed albumin (ssa) gene using a combination of field surveys, a glasshouse competition trial and a field experiment conducted in native grasslands typical of the southern tablelands of NSW. Based on field surveys, we determined that Trifolium subterraneum is a widespread but relatively uncommon constituent of native remnant grassland communities. In the glasshouse competition trial we found that the transgenic Trifolium subterraneum showed no added competitive ability above that of the non-transgenic line. The implications of these results and those of the ongoing field trial for the ecological risk assessment of Trifolium subterraneum expressing the ssa gene will be discussed.

Eligible for student award? **no** *Presentation mode:* talk

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The influence of incubation temperature on the morphology, performance and microhabitat choice of the tropical Skink, Carlia longipes.

Different habitat structures pose different problems to those organisms moving within them, and as a result we expect organisms to be morphologically adapted to the habitats they predominantly use. Incubation temperature can have a pronounced effect on morphology in squamate reptiles, which can affect the locomotory performance of hatchling lizards. Does the effect of incubation temperature on morphology in turn influence a lizard's choice of substrate? I tested this hypothesis using the skink Carlia longipes. Adjacent populations of this skink occupy either rock or leaf litter dominated habitats. My previous work on other skink species indicates that locomotion on these two substrates is enhanced by different morphological traits. Specifically, longer legs are better for climbing on rocks, and shorter legs for locomotion in leaf litter. Freshly laid eggs of C. longipes were randomly allocated to two incubation regimes (cool and warm) in a split-clutch design experiment. At hatching, each lizard was sexed and measured, and had its sprinting and climbing performance quantified, before being allocated to a microhabitat choice experiment. This experiment assessed whether lizards from different incubation treatments selected those microhabitats in accordance with their morphology (i.e., whether longer legged individuals selected rocks, while shorter-legged individuals selected leaf litter).

Eligible for student award? **yes** *Presentation mode:* talk

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Ecosystem services: some theoretical foundations

In the mid 1990s the term ‘ecosystem services’ entered popular science books and the ecological economics literature. The concept provides a new arena for debating sustainability, integrating scientific disciplines, combining scientific and local knowledge, and for fostering understanding among policy makers, stakeholders and researchers. The concept draws on a range of theories. Neoclassical and environmental economics, tempered with psychology, provide theories of value, including the value of ecosystem services, or their seeming lack of value. Property rights theory shows how values get appropriated, and political economy is about how property rights get established or changed. Neo-classical production functions show how ecosystem services can be combined with industrial inputs to produce outputs. However, they are too simple and static to represent the complexity and spatio-temporal variability of ecosystems. Hydrology, soil science, biology, and population and conservation ecology contribute to the construction of relatively sophisticated production functions. However, ecosystems can behave in non-linear and unpredictable ways, making these conventional approaches to modelling production functions unsuitable. Uncertainty brings to the fore the importance of ecosystem attributes that confer resilience. Resilience and complex system theories will become increasingly important as the uncertainty over the future supply of ecosystem services taxes governments, the public and researchers.

Eligible for student award? **no** *Presentation mode:* talk

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Spatial estimates for forest environments of the humid tropics of North Queensland in late Pleistocene and Holocene climates

Palynological and relict charcoal evidence reveal the forest mosaic in humid tropical North Queensland was quite dynamic and that the relative areas of rainforest and sclerophyll forests altered considerably in response to past climate changes. As this approach cannot provide detailed spatial estimates of past forest environments, we developed an approach, based on artificial neural networks, to quantify the relative suitability of environments for various forest classes using a structural-environmental classification of forest types, vegetatio maps and spatial estimates of environmental factors. Model inputs include climate, soil parent material and terrain variables, and the spatial distributions of forest environments were estimated in three selected climates since the last glacial maximum. The modelled distributions shift dramatically in response to past climate changes. Certain landscape locations are characterised by rainforest environments in only some climates while others always remain appropriate for rainforest despite large changes in regional mean annual temperature and precipitation. Environments suitable for the various rainforest types respond differently to climate changes and are most restricted at different times. As the charcoal evidence generally corroborates these past vegetation models, they have important implications for interpretations of present patterns of biodiversity and the possible impacts of current global warming.

Eligible for student award? **no** *Presentation mode:* talk

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Patterns in endemic species diversity

Characterizing patterns in the areal distribution of endemics within a habitat, or the "endemics-area relationship", is important when examining diversity patterns, when estimating extinction rates due to habitat loss, and when making conservation decisions. Here, we examine the interrelationships between area, species abundances, spatial distribution and endemic species richness by building on a previous study focused on total species richness. We first derive an endemics-area model for species whose individuals are randomly distributed in space and use this random model to examine the form of the endemics-area relationship for species abundance distributions which vary in their degree of dominance. We then derive an endemics-area model for a nonrandom distribution of individuals. Using this nonrandom model, we examine the form of the endemics-area relationship for varying degrees of aggregation and regularity in the spatial distribution of individuals. Our analyses suggest that in a given area, increased species dominance and spatial aggregation of individuals within species results in greater endemic species richness. This result strikingly contrasts that of a previous study focused on total species richness, which found that, in a given area, increased dominance and spatial aggregation result in lower total species richness.

Eligible for student award? **no** *Presentation mode:* talk

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Age, isolation or structure. Which control the development of beetle assemblages within replanted rainforest?

It has been suggested that reforestation and ecological restoration could contribute to sustaining biodiversity. However, knowledge of how invertebrates such as beetles (one of the largest contributing groups to biodiversity) respond to rainforest revegetation is lacking. Beetles were sampled from 30 sites across the Atherton tablelands in North Queensland, Australia. These sites included rainforest restoration plantings (varying in age and isolation from intact rainforest), and reference sites of pasture. Flight interception traps were used to capture beetles. Beetle abundance, species richness, family richness, feeding guilds, and assemblage composition were compared among sites and with site structural and resource attributes. Interim results from this study test how factors such as resource development, site age, and isolation affect the development of beetle assemblages.

Eligible for student award? **yes** *Presentation mode:* talk

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Modelling and managing dead wood dynamics in production forests for biodiversity conservation: a Tasmanian perspective

Dead wood is one of the most important reservoirs of forest biodiversity, and its maintenance in forests managed for timber production is a key challenge for ecologically sustainable forestry. The issue is particularly acute in wet eucalypt forests managed by clearfelling, especially if timber harvesting is coupled with wood residue harvesting for energy generation or for other "waste minimisation" purposes. For biodiversity conservation, the challenge is to ensure that silviculture sufficiently mimics the natural dead wood dynamics that occur in equivalent unmanaged forests as a result of periodic wildfires, because we assume that most dependent species have life-history strategies enabling them to cope with these dynamics. In practice, this means trying to deliver comparable rates of input and output of dead wood through successive rotations throughout the production forestry landscape. As a case study, we consider models of dead wood dynamics that have been developed to address this issue in Tasmania's wet eucalypt production forests.

Eligible for student award? **no** *Presentation mode:* talk

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The Masked Booby, Coral Cays, and Ocean Currents: Explaining the Timing and Location of Pelagic Seabird Breeding Events on the Great Barrier Reef

What factors determine when and where pelagic seabirds breed? I investigated a wide range of environmental factors in order to explain the timing and location of breeding events of a pelagic seabird, the Masked Booby, Sula dactylatra. The spatial and temporal distribution of seabird breeding events on the Great Barrier Reef is often explained by observations of the preferred nesting habitat of the species of interest. However, these observations include irregularities in breeding distribution that are not always easily explainable. Furthermore, observations of nesting habitat preferences and other environmental factors can be confounding and may prevent a clear understanding of what are the critical predictor variables. By a combined analysis of the features of breeding islands, oceanographic data and satellite images, and aspects of the breeding biology and foraging ecology of these birds, it was therefore possible to increase our power of explanation of the spatial and temporal distribution of masked booby breeding on the GBR. Further research involving the use of satellite telemetry techniques would aid in unequivocally confirming the foraging distribution of breeding Masked Boobies. This is especially significant for the future conservation of Masked Booby populations of the Great Barrier Reef as some of these feeding areas are within management zones allowing exploitative activities such as commercial trawling operations. Identifying those areas utilised for feeding by breeding pelagic seabirds will also contribute towards efforts by GBRMPA's Representative Areas Program to provide higher conservation status to non-reef areas of the Great Barrier Reef Marine Park.

Eligible for student award? **yes** *Presentation mode:* talk

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Food web processes: eat home grown or home delivery?

Food web processes in estuarine systems are considered to differ from terrestrial systems in having a greater movement of carbon (energy) amongst habitats. This movement of carbon in the water column provides consumers with a greater range of possible food items, from either locally fixed carbon, or carbon imported from adjacent habitats. This study examines the influence of the position of an animal within a patch of habitat, and its ultimate source of carbon. We measured the stable isotope ratios of carbon for two crab species (Parasesarma erythrodactyla and Australopax tridentata) located at different positions (centre, intermediate and edge in saltmarsh; intermediate and centre in adjacent mangroves) in patches of estuarine habitat. Isotope ratios of both crab species collected in saltmarsh were found to be significantly different from those collected in mangroves, but crabs collected within each habitat were not significantly different. Isotope ratios of crabs collected in saltmarsh closely reflected the isotope ratio of saltmarsh grass (Sporobolus virginicus) indicating that they derive their nutrition from local sources. Crabs collected in mangroves however were more enriched in 13C than the mangrove plants and are therefore considered to have a mixed diet.

Eligible for student award? **yes** *Presentation mode:* talk

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Nematode assemblages from Avicennia marina leaf litter in a temperate mangrove forest in south-eastern Australia

Meiofauna from Avicennia marina leaf litter in a temperate mangrove forest was enumerated, and the nematode assemblages compared on the bases of leaf colour (used as a guide to leaf age) and shore horizon where samples were collected. Twenty-one putative nematode species were collected from 48 leaf litter samples. Univariate analyses indicated that neither the colour of the leaf nor the shore horizon significantly affected abundance of nematodes. However, rarefaction curves revealed highest diversity on brown leaves from under the shade of the tree canopy (H= .751 ± 0.126 SE, n 7). Species diversity of leaf litter nematodes was lower in this temperate mangrove system than reported from tropical mangrove studies. ANOSIM tests confirmed a significant effect of shore horizon on nematode assemblages. The dominant feeding group among nematodes was non-selective deposit feeders (7/21 species but 77% of all nematodes). Epigrowth grazers were represented by 8/21 species of nematodes, but only 19% of the total number. Chlorophyll in Avicennia marina leaves tethered on the mudflat in litter bags was estimated by spectral absorbance of leaves, and declined by 50% over about 13 weeks. Excised leaves became skeletonised by about 15 weeks. Shorter temporal scales of life cycles of nematodes compared with leaf degradation, and the dynamic nature of epibiontic assemblages probably explain the similar assemblage structure on yellow and brown leaves

Eligible for student award? **yes** *Presentation mode:* talk

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Recent exposure - insect life on the edge in New Zealand forest fragments

Habitat fragmentation has been one of the most discussed topics in the conservation of biodiversity in the last century. The New Zealand landscape like many places worldwide, has been reduced to urban centres enclosed by extensive rural landmass, consisting mainly of pasture and isolated patches of native vegetation. The edges of these forest remnants have physical and biological characteristics that differ to the interior forest. Because there is a higher proportion of edge habitat on a landscape scale than ever before, the question arises what impact does this increase in edge habitat have on remaining forest and how does it influence native biodiversity? This paper presents results from an eight month field study of four forest fragments in the Rodney district northern New Zealand. The aim of the research was to determine the affect forest edge has on invertebrate communities and to elucidate the relationship between insect diversity and microclimate, forest structure and forest species composition. A combination of focal taxonomic groups included the Lepidoptera and the Coleoptera. Significant trends were seen relating species diversity of plants and insects with distance from forest edge. The mediating influences of microclimate, dead wood and leaf litter cover are also considered.

Eligible for student award? **yes** *Presentation mode:* talk

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Spectral Mixture Analysis (SMA) to detect the fractional quantity of weed species at the sub-pixel level, and the spatial, spectra and radiometric resolution required.

Percentage cover and spectral reflectance data of weed species were measured in the field using a "Cropscan" Multispectral Radiometer. Imagery of the powerline corridor was acquired at two spatial scales, Ikonos multispectral satellite at 4m, and an Airborne Data Acquisition and Registration (ADAR) system at 1m ground resolution. Percent cover of weed species showed that within each 1.0 m2 , 1 - 3 main species were present suggesting that SMA was a viable technique for determining the quantity of weed fractions in imagery at 1m spatial resolution. Signatures from the spectral reflectance measurements were found to be statistically separable. Empirical calibration was employed to relate field spectral responses to the imagery, avoiding complex atmospheric corrections. Difficulty was experienced with calibration of the ADAR imagery due to an inherent interpolation algorithm in the camera's output. SMA was also unsuitable for the spatial resolution of the Ikonos imagery. An image classifier that considers the wide variance in vegetation reflectance may be needed rather than one that uses just a mean value, as in SMA. A sensor with the spectral and radiometric qualities of the Ikonos satellite imagery, but with higher spatial resolution (1 m2) is likely to be far more successful.

Eligible for student award? **yes** *Presentation mode:* talk

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Predictive value of plant functional types in determining future high impact weeds

Among the greatest challenges in understanding ecosystem processes is that of dealing with large heterogeneous species sets. One method of simplifying this problem involves grouping plant species by some aspect of their ecology, with the characteristics defining each group being the plant functional type (PFT). We can then generalize the performance of group members, and predict the behaviour of other species conforming to the PFT definition. The PFT concept has evolved considerably from its beginnings as an ad hoc definition. The modern form is data-driven, and uses a series of steps to define PFTs and validate groupings. We aim to compare high- and low-impact naturalized species in SE Queensland to test the applicability of PFT methods to weed management issues. PFT methods may improve screening for high-impact weeds and assist in identifying priority targets for eradication among recently naturalized species. Such methods could also generate testable hypotheses regarding the ability of exotic species to colonize plant communities and modify ecosystems. However, the applicability of the approach could be limited if interactions between plant traits and environmental parameters render groupings highly context dependent.

Eligible for student award? **no** *Presentation mode:* talk

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Generalised models of presence and absence of a vulnerable macropodid marsupial

The presence or absence of quokka populations at 66 sites in the northern jarrah forest was investigated using generalised linear and additive models. Three of the 13 uncorrelated variables used in the linear model explained 34% of the deviance in the data. These variables were the number of poison baits ha-1, the average age of the swamp and a habitat factor score pertaining to large areas of recently burnt Agonis swamp habitat type. A generalised additive model was run on this final list of variables and this explained 52% of the deviance as two of the smoothed curves exhibited a significantly better fit to the data than the linear fit. Two other variables also showed substantial support; distance to disturbance and a habitat factor score relating to swamp habitat that was burnt 15 to 19 years ago. The addition of these variables explained 38% of the deviance in the linear model and 74% in the additive model. It is concluded that if more were known about the metapopulation structure of the species then more of the deviation in the data may have been explained. The model provides indirect evidence for the significance of fox predation and habitat on the quokka.

Eligible for student award? **yes** *Presentation mode:* talk

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Characterising landscape patterns for conservation: what about the frogs?

Conceptual spatial models have been developed to characterise and define landscapes for ecological interpretation. These models are often used as a foundation for studies that examine how landscape modification has affected biota. This paper explores these models and their applicability to an animal group that has received little attention in modified Australian landscapes - frogs. Conventional species habitat models are often based on vegetation patterns. In this paper, habitat models were developed to reflect landscape patterns of relevance to frogs in the Southern Tablelands of NSW. While vegetation may be an important defining landscape feature for birds or mammals there are several other components (eg. wetlands, constructed ponds and soil moisture gradients) likely to influence the spatial distribution of frogs. Habitat models that link land and water may be used to design studies that examine multiple animal groups simultaneously, such as reptiles and amphibians. While it is common knowledge that habitat is a species-specific concept, this is not reflected in the way we characterise modified landscapes for conservation. Habitat models that underpin landscape scale studies require further complexity to avoid land management and conservation strategies with inappropriate assumptions of how biota respond to landscape change.

Eligible for student award? **yes** *Presentation mode:* talk

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Potential impacts of global warming on a biodiversity hot spot

The Wet Tropics of NE Queensland is perhaps the most significant biodiversity hot spot in Australia and is considered to be one of the most significant regional ecosystems in the world. In less than 2000 km2, the region supports one third of all Australian vertebrates (741 species), 65% of Australia's ferns, 37% of the conifers and 30% of both the orchids and vascular plants. Many of the region's endemic species are confined to the cooler uplands and highlands that are scattered islands of cooler climate. Consequently, the endemics may be particularly vulnerable to global warming. This paper reviews the expected climate changes for the region and recent modelling of potential impacts on forests and some individual species. These preliminary studies suggest that climate change in the coming decades may be a very significant threat to ecosystem function and biodiversity in the Wet Tropics and other, similar, mountainous tropical regions. For example, many vertebrates may have very little or no habitat after two or three degrees of warming. The absence of montane rainforests to the immediate south of the region precludes range shifts that could conserve these species. Interactions with other global change drivers are likely to exacerbate this threat.

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Integration of top-down with bottoms-up conservation planning: Case study in the Central Pastoral Sub-Region, Cape York Peninsula

The current challenge in conservation planning is to integrate the strengths of expert-centred systematic planning, with participatory public policy-making-of the top-down with the bottom-up. The Australian Natural Heritage Charter establishes conservation planning which integrates expert scientific advice and community involvement from the beginning. The Charter pays attention to both human perception and scientific assessment in understanding significance, requires conservation goals and policies to be established in the context of existing management realities, and promotes the concept of compatible uses. Recently the parties to the Cape York Heads of Agreement engaged in planning for the Central Pastoral Sub-region, guided by the Charter. Assessment of the natural heritage significance of the region enabled the identification of land uses that are broadly incompatible and should be eliminated: broad-scale clearing, intensive grazing, commercial logging and changes to water flow regimes. Activities suitable for management in partnership with local peoples included open range grazing, road, track and fence construction, feral animal and weed incursion, mining, and fire regimes. Uses identified as potentially compatible with natural heritage include tourism, subsistence, wildlife farming, rehabilitation of retired lands, and land management through a conservation agreement. This framework provides a coherent basis for integrating expert-centred and community-based conservation.

Eligible for student award? **no** *Presentation mode:* talk

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Understanding gregariousness in a larval lepidopteran: the roles of host plant, predation and microclimate

The larvae of many moths and butterflies are gregarious early in development, but become solitary in late instars. This ontogenetic variation in behaviour is probably the result of temporal changes in the costs and benefits associated with gregariousness. Here, we provide evidence that a series of different ecological factors influence larval behaviour at different times during development. Field observations show that young (first to fifth instar) caterpillars of the limocodid moth Doratifera casta form large aggregations during foraging, but that larvae are largely solitary in later instars. A field experiment revealed that individual first to third instar larvae in large groups develop more rapidly, although group size had no detectable influence on the survival. The developmental advantage associated with gregariousness is affected by host plant species, but not by the exclusion of predators, suggesting that group living in these cryptic early instar larvae may promote feeding facilitation, but that it does not provide individuals with protection from natural enemies. Field observations provided no evidence that gregariousness is associated with a thermal advantage for individuals, indicating that microclimatic factors are unlikely to have played a significant role in the evolution of group living in this species. We conclude that gregariousness in D. casta is likely to confer at least two different advantages on larvae at different stages in development, but that these advantages disappear or are outweighed by the costs associated with intraspecific competition in the final instars.

Eligible for student award? **no** *Presentation mode:* talk

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Bird communities in remnant vegetation of an Australian coastal city

This study reports on the composition of bird communities in remnant vegetation of a coastal city in Australia, in relation to the surrounding urban matrix. The effects of type of housing matrix, remnant size, and the vegetation of the remnant, were investigated. The bird community composition was shown to be significantly different in remnants surrounded by an urban matrix, and remnants of 1-5ha. The community composition was significantly different in relation to vegetation type only when the remnant was greater than 35 ha. A similar group of medium sized native species often classed as generalists or associated with more developed land, were responsible for the different community composition of the urban and 1-5 ha remnants. Several small insectivorous birds, not commonly found in surrounding urban matrices, also occurred in urban and 1-5 ha remnants suggesting that these remnants are necessary if small birds are to remain in the urban environment. The presence of the Noisy Miner Manorina melanocephala appears to be closely associated with significant differences in community composition, but it was not possible to determine whether this was a direct response to the factors of urbanisation, or to the aggressive behaviour of the Noisy Miner.

Eligible for student award? **yes** *Presentation mode:* talk

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The successful eradication of the African Big-headed ant, Pheidole megacephala, from Kakadu National Park.

The African Big-headed ant is one of the most invasive and ecologically destructive of all pest ant species. Its impacts have been documented near Darwin and shown to displace most native invertebrates where it invades. A population of this ant was recently found within Kakadu National Park, and a project was undertaken between CSIRO and Environment Australia to eradicate it. It s distribution was mapped, and found to occupy approximately 200 ha in four locations throughout Kakadu. The ant was removed by blanket coverage of the formicide hydramethylnon, in the form of Amdro®. The project was a complete success with all populations of this ant having been eradicated. The project took approximately 1 year, 600 man hours and a total cost of less than $70,000. The project is highly significant for many reasons. 1. It is the largest known successful eradication of its kind in the world. 2. The project was conducted within the world heritage listed Kakadu National Park. 3. The project was a joint operation between CSIRO, Environment Australia and the traditional owners of Kakadu National Park.

Eligible for student award? **no** *Presentation mode:* talk

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Impacts of willow invasion on riparian birds

Although woody plant invasions threaten riparian zones worldwide, surprisingly little is known about their impacts on higher trophic levels, such as birds. This study examined the impacts of invasive willows on bird assemblages along the lower Tarago River in southern Victoria. Bird species richness as well as species and foraging guild composition was compared along river corridors lined with native woody species, white-crack willow (Salix x rubens), or cleared of woody vegetation. Birds were surveyed along five sections of each type from spring through summer. Since willow invasion may alter resource levels and habitat structure, invertebrate abundance and vegetation structure were also determined. Overall, 70 bird species from 14 foraging guilds were observed, of which the superb fairy-wren, grey fantail, brown thornbill and white-browed scrub wren were most abundant. Native sections had significantly more birds, more bird species and a greater diversity of foraging guilds than either cleared or willow-invaded sections, with woodland-dependent bird species being almost twice as abundant along native sections of the river. Willow-invaded sections provided significantly fewer branch invertebrates and a simpler habitat structure than native sections. Willow invasion directly into the native riparian zone is likely to reduce markedly the abundance and variety of birds. Its spread into previously cleared sections is unlikely to facilitate many woodland-dependent species.

Eligible for student award? **yes** *Presentation mode:* talk

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Time budget and foraging behaviour of the squirrel glider Petaurus norfolcensis in northern Victoria

The squirrel glider Petaurus norfolcensis is a gliding possum of eastern Australia. Uncommon throughout much of its range, the species is classified as endangered in Victoria. The squirrel glider has been the subject of few studies, particularly within the southern portion of its range. The time budget and foraging behaviour of the squirrel glider was examined within a linear strip of remnant vegetation near Euroa, Victoria. Six adults (three males, three females) were radio-tracked in four seasons throughout the year. Data was obtained via direct timed observations. In all, 63% of observation time was spent foraging, while 10% was devoted to moving (gliding and climbing). Animals were inactive for just 6% of time. Honeydew and manna were the most important dietary items, accounting for 85% of observed foraging time across all seasons. During winter, honeydew/manna was harvested almost exclusively (98% of foraging time). Nectar and pollen was found to be an important resource when available, while the relative importance of arthropods as a dietary resource varied temporally. Results reported here from a grey box Eucalyptus microcarpa dominated woodland show marked differences to previous investigations into the foraging behaviour of the species within floristically diverse sites.

Eligible for student award? **yes** *Presentation mode:* talk

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Foraging activity of the Red Imported Fire Ant (Solenopsis invicta Buren) in relation to temperature

Solenopsis invicta Buren (Red Imported Fire Ants) are a new and serious pest incursion discovered in Brisbane in early 2001. Little is known about the biology of this species in the Australian environment. Relationships between foraging activity by Red Imported Fire Ants and: soil temperature, maximum daily air temperature and minimum air temperature were investigated by measuring the amount of bait retrieved by foraging worker ants at various times between February and September 2002. Foraging rate was positively correlated with all variables but most strongly with mean soil temperature. Results show that ant activity decreases substantially when mean daily soil temperature is less than 19ºC, but increases rapidly when temperatures exceed 21ºC. However, a reduction in foraging activity was also recorded in response to high temperatures. These results are used to determine optimum treatment times for Red Imported Fire Ants

Eligible for student award? **no** *Presentation mode:* talk

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Do presence/absence and abundance data yield the same species composition patterns?

Species composition is a widely used biological response variable in studies of landscape pattern and environmental impact. There is often a trade-off between the number of samples collected and the detail of data obtained for each sample. For example, one may collect more samples if only presence/absence data were recorded rather than an estimate of abundance; however, the abundance data may contain information about compositional relationships that could not be detected by presence/absence data alone. In this study, we asked to what extent the compositional relationships evident in abundance data could be retrieved from presence/absence data. Forty-eight vegetation survey datasets from NSW were chosen representing a range of vegetation type, location, sample size and species richness. Mantel tests were performed between abundance and presence/absence dissimilarity matrices. Comparative tests were performed on classifications derived from abundance and presence/absence data using Analysis of Similarity and Mantel tests on group membership matrices. The results suggest wide variation between datasets in the relationship between presence/absence and abundance data and in their ability to reflect similar patterns in species composition. We investigated explanatory variables such as species richness, gradient length, evenness and sampling intensity using multiple regression.

Eligible for student award? **no** *Presentation mode:* talk

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CHANCE OR DETERMINISM? THE STRUCTURE OF VISITOR ASSEMBLAGES ASSOCIATED WITH RAINFOREST TREES

The assemblages of insects which visit particular flower species within an ecosystem may reflect a predictable, organised, perhaps co-evolved, set that is responding to the particular inflorescence based on the colour, morphology, phenology or chemistry of the plant concerned. Alternatively the assemblage may represent a set that is assembled by chance from the overall canopy fauna. If the latter 'null' explanation is in fact the case then we would expect convergence in the structure of assemblages sampled at or near flowers as comprehensiveness and sample size increases. Using several independent methods we have studied the visitor assemblages associated with ten different canopy species within the lowland rainforest of North Queensland. Even an analysis at the ordinal level shows that there are substantial, statistically significant differences across plant species, even when these were sampled at the same seasons. It seem likely that visitor assemblages represent a predictable response to particular plant species but much uncertainty remains about the levels of host specificity involved, and the underlying variability in assemblage structure both within and between years.

Eligible for student award? **no** *Presentation mode:* talk

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Impacts of climate change on species and ecosystems: is the future already here?

Global warming is no longer a theory. Global mean temperatures have risen approximately 0.6oC since the mid 1800s and changes in rainfall patterns, sea levels, and rates of glacial retreat have also been detected that are consistent with expectations of ‘greenhouse’ climate change. Until recently, it was expected that the effects of climate change on species and communities would not be detectable for at least another couple of decades. But over the last few years, evidence has accumulated that the relatively modest warming experienced so far has already had measurable impacts on the distributions, physiology, and life cycles of a variety of plant and animal species. For example, the distributions of some species of birds, mammals and insects have apparently moved toward the poles and/or upward in elevation, in response to shifting climate zones. There is also increasing evidence of earlier flowering and fruiting in plants, and earlier reproduction in vertebrates and insects, in response to warmer temperatures. This talk will give an overview of these impacts with examples from ecological communities in both Australia and elsewhere. The use of Australian species as ecological indicators of climate change will also be discussed.

