Quantitative and Applied Ecology Group
Masters & Honours projects for prospective students
www.qaeco.com

Bogong moth monitoring
Professor Brendan Wintle – brendanw@unimelb.edu.au
Recent reports of Bogong moth migration failure have caused major concerns among managers, ecologists and the general public not least because of the important role the moth plays in the diet of the critically endangered mountain pygmy possum. It is also a culturally important species to Indigenous communities throughout the region. This project will help clarify the population status of the moth and its role in possum breeding success, enabling more targeted emergency management strategies of species dependent on the moth in years of moth migration failure.

This project seeks to establish a robust Bogong moth monitoring strategy that will provide accurate estimates of the annual variation in biomass available to possums. The student will test moth survey and population estimation methods in the Victorian Alps. This will help clarify the role of the moth in possum breeding success, enabling more targeted emergency management strategies of species dependent on the moth in years of moth migration failure. The project will require some field work to trial moth monitoring methods at possum breeding sites and other locations in alpine areas.

Cost-effectiveness of restoration for threatened Buloke Woodlands in the Victorian mallee
Dr David Duncan, with Dr Libby Rumpff, and Dr Peter Vesk

The endangered buloke woodlands in Victoria's mallee national parks were withdrawn from livestock grazing use many decades ago but are still stuck in a regeneration crisis, with scant evidence of positive change over the past 50 + years! The main limitation is thought to be the combined herbivore pressure from rabbits, goats and kangaroos, which appears to limit seedling growth and survival even at low densities of animals. This project will use modelling and new field data to explore the tradeoff between cost of restoration (principally fencing to exclude herbivores) and survival and growth rates (lower where herbivore pressure is lower), looking for cost-effective strategies to achieve large-scale restoration of this endangered plant community in the shortest possible time frame.

Predicting tree species responses to environment with traits
Supervisors Dr Peter Vesk with Dr Daniel Falster, Dr Martin De Kauwe (UNSW)
Newly developed Trait-Environment Species Distribution Models (Pollock et al 2012 [1]) enable the sharing of understanding about how species respond to environments. This opens the door to predicting where species occur from their traits and environmental data alone. It also enables predictions about the suitability of a particular site for species from their traits, or their susceptibility to risks like drought mortality (Anderegg et al 2016 [2]). Associated with a newly funded 3 year project we have exciting opportunities for students, here are two possibilities:

Project one: Drought mortality of forest and woodland trees is occurring and is expected to increase as the climate changes further. But it occurs in some particular places and in some species more than others. Being able to predict which species, where, are at greater risk of drought mortality is important to the Victorian Government DELWP for planning and management of woodlands and forests. This project will involve field work in central and northern Victoria to sample trees, measure traits, and statistical modelling to make predictions of occurrence and susceptibility.

Project two: Our confidence to predict tree responses depends on having a better dataset of species traits and doing comparisons from one region to another. Here you will collect data on eucalypt species traits in the field, and fit statistical models and evaluating their predictions. We have a particular interest in East Gippsland and SE forests of NSW.

The influence of size on detectability
Professor Mick McCarthy mamcca@unimelb.edu.au
Imperfect detection of species is important when surveying species, estimating vital rates and understanding distributions. The rate of imperfect detection of species is likely to vary with traits of the target organism, traits of the searcher, aspects of the environment, and interactions between these. This project will develop and evaluate mathematical models of how target size (and potentially other aspects of the target) influences detectability. The project can either emphasise the development or evaluation of these models depending on the interests of the student. The student will learn how to conceptualise, develop and analyse ecological models.

Modelling relationships between pyrodiversity and biodiversity
Professor Mick McCarthy mamcca@unimelb.edu.au
While thought experiments suggest that greater variation in fire regimes (increased prodiversity) will increase biodiversity (Martin and Sapsis 1992), recent field tests of this concept have shown that pyrodiversity will not always increase biodiversity. This varied relationship between pyrodiversity and biodiversity is supported by preliminary modelling of the relationship. Further, modelling effects of pyrodiversity on biodiversity has tended to focus on effects of time since fire on biodiversity patterns, with other aspects of the fire regime yet to be fully considered. This project will develop models that examine how variation in fire regimes influences biodiversity to help explain the complexity of relationships that might exist in field studies. The student will learn how to conceptualise, develop and analyse ecological models.

Manipulating environmental conditions to conserve frogs threatened by chytrid
Dr Matt West, matthew.west@unimelb.edu.au
Recent evidence suggests that manipulating environmental conditions at breeding ponds (e.g., reducing canopy cover, increasing salinity) can enable frog persistence in the presence of chytrid fungus, a pathogen linked to widespread amphibian declines. This project will clarify environmental conditions that restrict chytrid survival and facilitate threatened frog persistence. This will involve laboratory experiments, biophysical modelling, and some field work.
*Other projects are available to help threatened frogs, please contact Matt for further information.

When are mark-recapture studies useful for assessing pathogen impacts on threatened species?
Dr Matt West, matthew.west@unimelb.edu.au
Understanding a pathogens impact on populations is crucial for designing prudent management strategies for species threatened by disease, but is challenging when both the species and the pathogen are difficult to detect. This project seeks optimize population monitoring programs by evaluating conditions (like imperfect detection) that influence the power of mark-recapture models to distinguish impacts of a pathogen (like chytrid fungus) on species. Whilst this project mainly involves modelling opportunities exist to contribute to and improve the design of actual threatened frog population monitoring programs.
*Other projects are available to help threatened frogs, please contact Matt for further information.