

ecological research in South Africa. The importance of an integrated approach towards ecological studies in human settlements will be explained using a selection of case studies.

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Arid ecosystems and academia: How competition and facilitation interactions shape community structure and function

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Ecologists are interested in the relationship between organisms and their environment. Availability of resources and how organisms interact in using them therefore falls within the realm of ecology. Organisms interact in a variety of ways and it is these interactions that shape the structure of the communities of other individuals (academics) and species (disciplines) within their realm of influence. There is also a longer-term, evolutionary consequence of these interactions (institutional structure). In this address, I tie together ecology—the study of interactions of living organisms with each other and their environment—with my vision of academia—the collective term for the scientific and cultural community engaged in higher research and education. I draw analogies between two types of environments, namely arid ecosystems, within which much of my research history resides, and the academic environment, within which I have resided for all of my working life. I will focus on two key interactions, seemingly opposite in type, aligned with my research interests—competition, where the interaction is negative (–/–), and facilitation, where it is positive (+/+), and how these shape communities. From a management point of view, it is extremely useful to understand how these interactions shape community structure. If, for example, something changes in the resource environment, such as the occurrence of a drought or an economic recession, it is useful to know how this may alter community structure so that remedial measures such as the removal of herbivores, active restoration, restructuring or bail-out packages can be considered. Similarly, if we wish to understand why the community is structured like it is (for example, why are women so rarely found in higher echelons of academia?), an examination of the forces structuring the community may assist in this understanding.

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Mechanisms of desiccation tolerance in resurrection plants: A review from the molecular to whole plant physiological level

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Desiccation tolerance is common in seeds but rare in the vegetative tissues of most angiosperms. Some 350 species of angiosperm (0.2% of total flora) tolerate desiccation in their vegetative tissues and are termed resurrection plants. Many of these are endemic to Southern Africa. Our research is aimed at gaining an understanding of the mechanisms of desiccation tolerance in general and the similarities and differences among species and between vegetative tissues and seeds. The research is conducted at several levels, from the molecular to the whole plant physiological level. Molecular studies have given insight into some of the genes, proteins and metabolites upregulated during drying and rehydration that may function as protection and/or repair systems. Biochemical studies are used to characterise the nature of protection offered by these molecules and ultrastructural studies to elucidate subcellular location and changes therein during drying and rehydration. This in turn is related to physiological responses from the root to shoot level. In this paper aspects from such studies will be presented for several species and discussed in terms of how these have facilitated our understanding of vegetative desiccation tolerance.

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Allocation of resources for protecting biodiversity

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Faced with substantial environmental treats, managers must decide how to invest the resources they have available. Managers must choose from a set of possible strategies, determine the level of investment in each, and decide where that effort should be located. For example, when surveying for an invasive weed, a manager needs to determine the methods used to search for the weed, where to look and how much effort to expend. This example is one of a number of problems requiring the allocation of resources to environmental management. Here I will present a theory for making such decisions. Using an example of designing surveys for an invasive weed, I show, not surprisingly, that when the aim is to minimize the expected environmental damage of the weed, sites should be surveyed if the probability of presence and the benefits of detection are sufficiently large. Less intuitively, sites receive the most survey effort where the rate of detection is intermediate because while survey effort is wasted at sites with low rates of detection, little effort is required when rates of detection are high. In this example the aim was to minimize the expected cost, ignoring uncertainty in the effectiveness of management. If we consider uncertainty, managers might aim to maximise the probability of achieving an acceptable outcome. This class of problem becomes very similar to determining the optimal allocation of an investment portfolio among financial assets. Just as some investors might be reluctant to rely solely on one financial asset, if the aim of management is to maximise the probability of achieving a modest goal, the optimal strategy is to diversify investment across a set of assets, depending on the

expected benefit, the uncertainty in the benefit, and the attitude to risk. I illustrate this class of problem with investment among the world's biodiversity hotspots to protect endemic plants, and conservation of urban grasslands within Melbourne.