Eligible for student award? **no** *Presentation mode:* talk

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Deer herbivory, plant competition and Nothofagus solandri var. cliffortioides regeneration in the Kaimanawa Ecological District, central North Island, New Zealand

Deer have prevented regeneration of Nothofagus solandri var. cliffortioides seedlings at many canopy-gap sites in the Kaimanawa Ecological district, central North Island, New Zealand through direct browsing. There is also evidence to suggest that deer have shifted competitive advantage at these sites away from deer-palatable trees towards browse-tolerant grasses, herbaceous plants and bryophytes. These browse tolerant turf communities may directly impair N. solandri seedling establishment, growth and survival and also be more attractive to deer as they provide highly productive grazing lawns. Therefore browsing pressure at these sites on the remaining N. solandri seedlings might be increased further. Consequently, herbivore-mediated plant successional processes may be more important than direct deer browsing at impeding Kaimanawa N. solandri regeneration. This study also shows that spatial scale is a highly important component of the interactions of site productivity, competition between plants and herbivore impacts.

Eligible for student award? **yes** *Presentation mode:* talk

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Tropical savanna productivity: impacts of seasonal drought and fire and their implications for carbon accounting

Through the estimations of above- and below-ground standing biomass, biomass increment, fine root production and turnover, litterfall, and ecosytem respiration, a carbon balance has been developed for mesic, Eucalypt open-forest savanna in northern Australia. Total carbon (C) stock of this savanna ecosystem was 204 ± 53 t C ha-1, with 84% below-ground and 16% above-ground. Below-ground store was dominated by soil organic carbon, which was 151 ± 33 t C ha-1. Vegetation biomass was 53 ± 20 t C ha-1, 19 t C ha-1 which was root carbon (40%) with 34 t C ha-1 stored in above-ground components (trees, shrubs, grasses). Annual Gross Primary Production (GPP) was 20.8 t C ha-1 and Net Primary Production (NPP) was 11.0 t C ha-1 y-1, of which 8.0 t C ha-1 (73%) was contributed by below-ground production. Total soil carbon efflux was 14.3 t C ha-1 y-1. Approximately three-quarters of the carbon flux (above-ground, below-ground and total ecosystem) occurs during the 5-6 months of the wet season. This savanna was a carbon sink during the wet season and a carbon source during the dry season. Annual net ecosystem production (NEP), the carbon sink strength, was 3.8 t C ha-1 y-1. This carbon sink estimate was integrated with data describing carbon losses due to burning from a known area of savanna. Carbon loss due to fire was significant and whilst NEP appears to be high, once fire impacts are included, the long-term sequestration potential (Net Biome Productivity) was approximately 40% of the value for NEP, at 1.5 t C ha-1 y-1.

Eligible for student award? **no** *Presentation mode:* talk

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Variation in offspring birthdate and survival: the influence of maternal age and condition in the common brushtail possum, Trichosurus vulpecula.

In most mammals, offspring are entirely dependent upon their mothers for nutrition prior to weaning. Maternal effects are thus a common phenomenon in many mammalian species and are often related to nutrition and food availability and a variety of studies have further demonstrated that both maternal age and condition can influence offspring development and performance. In this study we investigated the influence of maternal age and pre-breeding body mass on offspring birth date and survival over two breeding seasons in a population of the common brushtail possum on Magnetic Island, North Queensland. Variation in maternal mass among individual mothers was manipulated using experimental automated feeders and females were aged using a tooth wear index. Body mass showed a non-linear relationship with age in breeding females, increasing to approximately four years of age before reaching a plateau, then declining from six years onwards. Maternal mass was strongly related to birth date, with heavier females giving birth earlier in the season. There was no relationship between maternal age and date of birth that was independent of the relationship between age and mass. Maternal mass was also significantly correlated to offspring survival during the period of lactation.

Eligible for student award? **yes** *Presentation mode:* talk

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Rainforest restoration along a creek linking rainforest fragments on the Atherton Tablelands: use by birds over time

Rainforest fragmentation and creek degradation are major problems on the Atherton Tablelands in North Queensland. Lake Barrine National Park has been isolated by clearing and is now separated from Wooroonooran National Park by a 1.5 km length of Toohey's Creek which was paddock with remnant rainforest fragments. The creek has been rehabilitated by fencing and revegetation to create a corridor between the rainforest fragments. The aim of this study was to monitor the success of the corridor in providing habitat for rainforest birds. Avian communities were monitored in the corridor and in adjacent rainforest sites using point counts over the period of re-establishment of a continuous rainforest canopy. Within two years, the bird community of the plantings was on a trajectory towards that of the rainforest sites. While some specialist rainforest-dependent species were absent from the corridor, others began to use the plantings within two years. Frugivorous species were quite abundant in even the youngest plantings, providing the potential for dispersal of rainforest plants into the corridor. However, even five years after planting, the planted sites still had distinctively different bird communities to both the rainforest sites and the fragments.

Eligible for student award? **no** *Presentation mode:* talk

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The mainland extinction of the thylacine reconsidered.

The mainland extinction of the thylacine is usually attributed to competition from the dingo. The evidence for this is that the thylacine went extinct on the mainland at about the same time (3 to 4 thousand years ago) that dingoes arrived, and persisted in Tasmania in the absence of dingoes. But there is another factor that shows the same correlation in space and time with this extinction: human population densities and the range of habitats occupied by people increased dramatically from about 5 000 years ago. This change is associated with evidence for more sedentary and intensive patterns of resource use in many areas, and with technological innovations that may have increased hunting pressure on large mammals. There were no such changes in Tasmania. I suggest that a human-caused reduction of prey abundance should be considered as an agent of the mainland extinction of the thylacine. This model has the advantage that it can accommodate the later extinction of the devil on mainland Australia, and provides support for the argument that devils should be re-introduced to the mainland.

Eligible for student award? **no** *Presentation mode:* talk

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Assessing the risk of coral bleaching on the Great Barrier Reef under climate change

Coral bleaching has been identified as a major risk to coral reefs under global warming. Bayesian risk assessment is used to quantify the risk of coral bleaching on the Great Barrier Reef due to increasing sea surface temperatures (SSTs) out to 2100. Monitoring of SSTs on three reefs off Townsville (Magnetic Island (inshore), Davies Reef (mid reef) and Myrmidon Reef (outer reef)) during the 1990s has allowed bleaching duration relationships to be quantified. A bleaching model, ReefClim, estimates bleaching degree days and bleaching duration using daily SST as an input and modifies that data according to varying scenarios of change in SST based on climate model output. For long series of artificially generated SSTs based on the observed data, the current bleaching risk to the inner, mid and out reefs is significant. When the input data is modified further according to global warming scenarios, the risk of severe and repeated bleaching increases markedly. Even if allowances are made for plausible rates of adaptation, by 2100 the above named reefs are likely to bleach in most years under the scenarios of least warming and bleach in all years under most scenarios. The evolving risk over the coming century will be presented.

Eligible for student award? **no** *Presentation mode:* talk

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Tree-kangaroo (Dendrolagus spp.) diet: Faecal analysis as a technique to determine food plants and feeding patterns.

The use of direct observation to obtain dietary preferences of cryptic arboreal herbivores (such as Dendrolagus spp.) are both time costly and of questionable accuracy. Cuticle fragment-based identification of plant species has proven precise and efficient. When applied to faecal samples of Dendrolagus matschiei in a captive population at Adelaide Zoo, the results demonstrated that individual rainforest species (leaves) consumed could be positively identified. The study further showed that D. matschiei individuals had unique "through-gut" times, while plant species all had similar passage times. Field studies of Dendrolagus lumholtzi conducted in far north Queensland have to date yielded seven positively identified food species, two of which (Beilschmiedia tooram and Irvingbaileya australis) had not been previously reported as food plants. Ongoing work at multiple sites in North Queensland is aimed at documenting a more comprehensive list of food plants.

Eligible for student award? **yes** *Presentation mode:* talk

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Coexistence of temporally partitioned spiny mice: Roles of habitat structure and foraging behavior.

Extreme temporal partitioning, to opposite parts of the diel cycle has been recorded only once among mammals, in spiny mice from rocky deserts in Israel. Acomys cahirinus is nocturnal and A. russatus is diurnal, although it becomes nocturnal if its congener is experimentally removed suggesting that the temporal partitioning is driven by interspecific competition. Using artificial food patches, we showed trade-offs in foraging efficiency between the two species leading to different strategies of microhabitat use which may help promote coexistence. A. cahirinus is a “cream skimmer”, a relatively inefficient forager, and a habitat generalist, whereas A. russatus is a habitat specialist, perhaps compensating for this restricted niche by foraging very efficiently. Provision of cover was more important than escape distance in determining microhabitat use. Boulder fields in rocky deserts provide a physical structure that is more complex and provides more continuous cover than is available in open deserts, where most research on community structure of desert rodents has been carried out. We propose that this physical structure of rocky deserts, in conjunction with the desert adaptations of A. russatus, may enable the extreme temporal partitioning to opposite parts of the diel cycle and, therefore, contributes to coexistence in this community.

Eligible for student award? **no** *Presentation mode:* talk

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What's it all worth? Biodiversity values of reforestation projects in tropical and subtropical Australia.

Rainforests in north-eastern Australia have been extensively cleared over the past two centuries. In recent decades, there have been increasing efforts to reforest some of these cleared lands, using a variety of methods, to meet a range of objectives. However, the styles o reforestation vary considerably in cost and economic potential and the extent to which they restore structure, composition and ecological function to cleared land under is poorly understood. In this paper, we attempt to quantify the biodiversity values of the main reforestation styles practiced in tropical and subtropical Australia, including unassisted regrowth, timber plantations and diverse "restoration" plantings. We discuss ways in which transect-level survey data (e.g., of plants, vertebrates and invertebrates) and various spatial metrics, including the size of the reforested area and the proximity of reforested areas to intact forest, might be integrated to attribute a single "biodiversity value" to a reforestation project (e.g., that could be used in a market for biodiversity credits). We compare the biodiversity values of the various reforestation styles with their relative costs and likely economic values, and discuss the implications of the results for strategies to reforest cleared rainforest lands.

Eligible for student award? **no** *Presentation mode:* talk

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Lumholtz's Tree-kangaroos Still kangaroos; well prepared or much to learn for life in the trees?

Tree-kangaroos in general have the longest gestation period and perform some of the longest periods of maternal care in the marsupial realm. Is this an ecological adaptation to their arboreal and largely folivore lifestyle? Gravitating towards this question examinations on feeding and nurturing behaviours of Lumholtz's tree-kangaroos promise to allow the distinction of general macropod phylogenetic traits from adaptive ecological behaviours of a secondarily arboreal species living in a complex rainforest habitat. Still essentially being a macropod, the species appears to exhibit adaptations, morpho-pysiological as well as behavioural, that facilitate living in a low-nutritional and structurally highly diverse arboreal habitat. It is envisaged that some behavioral strategies complement and probably even replace essential macropod characters to sufficiently utilise this type of habitat. Preliminary results support the proposition that the habitat/food resource complexity necessitates not only a diurnal as well as nocturnal feeding activity but also an extended offspring introduction to their environment. A comparison with non-arboreal rainforest macropods potentially holds clues to further elucidate the evolutionary history of the tree-kangaroo genus. By clarifying the balance of pysical and behavioural adjustments a refined assessment of the species' level of adaption for a life in the trees ought to be achieved as well.

Eligible for student award? **yes** *Presentation mode:* talk

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The population dynamics of rarity: why you' ve never met a Jumblie

Ecologists from Darwin to Andrewartha have noted that " the vast majority of species are rare" , yet the population dynamics of rarity are not well understood. In particular, what population-level mechanisms prevent rare species from either becoming common or going extinct? Here, we introduce a simple population model for distribution and abundance, the two dimensions of rarity, and explore the circumstances under which different forms of rarity might arise. In addition to commonness, the model demonstrates three types of rarity: 'localised' species have restricted geographical distributions but high local abundance, 'sparse' populations are widespread but with low local abundance, and 'scarce' populations are the rarest of all, with narrow distribution and low local abundance. The model reproduces the empirically-observed correlation between distribution and abundance, and supports theory on the optimality of intermediate dispersal rates and the possibility for alternative stable equilibria. We show how the model can provide a basis for understanding the distribution and abundance of particular rare species, such as a New Zealand aphid, a Scandinavian butterfly, and Edward Lear's nonsensical Jumblies.

Eligible for student award? **no** *Presentation mode:* talk

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The spatial distribution of the introduced Asian house gecko (Hemidactylus frenatus) across suburban/forest edges

The introduced Asian house gecko, Hemidactylus frenatus, is a highly successful human commensal which is well established in urbanised regions of northern Australia. In areas where suburban development and forest remnants come into contact, H. frenatus has the potential to invade natural habitats. This study examined the way in which H. frenatus responds to the edge between urban and forest habitats and aimed to provide an insight into the nature of invasive edge effects. Call rates were used to measure the relative abundance of H. frenatus across edge transects at five sites in and around Darwin, NT. A set of alternative statistical models was fitted to the abundance data from each site using Maximum Likelihood methods. The models fitted to each of the sites revealed that H. frenatus did not have a consistent distribution across the edge; rather it displayed a range of different patterns of abundance. The large amount of variation in the distribution of H. frenatus across the urban/forest interface reveals that site specific differences are critical in determinin the way in which invasive species respond to edges.

Eligible for student award? **yes** *Presentation mode:* talk

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Humpty Dumpty had a big fall: what can the King's horses and men do for Australia's remnant grassy woodlands?

Australia's temperate grassy woodlands have been decimated. In NSW alone, over 12 million ha (>80%) of grassy woodlands have been cleared. Woodland restoration, through Landcare and other programs, has been an emerging priority for governments, industry and the community in the past two decades. The success of these projects is reported in terms of dollars spent, kilometres of fence constructed, number of trees or hectares planted, but ecological audits are conspicuously sparse. Recent policy initiatives, such as 'No-Net Loss', aim to reverse the decline by restoring native vegetation at a faster rate than it is lost. Implicit is the expectation of 'gains' by replanting areas now devoid of native vegetation. We asked to what extent and at what rate restored vegetation regains the structure and composition of native ecosystems. We compared restored vegetation with untreated pasture (control) and remnant vegetation (reference) for an extensive, well-resourced restoration project on the Cumberland Plain. The results suggest either failure of ecological convergence or century-scale lags in the recovery process. If further studies confirm the low feasibility, long lags and high cost of restoration, the emerging policy initiatives would seem to undervalue the remaining resource by assuming that ecological losses may be readily compensated by gains.

Eligible for student award? **no** *Presentation mode:* talk

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Prioritising the conservation status of South African mammal species

A regional threat assessment for South African mammal species is long overdue. Currently, the only existing threat assessment is based on the IUCN 2001 global Red Data List assessment. The Red Data List provides a structured threat assessment and resulted in 33 of the 240 South African terrestrial mammals being highlighted as under high risk of global extinction (threatened). However, such global assessments may not be useful at a regional scale, where management decisions take place. To obtain a regional threat assessment, a Regional Priority Scores (RPS) technique was implemented using additional rarity traits (e.g., taxonomic distinctiveness). This technique identified a unique species list, including various non-IUCN threatened species. Numerous high profile and charismatic global IUCN threatened species were not identified using RPS. In comparison, a recent regional Conservation Assessment and Management Plan process (CAMP) prioritised both terrestrial and marine South African mammals according to the IUCN Red Data List criteria on a regional scale. Although these analyses are preliminary, forty-three species were identified as threatened, and 44 species (predominantly cetaceans), as data deficient. The regional assessments based on both RPS and CAMP indicates vast differences in the species highlighted as important to conservation. A comprehensive regional threat assessment is therefore essential for both local and regional management decisions.

Eligible for student award? **yes** *Presentation mode:* talk

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Productivity and the global and Australasian distribution of mast seeding

Mast seeding is synchronous, highly variable seed crops among years in perennial plants. A global analysis of 570 quantitative masting datasets of 6 to 35 years duration showed a number of trends. The data were skewed with many studies from northern temperate forest trees (especially in the USA and Finland), and very few from the topics, or from shrubs and herbs. New Zealand had 50 studies from 21 sites while Australia had 29 studies from only 2 sites (in Tasmania and WA). New Zealand currently holds the world record for the most variable species despite having an equable climate. An analysis shows that masting is more likely in mid latitudes (due to unreliable rainfall), in less productive habitats, in wind pollinated species, and in species with seed predators. It is sometimes claimed that for plants with predator-dispersal (scatterhoarding), masting improves dispersal, but this is incorrect: the benefits are all through predator satiation. Site productivity effects on increasing the strength of masting are seen over latitude, altitude and soil fertility gradients. All this suggests that Australia ought to have many strongly masting species, if only the data had been collected and published.

Eligible for student award? **no** *Presentation mode:* talk

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Conservation planning at a subregion scale - The Herbert Subregion.

A conservation plan for the Herbert subregion of the Wet Tropics which was developed by the Environmental Protection Agency is outlined. The project involved the initial production of GIS based coverages of land types and regional ecosystems using aerial photography at 1:25 000 scale. A conservation assessment was then produced which outlines the area of each land type remaining, and the current threats affecting each type (such as clearing pressures, weed infestation and drainage alteration). Each land type was allocated a "Conservation Priority" rating indicating the level of urgency for which conservation action is required. Since completion the conservation plan has been used by government agencies for a variety of purposes including assisting with assessment of tree clearing applications, purchasing land for conservation, and assessing suitability of habitat for the Endangered Mahogany Glider.

Eligible for student award? **no** *Presentation mode:* talk

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The effect of fire regime on small mammal community dynamics on Fraser Island

Many of Australia's flora and fauna species are adapted to particular fire regimes, however, most studies on the affect of fire on vertebrate communities have concentrated on the effects of single fire events. Rarely are the effects of fire regime on community dynamics and community responses to fire events considered. Understanding the effects of fire regime on community dynamics is particularly pertinent on Fraser Island where the current policy of wildfire mitigation may be detrimentally affecting the biota of open forests. We determined the response of small mammal communities to fire regime (i.e. frequency and time since fire) by examining past fire events and applying prescribed burns. We also have taken a multi-experimental approach to determine processes underlying these patterns of response by manipulating trophic level interactions. Initial results suggest that time since fire affects both species abundance and composition and fire frequency affects only species abundance, without affecting small mammal succession.

Eligible for student award? **yes** *Presentation mode:* talk

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Top-down control in a stream community under contrasting flow regimes

Are communities are structured by natural enemies (top-down) or by the availability of primary producers (bottom-up)? We examined top-down control by fish and shrimp (macroconsumers) in a monsoonal stream in northern Australia in the wet and dry seasons. We also examined the relative importance of diurnal and nocturnal macroconsumers in the dry season. Electrified quadrats were used to exclude macroconsumers from feeding on artificial substrates. The benthic communities that colonised the artificial substrates were sampled for macroinvertebrates, chlorophyll a, and Ash Free Dry Mass (AFDM). Top-down control was evident, but only in the dry season under low flow conditions when macroconsumer exclusion resulted in a 2-4 fold increase in insect abundance, algal standing crop and AFDM. This effect is not consistent with models of trophic cascade which predict that, in the absence of top consumers such as fish, increases in herbivorous insects lead to decreases in algae. Our study adds to a growing body of evidence suggesting that trophic cascades are rare in tropical streams which are often dominated by omnivorous and detritivorous macroconsumers. While diurnal fishes are by far the most abundant and conspicuous macroconsumers in the system, they were relatively unimportant in structuring the benthic community.

Eligible for student award? **yes** *Presentation mode:* talk

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Invertebrate and Plant Species Diversity in Sustainable Grazing Systems

The Sustainable Grazing Systems Key Program seeks to develop grazing enterprises that are economically, environmentally and socially sustainable. As part of this national program, this paper presents data on the effects of fertiliser addition and contrasting grazing management systems on the biodiversity of plants and invertebrates at Carcoar, on the Central Tablelands of New South Wales. The vegetation was a typical Tablelands 'naturalised' pasture, dominated by native perennial grasses (esp. Austrodanthonia spp., Microlaena stipoides, Bothriochloa macra) but with numerous exotic species as well (e.g. Vulpia spp., Trifolium subterraneum, Hypochaeris radicata, Echium plantagineum). More than 120 plant species have been recorded from this site. The invertebrates were collected using pitfall traps in November 1999, three years after the fertiliser and grazing treatments were imposed. More than 68 000 individuals, representing 18 orders, were collected; there were 12 beetle families, 15 ant Genera and 18 wasp families. Fertiliser addition increased the overall abundance (but not the richness) of invertebrates, especially the beetles, wasps, Red-Legged Earth Mites (but not other mites), flies and grasshoppers. For most invertebrate groups, the unfertilised/continuously grazed plots seemed to be least favourable treatment with decreases in both abundance and species richness.

Eligible for student award? **no** *Presentation mode:* talk

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Factors influencing post-release survival of reintroduced Gouldian Finches, Erythrura gouldiae

Reintroductions have been used worldwide to re-establish endangered species in the wild. However, the majority of reintroductions fail, the reasons for which are mainly unknown. The reintroduction of the endangered Gouldian Finch, Erythrura gouldiae, into the Mareeba Wetlands, north-eastern Australia, provided a unique opportunity to study the factors influencing reintroduction success. The aim of this study was to determine whether intrinsic factors (morphology, sex, body condition, social status) influenced post-release survival of Gouldian Finches under the soft-release strategy employed. Of 20 birds released, 19 disappeared within 4 months of the release. As birds consistently stayed at the release site and utilised the feeding station as their main food source, missing birds were assumed to be dead. Morphology, sex, body condition and social status showed no significant influence on post-release survival, whether separately or combined into clusters, suggesting that the soft-release strategy removed the influence of intrinsic constraints on post-release survival. Predation was the most likely cause for the high mortality, suggesting a great lack of experience in the captive birds. The study indicates that extrinsic factors greatly influenced post-release survival, and that improving survival skills and reducing post-release mortality are essential in order to increase reintroduction success of Gouldian Finches.

Eligible for student award? **yes** *Presentation mode:* talk

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How does being deciduous provide Nothofagus gunnii with a competitive advantage over N. cunninghamii in montane Tasmani

The advantages of being cold-deciduous in the Tasmanian highlands were examined by comparing the deciduous Nothofagus gunnii to the evergreen N. cunninghamii. Carbon gain and allocation was examined by measuring photosynthetic responses to temperature, relative growth rates and biomass allocation patterns of annual shoot increments. Leaf mechanical protection and the costs of constructing and maintaining leaves provided an indication of how initial investments might influence leaf lifespan. Results showed that N. gunnii leaves had significantly higher mass- and area-based maximum photosynthetic rates and higher growth rates of annual shoots. N. gunnii leaves had a significantly higher specific leaf area, were less mechanically protected, cheaper to construct (mass and area basis), had lower construction costs per unit carbon gain both on a mass and area basis, but had higher mass-based maintenance costs than N. cunninghamii leaves. The deciduous strategy enables N. gunnii to maximise carbon gain during the short summer period and avoid the cost of surviving harsh winter conditions. By comparison, N. cunninghamii has leaves that are built more robustly to survive winter and live longer. However, the maximum photosynthetic rates for N. cunninghamii are lower due to trade-offs with various leaf traits. The increasing costs of constructing better protected (evergreen) leaves may mean that N. cunninghamii cannot amortise initial construction costs at the highest altitudes, and hence, at these altitudes deciduousness is an advantage.

Eligible for student award? **yes** *Presentation mode:* talk

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A tropical rainforest possum that can't take the heat

The green ringtail possum (Pseudochirops archeri) (Marsupialia: Pseudocheiridae) is a small marsupial folivore restricted to upland rainforest in Australia's Wet Tropics, possibly due to thermal intolerance. The lower limit of the altitudinal range of P.archeri) is around 3-400 m, and it is abundant only at sites where the average maximum temperatures of the hottest week of the year are less than 30oC (Kanowski, unpublished). In the laboratory, P.archeri responded to ambient temperature in a normal mammalian way; increasing metabolism at low temperatures to maintain body temperature, and increasing evaporative water loss at high temperatures. However, at ambient temperatures above 30oC they did not evaporate sufficient water to maintain a constant body temperature and their body temperature rose linearly over time. I interpret this as a water conservation strategy. Highest annual temperatures occur in the late dry season when the canopy is dry. Water used in evaporative cooling could only be replaced by increasing water intake in foliage, also increasing intake of plant toxins and the risk of intoxication. I present the hypothesis that the distribution of this species is limited by the interaction between the duration of extreme temperatures, water availability and plant toxins. Such limitation also puts this species at great risk from the effects of climate change.

Eligible for student award? **no** *Presentation mode:* talk

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Seed viability in topsoil stockpiles and the implications for minesite rehabilitation

The stockpiling of topsoil for its seed bank is viewed by the mining industry as an important technique for land rehabilitation. Various studies have been carried out on the stockpiling of topsoil for Bauxite mines in temperate regions, but little information is available for arid regions. It is not clear exactly what happens to the seeds within the stockpiles over time and whether soil stored for long periods of time (>2 years) will contain any viable seed. This study addresses how the viability of the seed bank is affected after a period of one year. Results obtained showed that the viability of many species declines to zero within three months. All of the species generally behaved as predicted by their morphological characteristics with fleshy fruits and soft seed decaying rapidly. Findings suggest that time, soil moisture and soil temperature were the most significant variables affecting seed longevity.

Eligible for student award? **yes** *Presentation mode:* talk

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Value of Ecosystem Services on the Goulburn Broken floodplain: description of biophysical/economic modelling

Flooding on the Goulburn River below Shepparton is presently controlled by a system of levee banks to the north and south of the river in conjunction with an emergency floodway to the north controlled by the Loch Garry regulator. A number of problems have arisen as a result of the construction of the levee banks including regular failure of levee banks (in a one in ten year flood) causing damage to the levee bank system and losses to agricultural production and increased power of the water has lead to stresses in the riverine environment including increased stream turbidity, nutrient loads, degradation of riverine ecosystems and loss of biodiversity. To address this problem the Goulburn Broken Catchment Management Authority (GBCMA) has proposed to more extensively utilise the floodplain on the north of the river to create a floodway of approximately 13 700 hectares. We have explored the implications of different scenarios on the value of ecosystem services within the detailed design of the proposed floodplain rehabilitation scheme using integrated biophysical and economic models. The simulation models are used to challenge and complement expert opinion in the process of defining and improving management options. This presentation describes the nature of the biophysical-economic models, presents results and discusses the lessons learnt from the modelling process.

Eligible for student award? **no** *Presentation mode:* talk

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Nesting ecosystem services: a useful way of thinking about complex interactions.

The first step in analysing the value of ecosystem services to the community of the Goulburn Broken Catchment of Victoria was to develop an inventory of services that the catchment community thought were important. The resulting complex list of interacting services reflected the diversity within commercial interests and social values of the catchment. From a management perspective it is useful to identify key services which if targeted would ensure enhancement of all other services. It would also be useful to identify services that need to be in place as precursors of the key services. This suggests a nested hierarchy of process relationships and dependencies is needed. Data collected on two ecosystem services, maintenance and regeneration of habitat and water filtration and erosion control support this proposition. We present a "straw-man" for what this ecosystem service hierarchy might look like.

Eligible for student award? **no** *Presentation mode:* talk

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Quantitatively describing the vegetated landscape: the value of GIS in designing regional ecological threshold studies.

Quantifying the pattern of distribution and condition of remnant vegetation is a key component of regional scale fragmentation and biodiversity studies. In a study aimed at to improving knowledge on ecological thresholds of vegetation retention and management in the Brigalow Bioregion in Queensland, a Geographic Information System (GIS) was used to calculate landscape metrics and provide an estimation of the level of spatial variation across the landscape. Regional ecosystem mapping was used to quantify remnants in the landscape and calculate metrics; area, shape, and context and connectivity. These metrics were stratified by regional ecosystems and disturbance was derived from the Statewide Land and Tree Study land cover change data to assist in the appropriate selection of field sampling sites. Issues arose regarding the scale and currency of the input mapping, as the vegetated landscape of the Brigalow Bioregion is dynamic due to land clearing and rapid regrowth. Field validation and remote sensing techniques were used to resolve these issues. The heuristic nature of GIS techniques enables all ecological envelopes to be identified, ensuring adequate sampling of the variation in the landscape for long-term ecological studies.

