

## Potential projects in the Arid Ecology Lab

My research focuses on developing an understanding of the inter-relationships between soils, animals and plants in arid and semi-arid rangelands. My interests are varied, ranging from more practical issues such as woodland management and rangeland monitoring, to the engineering effects of animals in deserts. Below are some examples of current projects. If you would like to discuss a potential honours project, email ([d.eldridge@unsw.edu.au](mailto:d.eldridge@unsw.edu.au)) or phone (9385 2194) me to arrange a meeting.

### ***Does encroachment alter foraging by ants ?***

Encroachment of shrubs into grasslands is a global phenomenon. The increase in shrubs alters the spatial distribution of plant communities, altering soil surface characteristics, and may therefore have potential effects on soil-resident invertebrates. Little is known about how the change from grassland to shrubland might affect the foraging activity of ants and therefore the potential for dispersal of plant seeds. This study will examine seed removal rates of ant-dispersed species in shrublands and grasslands by different ant communities in order to enhance our knowledge of potential changes associated with shrub encroachment.

*Location: Yathong Nature Reserve (Cobar)*



### ***Facilitation and competition in the semi-arid woodlands***

Facilitation is an important ecological process whereby woody plants (nurse plants) enhance the growth and survival of their understorey (protégé) species. This study will test the notion that plant richness and productivity change in relation to a gradient out from the trunk of large trees, and that plant functional type explains a large amount of variation in response of protégé species to canopy location under different nurse species.

*Location: Yathong Nature Reserve (Cobar)*



### ***Logs as abiotic nurses***

Much has been written about plant-plant interactions in arid and semi-arid systems, but relatively little is known about how abiotic structures such as logs, rocks and depressions might affect the growth and survival of vascular plants. This study will examine the effects of abiotic structures such as logs on the growth and survival of plants and will combine field-based manipulations with glasshouse studies of plant responses to abiotic structures.

*Location: Scotia Sanctuary, in conjunction with Australian Wildlife Conservancy.*



### ***Animal disturbances and Island Biogeography Theory***

Soil foraging animals are an important driver of heterogeneity in arid and semiarid systems. Disturbances such as foraging pits, rabbit warrens, resting sites of kangaroos and scratchings formed by echidnas are common forms of disturbance. Once stabilised, these disturbances form fertile patches, which accumulate seeds and support a range of annual plants species. This study will test the notion that larger disturbances support a greater diversity of plant species (consistent with expectations under IBT). It will be supported by manipulative experiments whereby disturbances of various size and shape will be constructed and the response of annual plants assessed.

*Location: Yathong Nature Reserve or Buronga*



### ***Effect of thinning in Callitris glaucophylla woodlands***

Dense stands of white cypress pine (*Callitris glaucophylla*) are claimed to suppress the growth of vascular plants by competing for water, nutrients and light. A limited number of studies have assessed the effect of thinning on understory communities. This study will combine measures of soil health (microbial respiration, infiltration, soil surface morphology, litter decomposition) with an assessment of plant dynamics to test the effectiveness of *Callitris* thinning on diversity and function.

*Location: Forbes in conjunction with Forests NSW.*



### ***Recovery of ecosystem function on ripped rabbit warrens***

The European Rabbit (*Oryctolagus cuniculus*) is Australia's number one vertebrate pest. In the past 20 years, land managers in western NSW have spent millions of dollars controlling rabbits. The most effective method is to destroy their warrens, usually by mechanical ripping. This study will test whether rabbit ripping has altered the ability of soils to accept infiltration. It will examine 1) changes in infiltration along a disturbance gradient, 2) the spatial distribution of infiltration among different rabbit warrens, and 3) compare these data with warrens that have not been treated.

*Location: arid and semi-arid NSW*



### **Biological soil crust dynamics in relation to shrub encroachment**

Biological soil crusts dominated by mosses, lichens and cyanobacteria are common components of arid area soils. These crusts protect the soil against erosion, produce carbon and nitrogen, and provide a habitat for soil organisms. Little is known about the distribution of biological soil crusts when grasslands are invaded by shrubs. This study will examine how biological soil crust communities change in relation to increasing shrub density and how this might be affected by grazing.

*Location: Buronga and Mallee Cliffs National Park in conjunction with OEH*



### **Decomposition of litter in a semi-arid woodland: biotic- or abiotic-driven ?**

Breakdown of litter in deserts is thought to be largely due to abiotic processes such as wind and water, given the low rainfall which drives biological processes. We hypothesise that litter deposited on the soil surface will contribute little to soil carbon and nitrogen pools compared with litter trapped below-ground (in animal diggings, under logs etc), which will break down at a faster rate and be incorporated into soil organic pools. A litter bag experiment will be used to track the breakdown of three types of litter in three different microsites (surface, below-ground, below shrubs). The study will determine breakdown of a plant components over time.

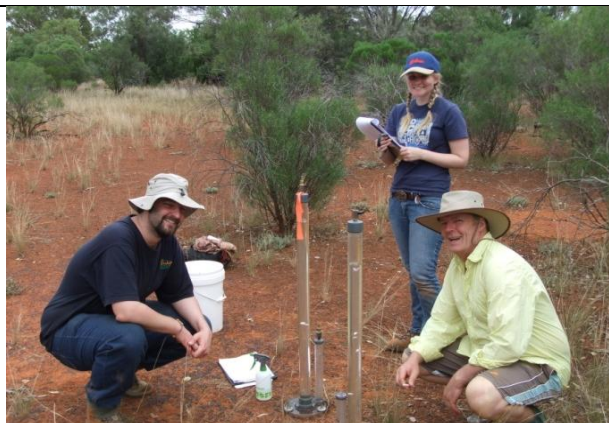
*Location: Yathong Nature Reserve*



### **Effects of shrubs on soil water movement**

Increases in densities of woody shrubs such as *Dodonaea* and *Eremophila* in former grasslands are likely to have substantial ecosystem effects on water flow. Little is known about the direct and indirect effects of shrubs on water flow, and this study will use Structural Equation Modeling to separate these direct and indirect effects of shrubs on water flow and soil respiration. Field work will be supported by laboratory measures of soil respiration.

*Location: Western New South Wales*



***Does overgrazing influence facilitation of plants beneath shrubs?***

The balance of competitive and facilitative processes in semi-arid woodlands can be driven strongly by grazing effects. It is hypothesized that under extreme levels of grazing pressure the facilitative effect of shrubs through anti-herbivore mechanisms far outweighs any competitive effects. This however has been tested in a limited number of environments. This study will use an established shrub density–grazing experiment in south-western NSW, and field-based measures will be supported by glasshouse study of seed emergence from the soil seed bank.

*Location: Buronga and Mallee Cliffs National Park in conjunction with OEH.*