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Paper Abstracts

Antioxidant and anti-inflammatory activities and phenolic content of *Podocarpus sensu latissimo* (s.l.) used in traditional medicine in South Africa

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Extracts of four species of *Podocarpus* s.l. (*P. elongatus*, *P. falcatus*, *P. henkelii* and *P. latifolius*) were evaluated for their antioxidant activity (AA) by measuring the ferric-reducing power (FRAP), inhibition of lipid peroxidation using the linoleic acid system and 2,2'-diphenyl-1-picrylhydrazyl radical (DPPH) scavenging activity. The anti-inflammatory activity was assessed using enzyme-based cyclooxygenase assays; COX-1 and COX-2. Total phenolic compounds including condensed tannins, gallotannins and flavonoids were quantitatively determined using spectrophotometric methods. The extracts showed a concentration-dependent antioxidant activity. Stems of *P. latifolius* exhibited the lowest IC₅₀ (11.2 µg/ml) inhibition of DPPH. The percentage antioxidant (% ANT) based on the bleaching rate of β-carotene ranged from 96.1 to 99.4%. In FRAP, the extracts showed ability to reduce Fe³⁺ by increasing absorbance at 600 nm. At a concentration of 0.6 mg/ml of plant extracts the absorbance ranged from 1.668 to 1.938. All extracts inhibited COX-1 and COX-2 prostaglandin biosynthesis at a concentration greater than 60%. Stem extracts of *P. falcatus* and *P. latifolius* exhibited the highest percentage inhibition (102.43% for COX-1; 96.52% and 97.59% for COX-2 respectively). The lowest IC₅₀ value was exhibited by stem extracts of *P. elongatus* (5.05 µg/ml for COX-1 and 6.06 µg/ml for COX-2). The total phenolic content based on gallic acid equivalents (GAE) confirmed the presence of total soluble phenolics ranging from 2.38 to 6.94 mg of GAE/g dry sample. There was no significant correlation between the antioxidant activities exhibited and total phenolic content ($r^2 \leq 0.1$). Hence, besides the composition of phenolics other factors may contribute to the antioxidant activity of plant extracts. The significant anti-inflammatory activities observed could be due to the presence of antioxidant activities. A number of biflavonoids with anti-inflammatory activities have been isolated from other species of *Podocarpus* s.l.

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Preliminary studies on the *in vitro* pharmacology of *Leucosidea sericea*

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Leucosidea sericea Eckl. & Zeyh. is a member of the family Rosaceae and the only species in the genus *Leucosidea*. It is an evergreen tree and native to the Afromontane regions of southern African countries such as South Africa, Swaziland and Lesotho. Pharmacological investigation and information on the species is limited. The shoot of the plant is used as a vermifuge, an astringent and in the treatment of ophthalmia by various African tribes. Organic solvent and water extracts of *L. sericea* leaves and stems were investigated for antimicrobial, anthelmintic and cyclooxygenase enzyme inhibitory activities. The organic extracts of the leaves and stems exhibited broad spectrum antibacterial activity. The most noteworthy minimum inhibitory concentration (MIC) of 25 µg/ml was displayed by petroleum ether (PE) and dichloromethane (DCM) leaf extracts against *Bacillus subtilis* and *Staphylococcus aureus*, respectively. The antifungal test organism *Candida albicans* was less sensitive to the extracts with 1.56 mg/ml being the best MIC value obtained. In the anthelmintic bioassay, the best minimum lethal concentration (MLC) values of 8.33 mg/ml and 0.26 mg/ml against *Caenorhabditis elegans* were obtained for the water and organic extracts, respectively. Both leaf and stem organic solvent extracts exhibited a high level of inhibition against COX-1 and -2 enzymes at a maximum concentration of 250 µg/ml. The extracts were further tested at three lower concentrations to observe their dose responses and the lowest IC₅₀ values of 0.06 µg/ml (COX-1) and 12.66 µg/ml (COX-2) were exhibited by the PE leaf extracts. Generally, the leaves exhibited better pharmacological activities than the stems. In view of the promising pharmacological activities displayed by *L. sericea* especially the leaves, we are currently investigating the safety and isolating the bioactive compound(s) as well as the phytochemistry of the plant in our laboratories.

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Towards assessing post-flood vegetation change along a section of the Sabie River, Kruger National Park

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Riparian vegetation along the Sabie River in the Kruger National Park (KNP) went through considerable structural and floristic changes in response to the 2000 flood. Open niches