Eligible for student award? **no** *Presentation mode:* talk

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Climate impacts of historical Australian landcover changes

Classically terrestrial ecosystem structure and function are viewed as changing passively in response to climate through temperature and water availability. Recently it has been recognised that terrestrial ecosystems dynamically interact with the climate system, through exchanges in moisture, momentum and energy, with feedback mechanisms that can modify local, regional and even global climate. In this manner, vegetation over bare soil can impact the amount of solar radiation absorbed at the surface, change evaporation rates through deep-rooted transpiration and precipitation interception, and alter turbulent atmospheric mixing through changed surface roughness. To understand the dynamic nature of Australian ecosystems with climate, CSIRO climate models are being used to investigate the climate response of land cover change in Australia since European settlement. This investigation compares global climate modelled with current day land surface conditions, against climate modelled with Australian land surface conditions, as they may have existed prior to landscape modification. Prelimary results show areas of regional warming and drying resulting from the changes in land surface conditions in areas of large-scale vegetation change. These initial findings suggest that the dynamic interaction of terrestrial ecosystems with the climate is an important factor when assessing any ecosystem response to climate change.

Eligible for student award? **yes** *Presentation mode:* talk

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Fine-scale movements and habitat preferences of the NZ eagle ray Myliobatis tenuicaudatus

Recent years have seen a worldwide conservation effort aimed towards the protection of large elasmobranches (sharks and rays), due to their vulnerability to habitat change and overfishing. Knowledge of activity patterns and habitat utilization is important in understanding the behavioural ecology of a species. International elasmobranch tracking studies to date have primarily focused on pelagic and coastal sharks, whose behaviour, diet, and movement patterns are very different to those of benthic rays. Eagle rays (Myliobatis tenuicaudatus) are among the largest regular inhabitants of New Zealand estuaries, but very little is known about these animals fine-scale movements, activity patterns and use of estuarine habitats. Five New Zealand eagle rays were caught in the Whangateau Estuary (Northland New Zealand) and fitted with individually coded ultrasonic tags. The rays' fine-scale movements were monitored manually from a boat using a unidirectional hydrophone. Foraging activity was investigated by recording the spatial and temporal distribution of ray foraging patches on intertidal flats relative to prey distribution and substrate type. Tracking results indicate that the rays' behaviour is moderated by the tides, showing movement into foraging grounds on the intertidal flats at high tide, and movement into deeper channels at low tide. Preliminary habitat data suggest that tagged eagle rays preferentially forage on intertidal sandy substrates, as opposed to mangroves or reefs.

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Spatial variation in the size and growth rate of Azorella selago Hook. (Apiaceae) across sub-Antarctic Marion Island

Azorella selago is widespread across the sub-Antarctic and dominates fellfield vegetation. This long-lived, cushion-forming species colonizes recently deglaciated terrain. Size and growth rate data may therefore provide information on past environments and the effects of climate change. Spatial variation in plant size and growth rate was high in and across three patches and three altitudinal transects on Marion Island. Size and growth rate differed significantly between sites, but were within the range previously reported for A. selago. Relationships between cushion size, growth rate and nearest neighbour characteristics were weak. However, nearest neighbour effects were strongest in high- rather than in low-density patches. Plant size was positively correlated both with distance to, and size of, nearest neighbours. Trend surface analysis revealed weak, but significant spatial structure in some variables. Altitude explained up to 30% of the variation in growth rate and up to 15% of the variation in plant size. Mean cushion age was estimated at 30 years, and establishment of A. selago over the last five years was found to be low. The high variability in A. selago across the island, combined with a limited ability to explain this, suggests that micro-environment is an important determinant of cushion characteristics.

Eligible for student award? **yes** *Presentation mode:* talk

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Agroforestry: the means to a functioning agroecosystem

A functioning and sustainable agroecosystem has to provide economic and social benefits to the community, as well as the essential ecological services. This paper reviews the causes of agroecosystem degradation and some recent developments in agroforestry in West Africa, SE Asia and Latin America, where the sustainability of agricultural land is being enhanced by the production of marketable non-timber forest products by subsistence farmers through multistrata agroforestry. It then examines the opportunities for enhancing the production of non-timber forest products in tropical farming systems through the domestication of indigenous tree species.

Eligible for student award? **no** *Presentation mode:* talk

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Experimental tests of the effects of additional water, nutrients and physical disturbance on the success of invasive species.

The invasion of natural ecosystems by invasive plants is a serious threat to biodiversity globally. On the low fertility soils of Sydney's Hawkesbury Sandstone vegetation communities, weed invasion typically occurs in areas receiving nutrient-rich stormwater run-off. We present the results from glasshouse and field experiments where we manipulated water and nutrient levels as well as physical disturbance and monitored growth and survival of a range of species. Species were categorized into one of four classes: exotic invasive, exotic non-invasive, native invasive or native non-invasive. The addition of water had no significant effect on survival and growth of any of the plant types. Native non-invasive species had lower survival under nutrient addition relative to exotic species. Exotic species had positive growth responses to nutrient addition while native non-invasive species showed little response. Exotic invasive, exotic non-invasive and native invasive species behaved more similarly to each other than to native non-invasive species. These results suggest that a significant factor in the success of invasive species is their ability to respond with increased growth and survival to elevated nutrient levels, particularly on low fertility soils.

Eligible for student award? **no** *Presentation mode:* talk

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Where the grass is greenest: Interactions between native perennial and exotic annual grasses in relation to soil moisture regin in the mid-north of South Australia.

The invasion of grasslands by exotic annual grasses is controlled by different processes at different scales. At the paddock scale the abundance of annual grasses correlates with soil texture and depth, suggesting that soil moisture regimes regulate annual grass abundance, affecting either growth or competitive interactions with native perennial grasses. To test whether soil moisture regimes affect the balance between annual and perennial grasses we monitored soil moisture over 20 months in a total of 72 plots with different grass type abundances at three sites. At each site plots with high annual grass abundance were wetter in winter / spring and drier in summer / autumn than those with low annual grass abundance. The correlations between soil moisture and grass type were highest after rainfall, suggesting that soil moisture regimes determine grass type abundance rather than result from it. We tested experimentally how growth and competitive interactions of annual and perennial grasses changed with soil moisture regime. The competitive interactions appear to be highly asymmetric: annual grasses have strong effects on perennial grasses and their absolute competitive effect increases with soil moisture because of higher annual grass biomass. We did not detect any effect of perennial grass biomass on annual grass biomass.

Eligible for student award? **yes** *Presentation mode:* talk

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Argentine ants invading the New Zealand urban environment: interactions with and effects on native and exotic ants.

We examined the interactions between Argentine ants (Linepithema humile) and native and exotic ants in the urban environment of three New Zealand cities. Argentine ants appeared to significantly lower ant diversity in urban areas. Other invading ants such as Technomyrmex albipes, and the most abundant native ant Monomorium antarcticum, appeared to be excluded from areas invaded by Argentine ants. Laboratory experiments suggest that Argentine ants were not competitively dominant over these species, in either exploitative or interference competition. Rather, it seems likely that Argentine ants numerically overwhelm resident ant populations. Simulations of climate tolerance indicate that these ants will be able to colonize many of the larger urban areas in the North Island of NZ, where they appear likely to exclude most resident species. However, as most NZ urban ants are exotic invaders themselves, this loss of biodiversity may not be missed.

Eligible for student award? **no** *Presentation mode:* talk

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Using an individual-based stochastic simulation modelling and GIS to explore dispersal mechanisms, management strategies a the associated invasion risk of Bridal Veil (Asparagus declinatus).

Bridal veil (Asparagus declinatus) is a recognised environmental weed within South Australia and Western Australia. Originating from South Africa, this bird-dispersed, scrambling and climbing geophyte has the potential to inhabit a range of vegetation communities including closed forests and open woodlands. The impacts of this plant appear to be similar to those of the declared weed of national significance Bridal creeper (Asparagus asparagoides), however little is known of the invasive capabilities of Bridal veil. An individual-based stochastic simulation model was developed using Visual Basic Application (VBA) in the ArcGIS 8.1 Geographical Information System to explore bridal veil seed dispersal from two contrasting species of birds (or agents), and predict the likely areas prone to invasion. Environmental stochasticity and dispersal variability were incorporated in the model using binomial and negative exponential deviate random number generators. Simulation models can be used to test and rank the relative effectiveness of different management strategies. In this study, the relative risks to selected native vegetation communities and threatened plant species resulting from simulated invasions was measured with respect to two management strategies.

Eligible for student award? **no** *Presentation mode:* talk

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Overland flow and soil infiltration: A simulation approach from an ecological perspective.

Rainfall records reported by the Bureau of Meteorology do not necessarily represent the amount of water entering an ecosystem that is available for plants. Many processes such as plant interception, evaporation, overland flows and infiltration will determine the effective rainfall available for plant growth. These are influenced by factors such as the biomass of vegetation and litter, the soil surface condition and soil structural properties. Simulation modelling provides a valuable means by which to understand the effect of the various processes on the retention and loss of resources from a system. This presentation will describe the hydrological processes modelled by the savanna.au model. We also explore the ramifications of various assumptions used to model hydrological processes.

Eligible for student award? **no** *Presentation mode:* talk

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The effects of fire on densities and behavior of three lizard species in an Amazonian savanna

We investigated the effects of fire on densities of Cnemidophorus lemniscatus, Kentropyx striata and Anolis auratus, and on some aspects of the behavior of C. lemniscatus and A. auratus in a Brazilian Amazonian savanna. Sixty-six transects(300 x 5m) were surveyed between 0700 and 1800 h, over a period of 15 days.Thirty-three transects were in burned sites and 33 were in unburned sites.In the short term (over a period of weeks), the percentage of individuals of C. lemniscatus and A. auratus exposed to sun were not affected by fire, but the time of day affected this percentage in both species.The fire affected the number active of C. lemniscatus, with more individuals active in unburned sites. For A. auratus there was a significant interaction between time of day and fire, indicating that fire affected the activity period of this species in short term.The number of lizards and the percentages of burned-area were estimated in 1000m long transects through 30 savanna plots (3.75 ha). In the medium term (6 months),the fire did not affect the densities of C. lemniscatus, Kentropyx striata or Anolis auratus, indicating that populations of these species are little affected by fires.

Eligible for student award? **no** *Presentation mode:* talk

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The effect of bitou bush invasion on leaf litter decomposition

Chrysanthemoides monilifera ssp. rotundata (Bitou bush) is a weed of national significance in Australia, covering most of the N.S.W coastline. Leaf litter decomposition is the major source of nutrients in many ecosystems; weed infestations could influence the rates of nutrient cycling through changes in leaf input and decomposition rate. Decomposition rates of bitou bush leaves and a native leaf mix (Acacia longifolia var. longifolia, Banksia integrifolia and Leptospermum laevigatum) were measured using coarse and fine mesh litterbags in heavily bitou bush infested areas and uninvaded native areas. Bitou bush leaves decomposed much faster than the native leaf mix, and the coarse bags decomposed faster than the fine. Interestingly all litter bags decomposed faster in the bitou bush invaded areas. Decomposition rates were modelled and compared amongst habitats. The bitou bush leaves had a different chemical composition to the native species, with a larger proportion of liable compounds, which are preferentially utilised by the decomposer community. It is proposed that the increased decomposition rate within bitou bush infestations is due to alterations in leaf litter depth, leaf fall, and ground cover. This will be discussed along with the movement of nutrients from the decomposing litter. These results have implications for weed management, habitat restoration and in predicting the impact of infestations on natural ecosystems.

Eligible for student award? **yes** *Presentation mode:* talk

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Restoration of a bauxite mine lease in Australia: ecological indicators of successful rehabilitation

Rehabilitation on mines needs to be monitored over time with easily measured ecological indicators so that trajectories can be used to evaluate success relative to lease closure criteria. We measured vegetation and soil surface indicators on rehabilitated sites on an open-cut bauxite mine operated by Nabalco in northern Australia. If the rehabilitation trajectory of these indicators is towards that for nearby savannas, then success is achieved because Nabalco's goal is to "establish a diverse and self-sustaining native vegetation community compatible with the surrounding environment and land use, and consistent with Nabalco's obligations under their lease conditions". We measured indicators on sites ranging in age from 0 to 26 years. Our results document that of the vegetation indicators, the increasing dominance of fire-resistant Eucalyptus trees on older sites was the best indicator. Of the soil surface condition indicators, a nutrient cycling index had a trajectory towards values found on nearby savannas. These two indicators clearly indicate rehabilitation success on minesites older than about 15 years. Sites younger than 15 years also appear to be on an appropriate rehabilitation trajectory. In functional terms, vegetation "takes charge" of the rehabilitation at about the stage that Eucalyptus trees begin to significantly contribute to the litter layer (about 8 years). Nutrient cycling relies on the production of Eucalyptus litter. Although our findings need to be confirmed for other mines, and for older sites, they do suggest that simple vegetation and soil surface condition indicators are useful for monitoring minesite rehabilitation in tropical savanna environments.

Eligible for student award? **no** *Presentation mode:* talk

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A protocol for integrated management, monitoring and enhancement of degraded Themeda triandra grasslands based on plantings of indicator species

Lowland temperate grasslands dominated by Themeda triandra are endangered in SE Australia. In many remnants, grass biomass must be removed frequently to maintain plant diversity, but few studies of the impacts of different biomass removal techniques have been undertaken, and no rapid monitoring schemes have been developed to guide managers. In this presentation, I describe a protocol to use re-introduced plants as indicator species to monitor the effects of biomass removal regimes. Three potential indicator species (Calocephalus citreus, Chrysocephalum apiculatum and Leptorhynchos squamatus) were selected by iteratively querying a regional quadrat database using a sequence of clearly defined criteria. All are widespread, herbaceous hemicryptophytic daisies. This protocol has three main aims (1) to provide a simple, rapid assessment method to help managers assess when biomass levels need to be reduced to maintain plant diversity; (2) to increase plant densities using enhancement plantings and; (3) to integrate ecosystem management, monitoring and enhancement plantings in an adaptive management framework to obtain synergistic benefits from all three activities. Despite a number of caveats, the scheme has the potential to provide a more clearly focused framework for grassland ecosystem management than currently exists.

Eligible for student award? **no** *Presentation mode:* talk

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Avifaunal responses to variation of fallen timber on forest floors: an experimental analysis

Habitat structure long has been identified as a primary factor influencing assemblage composition. Fallen timber is one of few habitat elements in woodlands that is manipulable with high precision. We conducted an experiment consisting of eight treatments in a Eucalyptus camaldulensis floodplain forest in northern Victoria. Treatments were a series of wood-loads (0 Mg/ha–80 Mg/ha) and two controls (with/without disturbance). Four variables were considered: species richness and summed densities of all species and also species reliant on fallen timber or ground foragers. The most substantial increases were in the 80 Mg/ha and disturbed-control plots; changes following manipulation in treatments with * 40 Mg/ha were little different from zero. Three birds increased substantially following manipulations: Lichenostomus penicillatus, Climacteris picumnus and Platycercus elegans flaveolus. The greatest mean increases following manipulation of timber in any one treatment were 9.92 birds/ha for L. penicillatus, 6.40 birds/ha for C. picumnus and 6.24 birds/ha for P. e. flaveolus. Given that average wood-loads are less than 30 Mg/ha in most river red gum floodplain forests, the strong increases evident especially for the 80 Mg/ha treatments suggest that substantial increases in fallen timber loads would be an advantage for birds in these intensively managed forests.

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The frugivore community and the fruiting plant flora in a New Guinea rainforest: identifying keystone frugivores

The flora at Crater Mountain in Papua New Guinea is very diverse: 228 tree species (e10 cm DBH) on a single hectare. The vertebrate fauna (169 bird and 29 mammal spp) is less diverse than many tropical sites. At least 43 % of bird spp are partially frugivorous, but only about 27% of the mammals are frugivorous. Using data on relative abundance, mass, and degree of frugivory for all frugivorous vertebrates at Crater, we generated a crude "index of importance" for each species. Using the fruit size and mass data from 400 plant species, we exclude fruits either too large or too heavy for each frugivore to disperse yielding a "possible diet" for each species. Three species (1@ cassowary, hornbill, flying fox) are almost exclusively responsible for the dispersal of >16% of the plant species. But to conclude these are keystone frugivores, we need data on their seed dispersal effectiveness. The highest ranking frugivore, Casuarius bennetti, is highly effective as a disperser. Cassowaries appear to be a keystone frugivore, especially for large-fruited plant species (65 spp > 50g at our study site). Although cassowaries might be critically important for some large-seeded plants, the relation is not always reciprocal.

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Bryozoan mitochondrial genetics: models of introduction and historical gene flow.

Cheilostome bryozoans disperse primarily via short-lived, non-feeding larvae. Many species that foul artificial surfaces have cosmopolitan distributions suggesting effects of ship-assisted introduction. Mitochondrial (COI) sequence variation was studied to develop models of historical effects of colonisation and gene flow. Three cosmopolitan and two restricted species were compared, providing a test of the ability to distinguish introduced and native populations genetically. The patterns of variation in the hull-foulers, Bugula neritina, Watersipora subtorquata and Watersipora arcuata, match the genetic predictions for modern range expansions. A contrast in diversity indicates that introductions stem from a different number of source populations. Mucropetraliella ellerii and Bugula dentata are native to south-eastern Australia. Mitochondrial structures of these two species demonstrate influences of long-term genetic isolation. In M. ellerii, Pleistocene disturbance cycles appear to be an important determinant of speciation. The elucidation of colonisation scenarios based on patterns of phylogenetic variation provides an avenue for future exploration of the evolutionary tie between population genetics and ecological adaptation.

Eligible for student award? **yes** *Presentation mode:* talk

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Forces shaping West Coast intertidal reefs

Local patterns in distribution and abundance of intertidal communities can be the result of many interacting factors between the variety of species that inhabit intertidal reefs. As superior competitors within these assemblages, the green-lipped mussel (Perna canaliculus) plays an integral role in structuring the composition of West Coast intertidal reefs. However in some areas this species has been the targe of heavy human harvesting, resulting in official and voluntary bans being placed on this resource. The effect that protection of this kind has on community structure, as well as other factors thought to be influential will be discussed with reference to a reef that has been under protection and subject to community based monitoring since 1993. Changes in the abundance of mussels following the 1993 ban were assessed and levels of larval recruitment were investigated to gain an understanding of the effect protection may have on mussel populations within the ban area. In addition, the impact of predation on established mussel populations was examined to gain an understanding of post-recruitment processes.

Eligible for student award? **yes** *Presentation mode:* talk

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Management units, sampling units, and reserve selection priorities.

Priorities for the creation of new reserves are usually based on complementarity of the proposed reserves to those in the existing reserve system. Methods of reserve selection based on lists of species usually assume that the information on species presence in potential reserves is absolute rather than statistical. However, in large areas, such as Amazonia, surveys are often restricted to a few sites in the potential reserve, which may cover more than 1,000,000 ha. Therefore, the sampling site does not correspond to the management unit. We investigated the effect of number of sampling sites on reserve priority generated by an iterative algorithm for many different taxa in an area that included savannas, forests and aquatic sites. There was a strong relationship between the priority generated by the algorithm and number of sampling sites, and the order of priority differed from that generated when we restricted the analysis to the same number of sampling sites per management unit. Use of the residuals from the relationship between number of sites and priority resulted in relative priorities similar to those when we restricted the number of sites. We are currently investigating a bootstrap methodology to generate priorities while using all of the data.

Eligible for student award? **no** *Presentation mode:* talk

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Determining urban/forest habitat preferences for Australian and North American birds.

As a preliminary step towards investigating whether there is a set of ecological characteristics predisposing birds to survival in urban environments, we sought to determine the relative habitat preferences of forest birds of Australia and North America. To do this, we analysed three pre-existing survey data sets collected by amateur ornithologists. Although habitat data at each survey point were uncertain, positional information was good, allowing survey points to be overlaid on a GIS map of global landscape cover. This coverage was of a course scale, but we were still able to assign each survey point to an "urban" or "forest" category, albeit of uncertain accuracy. An index of a species' relative abundance in each habitat type was calculated, based on the proportion of surveys of each habitat type in which the species was present. Separate abundances were calculated for each state and for winter and summer surveys. Non-metric multidimensional scaling was then used to determine whether there was a difference in community composition associated with habitat type, geographical region and season. The coincidence between the observed and expected distribution patterns reassures us that the data sets are sound and that it is reasonable to assign habitat preferences to each species in this way.

Eligible for student award? **no** *Presentation mode:* talk

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Causes of mortality of stilt chicks

Kaki (black stilt, Himantopus novaezelandiae) are a critically endangered wading bird found only in central South Island, New Zealand. Failure of kaki chicks to fledge is a prime reason for the lack of recovery of this species. Despite intensive management since 1981 causes of mortality are known for only nine of 350+ chicks that hatched in the wild, and this has hampered efforts to increase fledging rates. Observations are difficult because chicks are hard to locate, precocial and are widely spread at very low abundance. Another sympatric species, the pied stilt (H. h. leucocephalus) is more numerous than kaki and therefore offers opportunities to examine causes o mortality of stilt chicks. Here, we report on an intensive 3-yr study of pied stilt chick mortality using continuous day-night observations of 89 chicks from 28 pairs. Thirty-seven chicks died or went missing, and for 16 of these we recorded cause and timing of mortality. Despite recording 2039 visits by 11 different predators, 75% of chicks died from non-predation causes. Half (43%) of deaths occurred within 5 days of chicks' hatching. We discuss the benefits and potential pitfalls of using pied stilts in this study and examine the management implications of these results for the future recovery of kaki populations.

Eligible for student award? **no** *Presentation mode:* talk

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WILDLIFE CONSERVATION SOCIETY - THAILAND PROGRAM

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FORAGING ECOLOGY OF INSECTIVOROUS BIRDS IN TROPICAL FORESTS OF NORTH QUEENSLAND

This study investigated the patterns of foraging ecology of insectivorous birds in tropical forests in the Wet Tropic biogeographic region of Northeastern Australia. The foraging ecology of twenty-six insectivorous bird species in rainforest and adjacent wet sclerophyll forest was quantitatively described using the distributions of foraging effort across vertical strata and different foraging substrates. The assemblage structure in the two habitats was similar, with slightly higher species diversity in wet sclerophyll forests. The analyses revealed that vertical distribution was the most important in separating species' foraging patterns. The foraging substrate was a significant factor in niche separation at a finer level. Insectivorous bird communities in both habitats were classified into four major groups: ground foragers, low-shrub foragers, arboreal foragers and canopy foragers. The degree of specialisation of each insectivorous bird species was examined by calculating diversity indices on foraging data. Most species were relatively generalised in their behaviour. The lack of specialisation in foraging patterns of insectivorous bird in this study supported the hypothesis that historical rainforest contractions may have affected the available species pool in the past, with only relatively generalised species surviving to the present.

Eligible for student award? **yes** *Presentation mode:* talk

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Establishing links between mangroves and fisheries in Australia: a conceptual framework

The juvenile stages of many commercially and recreationally important species of fish and invertebrates use mangroves as nursery habitats and this has led to the paradigm that mangroves are critical for the survival of many fish and invertebrate species. In some fisheries (e.g. banana prawns) a link between the length of mangrove-lined rivers and the catch in adjacent fisheries has been suggested. However, the mechanisms that account for this link are uncertain. We review the literature and data on the underlying physical and biological processes which may explain these linkages by focussing on five key questions: (1) What attributes of mangroves contribute to their role as nurseries? (2) Which fish and crustacean species use mangroves and how strong is their dependence on mangroves? (3) What effect has the removal of mangroves had on fisheries production? (4) What other environmental factors influence fisheries production? and (5) What data do we need to collect to test the paradigm? The answers to these questions have helped to develop a conceptual framework for the links between mangroves and fisheries production. This framework will be used to assess evidence for the links between mangroves and fisheries in Moreton Bay and the Fitzroy River, and will provide a basis for the design of future fisheries and mangrove monitoring systems.

Eligible for student award? **yes** *Presentation mode:* talk

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Between-year variation in the bird communities of a fragmented woodland ecosystem

Most studies of bird communities in remnant patches of habitat essentially provide 'snapshots' that tell us little about dynamic change over time. An understanding of the range of such temporal variation is essential for optimal conservation recommendations to be made. Watson et al. (1999) censused the bird community of a highly fragmented system of endangered Buloke woodland remnants in south-eastern Australia for one year in 1994-95. To determine whether their study provided an accurate description of the bird community of these remnants over a longer time scale, we exactly replicated their survey in 2001-02. We found that species richness per remnant was significantly higher in 2001-02. This was due to the majority of species present within the system being more widespread among the remnants during the recent survey period, rather than to additional species that were not present in the earlier survey period entering the system. The total number of birds recorded during the 2001-02 survey was more than three times greater than that recorded in 1994-95. The extent to which the bird communities of the various remnants formed a series of nested subsets, where species present in sites with lower species richness were non-random subsets of species found in sites with higher species richness, was also significantly greater in 2001-02. We suggest that climatic variation may have been significant in causing this temporal variation in the bird communities, as areas inland of the system of remnants studied experienced below average rainfall during, and for 2 years prior to, the 2001-02 survey period, whereas no such conditions were evident in the 2 years prior to the first survey period. Thus the suite of remnants may, despite its extreme degree of fragmentation and degradation, provide valuable refugia for woodland birds during drought.

Eligible for student award? **yes** *Presentation mode:* talk

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Den-tree use by Bobucks (Trichosurus caninus) in north-eastern Victoria.

Tree hollows are an essential resource for most species of arboreal marsupial. We are investigating the use of den-trees by 48 radio-collared Bobucks (Trichosurus caninus) in the Strathbogie Ranges, north-eastern Victoria. We have collected more than 4000 daytime radio-fixes on Bobucks located in both a 150ha forest block and in narrow linear remnant forest vegetation beside roads. Ninety-six percent of fixes located animals in tree hollows, confirming the importance of this resource. All individuals use multiple dens: Bobucks in the forest population use a mean of 5.7 dens, roadside animals a mean of 9.3 dens. Although some individuals use up to 15 trees, most have one or two preferred trees. Despite the high population density, each tree is used by only one adult male and female pair and their associated offspring, suggesting that Bobucks may have some form of "ownership" of particular trees. In the forest population, most den-trees used by an individual are located on the periphery of the area used at night for foraging by that individual, suggesting that den-trees in close proximity to food trees may be limiting. We are artificially supplementing den availability using nest boxes to investigate this possibility.

Eligible for student award? **yes** *Presentation mode:* talk

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Birds and cattle grazing: the avian winners and losers in a variegated landscape.

Grazing by livestock is the most extensive land use in Australia affecting over 70% of the continent. While the effects of grazing on vegetation have received attention the impact on fauna is less well known. This study investigates the impact of cattle grazing on birds of a variegated landscape in southeastern Queensland. This is the first study in Australia to specifically examine grazing effects independent of tree clearing effects. Before data was collected and analysed, species-specific predictions were made on bird responses to grazing based on a species foraging and nesting substrate model and on expert opinion. These predictions were then tested in this natural landscape experiment, using a multivariate approach, where bird species composition, abundance and richness where examined across three habitat types: eucalypt woodland, native grassland and riparian vegetation with three levels of grazing: none/low, moderate (selective) and high (non-selective, producing a lawn-like sward structure). The differences between woodland, riparian and native pasture habitats on the bird community was greater than the effects of grazing, but within these, the three levels of grazing all had strong effects shaping the bird assemblage within each habitat. Implications of these results are discussed and comparisons are made to our a-priori predictions.

Eligible for student award? **yes** *Presentation mode:* talk

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Social instruments of environmental weed control

Understanding and implementing social instruments such as legislation, economics, policy and education to ecological problems will maximise the potential for beneficial conservation outcomes. Invasion of natural ecosystems by environmental weeds and resultant detrimental impacts on ecosystem structure and function represent important foci for collaboration between natural and social sciences. Ecological and life history factors have often been the focus of environmental weed research. However, social factors also influence environmental weed invasion. Human landuses, landscape processes, human weed control efforts, funding availability, perception of the weed problem and legislative constraints on activities may significantly affect the overall efficacy of eradication, control and / or management programs for environmental weeds. We have analysed the effectiveness and limitations of weed policies, legislation, economics and educational programs at the national, state and local level. Current social infrastructure in New South Wales provides a case study of state and local initiatives. The threats to natural ecosystems posed by environmental weed invasion have mobilised all tiers of government, private organisations and community conservation groups. The existing social framework used by weed control organisations will be discussed and opportunities for enhanced ecological input to current social instruments will be identified.

Eligible for student award? **yes** *Presentation mode:* talk

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Koalas: their impact on manna gum condition on Kangaroo Island

Koalas were introduced to Kangaroo Island in 1925, and since then the population has flourished. However, over browsing in riparian habitat, particularly manna gum, has increased to an unsustainable level. To determine the ecological constraints of koala management on Kangaroo Island we used data collected since 1997 to identify: 1. koala distribution and abundance, 2. eucalypt species that are threatened by over browse from koalas; 3. condition of eucalypt species and the rate of decline in condition, and 4. a sustainable koala density. This information provides a solid ecological base for decisions to be made regarding the resources required for future koala management actions.

Eligible for student award? **no** *Presentation mode:* talk

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Biomass allocation in a woody weed: does it contribute to invasion success?

Berberis darwinii (Darwin's barberry) is a serious environmental weed in New Zealand, capable of invading a range of different light environments, from grazed pasture to intact forest. I examined biomass allocation patterns in Berberis seedlings to determine whether plasticity in biomass allocation contributes to invasion success. Seedlings were grown for 7 months in five natural light environments in the field, and three artificial light environments in the shadehouse. In the field, seedlings grown in full sun were an order of magnitude taller and heavier, had five times as many leaves, and had a significantly higher leaf mass ratio than seedlings grown in other light environments. Shade increased specific leaf area and leaf area ratio, but did not affect the root: shoot ratio. While seedling survival was high in the sun, and low in the shade, patterns of biomass allocation to root, stem, and leaf were not significantly different in four of the five light environments. The shadehouse experiment produced similar results, although seedlings in the deep shade experienced heavy herbivory. I conclude that although leaf morphology does change, early patterns of biomass allocation in Berberis darwinii are generally not plastic, and do not explain invasion success in a range of light environments.

Eligible for student award? **yes** *Presentation mode:* talk

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Bayesian methods for ecological data analysis and prediction

Null hypothesis testing is taught and used extensively in ecology, so much so that in some peoples eyes it represents the only way of conducting science: one must be testing a (null) hypothesis. However, numerous scientists in numerous different fields criticize this approach to science as being inefficient and misleading. Freely-available software and accessible reviews of the methods make Bayesian statistics a practical alternative to null-hypothesis testing in ecology. Data and prior information are used to assign degrees of beliefs in multiple alternative hypotheses and parameter values. Relatively complex data analyses can be conducted in a Bayesian framework much more easily than when using regular statistical software. A study of the effects of toe clipping on frogs is presented as an example. The Bayesian analysis provides a consistent picture of how return rates decrease for each additional toe that is removed.

Eligible for student award? **no** *Presentation mode:* talk

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Scaling up relationships in the population dynamics of an insect herbivore.

Population dynamics and species interactions are strongly influenced by spatial structure, and relationships and mechanisms are known to be spatially variant. Nonetheless, the form and extent of such changes across spatial scales is understood for few species. One of the best understood insect-plant interactions is the stem-galling sawfly, 'Euura lasiolepis', and its willow host, 'Salix lasiolepis'. The mechanisms underlying the population dynamics of this sawfly have been well-established. However, field studies have been confined to few plants in single patches. Here we examine the system across an altitudinal gradient, effectively shifting the scale of observation from local to landscape level. We determine if the robust relationships at fine scales hold across the landscape, and quantify the spatial structure in sawfly abundance. Although gall density was not related to altitude, survivorship increased with altitude as an apparent function of declining parasitism and host plant-induced mortality. Well-established relationships did hold at the larger scale, and host-plant quality remained important. However, spatial structure in sawfly population parameters emerged, suggesting additional mechanisms, such as parasitism and dispersal patterns, as being important population dynamics mechanisms at the landscape scale. Such multiscale studies are likely to provide interesting insights into the spatial population structures of species.

Eligible for student award? **no** *Presentation mode:* talk

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Byron Bay to Carnarvon - Darwin to Hobart: when does landscape variation matter?

Landscapes encompass a huge range of complexity and involve many processes operating at different scales. Generalizing can be difficult, but there is a need for a framework that has continental-wide scope, thus providing a national context for oral and written communication. We propose a framework to encompass landscape variation using variables thought to most effectively describe major differences in landscape sensitivity to, and expression of, ecological dysfunction. Our framework includes climate (linked to bioregions) and vegetation structure to create a primary matrix representing biophysical variation. Vegetation clearing and modification are proposed to describe the impacts of agriculture and urbanization. These four variables can be used selectively to identify a range of landscape types that might be relevant to a particular application. It is hoped that the framework will assist in the organization of existing and future learning about vegetation management. It can be used to identify where management can and cannot be generalised, enabling management strategies to be developed for different landscape types.

Eligible for student award? **no** *Presentation mode:* talk

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Evaluating the recovery of restored riparian areas in comparison to intact and degraded regions

Riparian areas have been a focus of restoration works due to their habitat value; however, previous restoration has often consisted of tree planting and weed control rather than re-creating vegetation structure and habitat diversity. This study evaluated restored riparian areas of different ages (2, 2.5, 7 and 10 years old), comparing them to reference sites (representing original condition) and control sites (representing degraded, pre-restoration conditions) in South East Queensland. To establish the level of ecosystem recovery and function, vegetation structure was used to measure habitat diversity, whilst ant community composition was used to indicate if habitat provision in restored areas was more similar to intact or degraded conditions. Vegetation structural complexity was highest at the reference sites, with only one of the treatment sites - the 10 year treatment - redeveloping structural complexity similar to its control site. The structural complexity of the remaining younger treatment sites was lower than that of their controls. In contrast, ant species richness and diversity was higher at the treatment sites than at the reference and control sites (with the reference and controls being similar to each other). The ant species richness of the 10 year treatment was the lowest of all the study sites, suggesting a different stage of recovery to the higher species richness of 2.5 and 7 years and moderate species richness of the 2 year treatment. For the restored sites, the development of an understorey with an appropriate vegetation species mix was limited, with Camphor Laurel (Cinamomum camphora) the dominant species of the understorey at the 10 year site. This suggests a greater focus needs to be directed at accelerating development of all vegetation layers, not the upperstorey alone, ensuring faster recovery of structural complexity and hence habitat diversity.

Eligible for student award? **yes** *Presentation mode:* talk

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Examining errors in the accuracy of fly-out counts of Spectacled Flying-foxes

Spectacled Flying-foxes, Pteropus conspicillatus, are a prominent component of the Wet Tropics fauna. They disperse both the pollen and seeds of their food plants and hence play a significant ecological role in tropical forests. They are currently listed as Vulnerable by Commonwealth Government under the EPBC Act, but simultaneously are a significant pest in orchards. Flying fox management is a divisive issue within the community and a focus of much of this concern is population estimation, which is important in addressing many management issues. Flying fox population estimation is inherently difficult and despite the best efforts of counters, counts are subject to error. We examined one component of population estimation accuracy; individual counter accuracy. This was done by comparing estimates of flyouts by individual counters with estimates derived from video-tapes of the same flyouts. Counters were found to undercount by an average 16 per cent in the study. Medium sized flyouts, of between 5 000 and 8 000 bats proved to be reasonably accurate. Smaller and larger flyouts had larger errors, though these tended to be predictable when conducted by experienced counters.

Eligible for student award? **no** *Presentation mode:* talk

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Population dynamics of Victorian koalas (Phascolarctos cinereus)

The density of a population is determined by the primary parameters fecundity, mortality, immigration and emigration, and is also affected by secondary parameters such as population age structure. The koala provides an excellent opportunity to examine the importance of each parameter in determining population abundance. We have access to large samples of animals from relocation programs at sites where population growth rates vary greatly. Age-specific fecundity data was collected from over 500 koalas from each of four closed "island" sites where fecundity varied (32-81%) in part due to reproductive disease caused by infection with the bacterium Chlamydia. This, combined with age-specific mortality data derived from a sample of over 200 pick-up skulls, provided a unique opportunity to develop accurate models of koala populations with different disease status and examine the population parameters involved in population growth.

Eligible for student award? **yes** *Presentation mode:* talk

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Conservation ecology of riparian forests in agricultural landscapes, West Coast, NZ.

The West Coast retains the majority of New Zealand's floodplain forests. Yet the floodplain forests on well drained soils were extensively cleared for agriculture in the late 1800's. 53% of the floodplains are currently in pasture, with only 0.8% of the agricultural landscape having native forest cover. Most of the forest patches are small, isolated from the river, and many are grazed by cattle. This presentation discusses the ecology of the forest patches with respect to intact forest, and identifies issues and options for protecting and enhancing these patches in the agricultural landscape.

Eligible for student award? **yes** *Presentation mode:* talk

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Restoring the mauri of Oruarangi Creek and the mana of its people: the prosed restoration of Oruarangi Creek

In recognition of the societal and cultural values of ecological restoration several community-based programs have been developed throughout the world. In particular those with interests in the field of freshwater and riparian management have developed numerous programs to encourage community involvement in their management. While each of these programs give de facto recognition to an ethos typically espoused by indigenous peoples, the concerns, values and localised knowledge of indigenous peoples continues to remain excluded from the management process. In documenting key aspects of the proposed restoration of Oruarangi Creek this paper aims to provide an example of how the concerns, values and knowledge of local indigenous communities can form a major component of the restoration process

Eligible for student award? **yes** *Presentation mode:* talk

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Bringing back the bugs: Hemipteran host-specificity in rehabilitated bauxite mines and Jarrah forest in Western Australia

Herbivorous members of the Hemiptera (true bugs) play a role in community succession and potentially influence vegetation composition of disturbed areas. Bauxite is mined in the Jarrah (Eucalyptus marginata) forest of Western Australia (WA), with an intensive rehabilitation program conducted subsequently. The objective of the mine rehabilitation program is to reinstate the original ecosystem present prior to mining. One would expect returning native plant species would result in recolonisation of Hemiptera host-specific to those particular plants. The reality may not be this simple. A few factors controlling the successful return of bugs to rehabilitated sites are: lack of certain native plant species; time taken to develop an overstorey; unpredictability of Hemiptera species response to disturbance; and lack of base-line studies of WA Hemiptera on which monitoring decisions may be based. This paper addresses these factors and analyses host specificity of Hemiptera in the Jarrah forest, and their subsequent response to bauxite mine revegetation. This was achieved by selectively sampling Hemiptera on 15 understorey plant species. Approximately 430 species from 51 families have been found. Approximately 65 of these species were considered highly host-specific and the absence of host plants in rehabilitation indicates that 15 of these species will not recolonise.

Eligible for student award? **yes** *Presentation mode:* talk

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Latitude, seed predation and seed size

We set out to test the hypothesis that rates of pre- and post-dispersal seed predation would be higher towards the tropics, and to quantify the slope and predictive power of the relationship between seed mass and latitude both within and across species. Seed mass, pre-dispersal seed predation and post-dispersal seed removal data were compiled from the global literature and combined with information regarding the latitude at which the data were collected. Contrary to expectations, we found no significant relationship between seed predation and latitude (log10 proportion of seeds surviving pre-dispersal seed predation vs latitude, P = 0.63; R2 = 0.02; n = 122 species: log10 proportion of seeds remaining after post-dispersal seed removal vs latitude, P = 0.54; R2 = 0.02; n = 205 species). These relationships remained non-significant after variation due to seed mass was accounted for. We also found a very substantial (R2 = 0.21) relationship between seed mass and latitude across 2706 species, with seed mass being significantly higher towards the tropics. There was a ten-fold reduction in mean seed mass for every ~21 degrees moved towards the poles, despite a wide range of seed mass within each latitude. Within-species slopes of seed mass with latitude were significant, but only about 1/3 as steep as the cross-species relationship. The strong relationship between seed mass and latitude shown here had been observed in previous studies, but had not previously been quantified at a global scale.

Eligible for student award? **yes** *Presentation mode:* talk

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Patterns of between-tree and between-site variation in foliar chemistry of Eucalyptus microcorys – the role of environmental factors and implications for arboreal marsupials

The concept of a direct link between soil fertility, plant defence and animal abundance has been an important driver of the conservation of arboreal marsupials in southern Australia. In the forests of south-eastern Australia, for example, Wayne Braithwaite and co-workers found that high densities of mammals occur where eucalypts with high foliar nutrients and low phenolics grow on fertile soils. At that time, the most important factor influencing feeding by marsupial folivores had not been identified. We will present findings from the first broad-scale leaf chemistry survey to include the formylphloroglucinol compounds (FPCs) across most of the geographical range of eucalypt species. Concentrations of the FPC, sideroxylonal, in the foliage of Eucalyptus microcorys varied widely both among and within 42 sites and showed strong relationships with site quality, elevation and to a lesser extent, foliar nitrogen. Other phenolic compounds also varied at both of these scales, but were only influenced strongly by foliar nitrogen. We will present evidence that this variation influences herbivory by koalas and will discuss how these findings suggest a rethink of how we assess current conservation strategies and the nutritional quality of forests for folivores.

Eligible for student award? **yes** *Presentation mode:* talk

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Differences among frugivorous bird species in their potential role as rainforest seed dispersers

A large proportion of rainforest bird species eats fruit, potentially dispersing the seeds of fleshy-fruited plants. However, little is known of the ways in which different species, or types of species, perform as seed dispersers in subtropical Australian landscapes. Based on field observation and an extensive literature review, we compiled a list of over 50 frugivorous bird species that potentially disperse plants in the Australian subtropics. These species were allocated to groups reflecting their potential importance as dispersers of rainforest seeds based on the number of fleshy-fruited plants eaten by each species, the specific composition of their diets, and the extent to which birds may disperse viable seeds. We also assessed the differential responses of these species and species-groups to rainforest fragmentation ar regeneration using field surveys at 48 sites in the Sunshine Coast hinterland. Implications for the dynamics and regeneration of rainforest patches within extensively cleared landscapes are discussed.

Eligible for student award? **yes** *Presentation mode:* talk

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Disturbance frequency and community stability in temperate grassland remnants - measuring rates and direction of community change over time

Plant communties are spatially and temporally variable in response to a variety of biotic and abiotic forces and a major challenge for ecology is to quantify the nature and direction of this variability. This is particularly important when conserving communities in landscapes that are subjected to substantial exogenous disturbance, non-native species invasions and fragmentation pressures such as isolation and edge effects. Temperate grasslands in western Victoria are one community where the conservation of the native flora is dependent on the preservation and sympathetic management of small, isolated remnants. Effects of fire frequency on species richness are well documented but there are no long-term studies to determine whether the maintenance of "status quo" burning regimes leads to stable community composition. Using data collected over 10 years from temperate grassland remnants with different long-term fire histories, I examined whether fragmented grasslands exhibit directional change or stability in response to different fire frequencies and the implications for conservation management. I introduce the use of time-lag analysis as a way to provide quantitative measurement of the rate, direction and pattern of community change and compare the results to more usual analyses such as univariate statistics and ordination.

Eligible for student award? **no** *Presentation mode:* talk

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Historical determinants of vertebrate endemism in the Australian wet tropics rainforests

It is now well established from several sources that the rainforests of the Australian wet tropics underwent severe contractions during the cool dry “glacial” periods of the late Pleistocene. Evidence from patterns of both species diversity and phylogeography suggest that vertebrate species were strongly affected by these changes in habitat distribution, but with varying geographical and temporal scales of local extinction and recolonisation. Recent macroecological theory stresses the importance of dispersal distance in determining the spatial scale at which historical processes influence species richness. Here we combine current and historical bioclimatic modeling of potential species distributions with molecular phylogeography to explore how historical range contraction has shaped geographic diversity in birds versus herpetofauna - two assemblages with contrasting dispersal ability and markedly different depths of divergence in molecular phylogeography.

Eligible for student award? **no** *Presentation mode:* talk

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Use of fire as a tool in restoring degraded eucalypt woodland - Scheville National Park.

Scheyville National Park near Sydney has been subjected to a variety of previous land-uses, some of which removed the tree cover of Cumberland Plain Woodland (an endangered ecological community), and involved ploughing or grazing. An experiment has been established by NSW National Parks and Wildlife Service and The University of Western Sydney to determine whether fire will be useful as a tool in the restoration of previously agricultural land to eucalypt woodland. Replicate experimental plots have been established allowing for two treatments (unburnt and burnt) on four previous land-use types (orchard, ploughing, grazing, and woodland grazing). Sampling of the experiment was conducted prior to burning plots in the burnt treatment in November 2001. The first post-fire sampling was conducted in July 2002. The burnt vs. unburnt comparison which was not significant prior to the November fire, was significant post-fire (ANOSIM analysis). Differences between land-use categories were significant both pre- and post-fire. Determining how individual species have responded to the fire is progressing.

Eligible for student award? **no** *Presentation mode:* talk

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Do hardwood plantations represent viable habitat for diverse faunal assemblages?

In the next 18 years State Forests/the Government aims to convert 3 million hectares of cleared land into commercial timber plantations, >80% of which is intended to be hardwood timber species. As such hardwood plantations will soon represent a significant landscape feature for wildlife, and so understanding their potential benefit to wildlife is a valuable conservation concern. In terrestrial animal communities disturbances that cause changes to vegetation may alter the structure of animal communities associated with the disturbed habitat, by altering the availability of fundamental environmental parameters. Hardwood plantations represent a novel habitat in the landscape mosaic in which they occur, as planting morphology at establishment and subsequent harvesting generates high structural simplicity. Thermal environments in plantations are significantly hotter than those available in native forests, with a higher level of radiant energy and more light reaching the ground for a larger part of the day. In this presentation I compare faunal assemblages identified from 6-year-old and 30-year-old plantations, with those found in old growth native forests in adjacent areas, and explain some of the observed differences in reference to vegetation structure and available thermal environments.

Eligible for student award? **yes** *Presentation mode:* talk

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Biosphere Reserves in Australia: Experiences, Lessons and Issues

Traditional insular notions of protected areas are being replaced around the world by a much more outward orientation linking protected areas with their broader regional landscapes, economies and communities. Perceptions of various models of protected areas are also changing rapidly..Australia established 12 Biosphere Reserves between 1977 and 1982 in all States except Queensland. No further reserves have been declared since then although a number of existing reserves have broadened their focus, driven in particular by local managers. The Mornington Peninsula has recently been nominated to UNESCO for consideration as a biosphere reserve, the first since 1982.. This paper describes some of the most recent developments in Australia s biosphere reserves, including an investigation of marketing and branding of biosphere reserve. The paper also discusses key agents for change and the potential of Biosphere Reserves as centres where new models for biodiversity conservation and sustainable use can be developed, trialed and implemented

Eligible for student award? **no** *Presentation mode:* talk

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Understanding the human dimension in cetacean-based tourism.

This paper examines the human dimension of the wildlife experience, in particular the psychological benefits deriving from whale watching in Australia and North America. This case study also reviews tourist attitudes and tourist satisfaction with cetacean encounters as well as other factors influencing the quality of the wildlife experience (eg. setting, gender, and level of tourist experience). Based on the five benefits (eg. physiological, safety/security, relationship, self-esteem, and fulfilment) measured in the study, a K-means cluster analysis was performed and a five cluster solution emerged with clear differentiation between the cluster membership. The clusters were then compared on 11 tourist characteristics and four setting variables resulting in a number of identifiable characteristics. Key variables found to be significant were tourist satisfaction, tourist gender, setting, and level of tourist experience with cetacean encounters. A preliminary integrative model is used to summarise the core directions of these findings. Understanding the human dimension of tourist-wildlife encounters can play a vital role in managing wildlife tourism by shaping visitor information and the presentation of wildlife species in different settings.

Eligible for student award? **no** *Presentation mode:* talk

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Caching of sandalwood seed (Santalum spicatum) by the woylie (Bettongia penicillata): Implications for the development of a sustainable sandalwood industry.

The woylie (Bettongia penicillata) was once common and abundant over the southern third of the continent. After European settlement its numbers declined dramatically until only three small populations remained. However, conservation programs have seen an increase in the number of woylies, which has given us an opportunity to study the ecology of a potoroid that, until recently, was threatened with extinction. Anecdotal evidence suggests that woylies cache surplus food items such as wheat and quandong seeds however, there has been no formal studies examining the role of woylies as seed dispersers and the possible impact woylie caches have on the recruitment of plants. The aim of this study was to determine the effect woylies have on the distribution and recruitment of sandalwood (Santalum spicatum). The study was carried out in Dryandra Woodland 160 km southeast of Perth. Spool and thread was used to track the fate of seeds taken from bait stations by woylies. All of the caches were similar in shape and had an average depth of 4.5 cm (range 4-6 cm). The caches were left un-buried with the seeds pushed well into the mineralised soil. Finding from this study have now been incorporated into current sandalwood harvesting programs.

Eligible for student award? **yes** *Presentation mode:* talk

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Predicting the Distribution and Abundance of the common wombat (Vombatus ursinus Shaw 1800) using Case-Based Reasoning (CBR) analysis of environmental factors.

The common wombat is a short thickset burrowing marsupial endemic to temperate Australia. It is widespread across south-eastern Australia, although sometimes patchily distributed throughout its range. For this reason, amongst others, this species was choosen for a major research project, only part of which is presented in this paper. This study represents the first application of case-based reasoning to the predictive modelling of the distribution and abundance of a species. The distribution prediction system was developed using pre-1995 data from across the natural distribution of the common wombat, and tested using post-1994 data from New South Wales and Victoria. The presence of the common wombat was correctly predicted with an accuracy of greater than 95%. The abundance modelling system was developed using the results of stratified surveying (n 8) across the natural distribution of the common wombat. The abundance prediction systems was able to correctly predict broadly categorised abundance 69% of the time.

Eligible for student award? **no** *Presentation mode:* talk

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Optimum Time for Sampling Floristic Diversity in tropical Eucalypt woodlands of northern Queensland.

The timing of vegetation sampling in tropical landscapes is critical in determining the proportion of the ground flora captured in a single sampling. Field work is expensive and it is important to maximise the capture of floristic data from a single sampling. This study records the floristic diversity at four sites near Mareeba, north Queensland at four sampling times for three consecutive years. There was significant variation in species diversity between the sites but in all four sites the May sampling recorded greater than 84% of the total recorded, whereas the November sampling's accounted for between 21 and 56% of the site total. As expected the amount of variation between these seasonal extremes is highest in MON1 which experiences the most extreme seasonal climate. This conclusion is confirme when comparing the percentage of the ground taxa recorded in the May sampling at a site to the accumulated taxa recorded across the whole three years

Eligible for student award? **no** *Presentation mode:* talk

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Predicting the future of Victoria's flora: Recent progress in modelling the effects of greenhouse warming for flora

Risk analyses of the potential impacts of global warming across a range of human activities and sectors have suggested that biodiversity is at significant risk from the likely impacts of climate change. Recent work has examined the potential effects of global warming on a selection of twelve plant species (some used as surrogates of specific vegetation communities) within Victoria to evaluate the utility of the approach. Models of future climates were developed by incorporating global and regional climate models (GCMs) provided by CSIRO - Atmospheric Research. The 'bio-climatic profile' of each species was determined for the current climate using ANUClim 5.1, and also modelled at five-yearly intervals until Year 2100 under a range of possible future climates. Results indicated that the distribution of each species declined within each modelled climate. This suggested that species' bio-climatic profiles were probably over constrained by the number of variables, and that 'bio-climates' were only one useful factor in modelling the effect of climate change on vegetation. Refinements to this process are leading to models of plant community distribution that will aid future land management decisions to hopefully minimise the impact of climate change upon native vegetation.

Eligible for student award? **no** *Presentation mode:* talk

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Setting conservation priorities for Melbourne's grasslands: how sensitive is irreplaceability to uncertain data?

The native lowland grasslands of southeastern Australia are Australia?s most endangered ecosystem. Less than 0.5% of the original distribution remains intact. Around Melbourne in particular, pressure from industrial and urban sprawl lends great urgency to the development of a method for prioritising sites for conservation. Systematic reserve selection provides a means for scheduling conservation action. Conservation planners have however rarely examined the effects of uncertainty and lack of data on the conservation value of a site. Where data are lacking, planners may rely on expert opinion. In this study, we collated estimates of areas of native grassland communities, and of rare and threatened species population sizes, for 48 grassland sites in the Melbourne area. We examined the effects of uncertainty by conducting a sensitivity analysis of the irreplaceability value of a site, calculated with two conservation planning packages, C-Plan and Marxan. The sensitivity analysis involved the random deletion of an increasing percentage of the data records. However, uncertainty in data of species abundance is rarely random, but is typically systematic. Cryptic species in particular can be easily overlooked. Therefore, we also compared the upper and lower bounds of the population estimates, which typically varied greatly.

Eligible for student award? **yes** *Presentation mode:* talk

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Are girls and boys different in the same way?: Is the evolution of dioecy correlated with consistent sex-based trait differences across Australian flowering plant families?

Dioecy in plants (separate male and female individuals) is a condition present in many angiosperm families, apparently having evolved independently numerous times. Dioecious species often exhibit sexual dimorphism but to date, general relationships between the evolution of dioecy and accompanying sexual differentiation have not been demonstrated in a rigorous comparative manner. Correlation studies have examined whether the dioecious breeding system is correlated with particular life history traits at the genus or family level. We conducted a phylogenetically structured analysis of Australian angiosperms using data from the literature and found that the same correlations could not be detected at the species level. Therefore, general patterns of life history differentiation consistent with the dioecious breeding system are likely to originate at deeper divergences in the phylogeny. We surveyed 20 Australian dioecious species from 19 families to identify whether patterns of differentiation in morphological and physiological traits between sexes are consistent across lineages. We studied a range of characters including specific leaf area, foliage density, leaf chlorophyll content and reproductive allocation. Our results show that although certain between-sex differences are consistent among species other traits differ in a way contrary to expectations.

Eligible for student award? **no** *Presentation mode:* talk

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Is the loss of avian fruit dispersers important for future forest composition?

Several studies have emphasised the potential consequences of disperser loss for future vegetation composition. In New Zealand, bird extinctions have left the native pigeon, kereru, which is itself declining, as the only disperser of several large fruited forest trees. In this study we assessed what forests are likely to be most vulnerable to the loss of kereru, and where in these forests the large fruited species occur. Twenty-two New Zealand species have large fruit (minimum diameter e 10 mm), comprising predominantly trees (64%). Of the large fruited species, 11 were present in our vegetation data set (1022 plots), occurring in 183 plots (18%). However, only two species, Prumnopitys ferruginea and Beilschmiedia tawa, were present in more than 5% of plots. Large fruited species were most common in northern forests with average temperature, winter temperature and VPD the most important predictors of their presence. Within these forests, large fruited species occurred mainly as canopy trees and in some forests accounted for a substantial proportion of total canopy basal area. We conclude that the loss of kereru could, in the long-term, result in significant shifts in forest composition for some norther New Zealand forests.

Eligible for student award? **no** *Presentation mode:* talk

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Reconstructing a native forest on mine spoil

Mount Owen open-cut coal mine is passing through 50% of Ravensworth State Forest, the largest forest remnant left on the Hunter Valley floor. The mining operations give rise to a large hill of barren waste rock requiring revegetation. This spoil material is devoid of all biological functions and processes with poor availability of some plant nutrients. The objective of the rehabilitation program is to reconstruct a functioning, sustainable, forest ecosystem, using species present in the adjoining forest community and provenance seed to conserve local gene pools. Using the remnant Ravensworth State Forest as a reference, several spoil amelioration strategies were trialled These were compared in terms of native species richness, weed infestation, vegetation structure, biomass and ability to restore important microbial associations such as rhizobia bacteria and mycorrhizal fungi. Applying a layer of forest topsoil over the spoil produced a diverse community similar to the remnant forest. Addition of biosolids to spoil produced the largest trees and numerous interactions with mycorrhizal fungi. Fertilizer application significantly increased the native species richness of the spoil to 70% of that of the topsoil treatment. One of the main deficiencies of the latter spoil ameliorants is the lack of subshrub and native herb species due to excessive initial competition from weeds and a lack of seed vectors.

Eligible for student award? **yes** *Presentation mode:* talk

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Managing Seabird Information to support Eco-tourism Management in the Great Barrier Reef World Heritage Area.

Effectively managing ecotourism relative to seabird conservation in the Great Barrier Reef World Heritage Area requires access to appropriate biological information. For more than a century, seabird populations on the Great Barrier Reef have been researched and monitored using varying degrees of scientific rigour. While some of this information is available to decision-makers in the form of specialist reports, the recently completed "Coastal Bird Atlas for Queensland" is now the primary data source. It provides information from as far back as the early nineteenth century, is readily accessible to management staff and is updated annually. However, the Atlas is the result of much laborious work to amalgamate a number of old datasets. To avoid past problems of inconsistent formats, adopting standard methods for collecting, storing and reporting seabird information across the state was a primary focus. This paper illustrates some practical uses of the Atlas for ecotourism management, and concludes with a brief account of how recent seabird research on the Great Barrier Reef is assisting with the management of ecotourism thousands of kilometres away.

Eligible for student award? **no** *Presentation mode:* talk

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Regional controls of biomass of Wet Sclerophyll forest types and the problem of forest restoration in a changing environment.

During the next 50 years, global climate change may cause an increase of mean annual temperature by more than 2°C and a change of mean annual precipitation in either direction in the Wet Tropics region of Northern Queensland, Australia. We present an empirical model of the biomass of Wet Sclerophyll forests. Basal area was measured for all trees larger than 2cm girth at breast height on a total of 3237 20m by 20m plots. At all sites, data for 11 local attributes were collected and additional 75 topographic variables were derived. We tested the predictive capability of all variables using generalized additive models (GAM). Precipitation and to a lesser degree temperature are the strongest predictors of biomass, indicating strong regional climate controls. Climate change scenarios predict a loss of approximately 10-20% of the current biomass with 5% precipitation decrease being roughly equivalent to a 1°C temperature increase. Within this century most of the wet sclerophyll region may experience climatic conditions that currently don't support these forest types. Reforestation attempts need to consider future climate change.

Eligible for student award? **no** *Presentation mode:* talk

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Stem-growth and mortality in lowland mixed dipetrocarp and heath forests of northern Borneo: patterns within three dominant families

Stem growth rates and mortalities over a nine-year period are reported for species within three dominant families (Myrtaceae, Dipterocarpaceae and Euphorbiaceae) in permanent plots of two lowland heath (Kerangas) and one mixed dipterocarp forest of Brunei, Borneo. Annual stem diameter increment averaged 1.26 mm per year and was highest in the mixed dipterocarp forest (MDF). Average year mortality was low (2.48%) with one of the heath forests having the highest value (Badas: 5.17% per year) that differed significantly from the other heath forest (Bukit Sawas: 1.25%) and from that recorded in the MDF (Andulau: 1.34%). Species within Dipterocarpaceae showed the highest mortality and stem growth, irrespective of site. A significant number of the dead trees were of smaller sizes indicating that death is dependent on tree size. We found evidence of an association between plant growth form in relation to mortality and stem growth increment. Implications of these findings for the maintenance of forest species diversity shall be discussed.

Eligible for student award? **no** *Presentation mode:* talk

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Green-blood pigmentation in bobtail skinks, Tiliqua rugosa

Blue-green pigmentation in the serum of bobtail skinks (Tiliqua rugosa) was the result of an excess of the bile pigment, biliverdin (hyperbiliverdenemia). This was confirmed by comparing the absorbance spectra of the affected serum with that of commercial biliverdin, TLC and acidification with both nitric and sulphuric acid. Significant changes in the packed cell volume, haemoglobin content, blood glucose levels, body mass and levels of erythropoietin were all observed during the development of hyperbiliverdinemia and are reported here along with suggestions as to the most likely cause for the condition.

Eligible for student award? **no** *Presentation mode:* talk

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African savanna ants: responses to fire

Little is known about the effects of fire on insect communities in Southern Africa, and consequently information for biodiversity management is incomplete. We report on results from the first long-term study on the effect of fire on savanna insects in Southern Africa. We tested the effects of fire frequency, season and time-since-fire (fuel age) on epigaeic ants in two vegetation types (Acacia savanna and Mopane woodland) in the Kruger National Park, South Africa. In the Acacia savanna, fire frequency, season of burn and time-since-fire had a limited effect on the ant communities. Differences in ant assemblages were only detected between burned (treatment) and unburned (control) plots. The effect of fire on ant assemblages in the Mopane woodland was less pronounced. The weak influence of fire in the Mopane woodland is likely to a consequence of the longer fire return period in this habitat, and the mismatch with fire frequencies used in this study. These results suggest that epigaeic ant communities in this savanna system are highly resilient to fire. From the perspective of epigaeic ant communities because fire in this system is likely to have little effect, burning management can afford to be flexible, and biased towards other taxa.

Eligible for student award? **yes** *Presentation mode:* talk

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Ecotourism Potential of Irrawaddy and Indo-Pacific Humpback Dolphins: Opportunities and Cost

Wild dolphin tourism including boat-based tours, shore-based observation, swim interactions, and hand-feeding is one of the most popular icons for marine tourism along Australia's coastline.The observation and interaction are mainly directed towards three species: the humpback whale, the southern right whale, and the bottlenose dolphin. Of the species considered to be resident in Australian coastal waters, only the Irrawaddy and the Indo-Pacific humpback dolphin are known to be relatively restricted to shallow coastal and estuarine waters of Queensland, the Northern territory and north of Western Australia. Despite this wide distribution ecotourism activities towards these species are very few and are only opportunistically directed towards Indo-Pacific humpback dolphins. Most of the northern coastline where these species occur are relatively uninhabited and isolated, making the development of such an industry difficult. However the presence of both species along the Queensland urban coast present some opportunities for dolphin watching tourism. The potential, opportunities and costs of developing ecotourism activities towards both species including boat-based tours and shore based observation will be examined using a well studied population off Cleveland Bay, Townsville, Queensland, as an example.

Eligible for student award? **yes** *Presentation mode:* talk

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Decline and persistence of pond-breeding frogs in urban and suburban Melbourne - a metapopulation study.

A metapopulation is an assemblage of spatially separated, local breeding populations connected by some level of migration. Metapopulation theory is an appropriate framework for studying pond-breeding frog species, as wetlands and ponds are naturally patchy and interspersed with terrestrial habitats. Ponds in urban and suburban areas are often highly modified, and may be less suitable as habitat for frogs than more natural ponds and wetlands. Urban ponds can also be separated by a hostile matrix of busy roads and housing estates, reducing the chance of successful dispersal between them. I investigated the persistence of pond-breeding frogs across Melbourne with a survey of 109 sites from the city centre to the rural fringe. I detected nine species of native frogs, and found an average species richness of 3.4 at ponds with a natural (soil) edge, compared to 0.5 at ponds surrounded by a stone or concrete wall. Ponds in the central parklands of Melbourne were dominated by the southern brown tree frog Litoria ewingi. I am using logistic regression and spatially realistic metapopulation models to determine whether pond size and isolation, as well as habitat quality, are influencing the probability of persistence of native frog species at urban and suburban ponds.

Eligible for student award? **no** *Presentation mode:* talk

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Nesting Success and Habitat Requirements of Small Insectivorous Birds in Suburban Gardens: Findings from the 2001 Birds in Backyards Community Survey.

I organised a community survey throughout the Greater Sydney region to examine the nest habitat requirements of small insectivorous birds to determine how various vegetative and anthropogenic factors might influence the nesting success of this guild in urban areas. Volunteers were required to complete a habitat questionnaire about their sites, regardless of whether a nest was found. If a nest was located the volunteer followed the development of the young. A total of 16 insectivorous species nested throughout the Greater Sydney region. The small insectivore guild showed a preference for gardens in which native vegetation was provided. This guild also had a comparatively high success rate of 78% and small insectivores were more likely to successfully raise young in gardens with dense shrub cover provided. These findings suggest that, where native vegetation and substantial shrub cover is available, small insectivorous species are capable of breeding successfully in suburban gardens. The loss of these species from the urban matrix is unlikely to be at this nesting stage, but rather due to some factors during adulthood. This supports the findings from the prior 2000 Birds in Backyards Community Survey.

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Survival, breeding success and dispersal of North Island robins (Petroica australis longipes) following two concurrent translocations to mainland reserves

North Island robins (Petroica australis longipes) are becoming increasingly used as subjects for translocation to mainland sites. These translocations are usually part of ongoing ecosystem restoration projects, and are possible due to the control of introduced mammalian predators. Questions were raised about the dispersal of juveniles and their subsequent recruitment into the breeding population, following almost nil recruitment of juveniles at one site with high breeding success. An experimental release design (involving a split release) was developed to test hypotheses about the factors influencing juvenile dispersal. The design was replicated with two transfers, one in contiguous habitat and one in fragmented habitat, in order to determine the effect that this had on dispersal. Results from the first breeding season following translocation will be presented, along with the dispersal and recruitment of first-year juveniles. Preliminary results suggest that habitat quality and preference was the main influencing factor in dispersal and establishment of territories in the contiguous forest, while density effects controlled dispersal in the fragmented habitat. The implications for future transfers to mainland reserves will be discussed.

Eligible for student award? **yes** *Presentation mode:* talk

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Threatened Species Management in the Arid Zone of the Northern Territory.

Many nationally threatened animal (16 species) and plant (14 species) species occur in the arid zone of the Northern Territory (south of 20 degrees latitude). The NT Parks and Wildlife Service has identified priority species for research and management action based on an assessment of conservation status, degree of endemism, and likely impacts of identified threats. Basic research involves the location of key populations, estimation of abundance and assessment of population cycles. Thereafter, the need for further research is assessed and external funding sought if necessary. Monitoring programs have been established for several species and are mostly carried out by Park rangers. The management needs of threatened species within the reserve system are incorporated into the park planning process through both park management plans and management strategies for threatening processes. If necessary, captive breeding programs are initiated at the Alice Springs Desert Park. Results of previous research also play an important role in determining future directions: the failure of long-term experimental re-introductions has resulted in such projects being discontinued until significant advances are achieved in feral predator management. Threatened species management outside the NT reserve system is more challenging, partly because of the diversity of stakeholders.

Eligible for student award? **no** *Presentation mode:* talk

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Predation of heliothis eggs in the field

Prey consumption by generalist predators is difficult to quantitatively measure in the field. Completely consumed prey cannot be counted and interactions between predator and prey are brief and difficult to observe. Despite these difficulties a number of techniques have been utilised to evaluate predator impact with varying degrees of success. The direct observation of feeding events in the field has provided a great deal of data on the dietary range of some predators. These studies are often tedious and time consuming. Sentinel prey has been used to increase the rate at which feeding events are observed in the field. Stationary prey stages are put in the field at natural densities and losses monitored. It is assumed that these losses are a result of feeding by predators. In reality some losses may be due to abiotic mortality agents such as wind and rain. It is essential that sentinel prey are equally susceptible to predation as the naturally occurring prey. This assumption is rarely tested. I use Helicoverpa armigera eggs on cards as sentinel prey to investigate predation by generalist predators in soybean fields. Preliminary experiments were necessary to determine if the predation rate observed on egg cards is similar to that of naturally laid eggs.

Eligible for student award? **no** *Presentation mode:* talk

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Are the densities of insect herbivores correlated with the growth and defence strategies of their host plants?

Investigation of the herbivorous insects associated with 18 understorey shrub species revealed correlations between insect density and several leaf traits including specific leaf weight, percent vein area and various leaf mechanical properties. Although individual leaf traits may be interpreted as antiherbivore defences, it may be more useful to consider certain leaf traits as components of the general growth and defence strategies of plants. Many leaf traits are intercorrelated, including leaf constituent levels, structural and mechanical traits and leaf life-span. Certain leaf traits are also correlated plant photosynthetic rate and relative growth rate. As plants must simultaneously cope with a number of different damaging processes, the evolution of a general suite of traits effective in reducing tissue loss may be more likely than the selection of specific traits which will reduce herbivore damage. Thus the long-lived leaves of slow-growing plants are likely to possess a range of traits that resist physical damage and these leaves are associated with low herbivore abundances. In comparison, fast-growing plants may have fewer traits that resist physical damage and may have to rely on 'out-racing' the herbivores in space and time, yet herbivore abundances are still likely to be higher on fast-growing plants.

Eligible for student award? **no** *Presentation mode:* talk

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Contrasting effects of dominant native and exotic shrubs on floodplain successions

Invasive exotic species are considered a major component of global change through their effects on both ecosystem- and population-leve processes in communities. Invasive species may also have major impacts on both primary and secondary successions. Primary successions in New Zealand and elsewhere are dominated by N-fixing herbs or shrubs. In our study system, a common, native N-fixing shrub, Coriaria arborea, dominates successions on floodplains, slips and volcanic plateaus. More recently, these systems are being invaded by a non-N-fixing exotic shrub, Buddleja davidii. Here, we report results from a survey on the influence of Coriaria and Buddleja on soil development and primary succession on riverine floodplains in Kaikoura, New Zealand. We sampled soils and vegetation along a 3 km stretch of the Kowhai River in each of four developmental phases: open (new substrate), young (0.5-2 m tall), vigorous (2-4 m tall) and mature (>4 m tall). Soil carbon and total N increased ca. 20- and 4-fold respectively from open to mature sites. The abundance of Buddleja was high in young sites (48 stems/9m2 plot), but decreased significantly to 15 stems/plot in vigorous and 0.8 stems/plot in mature sites. In contrast, there was only ca. one Coriaria plant per plot throughout all stages. Exotic species comprised 71-77% of total species richness in open and young sites, but only 24% in vigorous and 15% in mature stands. Although Buddleja and other exotic plant species were abundant during early primary succession in this system, native plant species eventually dominated mature sites. The next step of this project is to link rates of successional change to shifts in biogeochemistry under Buddleja (which may accumulate P) and Coriaria (which fixes N), and to determine whether native vs. exotic plants are able to alter successional pathways.

Eligible for student award? **no** *Presentation mode:* talk

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Conservation and Management of Multiple Species in a Disturbed Forest Ecosystem

This study investigates the long-term response of multiple species to disturbance in the form of commercial logging and high intensity fire. We used historical studies and life history data to construct spatially explicit models using VORTEX, to predict the long-term effects of disturbance on populations of small mammals and lizards. The predictions were then tested against the actual outcome of those populations in sites with four different levels of residual disturbance. Although Population Viability Analysis (PVA) has been widely used in conservation management the results have rarely been tested. Regression analyses indicate a generally good fit between the model's predictions and the observed trends in abundance and patch occupancy. The current management plan for the forest involves commercial logging on a 20 year cycle and infrequent hazard reduction burning. PVA predicts that of the species studied, Antechinus swainsonii and Lampropholis delicata are at the greatest risk of extinction. Conservation of multiple species is a complex task involving adaptive management, evaluation of model outcomes and decision analysis. To achieve the goal of conservation of all species, management should target reducing the risk for these species.

Eligible for student award? **yes** *Presentation mode:* talk

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Diseases in Far North Queensland Frogs Received by the Cairns Frog Hospital

A community-based frog rescue and rehabilitation facility, the Cairns Frog Hospital, has been soliciting and receiving sick, injured and translocated frogs from the public since August 1998. Over the past four years, over 750 frogs have been cared for in our facility. During the first year, the majority of frogs brought to us by the public were injured. However, over the course of the last three years, the number of diseased frogs has greatly increased. Currently, 9 out of 10 frogs arriving are suffering from diseases, some of which remain unidentified. At this time of writing, tests results for chytrid fungus are pending but sick frogs arriving in the past two weeks have symptoms consistent with chytrid infection. Over the past three years, significant numbers of mortalities have been caused by severe parasite infestations. This pattern has been seen not only in the Cairns region, but also in human-settled areas from Townsville to the tip of Cape York. Immunodeficiency has been identified from parasitised frogs but the cause of the immune system malfunction has not yet been identified. Additionally, at least four frogs have had large, nasopharyngeal tumors where were biopsied and identified as squamous cell carcinoma. In a further three cases, inverted papillomas were found, but other growths continue to defy clear diagnosis. The parasite infestation problem continues to be studied, although pathology testing has been difficult due to the high expense and a lack of secure funding. In summary, it appears that an increasing number of frogs in the FNQ region are stricken by a variety of diseases. To improve our understanding of this trend, it will be necessary to create a broader-based effort that links community groups that monitor local populations with scientists studying the etiology of these diseases.

Eligible for student award? **no** *Presentation mode:* talk

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Ecological constraints in the conservation of the endangered spider orchid Caladenia behrii

Caladenia behrii is an endangered sexually deceptive spider orchid of South Australia. Fragmentation and the orchid's dependence on a series of ecosystem functions including complex relationships with animals, plants, and mycorrhizae threaten the orchid. At the time this abstract is written, the third field season on the ecology and conservation of Caladeni behrii has just started. The presentation will focus on the latest findings concerning the above issues, evaluate how the fate of individual orchids relates to their history, and provide recommendations for their conservation.

Eligible for student award? **no** *Presentation mode:* talk

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The View From Above and Below: Developments in Remote Sensing of Tropical Forest Structure and Condition

A major goal of the Rainforest Cooperative Research Centre has been to develop new tools for management agencies to monitor tropical forests. Our work has addressed this goal by collecting an extensive set of field and image data sets, and working closely with key management agencies to evaluate their needs. As a result, a selection of new techniques has been developed, to use with emerging remote sensing technologies for monitoring parameters of tropical forests relevant to ecologists and forest managers. A key component of this project was a framework developed with the Wet Tropics Management Agency to link their environmental indicators to suitable remotely sensed data and processing techniques. The key to this framework and our projects has been explicit consideration of the spatial scale of rainforest features, in relation to the scale of image data and processing techniques. High spatial resolution data were used to delineate and count tree crowns and gaps. In addition, regional scale models of forest structural attributes (e.g. gaps size and density), have been developed from Landsat Enhanced Thematic Mapper data. However, the most promising results have been for developing all-weather capabilities to map forest composition, structure and their changes over time.

Eligible for student award? **no** *Presentation mode:* talk

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Limited mobility cannot explain host-choice mistakes in a herbivorous marine amphipod

Host-choice by herbivores may be constrained by their ability to move among alternative plants. Herbivores of limited mobility are thus expected to be strongly influenced by the spatial arrangement of their host plants. The herbivorous marine amphipod Peramphithoe parmerong, displays limited mobility in laboratory assays, remaining on poor quality algal hosts even when higher quality hosts are close by (within 5 cm). In the field, Peramphithoe occurs on the brown alga Padina crassa despite growth and survival on this alga being significantly reduced in comparison to their primary hosts, Sargassum linearifolium and S. vestitum. Measurements of the distances among alternative hosts in the field and a series of colonisation experiments were conducted to test the hypothesis that host use by Peramphithoe was constrained by their mobility between hosts. Peramphithoe was found to rapidly colonise algae that had been cleaned of all amphipods, returning to natural densities within two days. Rates of colonisation did not decline with increasing distance among plants for the spatial scales over which amphipods were required to travel among alternative hosts (< 3m). Mobility among plants, thus cannot explain teh continued persistence of Peramphithoes on poor quality hosts.

Eligible for student award? **no** *Presentation mode:* talk

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Are trade-offs in allocation pattern and root morphology related to species abundance? A congeneric comparison between rare and common species in the SW Australian flora.

We compared growth, biomass allocation, and root morphology of two narrowly endemic Hakea species (Proteaceae) of Mediterranean south-western Australia with those of five more widespread congeners, in a glasshouse study. The rare Hakea species occur in endangered winter-wet shrublands that grow on skeletal soils, whereas their common congeners occur on nearby deeper soils. During early development the endemics allocated relatively more biomass to their roots, and had a higher specific root length, leading to a considerably greater total root length. They also invested more root mass in the deeper layers of the pots. In the ironstone endemics the main root axis continued its extension upon reaching the bottom of the pot, whereas in the other species it was clearly suppressed. We suggest that the observed differences are the consequence of evolutionary trade-offs and represent specializations of the endemic species to their highly restricted drought prone habitats. These traits will increase the chances of getting access to water before the summer drought starts. However, while adaptive in a shallow-soil habitat, we argue that these specializations reduce their success on deeper soils by compromising both their below-ground and above-ground competitive abilities.

Eligible for student award? **no** *Presentation mode:* talk

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Optimal adaptive monitoring of populations

Wildlife managers and conservation biologists often ask the question: what is the optimal monitoring strategy for this species in this place? In this paper I show that there may be no fixed optimal monitoring strategy and we should consider adaptive monitoring strategies. In an adaptive monitoring strategy the effort expended on monitoring in any year will depend on the cost of different monitoring strategies, the consequences of having too many or too few individuals of the species concerned, the suite of available management options, and the current perceived state of the population. I use stochastic dynamic programming to find an optimal adaptive monitoring regime for lynx in Sweden. If there are too few lynx then the species is in danger or regional extinction. If there are too many lynx then reindeer herders suffer unacceptable losses. The best monitoring strategy in any year depends on whether the lynx population is close to being too abundant or not abundant enough. The idea of adaptive monitoring could be applied to many species of conservation concern.

Eligible for student award? **no** *Presentation mode:* talk

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The tradeoff between efficiency and design in conservation planning: reasons and reconciliation

Many studies over the last 10 years or so have shown that there is a tradeoff between efficiency and design in conservation planning. The efficiency of a plan is higher if targets for features (e.g. species, vegetation types) can be achieved in a smaller total area of proposed reserves. Efficiency addresses the need for representation. The design of a plan is better if it includes larger, more connected proposed reserves. Design addresses the need for persistence and manageability. The conflict between efficiency and design has not been clearly explained. This study uses a recent data set for conservation planning in the Cape Floristic Region of South Africa to show that the conflict is due to two main factors: (i) spatial autocorrelation; and (ii) size of targets. We also argue that the conflict is an abstraction, stemming from an artificial divide between pattern and process in conservation planning. We use the regional data set to show that explicit targets for both pattern and process can be achieved efficiently in a well-designed system of proposed reserves.

Eligible for student award? **no** *Presentation mode:* talk

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Leaf attributes in the seasonally dry tropics - habitat, phenology and phylogeny

Leaf attributes such as leaf mass per area (LMA), assimilation per unit mass (Amass), leaf N and lifespan are inter-correlated and are affected by environmental factors such as water and nutrient availability. Species from many biomes have been included in such studies, but a notable gap is for seasonally dry tropical environments. We studied leaf attributes of 21 tree species from four contrasting habitats near Darwin. This area is interesting because (i) rainfall is extremely seasonal (ii) many habitats are embedded within the savanna matrix (iii) dry-season deciduous, semi-deciduous and evergreen tree species all occur and (iv) the native flora contains Pan-tropical, Australasian, Old World Tropical, Indomalaysian and Cosmopolitan genera. Species segregated into two groups - Myrtaceous species, with sclerophyllous, thick, long-lived leaves with low Amass, N and P content, and non-Myrtaceous species, with generally thinner, often deciduous leaves with higher Amass, N and P content. The closed canopy dry monsoon forest contained a higher proportion of non-Myrtaceous species than did the eucalypt open forest, mixed woodland and Melaleuca swamp. This, together with more fertile soil, resulted in higher Amass and higher growth rates in the dry monsoon forest than in the other habitats. Leaf thickness, density and LMA were less than predicted from previously derived relationships with temperature and precipitation, showing the importance of including a full range of biomes in global meta-analyses.

Eligible for student award? **no** *Presentation mode:* talk

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Modelling cyclone disturbance of the Great Barrier Reef using GIS

Tropical cyclones periodically cross the Great Barrier Reef (GBR). The large waves they generate break along shallow reefs, resulting in impacts ranging from broken corals to removal of entire sections of substrate. Over time, repeated widespread impacts have the potential to significantly alter coral reef community structure. Thus, effective management of the GBR requires an understanding of the cyclone disturbance regime (which reefs are likely to be affected and how often). However, the temporal and spatial distribution of cyclone impacts across even a single reef in the GBR is poorly known. Meteorological models can be used to reconstruct the likely magnitude and distribution of cyclone energy from the meteorological record. This hindcast energy can then be linked statistically to field observations of reef impact to predict the distribution of cyclone impacts on areas not surveyed. With today's improved computing power and advances in GIS technology, it is now possible to use these techniques to span longer time periods (3 decades) and cover larger areas (the entire GBR) than has been done before. The resultant cyclone history can be used to examine the degree to which cyclone disturbance controls broad measures of reef community structure (dominant size classes and growth forms).

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Canopy rodents and their role in seed predation and dispersal

This project examines rodent abundance and distribution from the ground to the canopy and the influence of resource availability on rodent abundance in a tropical Australian rainforest. The impact of rodent seed predation and dispersal on Acmena graveolens fruits will also be determined. The structure and maintenance of diversity in tropical forests can be greatly influenced by seed predation and dispersal, however the role of rodents in this process is poorly understood. Preliminary results indicate that one species of rodent is restricted to the ground/near ground levels and two others have been captured from the ground to the canopy. The Prehensile-tailed rat (Pogonomys sp.) is the only species captured exclusively in the canopy. Observations indicate that rodents are dispersing Acmena graveolens fruits.

Eligible for student award? **yes** *Presentation mode:* talk

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Selective herbivory by macropods following fire at Whiteman Park, Western Australia.

This study demonstrates the impact of selective browsing by macropods on seedlings after a major disturbance, fire, in natural bushland on the Swan Coastal Plain. Whiteman Park, near Perth, contains 1000 hectares of original Banksia woodland in near pristine condition. A large area was burnt by an extensive bushfire in early February 2001. The study involved the monitoring of 19 plant species. Species were grouped as grass-like or non-grass-like, and planted at two densities. The Western Grey Kangaroo (Macropus fuliginosus) was the major herbivore, consuming seedlings within 12 hours of opening study plots. Herbivore behaviour and densities were analysed in relation to herbivory patterns. The results of this study aim to determine the relative importance of macropod herbivory versus other factors (competition, drought, other herbivores) in explaining recruitment patterns after a large disturbance and formulate methods of reducing impacts on natural regenerating and rehabilitated bushland. Trials have begun on the relative value of mechanical plant guards, nurse and sacrificial plants in reducing herbivory levels.

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Minimum viable metapopulation size of a beetle, Osmoderma eremita, living in hollow trees in Europe

Osmoderma eremita is an endangered beetle species associated with old, hollow trees, mainly in pasture woodlands. Observed low migration rate, small population sizes per tree and asynchrony in population fluctuations between trees suggest that O. eremita individuals in each tree may be described as a local population and the individuals in a stand of trees together form a metapopulation. A survey revealed that habitat occupancy/tree was higher in larger stands than in smaller stands, but there was no correlation between occupancy/stand and isolation of stands. O. eremita was found in most of the larger stands, and this probably mirrors the fact that the density of old oaks was much higher in Sweden 200 years ago, but has decreased since that time. Computer simulations of population survival, based on our knowledge about the population dynamics, suggest that many O. eremita populations in small stands will go extinct, however, this may take several decades or even centuries. A minimum number of suitable trees aggregated in stands is necessary to provide long-term viability of O. eremita populations. Therefore, priority should be given to maintaining the quality of large sites, or to increase size and connectivity of smaller stands with hollow trees.

Eligible for student award? **no** *Presentation mode:* talk

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Management Guidelines for the Retention of Habitat in the Top End.

Since European settlement in Australia, the Northern Territory landscape has undergone limited land clearing. In recent years this situation has begun to change with opportunities emerging to exploit expanding agricultural markets. Although there is abundant literature on the effects of habitat fragmentation on fauna in other areas of Australia, no information is available regarding how these activities may be affecting the wildlife of this region. Fauna surveys were undertaken in the rural area near Darwin in remnant habitat patches of variable size and isolation, cleared areas and undisturbed "continuous" bush. There were 75 species of bird, mammal, frog and reptile recorded frequently enough to analyse. Only a small proportion of these (25%) used modified land, but most (69%) did use corridors. There were no species that could confidently be classified as edge specialists, preferring the interface between woodland and modified land. Three variables were found to have a strong positive influence on the animals that would occur in a fragment. They were the area of the fragment, the total amount of woodland within 4 km of the fragment, and the extent of corridors linking the fragment to other large woodland tracts. The edges of fragments were slightly different to the interiors with about twice the cover of weeds and just above half the cover of trees. However, both effects dissipated quickly inside the fragments.

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Is bigger really better?: Invertebrate diversity and abundance in snow tussock (Chionochloa macra) patches

Invertebrates were sampled by pitfall trapping and clipping tillers in 10 snow tussock patches to determine whether invertebrate diversity was influenced by snow tussock patch size or sampling position within patches. The study site was at 1350m a.s.l. in the Rock and Pillar Reserve, Otago, New Zealand. Analysis of similarities for pitfall-trapped invertebrate morphospecies revealed that some patch sizes have different communities from each other, but that there were small differences between sampling sites within patches. For patches larger than 2 tussocks, species richness (S) and abundance (N) of invertebrates from pitfall-traps were partially explained by patch size. This was primarily due to samples from the centre and leeward edge of patches, while those from the windward edge showed greater variability. When 1- and 2-tussock patches were added, the relationship degenerated. The diversity of tiller invertebrates was low, but one morphospecies of mite was abundant. Neither S or N of tiller invertebrates were closely related to patch size or position in patch. These preliminary results will be expanded upon and discussed with respect to species-area relationships, sampling effect, and human perceptions of habitat patches.

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Miniaturised global positioning devices as a method of characterising flight trajectories.

Migration and dispersal are essential life-history characteristics of many animal species. In order to effectively manage species engaging in these types of long-distance movements, we need considerable amounts of information accurately describing the locations of animals over time. Such position information has often been difficult to acquire using traditional animal tracking techniques such as anecdotal observation, banding programmes, and radio telemetry. Although these techniques have proved useful, to further our understanding of the factors affecting migration and dispersal, we need even greater quantities of highly accurate position information. Recently available miniaturised Global Positioning Devices (mGPDs) now provide a cost effective means of increasing the accuracy, precision, and density of location data from which one can describe these movement patterns. Through our current research on the navigational abilities of racing pigeons, we first demonstrate the applicability of mGPD technology for describing flight trajectories. We then suggest how the use of mGPDs can be extended to the studies of migration and dispersal, using as examples several New Zealand Procellariiforms.

Eligible for student award? **yes** *Presentation mode:* talk

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Experimental translocations - shedding new light on frog population declines.

Despite considerable research efforts during recent years, the causes of catastrophic declines in frog populations remain unexplained. The aim of this project was twofold: 1) to determine whether or not the process responsible for recent declines in north Queensland has abated, and 2) to generate new information on declines through a series of field experiments that "re-create" decline events. Frogs of Litoria rheocola (a species known to be susceptible to decline) were collected from lowland populations and translocated to large enclosures at three upland streams (experimental sites) and three lowland streams (control sites). Frog mortality was significantly higher and its onset more rapid at upland sites than at lowland sites, and considerably higher during winter than during summer. These observations indicated that the process responsible for historical declines continues to operate, but that its impact varies with environmental conditions. All frogs were assessed for infection with the amphibian chytrid fungus during experiments. There were extremely high levels of chytrid infection among frogs found dead, but surviving frogs were largely free of infection. Also, infection levels were higher at upland sites than at lowland sites and during winter than during summer. These results suggest that disease caused by the chytrid fungus is associated with frog declines. A seasonal shift in the behaviour of frogs was also consistent with patterns of mortality, and this observation provides insights into the relative susceptibility of other species to decline.

Eligible for student award? **no** *Presentation mode:* talk

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Beta Diversity in the Wet Tropics: Bugs to Birds

The detailed and comprehensive data now available on the distribution patterns of species from the Wet Tropics of Australia provide exceptional opportunities for examining ecological patterns and processes in tropical rainforests. A universal issue, which these data can now be used to address, is the one of measuring biodiversity surrogates for use in conservation planning. A new approach is described, which combines ED, an "environmental diversity" measure based on the p-median, and generalized dissimilarity modeling (GDM), to measure biotic turnover or ß-diversity by linking species-compositional dissimilarities to observed environmental differences. Data on plants, vertebrates and invertebrates across the Wet Tropics are used to asses how well environmental variation explains species-compositional dissimilarity. GDM results show that biotic turnover can be explained well by measured environmental variation. However, the predictive relationship between species-compositional dissimilarities and measured environmental variables differed between taxon groups. We also compared continuous (based on ordination) and discrete (dissimilarities alone) versions of ED. Results have implications for regional conservation planning and the understanding of ecological and evolutionary processes in tropical rainforests.

Eligible for student award? **no** *Presentation mode:* talk

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Assessing the benefit of frugivory for seed germination: getting the right design

Frugivory provides two well-known benefits for the plant - dispersal and germination. However, few studies adequately address the potential fate of seeds that are not consumed by frugivores and thus we cannot evaluate the degree of dependence on vertebrates for germination. The germination benefit of gut passage includes two components– the removal of inhibition from the fruit flesh, and the scarification of the seed coat. The majority of international studies appear to test the scarification effect only. However, this effect appears to be relatively small and inconsistent, while the inhibitor effect seems to be rarely studied (Traveset 1998). Here, we review all known studies on the germination of New Zealand fleshy-fruited species, which in contrast, mostly test the inhibition effect. Most species show very poor germination in intact fruit, but high rates when the flesh is removed – thus, removing the inhibition effect seems to be the main benefit of gut passage. However, virtually all of these studies used short-term trials in petri dishes – conditions that are very different from those in the field. We present data from a two-year trial that uses an improved field-based design. Of three species tested, two showed a significant inhibition effect.

Eligible for student award? **no** *Presentation mode:* talk

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Size-Dependent Distribution in the Cannibalistic Lowland Copperheads, Austrelaps superbus (Serpentes:Elapidae).

Lowland copperheads, Austrelaps superbus, are a highly venomous, large-bodied species of elapid snake displaying marked sexual size dimorphism, with females being the smaller sex. They are also known to exhibit cannibalistic behaviour. As part of a life-history study, a population of A. superbus was sampled over three years at a small (0.5 km2) site in a coastal sunkland habitat in south-eastern Victoria. The site was characterised by three different habitat types, with a large, artificial canal on the north-western boundary, a Melaleuca ericifolia shrubland in the centre, and a smaller, also artificial canal and its tributary on the south-eastern boundary. The main prey of A. superbus at the site consisted of small lizards and house mice and, to a lesser extent, frogs, without apparent differences among habitat types. However, an analysis of body size distribution of A. superbus showed significant differences among habitat types. Juveniles, subadults and small males and females were restricted to the M. ericifolia shrub, without direct access to permanent water. Females and small males were found along the main canal on the north-western boundary. The largest males were captured along the small canal and its tributary on the south-eastern boundary, and recapture data indicate that they display strong site fidelity. These differences in size-distribution among habitat types are partly attributed to differential thermal requirements of small versus large-bodied ectotherms, but also partly to the fact that A. superbus are cannibalistic, so that small-bodied individuals may be restricted to suboptimal habitats in order to avoid predation by larger conspecifics.

Eligible for student award? **no** *Presentation mode:* talk

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Pocket gopher activity patterns in a highly seasonal environment

Many animals respond to seasonal variation in their environment. Animals that live belowground might appear to be buffered against such variation. However, in some areas pocket gopher activity patterns seem to be tied to seasonal patterns of rainfall. These patterns may be due to the ease of digging in moist soils or increased food availability during the wet season. I used field experiments to investigate which of these two factors influence seasonal variation in activity. Results indicate that an increase in soil moisture causes the initiation of activity, but does not sustain high levels of activity. Other factors such as the availability of vegetation for consumption might be more important in maintaining activity through the wet season.

Eligible for student award? **yes** *Presentation mode:* talk

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Plant community changes in edges and interiors of forest fragments: effects of fragment size, age, disturbance and fire.

We studied the effects of fragmentation on diversity, composition and functional groups in an open-forest plant community in coastal NSW. As the effects of habitat loss and isolation may intensify when combined with other forms of disturbance, we examined the relative influence of fragment size and age, anthropogenic disturbance and fire. Patterns of native species richness across edges of long un-burned fragments were contingent on edge age, with a zone of elevated richness consistently associated with the edge, but progressing inwards from the treeline with increasing edge age. This pattern appeared to be associated with corresponding changes in vegetation cover, and to be present regardless of fragment size or disturbance. However, in older edges of small fragments with major disturbance, edge effects were either dominant throughout fragments or were indistinguishable from an overall disturbance-related reduction in richness. Recent fire increased native species richness overall, but consistent edge effects were not detected. Exotic species invasion was minimal in the above-ground vegetation, but was greatest in fragments with major disturbance. Differences in species composition were detectable between the edge zones and interiors of fragments, and were explored for both species and functional groups.

Eligible for student award? **yes** *Presentation mode:* talk

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Exotic grass invasion alters fire regimes in the tropical savanna of northern Australia

Andropogon gayanus Kunth. (Gamba grass), a tall perennial grass from Africa, is invading ecosystems in the Top End of northern Australia. This invasion could have dramatic, irreversible ecological consequences for the savannas of northern Australia. However, at present the impacts of invasion are largely speculative. This study compared the fuel loads and fire characteristics of invaded sites with those of native grass savannas to determine if A. gayanus invasion alters savanna fire regimes. Fuel load and fire characteristics were measured at two sites at the Wildman Reserve, approximately 170 km south east of Darwin. Experimental fires were lit early in the dry season in savannas dominated by A. gayanus. Fuel loads were determined prior to ignition and fire-line rate of spread was determined using a series of electronic timers activated by thermocouples. These data were used to calculate Bryam fire-line intensity. Fuel load was substantially higher at sites in which A. gayanus dominated the understorey, ranging from 0.69 to 1.91 kg/m2 in A. gayanus dominated sites compared to 0.20 to 0.58 kg/m2 in sites dominated by native grass. This higher fuel load supported fires up to 8 times more intense than that in native grass savannas at the same time of year (means 15700 ± 6200 and 2100 ± 290 kWm -1). These are the highest fire intensities ever recorded in the Northern Territory. These results suggest that A. gayanus is a serious threat to the savannas of northern Australia, with the potential to affect savanna tree mortality and recruitment and initiate a grass-fire cycle in the Northern Territory. This cycle could cause a decrease in savanna tree cover and the conversion of a diverse savanna ecosystem into a tall perennial grassland.

Eligible for student award? **yes** *Presentation mode:* talk

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Factors Correlating with the Presence of Introduced Mammal Species on New Zealand Offshore Islands

This paper describes a study which investigates the factors that correlate with the presence of introduced mammals on New Zealand offshore islands. The offshore islands of New Zealand provide a unique opportunity to investigate insular biogeographic patterns and processes with respect to the relatively recently introduced mammal taxa (c. 200 years ago), whose colonisation and expansion across the entire archipelago is well documented. This study used logistic regression (presence/absence data) to quantitatively establish what variables are most significantly correlated with introduced mammal presence on offshore islands. Multivariate linear discriminant factor analysis is then independently used to establish which variables most clearly distinguish between islands upon which introduced mammals are present, and those on which they are absent. Results showed that the distribution of individual introduced mammal species is generally reflected by a number of limiting factors, which vary widely, though not unexpectedly, between species. The use of islands as 'stepping-stones' by stoats to colonise islands outside their natural swimming distance is highlighted, as is the nature and intensity of interactions between the four rodent species found in New Zealand. The degree of anthropogenic activity is consistently the strongest factor that distinguishes between introduced mammalian presence or absence on offshore islands.

Eligible for student award? **yes** *Presentation mode:* talk

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Post-release dispersal of juvenile and sub-adult captive-reared kaki in South Island, New Zealand

The kaki (black stilt, Himantopus novaezelandiae) is an inland wading bird endemic to New Zealand. The combined impacts of habitat degradation and introduced mammalian predators depressed kaki numbers to less than 30 wild adults, represented by a single population in central South Island. The kaki has been intensively managed since 1981. The greatest gains in numbers of wild breeding kaki have been achieved in recent years through a programme of artificial incubation and the release of captive-reared birds. Release sites are selected with the aim of restocking or supplementing wild populations in specific river systems. Trial releases of sub-adult (9-10 months of age) and juvenile (2-3 months) have been undertaken to identify the age at which post-release survival and release-site fidelity are greatest. This study examines the release site fidelity of juvenile versus sub-adult kaki. Patterns of post-release dispersal are related to the apparent higher survival of sub-adult inoculants, and to the behaviour of wild-born kaki at the juvenile and sub-adult stages.

Eligible for student award? **no** *Presentation mode:* talk

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Intra- and interspecific neighbour interactions among Eucalyptus obliqua, Allocasuarina littoralis and Poa labillardieri.

An experiment was designed to determine if the simultaneous reintroduction of tree, shrub and groundcover species would accelerate dry sclerophyll forest restoration on agricultural land compared to plantings of single species. A modified target-neighbour experimental design was used to examine the competitive effects of three species, Eucalyptus obliqua seedlings, Allocasuarina littoralis seedlings and Poa labillardieri tillers towards each other. Monocultures or two species mixtures of four individuals were planted around each target species at two distances (3.5 and 7 cm) and in addition each species was also planted without any neighbours. Analysis of the growth six months since planting showed that each target species had neighbour combinations at both distances which promoted higher growth rates than that of individuals planted without neighbours. For A. littoralis and E. obliqua the greatest growth occurred when its neighbours were four A. littoralis seedlings planted 7cm from the target species, whilst the greatest growth by P. labillardieri occurred when its neighbours were planted 3.5cm away and were a mixture of itself and E. obliqua. These results suggest that intra- and interspecific competition can have a positive effect on the growth of the three species.

Eligible for student award? **yes** *Presentation mode:* talk

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Response of bird communities to secondary succession in the Central Highlands forests of Victoria

Severe forest disturbance, whether natural or anthropogenic in origin, can lead to regeneration and secondary succession, which may influence bird community composition through progressively changing habitat structure and resource availability over time. Avian community composition was examined at five stages of succession after wildfire and timber harvesting in wet eucalypt forest (2-5, 10-15, 20-30, 60, and >100 years post-disturbance) in the Victorian Central Highlands. Three bird counts were conducted in each of 12 replicate sites in each forest age-class during summer 1999-2000. Of the 52 species recorded, 75-81% occurred in any one age-class. Overall, bird community composition varied significantly as a function of forest age-class; eight of the ten possible pairwise comparisons exhibited significant differences, the greatest being those between the oldest and youngest age-classes. No difference in avian community composition was found between the two oldest forest age-classes or between the 10-15 and 20-30 year age-classes. Bird species varied in their response to successional change. Two species (Brown Thornbill and Golden Whistler) were similarly prominent in all age classes. Five species (Grey Fantail, Silvereye, White-browed Scrubwren, Rufous Fantail and White-eared Honeyeater) were relatively less prominent community members in the later than in the earlier successional stages, whilst six others (Crimson Rosella, Crescent Honeyeater, Eastern Spinebill, White-throated Treecreeper, Superb Lyrebird and Striated Pardalote) exhibited the reverse trend. Members of this last suite of species were largely responsible for the differences in bird community composition between the oldest and youngest age-classes. The findings indicate that successional habitat change after severe disturbance in southern wet forests has important long-term implications for native bird community ecology and conservation.

Eligible for student award? **yes** *Presentation mode:* talk

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The effect of canopy and ground layer disturbance on Andropogon gayanus establishment

Andropogon gayanus (Gamba grass) is an introduced perennial tussock grass that is spreading out from pastoral properties into non-pastoral areas in northern Australia. To help understand the factors that contribute to its spread, this project investigated the effect of canopy cover and ground layer disturbance on A. gayanus germination and establishment. Three canopy treatments were applied: a natural gap between canopies, an artificial gap (tree lopped), and a control. Within each canopy treatment, quadrats were subjected to three different ground treatments: ground flora clipped, ground flora clipped and soil disturbed, and control. A. gayanus seed was sown into quadrats and seedling emergence and establishment success was monitored. The results showed that A. gayanus was able to germinate and establish in control treatments but success was greater when soil and/or ground vegetation were disturbed or when canopy cover was naturally low or artificially reduced. This suggests that undisturbed savanna is at risk of invasion from A. gayanus and that this risk increases with soil and/or canopy disturbance.

Eligible for student award? **no** *Presentation mode:* talk

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Modelling pest management options in cotton within an ecosystem services framework

The concept of ecosystem services is broad and a new field of research endeavour in natural resource management. When considering the implementation of ecosystem services, there may be tradeoffs between ecological and economic goals. We attempted to quantify those tradeoffs by developing bio-economic models. Natural pest control by beneficial insects and the variety of management options available is a good system to model, testing the environmental and economic drivers behind the adoption of environmentally friendly pest control management options in cotton. Field data from a study by Hoque et al. (2000) suggests that there is an economic benefit to growers who adopt environmentally friendly pest management practices and yet there are several regions in which growers continue to use broad-spectrum insecticides. The model will explore pest and beneficial insect population parameters in different cotton growing regions and will simulate the environmental and economic outcomes of adopting "soft" and "hard" pest management in seasons of light and heavy pest inundation. Hoque Z., Farquharson B., Dillon M. & Kauter, G. 2000 An economic evaluation of an on-going IPM program within the Australian Cotton Industry. Proceedings of the 10th Australian Cotton Conference, Bribane 2000. Australian Cotton Growers Research Association, Inc.

Eligible for student award? **no** *Presentation mode:* talk

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The Rat's Tale – use of small mammals as bioindicators in a restored forest linkage in far North Queensland, Australia.

Determining success in restoration relies on recognition and scrutiny of suitable bio-indicators. In this study we present our findings on colonisation and movement of small mammals including Melomys spp and Rattus spp in a restored forest linkage in far North Queensland. In as little as two years after completing the forest linkage we observed colonisation by a range of small mammals recognised as forest obligates. Movements of individual animals was also monitored using mark/recapture methods. The three year study demonstrated the utility of our linkage for small mammals and gives us reason to claim success in attempting to address fragmentation and isolation issues for the isolated Lake Barrine Section of the Crater Lakes National Park.

Eligible for student award? **no** *Presentation mode:* talk

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Quantifying Tropical Forest Fragmentation using Landscape Pattern Metrics for State of the Wet Tropics monitoring in Far North Queensland, Australia.

Current methods for monitoring forest fragmentation in the Wet Tropics Bioregion for State of the Wet Tropics Reporting are costly in time and resources. This paper describes an investigation of landscape pattern metrics, combined with remotely sensed imagery, for measuring forest fragmentation. A subset of landscape pattern metrics was selected from those contained within a widely available spatial pattern analysis software program, ESRI's Patch Analyst. These metrics were calculated from land-cover maps produced through interpretation of aerial photographs and classification Landsat Enhanced Thematic Mapper satellite imagery. Key findings were: (1) classification of remotely sensed images produces maps with the level of detail necessary for mapping regional scale land-cover in tropical mountainous environments; (2) select landscape pattern metrics quantified the major structural features of landscape pattern associated with tropical forest fragmentation; and (3) for ease of interpretation and analysis, a subset of simple metrics (percent of landscape, patch density, mean patch size, median patch size, edge density, area weighted mean patch fractal dimension, mean nearest neighbor distance, core area percent of landscape and core area density), instead of all published metrics, should be the focus of monitoring tropical forest fragmentation. The study produced a set of metrics that could constitute a standardized methodology for quantifying tropical forest fragmentation in the Wet Tropics Bioregion using remotely sensed imagery and landscape pattern metrics.

Eligible for student award? **yes** *Presentation mode:* talk

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The reproductive ecology of Cytisus scoparius (L.) Link (Fabaceae): An invasive weedy species infesting Barrington Tops NSW

Scotch broom, Cytisus scoparius (L.) Link (Fabaceae), a shrub native to Europe, was introduced to Barrington Tops NSW in the 1840s and has since become a major invasive weed on the Barrington Tops Plateau. In this study, field and laboratory experiments were undertaken to determine whether pollinators are needed to effect seed set. We investigated the plant's breeding system, floral phenology and floral visitors. C. scoparius was found to employ an obligate xenogamous breeding system at Barrington Tops and it maintains a floral tripping device that precludes many pollinators and favours a melittophilous pollination syndrome. In its native range, scotch broom primarily relies on bumblebees (Bombus spp) to effect pollination. Bumblebees have not yet established on the Australian mainland and the introduced honeybee (Apis mellifera) was identified as the major pollinator of this population with some floral visitation by native bees. Although honeybees are in low numbers at climatically harsh Barrington Tops, they are very effective pollinators and calculations revealed that a flower could receive c. 16 honeybee visits over its lifetime. The findings of this study indicate that there is potential for implementation of control at the reproductive stage of the plant's life cycle in terms of controlling honeybees.

Eligible for student award? **yes** *Presentation mode:* talk

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Bottom-up and top-down influences on algal-associated assemblages on subtidal rocky reefs

Experimental manipulations of predators and herbivores have repeatedly shown the importance of top-down control of benthic assemblages inhabiting marine intertidal and subtidal rocky reefs. Less well understood is the importance of nutrient supply on these assemblages (bottom-up control). We investigated the relative effects of bottom-up and top-down control, by nutrient enrichment and predator exclusion respectively, on the invertebrate fauna associated with the brown macroalga, Sargassum linearifolium, on subtidal rocky reefs in Sydney. A second experiment used artificial plants to test the hypothesis that increased epiphyte levels will affect the abundance of epifauna in the absence of changes in host plant quality. Preliminary results have shown that it is possible to experimentally enrich the water column, resulting in changes in abundance of some taxa (bivalves and polychaetes). Experiments of this kind will assist in predicting the biological effects of coastal eutrophication, and of changes in predator abundance due to overfishing.

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The Pygmy bluetongue lizard (Tiliqua adelaidensis) - Proud flagship for grassland conservation or Maire Celeste?

The endangered Pygmy bluetongue Lizard (Tiliqua adelaidensis) inhabits threatened remnant native grasslands, in South Australia. We examined the relationship between lizard abundance and grassland community structure along transects across the edges of lizard populations. Our hypothesis was that lizards should be associated with specific native plant communities. Transect data from five sites, four with lizard populations of varying sizes and one without lizards, showed significant differences in vegetation community structure among sites, but not across lizard population boundaries within sites. The sites with the greatest lizard abundance had the lowest native plant diversity whilst the site with no lizards, a conservation park, had the highest native plant diversity. Floral diversity and species composition were thus poor predictors of lizard abundance. We started with an apparently reasonable assumption, that conservation of individual species and the communities they inhabit should be complementary. This example demonstrates that this assumption need not be true. In this case establishing a reserve with conditions suitable for the conservation of the Pygmy bluetongue would not conserve a significant tract of native vegetation, whilst the conservation park studied was proclaimed due to its high diversity of native plant species but does not support any lizards.

Eligible for student award? **yes** *Presentation mode:* talk

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Litter layer development in a 27-year age series of tropical sites rehabilitated to native forest species after bauxite mining (Go NT).

The litter layers formed in an age series of sites rehabilitated to forests dominated by Eucalyptus tetrodonta and Eucalyptus miniata are described. The standing crop biomasses of the litter layers substantially exceed those of the surrounding native forests dominated by the same tree species. The pH, EC and concentrations of selected nutrient and other elements in the litters are presented in relation to time since rehabilitation and to other characteristics of the vegetation and soils.

Eligible for student award? **no** *Presentation mode:* talk

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Using replicated censuses of migratory waders to increase usefulness of historical counts in a long-term monitoring programn

Reliable fauna surveys are vital for measuring changes in abundance within a population or community over time. Migratory waders worldwide are increasingly threatened by loss and modification of their non-breeding intertidal feeding and roosting grounds. Their migratory lifestyle makes it difficult to measure impacts of habitat change on their survival or reproductive output. Decline in the number of waders using an area can also be difficult to measure in a meaningful way because comparable, long-term census data is not often available. We used replicated counts to census the wader community in Trinity Inlet, Cairns. We counted at known high tide roosts, at high tide and on both outgoing and incoming tides. We found that the site used historically for wader censuses, the Cairns Esplanade mudflats, was not used by the majority of the birds of several species, and that the incoming tide produced the best count. Historical counts are available for the Cairns area from 1987 to present. Analyses of our replicated counts of all known roost sites can be used to determine appropriate measures of confidence in historical counts, thereby providing a longer-term data set that may be useful in measuring changes in abundance in the local wader community.

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Roadside shrubs and council graders: a disturbing relationship

In many areas of the wheat-sheep belt, there has been a dramatic decline in biodiversity, with only scattered remnants of the original woodlands remaining in cleared agricultural landscapes. Remnant woodlands are now mostly constricted to roadside reserves, many of which are of high conservation status. Conventional theory predicts an increased risk of species extinction in these small and isolated populations. It is also often assumed that native plant recruitment may decline due to lack of natural disturbances. However, this theoretical framework does not accommodate historical changes in anthropogenic disturbance regimes, and it is conceivable that many species may prosper under these novel environmental conditions. Population structural dynamics of roadside stands of Acacia pycnantha, A. montana and A. decora were assessed, and disturbance variables recorded, in the Lockhart region of southern NSW. On a regional scale, populations were expanding, but recruitment was often highly pulsed, with distinct groups of colonising, stable and senescent stands. Soil disturbance from previous road construction activities, in conjunction with historic changes in grazing pressure, are suggested as the main causes of increased shrub recruitment. These results suggest that ongoing management of disturbance regimes in roadside environments may be critical to shrub persistence and associated fauna habitat.

Eligible for student award? **yes** *Presentation mode:* talk

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Valuing Ecosystem Services - an Emergent Theory of Individual and Societal Development

Early research in the area of ecosystem services involved non-market valuation studies focused on the problem of market failure as a key driver of human-induced pressure on ecological systems. The goals of sustainability and social equity have led to a gradual broadening of research that has attempted to embed economic and ecological models within a larger social process of decision-making and development. In this paper we postulate on the emergence of a further dimension to ecosystem services research linked with the observation that our models of human development must take account of defensive behaviour resulting from human nature's fundamental desires for self-preservation. We attempt to characterise the problem and put forward a model that identifies possible stages of individual and societal development from what we call exploitative and defensive self-interest to co-existing self-interest. Finally, we propose that the name ecosystem services, provides a fitting symbol for the service ethic that underpins our co-existing developmental model.

Eligible for student award? **no** *Presentation mode:* talk

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The behavioural consequences of multiple predators

The threat of predation can have marked effects on a variety of prey behaviours. Most studies of anti-predator behaviour have been confined to single predator systems, despite the fact that most prey are faced with several predators simultaneously in nature. In multi-predator environments avoidance behaviours towards one predator may conflict with avoidance of a second predator. How prey cope with the dilemma of conflicting anti-predator behaviours and what effect these have on prey decisions is largely untested. My study aims to address this by investigating the behaviour of lizards in response to a common snake and bird predator, when they are encountered individually and simultaneously. The study found that the presence of predators singularly and together altered the lizards behaviour. Refuge use increased in the presence of the bird, decreased in the presence of the snake, and was unchanged when both predators were present. The proportion of time spent basking was reduced in the presence of both predators and the lizards activity patterns were altered. The results suggest that the combination of predators has dramatic effects on the lizard's activity patterns and its ability to bask more than either predator alone.

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Environmental Education: Participatory action in the tropical marine environment

Environmental education (EE) programs tend to make awareness and attitudes their primary goals, consequently current EE programs are not producing the outcome of ecological participatory action. This presentation discusses research undertaken to study ways of improving outcomes generated by educational programs. Awareness is important in realizing that a problem exists, but does not necessarily include rectifying the problem. Current publications overwhelmingly state the relationship between awareness and action is not strong. If increased participation of citizens is important to solve existing ecological problems, then innovative education techniques must be developed. New ideas and fresh approaches are needed to help translate awareness and attitudes into action. Coral reef monitoring by students offers a method to move from a position of awareness to participatory agency through experiential education, and by developing a relationship between the students to the resource itself. This article explores correlations between awareness, attitude and participatory agency. Initial steps in the process of the knowledge-attitude-agency relationship are not achieving the end result of positive citizen action. Promoting the desire to act responsibly requires changing human eco-agency and increasing ecological participation at the community level. If participatory action skills are a desired outcome, then awareness and attitudinal change not enough.

Eligible for student award? **yes** *Presentation mode:* talk

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Getting wheat farmers hooked on plant biodiversity: some novel communication products

Agricultural landscapes in the NSW sheep-wheat belt typically have small areas of highly fragmented remnant vegetation, widespread dryland salinity, declining native species and minimal natural regeneration. We examined patterns of biodiversity on sheep-wheat farms, roadsides, and state forests as part of an project in the NSW Riverina to 1) record the diversity of birds, invertebrates, mammals, frogs and reptiles, vascular plants, fungi, mosses and lichens; 2) develop cost-effective management and monitoring plans and 3) assist in communication and implementation of our results. We surveyed 35 remnants dominated by Eucalyptus microcarpa (grey box) and E. melliodora (yellow box), Callitris glaucophylla (cypress pine) and Allocasuarina luehmannii (buloke). We found a surprising diversity of species including 106 species of birds, 63 cryptogam species, 35 new species of fungi and 250 species of vascular plants. Using "Bioselect" we determined that at least 20 different remnant woodland areas are needed to conserve just one representative of each of these plant species. We developed a range of materials to communicate the value and management requirements of this diversity. Products included a "virtual herbarium" based on high resolution digitally scanned plant images and linked to a relational database, GIS revegetation scenarios and fact sheets to deliver key messages to assist farmers and agencies develop an understanding and vision of how biodiversity can be conserved within agricultural landscapes.

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Following a snail trail: progress on Placostylus landsnail research

The large landsnails Placostylus ambagiosus and Placostylus hongii (Pulmonata: Bulimulidae) from northern New Zealand are now reduced to small local populations by habitat destruction and introduced mammalian predators, particularly rodents. We summarise our research since 1988 aimed at identifying conservation units and developing methods to enhance local populations or establish new colonies. Morphometric analysis and mitochondrial DNA sequencing (Cytochrome oxydase 1) are being used to identify populations of genetic similarity. An analysis using isozymes has already shown that there are fewer groups than previously identified by traditional taxonomy. Captive breeding was successful and 11 captive-bred P. hongii were released in the field in August 2002 with harmonic radar transponders attached to help follow their progress. Two wild to wild translocations of 31 and 32 snails resulted in two new colonies. These colonies are being used to confirm a previous result that increased adult recruitment follows when rodents are controlled. Mark-recapture data show that these snails develop slowly, are long lived, and that adults show site fidelity whereas juveniles disperse. Reciprocal translocation experiments within colonies demonstrated that adult snails return to their original site over > 80 m. The implications of our results are discussed in relation to conservation management.

Eligible for student award? **no** *Presentation mode:* talk

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Where the wild weeds are: explaining local patterns of distribution and spread of New Zealand' s environmental weeds.

We report on recent studies documenting how weed dispersal by people, together with strong dispersal limitation, explain the current local distribution and short-term spread of environmental weeds. In a survey of coastal native forest fragments in eastern Northland, over 65% of the variation in the exotic plant species richness of these fragments was explained using only the number of houses within 250 m of a fragment boundary. Also positively correlated with exotic species richness were settlement characteristics such as housing density, housing age, and the species richness of settlement gardens In almost half of these fragments, we found evidence of recent dumping of garden refuse, including many of the worst local environmental weeds. In a related study, we investigated how the weed invasion of native forest fragments differed when the neighbouring landscape was Pinus radiata plantations or grazed pasture. The diversity and abundance of exotic plant species in these forest fragments was again dominated by proximity to the nearest propagule source. Because most individual weeds originate from nearby parents, grazed pastureland with an open fragment edge proves to be a more effective buffer against most forest weeds than P. radiata plantations.

Eligible for student award? **no** *Presentation mode:* talk

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The influence of cattle grazing and associated burning on eucalypt trunk invertebrates, a diverse component of forest biodiversity.

The invertebrate fauna of eucalypt trunks in the forests on the Northern Tablelands of NSW forms a superabundant and diverse community, with over 103,000 individuals and 215 families identified in this study. It also bears a remarkable resemblance at family level to those present in amber from many millions of years ago. This supports the notion that the sticky-traps are sampling a distinct community and not a random assemblage of passing fauna. The community composition of trunk invertebrates differed between cattle grazed/moderately frequently burnt and ungrazed sites, but overall abundance and diversity were similar. Flies comprised 84% of all captures, the great majority of which have larvae that are detritivores. Of these, the Sciaridae or dark-winged fungus gnats, was the most abundant family (50% of total captures), and was marginally but consistently more abundant in the grazed/moderately frequently burnt sites. The data indicate that at grazed/moderately frequently burnt sites the functional role of these taxa as detritivores is not noticeably affected. Diptera, although generally inconspicuous, are very important in forest ecosystems because of the role many species play in the processes of litter decomposition and nutrient cycling.

Eligible for student award? **yes** *Presentation mode:* talk

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Experimental test of interspecific competition between the sympatric skinks, Ctenotus robustus and C. taeniolatus.

On regenerating sand-mined areas of coastal NSW, the skinks Ctenotus robustus and C. taeniolatus are sympatric at medium vegetation densities. On more open areas C. taeniolatus is absent and on more densely vegetated areas C. robustus is absent. We tested for interspecific competition between these two species using field manipulations of densities. Ctenotus taeniolatus were transplanted to open sites where C. robustus densities had been reduced. Recapture rates of C. taeniolatus on open sites were similar to those on medium and dense sites, indicating that their absence from open vegetation is unlikely to be due solely to unsuitability of habitat. Ctenotus robustus were transplanted to dense sites where C. taeniolatus densities had been reduced. Recapture rates of C. robustus on dense sites were lower than on medium and open sites. Thus their absence from dense vegetation may be due to unsuitability of habitat. At medium vegetation densities we removed one species and monitored the response of the other species. Results suggest that competition does not entirely explain the pattern of distribution and abundance of Ctenotus in relation to vegetation density. The relative importance in this system of competition and other factors such as thermal requirements will be discussed.

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Identifying optimal captive breeding strategies

To use captive breeding most effectively as a tool to manage endangered species we need to optimize decisions such as when to capture wild animals or release zoo-bred individuals into the wild. There has been an ongoing debate within the conservation community about the merits of captive breeding as a method to conserve threatened species. Captive breeding is expensive, however provides a level of certainty that may not be possible with in situ conservation. For many species captive breeding is the only viable option to prevent extinction because we do not know the causes of population decline in the wild or we are unable to eliminate the problem quickly enough. To address these management issues, we constructed a first order Markov chain population model for two populations, a captive population and a wild population, and used stochastic dynamic programming to identify optimal size of translocations between the zoo and the wild. This provides a practical tool for one aspect of captive breeding decision-making and suggests a number of rules of thumb for their management.

Eligible for student award? **no** *Presentation mode:* talk

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Using Microbial Symbionts to Improve Revegetation & Rehabilitation of Australian Landscapes

Symbiotic interactions between plants and soil organisms are important components of all plant communities. A consequence of the low nutrient levels of Australian soils is that partnerships between native woody plants and microbial symbionts offer the possibility of major advances in the success of revegetation projects. Shrubby legumes (Acacia spp.) constitute a major plant group that forms nitrogen-fixing partnerships with rhizobial bacteria. Results from glasshouse and field inoculation trials indicate enormous variability among rhizobia in their ability to form effective symbioses, with large differences in growth and survival of particular plant-rhizobial combinations. Importantly, the benefits of these associations also extend to other plant species. While within an Acacia species, elit rhizobial strains (those best at promoting host growth) are highly effective across provenances, such relationships may not hold across host species. Because native rhizobia rapidly vanish from agricultural soils, particularly where vegetation has been cleared as a result of cropping or where continual grazing has occurred over long periods, they may be absent from areas where revegetation is most crucial, requiring re-introduction of effective strains. Large-scale field trials are underway to further explore the potential benefits of these interactions in mitigating environmental problems associated with the mass-clearing of native vegetation.

Eligible for student award? **no** *Presentation mode:* talk

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What happens to weeds after pest animal control?

What happens to weed abundance following animal pest control? We reviewed the evidence—anecdotal, quantitative and experimental—from various sites throughout New Zealand. We found several striking examples of weeds increasing after pest animal control. Three quarters of our records reported a weed increase. In particular, shrub and grass or herb species increased following goat, stock or rabbit control in grassland and following goat control in damaged native forests or open sites. However, very few reports were backed by experimental manipulation. Thus, we could not isolate the influence of animal control from other biological and physical variables. Nevertheless, the results demonstrated the potential magnitude of the problem and suggest that the topic is worthy of further investigation. The next step is an experimental management study associated with a range of goat control operations in disturbed, weedy areas. This will help resolve the magnitude and parameters of the problem. This should help conservation managers to design integrated and adaptive conservation projects to both control animal control and minimise subsequent weed invasions.

Eligible for student award? **no** *Presentation mode:* talk

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Survival of large bodied skinks (Oligosoma spp.) threatened by exotic mammalian predators on the South Island, New Zealand.

Within the New Zealand skink genus Oligosoma existing on the South Island there are two broad body size categories: large bodied (maximum SVL's 106-124 mm) and small bodied (maximum SVL's 70-77mm). The six large bodied South Island Oligosoma generally have higher threat categories (two nationally endangered and four gradual decline) than the five smaller bodied skinks (one gradual decline, one sparse, and three not threatened). Within the large bodied Oligosoma, four have widespread distributions and are therefore numerically strong. Threat categories are correspondingly lower for these skinks (gradual decline). Two others, with relatively high habitat specificity and more limited distributions have the highest threat categories for any skink on mainland New Zealand (nationally endangered). The purpose of this paper is to compare and contrast a selection of life history traits for these large bodied skinks on New Zealand's South Island to test whether the differential threat classification can be at least partially explained by differences in life history traits between the species. In particular, size specific survival is investigated using mark and recapture techniques.

Eligible for student award? **no** *Presentation mode:* talk

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Assessing the biophysical health of savanna landscapes at the hillslope scale

We describe a procedure for assessing the biophysical functioning of landscapes that uses information acquired at two nested scales. The procedure has a wide potential application because it is based on the economy of vital resources and its interaction with biota, supported by a conceptual framework. At coarse scale, we divide the hillslope into zones that either tend to gain mobile vital resources such as water, organic matter and propagules ("patches") or lose them ("interpatches"). At this scale, we describe well-functioning landscapes as retentive of resources, whilst dysfunctional landscapes "leak" resources out of the system. At a finer scale, we use 11 visually assessable indicators to assess the functional status of the soil in each patch and interpatch. Each indicator has a process-based interpretation. These indicators are turned into emergent properties refecting soil stability, infiltration of rainfall and nutrient cycling that have relevance at the hillslope as well as the patch scale. We also present relationships between these emergent properties and the variables they represent, showing good agreement across a range of landscape types.

Eligible for student award? **no** *Presentation mode:* talk

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Landscape supplementation provided by an exotic matrix: implications for bird conservation and forest management in a forestry system in south-eastern Australia.

This study investigated landscape supplementation (sensu Dunning et al. 1992) by bird species across boundaries of eucalypt and pine forests at Tumut, NSW. Birds were surveyed by the area search method within 0.5ha quadrats in 32 boundary sites. Patterns of species occurrence along varying distances into stands of pine plantations from native forest edges were examined using generalised linear mixed models. Species richness in quadrats within pine forests decreased with increasing distance from eucalypt forests, suggesting that several species forage in pine plantations. Species richness decreased more quickly with distance from eucalypt patches in younger than in older exotic plantations, suggesting that longer rotation periods promote better bird conservation. Furthermore, bird species richness decreased more rapidly in exotic plantations adjacent to wide rather than narrow patches of native forest. We suggest the term "Halo Effect" for this influence of eucalypt patch dimensions on the differential use of matrix. The study suggests that appropriate conservation of birds in native patches in this exotic plantation system should consider the maintenance of 100m wide bands of old pine forests around the patches. This extension of conservation efforts towards the limits of the home ranges would ensure sufficient landscape supplementation for the bird species.

Eligible for student award? **yes** *Presentation mode:* talk

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Managing Ecotourism in relation to Seabird Issues on the Great Barrier Reef

The Great Barrier Reef World Heritage Area is vast and contains over 1250 potential seabird breeding sites in the form of islands, cays and rocks. Many of these sites are also popular tourist destinations. Tourism is a legitimate use of the World Heritage Area and creates big business in Queensland. The potential for conflict between seabird conservation and ecotourism is substantial but mechanisms are in place to ensure the continued viability of both activities. While the permit system administers management decisions, it must be accompanied by appropriate biological information to be conducted effectively and fairly. A seabird monitoring strategy has been developed to ensure key information about seabirds, including the impacts of ecotourism, is collected and made available to decision-makers. The strategy takes account of many factors including site accessibility and significance, the need for indicator sites and the risks associated with visitation. Queensland Parks and Wildlife Service marine parks staff are tasked to implement the strategy. NB This talk is should precede the talk to be given by Paul O Neill "Managing Seabird Information to support Ecotourism Management in the Great Barrier Reef World Heritage Area".

Eligible for student award? **no** *Presentation mode:* talk

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Measuring Forest recovery in Victoria after logging: are we on the right track?

Permanent monitoring sites, established prior to timber harvesting, were re-sampled at multiple times in forests in the Otway Ranges and East Gippsland, Victoria. These long-term datasets represent some of the most comprehensive evaluations of forest recovery following logging in Australia. A study of the impact of clearfell logging on flora values of Mountain Ash (Eucalyptus regnans) dominated forests of the Otway Ranges was established in 1983. Floristic and structural changes in the vegetation were re-assessed at intervals until 2001. The recovery of drier, mixed eucalypt forests of East Gippsland following logging was studied through the Silvicultural Systems Project set up by the Victorian government at Cabbage Tree Creek. These forests were subjected to a range of experimental harvesting treatments including gap creation, small and large clearfells, shelterwood and seedtree. The response of the vegetation to these treatments was measured after two, four and 12 years. This paper will describe the floristic and structural changes in the vegetation of these different forest types following logging. It will also compare the various methods of sampling used in the two studies and examine alternative approaches to measuring ecological recovery after major disturbance.

Eligible for student award? **no** *Presentation mode:* talk

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Short-term bird and reptile community responses to seasonal controlled burns.

The impacts of fire management on vertebrate communities in tropical savannas of Queensland are still unknown. This study examined effects of experimental regimes of seasonal fires, used to control rubbervine (Cryptostegia grandiflora), on bird and reptile communities in grazed open woodlands. Study sites had three experimental plots: a wet season burnt plot, a dry season burnt plot and an unburnt control plot; and were established on three separate tributaries of the Burdekin River, north Queensland. Bird and reptile species richness, mean abundance and community structure were compared between seasonally burnt and unburnt control plots. Bird and reptile species richness did not vary significantly between fire treatments. Overall bird abundance was higher in burnt treatments compared to unburnt controls. Community structure of birds varied between treatments, with a higher overall abundance of insectivores observed in dry burnt treatments. However, some species (e.g. Malrus melancephalus) were more abundant in the control treatment. Total reptile abundance and community structure of reptiles did not vary between fire treatments, with the exception of Carlia munda, which was more abundant in dry burnt treatments. This study suggests that whilst small-scale, control burning in grazed open woodlands does not appear to decrease overall abundances of birds or reptiles, management should proceed cautiously to reduce negative impacts on potentially fire sensitive species.

Eligible for student award? **yes** *Presentation mode:* talk

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Ecological effects of Red Imported Fire Ants (Solenopsis invicta) in the USA and Australia

Red Imported Fire Ants (Solenopsis invicta Buren) are a highly invasive and aggressive organism with a natural distribution centred on the Pantanal region of South America. Introduced to southern USA early in the 20th century, it has continued to spread by natural and anthropogenic means; and now infests over 125 million hectares. The economic impact of this insect is measured in billions annually but the ecological impacts are just as great. Some time in the last decade or so, fire ants managed to establish a substantial population in Brisbane Australia. Here we describe some of the ecological impacts of Red Imported Fire Ants in the USA and speculate as to their likely effect on Australia's fauna and flora. Fire ants have broad habitat preferences and are likely to occupy much of the Australian continent if left to spread. They are likely to cause substantial additional pressures on many vertebrate and invertebrate assemblages including: all terrestrial reptiles, crocodiles, sea turtles, ground-nesting birds, small ground-active mammals and almost all invertebrates (especially ants). Secondary impacts may extend to reductions in the dispersal ability of myrmecochorous plants and increased predation rates on plant seeds resulting in lower rates of plant establishment.

Eligible for student award? **no** *Presentation mode:* talk

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Squirrel diets and dispersal of fungus in a changing forested landscape, eastern Canada.

Consumption of hypogeous ectomycorrhizal fungi (‘truffles’) by northern flying squirrels (Glaucomys sabrinus) and red squirrels (Tamiasciurus hudsonicus) was studied in old-growth mixed coniferous (Acadian) forest in eastern Canada between 1999 and 2001. Fungus was consumed by both species at all times of the year, but peaks in consumption and diversity occurred in summer and fall. Both species showed considerable dietary overlap. To evaluate the significance of mycophagy to plant hosts we then compared inoculation rates and degree of fungal development on red spruce (Picea rubens) seedlings grown under a variety of treatments. Significantly more seedlings developed mycorrhizae in natural forest soil (97.5%) compared with sterile soil treated with squirrel faeces (69.2%) or truffle spores (27.5%). Treatments with faeces and spores also differed significantly from each other. Our work shows that squirrels in the region are important mycophagists and that digestion and excretion of truffle spores may enhance germination potential of spores. Because our data also suggest that squirrels are declining at the landscape level due to human forestry practices, we believe that concern about disruption to long-term ecosystem processes, as a result of continued habitat fragmentation, is warranted.

Eligible for student award? **no** *Presentation mode:* talk

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Resprouting of semi-arid plants

A widely accepted view of vegetation response to disturbance is that species can be clearly classified as sprouters or non-sprouters. We aimed to assess how well this binary classification (sprouter / non-sprouter) described the responses of a semi-arid flora to disturbance. We also aimed to determine how similar species responses were to different disturbances. Sprouting ability was assessed for 45 species from a range of growth forms from semi-arid NSW. We compared sprouting ability in response to clipping at stem base, and to clipping followed by scorching with a blow torch, killing buds above 6 mm below ground. The binary classification accounted for over 60 % of the deviance that was explained by species identity. Models with three or four groups were not substantially better at accounting for the responses recorded. Mean percentage survival for non-sprouters was 23 % after clipping and 6 % after burning, while sprouters had means of 90 % after clipping and 79 % after burning. Sprouter species were likely to have more stems per plant, shorter potential height and deeper buds than non-sprouters. Within species, having more stems or larger basal area and being taller were associated with sprouting success. Species responded similarly to the clipping and burning treatments. Differences were quantitative rather than qualitative, relating to the possession of buds below ground.

Eligible for student award? **yes** *Presentation mode:* talk

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Assessing the environmental weed risk of agricultural and forestry plants in South Australia

Environmental weeds are plant species that have been introduced to regions beyond their native range, and which have subsequently invaded natural habitats to the detriment of indigenous biodiversity. The environmental weed risks of twenty agricultural and forestry species in South Australia (SA) were determined using a ranking system developed by the Animal and Plant Control Commission. The system considers the invasiveness, impacts and potential distribution of a species to give a weed importance score. Species were assessed using information from a questionnaire, the State Herbarium, a literature review, field observations and GIS analysis of climatic and soil preferences. Key factors influencing the scoring of species were weed history, establishment ability, reproduction, dispersal, potential density in native vegetation (if uncontrolled), plant size and climatic suitability. Alleppo and Turkish pine (Pinus halepensis, P. brutia), wattles (Acacia saligna, A. cyclops) and perennial Veldt grass (Ehrharta calycina) posed the highest environmental weed risk. Various Eucalypts, lucerne (Medicago sativa), saltbushes (Atriplex nummularia, A. amniocola) and puccinellia (Puccinellia ciliata) were low weed risks. Radiata pine (P. radiata), Swamp sheoak (Casuarina glauca), tagasaste (Chamaecytisus palmensis) and tall wheatgrass (Thinopyrum ponticum) ranged from low to high weed risks between different SA regions depending on climate and/or soils.

Eligible for student award? **no** *Presentation mode:* talk

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Chytridiomycosis and New Zealand frog population declines

Global amphibian declines recorded since the late 1980s have coincided with the spread of emerging infectious diseases. New Zealand frogs were first diagnosed with chytridiomycosis in 2000. Before this, introduced New Zealand populations of bell frogs, Litoria raniformis and L. aurea, remained robust even as their Australian source populations seriously declined. New Zealand research offers insights into modes of virulence and spread of the chytrid fungus Batrachochytrium dendrobatidis. At first, epizootics of chytridiomycosis appeared limited in extent and duration. Only 16 of over 1000 adult L. raniformis in a Canterbury pond showed evidence of morbidity or mortality. This was followed, however, by episodes of massive mortality among metamorphs (“post-metamorphic death syndrome”). Only six adults returned to breed during the following year, and none two years later. Incidences of chytridiomycosis radiated out from the original locality through natural dispersal and human-mediated translocations. Initial incidents of chytridiomycosis in the South Island were followed within a year by epizootics in North Island populations of L. aurea. Shortly thereafter, native Archey’s frogs, Leiopelma archeyi, were found infected with chytrids, and all extant populations now appear in danger of extinction. Genetic analyses reveal few base-pair substitutions among New Zealand, North American, and Australian B. dendrobatidis isolates.

Eligible for student award? **no** *Presentation mode:* talk

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The Relative humidity preferences and tolerances of the invasive Argentine ant, Linepithema humile: comparisons with native Iridomyrmex sp.

The Argentine ant, Linepithema humile (Mayr), is a widespread invasive ant species that displaces native ants and other ground-dwelling invertebrates in its introduced range. Previous studies have documented a relationship between the distribution of Argentine ants and the abiotic conditions, suggesting that the invasion success of Argentine ants may be related to specific abiotic factors. This study records the relative humidity preferences and survival of Argentine ants and a dominant native ant genus, Iridomyrmex, in the laboratory. After four hours, the number of Argentine ant workers in the highest relative humidity container (>90%) was significantly greater than that of Iridomyrmex, however, after 24 hours, both Argentine ants and Iridomyrmex sp. preferentially selected containers with the highest humidity. A second series of trials found that the survival of both species was related to the relative humidity conditions. After four hours, the survival of the Argentine ant colonies was reduced in comparison with Iridomyrmex sp., however, after 24 hours, both species displayed similar survival in all relative humidity conditions. These findings suggest that there is a relationship between the level of moisture and the survival of Argentine ants, and may have consequences for the invasion success of Argentine ants in Australia.

Eligible for student award? **yes** *Presentation mode:* talk

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The importance of being lignotuberous

Australian forests and woodlands are dominated by eucalypts. Over 95% of species within the genera Eucalyptus, Corymbia and Angophora produce basal stem swellings called lignotubers. Sprouting of buds stored within these lignotubers enables seedlings and juvenile plants to survive loss of aerial biomass that would otherwise kill them. Sprouting by this means is a common survival strategy of plants living in fire-prone mediterranean-type climates. Carbohydrate reserves also stored within tissues of lignotubers are used during sprouting and have been studied in several woody genera including Arbutus, Erica , and Leucaena. Similar use of carbohydrates by eucalypts during sprouting has been neither confirmed nor quantified. Lignotuber development varies between and within species, due to both genetic and environmental components. For example, lignotuber diameters of glasshouse-grown Corymbia variegata seedlings can be twice that of Eucalyptus acmenoides seedlings of the same age. Lignotuber growth of E. obliqua varies across its wide distributional range, but variation of associated carbohydrate reserves has not yet been studied. The present study aims to use a variety of provenances of E. obliqua to determine intra-specific variation in lignotuber development and levels of reserve carbohydrates and to confirm and quantify the use of reserve carbohydrates during sprouting.

Eligible for student award? **yes** *Presentation mode:* talk

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Plant assemblages for rainforest restoration and recovery: an eastern Australian perspective.

This paper examines patterns of change in plant assemblages following different approaches to the re-acquisition of tree cover in tropical and sub-tropical rainforest in eastern Australia. We sampled plant assemblages in quadrats using frequency counts in three strata in a network of 104 sites, spanning a range of land cover types in the Atherton Tablelands region of northern Queensland (50 sites) and the Border Region of NSW and Queensland (54 sites). Quadrats were in patches of least 4 ha. Multivariate pattern analysis revealed that after 5-10 years, the plant assemblages of ecological restoration plantings had moved substantially towards the "forest" state, while agroforestry and other plantations remained more similar to pasture sites. These patterns of rainforest recovery differed markedly depending on the stratum considered. However, regardless of stratum, levels of "movement" differed between regions and between types of plantings. Similarly, type of restoration differed in proportions of recruited taxa of different growth form and origin. The two regions differ in the composition and timing of the establishment of introduced taxa, which in association with management regime, influences the trajectory of rainforest restoration. We consider the ecological processes determining the future structure of reforested sites, and associated implications for landscape management.

Eligible for student award? **no** *Presentation mode:* talk

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Biodiversity and Ecosystems: Grasslands, Islands and Deer.

While the effects of abiotic factors on ecosystem functioning have been long recognised, there is a growing appreciation of the role that species effects, and differences among species, may have in driving ecosystems. This presentation will consider how plant species,species traits, and diversity of vegetation, may influence ecosystem properties. This will be done through the use of three examples. The first focuses on a field experiment in a New Zealand perennial grassland in which the effects of exclusion of different plant functional groups on the composition and performance of the decomposer subsystem was investigated. The second involves ongoing work on a group of lake islands in northern Sweden which differ in the vegetation that they support and each of which operates as an independently functioning ecosystem. The third considers the impact of introduced browsing mammals on the functional composition of vegetation in New Zealand forests and the consequences of this for the belowground subsystem. These examples in tandem serve to illustrate how differences between species, biotic interactions, and linkages between aboveground and belowground communities may all serve to operate as key drivers of ecosystem functioning.

Eligible for student award? **no** *Presentation mode:* talk

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Population biology of Trachymene incisa (Apiaceae): a matrix population model

Population studies of Trachymene incisa have revealed that this herbaceous perennial plant has a complex life cycle which includes seeds, rosette plants, and dormant adult tap-roots. These components of the population ensure that T. incisa is capable of multiple responses to disturbances such as fire. Plants may either resprout from a tap root or seeds may germinate from a seed bank. Interestingly, there are two forms of seed bank in these populations; a transient aerial seed bank and a long-lived soil seed bank. These complex life history attributes are incorporated into a stage-based matrix population model. This enables us to evaluate the relative contributions of the two seed banks and the adult dormancy to the population growth rate. The demography of two populations of T. incisa, one of which had recently been burnt, are compared and the consequences of the seed bank for population persistence are presented.

Eligible for student award? **no** *Presentation mode:* talk

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Predicting abundance from occupancy: a test for an aggregated assemblage

The ubiquitous, positive abundance-occupancy relationship is of potential value to conservation and pest management because of the possibility of using it to predict species abundance from occupancy measures. He & Gaston (2000) developed a model for the prediction of abundance from occupancy based on the negative binomial distribution. There are to date few empirical tests of this model, and here we test it in a field-based mesocosm experiment using a Drosophilidae assemblage associated with decaying fruit. Abundance estimates derived from the model differed significantly from measured values, and were least accurate for the most abundant species. Substitution of k-values corrected for species density into the model did not improve abundance predictions significantly. However, substitution of k-values calculated directly from the negative binomial distribution yielded highly accurate abundance predictions. Although the distribution of fly species did not deviate significantly from the negative binomial distribution, and the finest possible minimum mapping units were used (individual fruit), the model consistently underestimated the abundance of species in the assemblage because individuals were very highly aggregated within fruit. Because of its potential importance, this model thus requires further exploration at fine scales, commonly represented by individual habitat units, for highly aggregated species.

Eligible for student award? **yes** *Presentation mode:* talk

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Spatial and temporal dynamics of Southern Bell Frog (Litoria raniformis) populations in agricultural landscapes

Amphibians are particularly vulnerable to habitat fragmentation due to their limited dispersal ability. Identifying the spatial and temporal patterns of habitat utilisation allows us to predict the impacts of fragmentation on amphibian populations. We investigated spatial structure and patterns of habitat use amongst a population of endangered Southern Bell Frogs (Litoria raniformis) in a large (700ha) section of the Murrumbidgee floodplain over an eight-month period. Our results identified strong temporal changes in both spatial structure and patterns of habitat use. Ripley's K Function analyses showed that spatial structure of the populations shifted from random prior to breeding ($p<0.005$), to strongly clustered at spatial scales between (0-1500m) during the peak breeding period. The types of habitat occupied by the frogs changed across the study period. Our results suggest that L. raniformis is highly mobile and utilises a variety of different aquatic habitats over time. As the frog interacts with the landscape at relatively large spatial scales this highlights the importance of the role of landscape ecology in conservation planning.

Eligible for student award? **yes** *Presentation mode:* talk

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Towards an improved approach to surveying bird communities

Transect-based surveys have become the standard inventory tool for sampling terrestrial birds, used as the basis for most pure and applied community-level bird research in Australia. While these methods yield comparable data for analysis, there are several important shortcomings which have been largely overlooked. As with other methods which use fixed area samples to standardize data, relatively smaller sites will be more thoroughly sampled. Also, since only those birds within transect boundaries are included, species occurring outside the transect are ignored, leading to conflict when interpreting distribution patterns of species known to be unrepresentative. Finally, and of most concern, the scale of sampling prevents inferences and conclusions from being framed in terms of the overall habitat patch--typically the most relevant biological and management scale. I propose a new approach for surveying birds--rather than constituting a new set of methods, it entails a new way of applying existing methods. By using results-based stopping rules, rather than the more conventional effort-based methods, samples of fixed (and known) completeness are obtained. And by surveying throughout the study sites, resultant data are collected at the patch-scale, allowing conclusions and recommendations to be more relevant and biologically meaningful. This sampling approach can also generate accurate incidence data, yielding robust estimates of relative abundance to complement presence/absence data. Using data from fragmented habitats in eastern Australia, I compare this new approach with more conventional transect and time-limited searches, highlighting the improved accuracy and resolution obtained.

Eligible for student award? **no** *Presentation mode:* talk

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The impact of fire frequency on the abundance and habitat preferences of small sandstone dwelling mammals: a case study in Kakadu National Park.

A capture-mark-release program (Begg and Dunlop 1981 a,b,c) looking at four native sandstone dwelling mammals (the Northern Quoll (Dasyurus hallucatus), the Sandstone Antechinus (Pseudantechinus bilarni), the Common Rock-Rat (Zyzomys argurus) and the Arnhem Rock-Rat (Zyzomys maini)) at Nawurlandja in Kakadu National Park found that all species except the Northern Quoll showed a decrease in the number of animals known to be alive after the application of a fire to the study area. In addition all species showed a shift in their preferred habitat, moving from closed forest and rocky slope habitats to scree slope. We re-sampled mammals in this area in April and July 2002 as part of a larger project aimed at assessing hte current status of small mammals in Kakadu National Park. The re-sampling showed that the trapping success rate for Northern Quoll, Sandstone Antechinus and the Arnhem Rock Rat have declined since the original study. The most dramatic declines were recorded for the Northern Quoll and Arnhem Rock Rat, with the latter species not being recorded at all during the 2002 re-sampling. In contrast, trap success rate for the Common Rock Rat increased dramatically. In contrast to the original study we found that the closed forest habitat supported the lowest diversity and abundance of small mammals. We used 21 years of fire history data to investigate the possible relationship between the observed changes in mammal populations and habitat preference with fire frequency in the four habitat types at Nawurlandja. This study follows that of Woinarski et al. (2001) which suggested at least local declines in the lowland woodlands of Kakadu National Park, this study is the first main consideration of the fate of the mammal fauna of the sandstone uplands. The results of this study could provide important information for the future management of fire and the conservation of the small mammal fauna inhabiting the sandstone habitats of Kakadu National Park.

Eligible for student award? **yes** *Presentation mode:* talk

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Is invasion of a non-native species dependent on community type? -Establishment of Cytisus scoparius in subalpine vegetation

Plant invasions represent a major threat to natural communities. However, not all communities appear to be equally invasible and the mechanisms that contribute to invasion are still strongly debated. Predicting which communities are more susceptible to invasive species could provide vital insights for their conservation management. This study focused on the recent (25yrs) invasion of subalpine vegetation by the exotic legume Cytisus scoparius. The establishment of C.scoparius is associated with a dramatic decline in species richness, and a change in ecosystem function. Mapping of C.scoparius distribution has found that certain community types appear to be more susceptible to invasion than others. Thus, this study addressed the question of what are the mechanisms driving invasion in the subalpine vegetation. Four community types were considered: (1) Celmisia herb field, (2) Poa grassland, (3) Podolobium alpestrae heathland and (4) Hovea montanus heathland. Within each community, C.scoparius transplants and seeds were placed in disturbed and undisturbed areas to examine the role of recipient community properties (biomass, cover, soils) and disturbance. Establishment of Cytisus was strongly influenced by community type, but this was independent of disturbance. The mechanisms involved are thought to be a combination of abiotic and biotic influences that will be further discussed.

Eligible for student award? **yes** *Presentation mode:* talk

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Healing Country: integrating indigenous knowledge and western management methodologies in the Wet Tropic Bioregion.

abstract being revised

Eligible for student award? **no** *Presentation mode:* talk

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Evaluating weed threats to the wet tropics bioregion using ecological attributes

There are diverse approaches to evaluating the invasive potential of alien plant species, including those used in a recent risk assessment of environmental weeds that are invading rainforests and other communities of the wet tropics bioregion. History as a weed elsewhere, occupation of a broad geographic distribution within the native range and being closely related to other known weeds are commonly used and reasonably effective predictors of weedy behaviour. However, not all plants that become naturalised and invasive have a history of weediness, and rarity is no barrier to becoming invasive outside a plant's native range. Therefore, other "predictors" are needed to facilitate and supplement assessment of weed potential. In this paper we endeavour to identify characteristics and patterns that are most useful in predicting weedy behaviour by evaluation of the ecological attributes of 57 species naturalised in the wet tropics bioregion and additional species drawn from the Northern Australia Quarantine Strategy alert list of weeds.

Eligible for student award? **no** *Presentation mode:* talk

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Vegetation changes around a new hut in beech (Nothofagus menziesii) forest on the Milford Track, Fiordland, New Zealand

In 1997 Clinton Hut, the first of three public huts on the Milford Track, was built within a clearing created in Nothofagus menziesii forest. The forest is species-poor as it grows on an old, leached river terrace. Nothofagus menziesii is the dominant species with occasional Phyllocladus aspleniifolius var. alpinus and Griselinia littoralis. The understorey is very sparse, comprising shrubs of fewer than five species and the ground cover is >90% mosses and liverworts with some patches of fruticose lichens. Since January of 1998 the changes to the ground cover in the clearing have been recorded along four transects running from the hut into uncleared forest. Within the cleared area around the hut, the bryophyte flora has changed composition over the five year sampling period; forest shrub and tree species have established; and exotic vascular plant species have been removed by hand pulling and spot spraying with glyphosate-based herbicide. The vegetation changes recorded will be discussed in the context of secondary forest succession processes, weed management and visitor impacts: the people who use the Milford Track - tourists and staff - bring weeds to the site on their clothing and gear and, if uncontrolled, the weeds impede forest regeneration.

Eligible for student award? **no** *Presentation mode:* talk

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Fruiting phenology and "keystone" fruit resources in upland Australian tropical rainforests.

Proponents of the "keystone species concept" have suggested that identification of keystones will prove a useful adjunct to attempts to understand ecosystem function and in predicting the consequences of species loss. In tropical rainforests, where as many as 95% of plants produce fleshy-fruited seeds which are consumed by a diverse frugivore fauna, fruit resources appear likely candidates for keystone status. Here we combine data from six phenological studies of upland Wet Tropics rainforests to ask what traits might identify keystone fruit resources and at what taxonomic level keystone resources might be identified? We identified six potential "keystone roles' and used data on diversity, abundance and biomass to identify potential keystones. In total 163 species from 104 genera and 54 families were recorded. Fruiting showed strong and consistent seasonality. Phenology differed markedly between the canopy and ground and between forest types and landscape contexts. While no single species consistently dominated any "keystone role" across all locations and years, a small number of genera and families contributed disproportionately to each "keystone role" at most times and places. Not surprisingly taxon richness contributes to this result. Whether these taxa are keystone or key fruit resources remains a matter of debate.

Eligible for student award? **no** *Presentation mode:* talk

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Plant ecological strategies: some leading dimensions of variation between species

The leaf mass per area - leaf lifespan (LMA-LL) dimension expresses slow turnover of plant parts (at high LMA and long LL), long nutrient residence times and slow response to favorable growth conditions. The seed mass-seed output (SM-SO) dimension is an important predictor of dispersal to establishment opportunities (seed output), and of establishment success in face of hazards (seed mass). The leaf size-twig size (LS-TS) spectrum has obvious consequences for the texture of canopies, but the costs and benefits of large vs small leaf and twig size remain poorly understood. The height dimension has universally been seen as ecologically important and included in ecological strategy schemes. Nevertheless, height includes several different tradeoffs and adaptive elements, which ideally should be treated separately.

Eligible for student award? **no** *Presentation mode:* talk

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Bridging the gap: the use of canopy bridges by rainforest wildlife.

In 1995, Rupert Russell of the Queensland EPA built an inexpensive aerial connection across a rainforest road near Cairns. He did this in response to studies showing that habitat fragmentation caused by roads in the wet tropics was isolating animal populations and impeding genetic interchange. Tree-dwelling species, so the story went, appeared to be particularly susceptible. Further, it was thought that canopy connections were probably crucial for some species. The ‘canopy bridge’ was subsequently promoted by the Main Roads Department, among others, as a means of encouraging safe fauna movement across road corridors in the wet tropics region. However, it was noted that the effectiveness of these had not been determined. Thus, it was recommended that trials of canopy bridges be conducted. Using methods including spotlighting, scat collection and analysis and infrared-triggered photography, it was found that several arboreal and scansorial species were using the existing bridge successfully. Subsequent trials that varied site selection and design were undertaken with similar results. The conservation of some arboreal species would benefit from canopy bridges becoming a standard feature of road design, especially in upland areas of the wet tropics region where canopy connections do not occur naturally.

Eligible for student award? **yes** *Presentation mode:* talk

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Patterns of local endemism of rain forest trees and putative refugial areas in the Wet Tropics of north east Queensland.

The Wet Tropics region of north east Queensland is well known for its high levels of species richness and species endemism. Of the nearly 1000 species of rain forest trees in the region, nearly 40% are regional endemics. Approximately one third of these regional endemics have a very narrow distribution; these are local endemics (narrow-range endemics), restricted to one or two small areas within the Wet Tropics. These local endemic species exhibit a wide range of distribution patterns. However, nearly 75% of these local endemic taxa occur within three areas in the Wet Tropics - the Cape Tribulation area; the Carbine Tableland; and the Bartle Frere - Bellenden Ker area. Rain forest Lauraceae comprise 83 taxa in the Wet Tropics, nearly 10% of the rain forest tree flora. Of these, 43 taxa are regional endemics, and 13 are local endemics. They are thus broadly representative of the rain forest tree flora. The patterns of variation within selected species of Lauraceae have been studied, to determine the extent to which the geographic patterns of variation correlate with the putative refugial areas.

Eligible for student award? **no** *Presentation mode:* talk

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A tonne per hectare per year perhaps: Fire and the carbon sequestration potential of savannas in north-western Australia

Tropical savannas cover a quarter of Australia. Much of the savanna biome in north-western Australia is relatively intact structurally, hence it represents a potential carbon sink. However, these savannas are subject to frequent, extensive fire, especially the wetter savannas. Fire regime is likely to affect the productivity and sequestration potential of savannas, via effects on both biomass and emissions. Savanna sequestration potential is estimated by quantifying carbon storage in biomass and soil pools, plus the net fluxes to these pools, plus carbon losses via disturbance, namely fire. We present data describing the magnitude and distribution of these carbon pools for mesic and semi-arid savannas of the NT. Previous work in mesic savanna demonstrated a significant carbon sink, although impacts of fire were not well accounted for. These estimates of sink strength are combined with remotely-sensed estimates of area burnt and associated emissions, to quantify the impact of fire on the long-term savanna sequestration potential, the Net Biome Productivity (NBP). Preliminary data indicate that these savannas are a net carbon sink (about 1 t/ha/yr) even when burnt, but reducing fire frequency is likely to increase the sink size. Uncertainties surrounding these estimates, and implications for land management, are discussed.

Eligible for student award? **no** *Presentation mode:* talk

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Determinants of plant population persistence in urban vs rural grasslands in southern, Victoria.

The persistence of many native temperate grassland plant species now depends on relict populations confined to small, isolated remnants in urban and rural landscapes. The objective of this study was to determine if there were differences between the persistence of plants in small patches of native grassland in urban vs rural landscapes. In 2001, we re-surveyed 31 Themeda triandra grassland remnants that had under gone comprehensive botanical survey between 1979 and 1990. We examined landscape setting, patch properties and plant attributes as possible contributing factors to the persistence of species. A total of 165 of the 843 plant populations (20%) were not relocated. Rural patches lost significantly fewer populations than urban patches and in general were burned on a more regular basis then the urban sites. No other patch property significantly predicted local extinction rate. Leaf position/orientation was the only plant attribute that predicted local population extinction of individual species. The results suggest that local extinction of plants is occurring faster in urban patches despite remnants having remained largely intact since their initial botanical survey. Many plant species are suspected to be going locally extinct due to short-term demographic causes, largely as a consequence of site degradation due to lack of regular burning.

Eligible for student award? **yes** *Presentation mode:* talk

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The future of biodiversity in the rainforests of the Australian Wet Tropics

We have come a long way towards understanding biodiversity in the Wet Tropics over recent years. We now have huge databases detailing the spatial distributions of vertebrates, invertebrates and plants. We have over 220 000 records of vertebrates based on data compilation and systematic surveys. Standardised surveys have been conducted at over 600 sites to estimate abundance patterns and assemblage structure. I will present a summary of this biodiversity research examining the patterns and processes determining and maintaining vertebrate biodiversity. I will examine rare species in more detail and the interactions between species ecology, landscape processes and historical biogeography that affect these rare species. These interactions determine the spatial patterns of abundance, specialisation and species richness and have many implications for the management and conservation of rare species. Lastly, I will demonstrate how, even in a well-protected system like the Wet Tropics World Heritage area, we cannot become complacent. Using our knowledge on current spatial patterns of biodiversity we can predict the impacts of global climate change. These impacts are likely to be catastrophic and wide-ranging across the region and across taxa. Conserving the biodiversity values of the region will be a challenging and vitally important task both for conservation and the economic future of the region.

Eligible for student award? **no** *Presentation mode:* talk

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DETERMINANTS OF RARITY IN MICROHYLID FROGS

Rare species are prone to extinction and therefore represent a management prioity. In order to better understand the determinants of rarity this study investigates the detailed ecology of microhylid frogs, a group that vary widely in their degrees of rarity. There are thirteen species of microhylid frog endemic to the Wet Tropics of North Queensland. While some of these species occur across most of the region, a number of species are restricted to single mountain ranges. This project investigates the ecological reasons behind the varying levels of rarity exhibited by these species by comparing the ecological characteristics of restricted and wide-spread species. I will compare the realised versus potential distributions, diet, reproductive biology and abundance patterns of rare and common species. Preliminary results suggest that: 1. there is no relationship between geographic rarity and local abundance; 2. there is no relationship between geographic rarity and body size; 3. reproductive biology appears to be similar in common and rare species; and 4. rare species appear to have a more generalised diet than widespread species.

Eligible for student award? **yes** *Presentation mode:* talk

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The impact of Phytophthora cinnamomi on small mammal communities in south eastern Australia.

The plant pathogen Phytophthora cinnamomi (cinnamon fungus) has major effects on vegetation floristics and structure in sclerophyll vegetation in Australia. Effects include loss of plant species, decline in vegetation cover, increases in bare ground and the abundance of resistant plant species. Such changes would be predicted to have effects on faunal communities inhabiting infected habitats. Analyses in heathlands and woodlands identified P. cinnamomi infection as being associated with low species richness, and low abundance of small mammals. Studies of Antechinus stuartii (Brown Antechinus) in woodlands found lower capture rates in infected areas, and alterations to habitat utilisation. The major contributing factor was changes to vegetation structure, rather than food availability. In heathlands, 13 plant species were significantly less abundant in diseased areas, and the cover of Xanthorrhoea australis and shrub species were significantly less. The density of understorey vegetation was significantly less between 0 and 0.6 m in diseased vegetation. Species such as Rattus lutreolus (Swamp Rat), Rattus fuscipes (Bush Rat), Antechinus agilis (Agile Antechinus) and Sminthopsis leucopus (White-footed Dunnart) were found to be less abundant in diseased areas, or utilised them less frequently.

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ECONOMIC VALUE OF SEABIRDS FOR ECOTOURISM IN AUSTRALIA – SOME LESSONS FROM THE CASE OF LITTLE PENGUINS

Australia being surrounded by sea and with thousands of islands and coral cays is home to a large number of species of seabirds, both resident and migrant. In some islands and cays they also breed in their tens of thousands. Some of the species found are rare and confined to Australia or the Australasian region. Apart from this, seabirds are also found in large numbers/colonies in the Australian sub-Antarctic islands, in addition to the large seabird colonies in the Australian controlled parts of Antarctica. This affords potential scope for the development of a seabird-based ecotourism industry or an industry complemented with other wildlife-based ecotourism ventures for the specialist or the generalist birdwatchers. At present, there is ecotourism based on seabirds, but the scale of operations remain very small relative to the opportunities/resources available. In this paper we outline broadly the current seabird-based ecotourism activities in Australia drawing comparisons from New Zealand. Some potential areas for sea bird-based tourism sites will be cited. The paper will discuss the economic value of a seabird-based ecotourism industry based on a case study conducted on Little Penguins on Phillip Island. The potential educational and conservation benefits, as well as the negative aspects of such tourism are explored.

Eligible for student award? **no** *Presentation mode:* talk

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Estimating and incorporating observation error rates in species-habitat analyses.

A species may be observed as absent at a site because the species is permanently absent from a site, momentarily absent, or present but un-detected. For many applications in ecology including species-habitat analyses, population monitoring and impact assessment, the latter two cases may be considered a 'false-negative observation', because the observation of absence is often used to falsely imply that the site is unused by the species. New data measuring the magnitude of false-negative observation error in standard surveys of arboreal marsupials and large forest owls will be presented. Data were collected in the Eden region of southern NSW. The effect of observation error on inference about species-habitat relationships is demonstrated with a simple case-study analysis of Greater Glider habitat preferences based on logistic regression. Unbiased methods for estimating observation error rates and true site occupancy rates are presented, along with a simple Bayesian method for deriving biased-adjusted estimates habitat model coefficients. The implications of ignoring observation error in management decisions will be briefly discussed.

Eligible for student award? **yes** *Presentation mode:* talk

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Have Australian species evolved characteristics that make them more flammable? An example using a grasstree that retains dead leaves.

Robert Mutch suggested in 1970 that species in fire-prone habitats have evolved traits that make them more flammable. In this regard, we wondered if the ‘skirt’ of dead leaves retained around the trunk of the grasstree, Xanthorrhoea preissii, in southwestern Australia might increase its fitness in the presence of recurrent fire. This grasstree is well adapted to survive fire, with temperatures around its apical meristem rarely exceeding 40°C during fire, compared with temperatures of up to 1020°C in the dead leaves. Flammability of the dead leaves is maximized by their retention in a downward direction, their dryness, and low nutrient content (efficient withdrawal before death, strong leaching). Furthermore, the longer the time span between fires, the greater its fuel load and combustibility. Other related traits suggest a beneficial relationship with fire: fire-stimulation of flowering and leaf production, and decrease in the health of long-unburnt grasstrees. An alternative hypothesis that leaf retention ensures maximum release of nutrients after fire is not supported. We doubt that there is an easy way to show that the enhanced flammability of this grasstree is to the detriment of its neighbours.

Eligible for student award? **yes** *Presentation mode:* talk

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Temperature and Chytridiomycosis in Rainforest Frogs

Environmental conditions such as temperature may strongly influence the course of an emerging fungal disease of amphibians, chytridiomycosis. We examined differential leukocyte counts, behaviour, and survival rates in four thermal regimes of orange-eyed treefrogs, Litoria chloris, with and without infections of amphibian chytrid, Batrachochytrium dendrobatidis. The treatments were: constant (20°C), fluctuating (13.5-23.2°C), 8°C thermal shock, and 37°C thermal shock. Infected frogs showed higher basophilic granulocyte counts and lower neutrophilic and eosinophilic granulocyte counts than uninfected control frogs. Behaviour varied with temperature, but not infection status. We found that the thermal environment affects the progress of the disease, and that housing frogs at an environmental temperature of 37°C for less than 16 hours can clear frogs of the pathogen. Elevated body temperatures similar to those experienced in behavioral fever and during normal thermoregulation can clear frogs of chytrid infection; therefore, variation in thermoregulatory opportunities and behaviors are likely to contribute to the differences in disease incidence observed among host species, populations, and regions. Appropriately applied thermal shocks may prove to be a safe and effective way of eliminating the fungal pathogen from captive amphibian populations and preventing accidental spread of the pathogen when animals are translocated or released from captivity.

Eligible for student award? **yes** *Presentation mode:* talk

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Marine pest monitoring - a risk based approach

The Ministry of Fisheries (MFish) has established a national monitoring programme to detect marine pest arrivals to New Zealand. The programme consists of two elements; port surveys and targeted surveillance. We have commissioned baseline surveys of our major ports to establish our current pest status. Future monitoring of the ports will be able to detect new introductions of non-indigenous marine species and measure the effectiveness of border controls. We used a risk-based approach to select ports for the monitoring programme, assessing factors including volume of ballast water discharged and number of vessel arrivals. MFish is also implementing regular surveillance for marine pests to enable rapid response to incursions. The surveillance is targeted at a small number of identified high-risk species. The initial focus is on eight harbours that have been identified as high-risk based on their past history of invasion, current international shipping movements, the variety of habitats available, and restricted exchange of water with oceanic environments. A wider surveillance network involving marine industries, local government and the public provides additional monitoring in a broad range of areas.

Eligible for student award? **no** *Presentation mode:* talk

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Patterns and levels of endemism in the Australian Wet Tropics rainforest: Concordant Signals from Vertebrates and Flightless Insects

We compared the level and pattern of endemism among 274 selected flightless, rainforest insects and all the 259 vertebrates found in the Wet Tropics region of Australia. Endemism is measured at two nested scales: (1) those confined to the Wet Tropics, termed "regional endemics", and (2) the subset of those species confined to a single subregion of the Wet Tropics, termed "subregional endemics". 70 vertebrate species are regional endemics and all 274 insect species we examine here are regional endemics. 50% of the regional endemic flightless insects are also subregional endemics compared with 15% of the known subregional endemic vertebrates. We will discuss the implications of spatial scale on the differences between vertebrate and insect endemism. The four subregions with the most endemic flightless insect species are the Uplands of Mt Finnigan, Carbine, Bellenden-Ker/Bartle Frere and Atherton. The 9 subregionally endemic vertebrates are found in Uplands of Thornton, Carbine, Bellenden-Ker/Bartle Frere and Mt Elliot. Multiple regression suggests that the combination of rainforest area and shape explain the most variance in the numbers of species of regional endemic insects (r2 = .603) and vertebrates (r2 = .850). We discuss these results in the context of the history of the Wet Tropics.

Eligible for student award? **no** *Presentation mode:* talk

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Land use change in the Darling Downs 1975-2001: mapping habitat fragmentation

We report preliminary findings from a multidisciplinary project that examines patterns of land use change over 26 years for a 1000km2 area in the Darling Downs region of Queensland. The project has assembled a GIS of land uses derived from the digital classification of Landsat imagery from 1975 to 2001 in approximately 5 yearly intervals. A range of complimentary data layers, including regional ecosystems, soils, road and water infrastructure support subsequent analyses. We first report on patterns of change for 5 key land use classes (native vegetation, pasture/grasslands, water, agricultural crops, urban settlements) and then focus on remnant vegetation. About 38,696 ha of native vegetation comprising 15 regional ecosystems was present in 1975 and this declined to 13,650 ha and 13 ecosystems in 2001. In 1975 there were approximately 1763 identifiable remnants with a mean size of 22 ha. By 2001 this had reduced to 1577 remnants with a mean size of 9 ha. Although only 10% of the 1975 remnants have been lost entirely, mean remnant size has been reduced by 60% over 25 years and two regional ecosystems are no longer represented. The value of landscape-scale temporal studies to assess biodiversity conservation in agricultural landscapes is discussed.

Eligible for student award? **no** *Presentation mode:* talk

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Aboriginal Wildlife Ecology and Wildlife Management in Australia

This paper provides a research review of Indigenous wildlife ecology in Australia. Indigenous wildlife knowledge includes names, taxonomy, ecology and behaviour of fauna species and also spiritual or totemic relationships with wildlife (eg. taboos on hunting or eating totemic animals; wildlife refuge areas). Indigenous relationships with wildlife include traditional knowledge, use and maintenance of fauna species and also contemporary involvement in Australian wildlife research and management (eg. fauna surveys, threatened species, feral animals, and wildlife reintroduction programs), mainly on Indigenous lands (eg. Arnhem Land, Cape York, Central Australia). This paper presents a detailed bibliography of wildlife research on Indigenous lands and other research on Indigenous wildlife ecology, use and management in Australia. Indigenous rights to hunt, gather and maintain wildlife resources are still an integral part of "caring for country." This involves Indigenous groups maintaining wildlife and landscapes (eg. fire ecology) according to traditional laws, ritual obligations and customary land management practices. Contemporary Indigenous relationships with native Australian wildlife or introduced wildlife species also include new scientific, recreational or commercial dimensions. Aboriginal wildlife ecology thus integrates both cultural and scientific perspectives of wildlife for effective wildlife management.

Eligible for student award? **no** *Presentation mode:* talk

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Assessing the potential impact of dryland salinity on threatened species in New South Wales using GIS

Dryland salinity poses a serious threat to biodiversity in Australia. Identification and quantification of the potential impact it will have on endangered and vulnerable plant and animal species is critical if further losses to native biodiversity are to be minimised. We examined the threat dryland salinity poses to the large number of threatened species in New South Wales through the use of digital map overlays in a geographic information system (GIS). We identified and prioritised IBRA regions and catchments containing species with a proportion of their distribution records overlapping areas of dryland salinity. We also identified a priority list of threatened plant and animal species due to their comparatively high level of exposure to dryland salinity (more than half of their known distribution occurs in areas of salinity). Our findings demonstrate that the percentage of land covered by dryland salinity, or the total richness of threatened species in regions and catchments, can not be used on their own as surrogates for prioritising conservation of geographical regions of NSW with respect to threatened species and the impact of dryland salinity.

Eligible for student award? **yes** *Presentation mode:* talk