

comprised of three components: a conceptual framework that depicts how landscapes work as systems, based on the processes that affect the availability of vital resources in space and time, a field procedure collects data about soil surface processes and an interpretational framework facilitates informed management decisions about landscape management. Problem isolation and rehabilitation of degraded lands is a specific application, so that causes, rather than merely symptoms are addressed. Self-sustainability, resilience and critical thresholds in landscapes are concepts that are explicitly and directly addressed. The procedure has been implemented in rangelands, farmlands, mined lands and nature conservation lands. Unlike most concepts and procedures, LFA does not address specific biota as such, nor deal with abstract metaphors. A wide range of community groups are able to take advantage of the procedure, which is also called "reading the landscape".

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LEAP Year 2008: LEA proteins come of age

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The name LEA protein, a contraction of late embryogenesis abundant protein, began to be used in print ~21 years ago, although the genes and proteins in question had been discovered five years or so before that. It therefore seems timely to review what we know of LEA protein function so far, and to look ahead to the remaining research questions in the field. Early attempts to understand the role of these proteins met with some frustration, but expression patterns and transgenic studies were commensurate with a function in cold tolerance and water stress tolerance in many plant species, and in acquisition of desiccation tolerance in developing seeds. Three major groups of LEA proteins have been described and homologues of group 1 and 3 proteins have been found outside the plant kingdom, among bacteria and invertebrates. In recent years, a growing number of *in vitro* studies have highlighted potential functions for LEA proteins as protein and membrane stabilisers, antioxidants, ion sinks and hydration buffers. To some extent, these various functions are distributed between different LEA protein groups, but a few examples suggest a degree of multifunctionality. More recently, we have shown *in vivo* function of a group 3 protein expressed in mammalian cells where it ameliorates formation of inclusion bodies by aggregation-prone proteins such as those associated with neurodegenerative disorders in humans. Further experiments of this kind should provide insight into the function of LEA proteins in the living cell and therefore deepen our understanding of stress tolerance and seed development.

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Fire management in South Africa's conservation areas: Why bother?

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Many of South Africa's vegetation types are fire-prone and fire-adapted. The vegetation evolved under a particular fire regime, but this may be changing as landscapes become fragmented, as human ignition sources become more dominant, as fire suppression becomes more effective, and as climate change happens. This talk will address three questions: (1) Is there evidence that fire regimes are changing?; (2) If they are, does it matter?; and (3) If it matters, what can we do about it? Evidence will be drawn from areas with good fire records, including many conservation areas in the fynbos and savanna biomes. Evidence from the fynbos biome suggests that short-interval (<6 years) fires are becoming more common, and that mean fire return periods, measured on a decade-by-decade basis, have decreased from ~30 to 13 years in some areas. Modern fynbos fire regimes are

dominated by unplanned wildfires, which account for >90% of area burnt. The increase in short-interval burning was associated with increased human populations, and therefore ignitions. More remote areas tend to have less short-interval fires. These trends, if they continue, could have detrimental effects on many dominant plant species, and they could exacerbate the problem of invasive alien plants. In the Kruger National Park (a savanna ecosystem), the current fire management approach combines point ignitions with unplanned and lightning fires. Under this system, wildfires account for >50% of area burnt. The approach is based on the untested assumption that a diverse fire regime will promote biodiversity. This assumption needs to be critically assessed. Early fire regimes in the Kruger National Park would almost certainly have been driven predominantly by lightning ignitions, which would have occurred late in the dry season. Historic human population levels would have been much lower, and lightning-ignited fires probably dominated. The new approach seeks to spread fires across the dry season. Such shifts in fire season (from late season, relatively low intensity fires to more intense, dry season fires) may exacerbate tree mortality in combination with elephants, which do considerable damage to woody vegetation, and increase the mortality of trees following fires. Human ignition pressures therefore appear to be dominating modern fire regimes. Evidence suggests that climate conditions combined with modern ignition pressures prevent effective management of fire regimes in our important conservation areas, and unplanned wildfires will continue to dominate. The potentially serious consequences of this will require a more pragmatic approach to fire management, in which these realities are recognised, and which will focus our limited resources on areas where key impacts can be avoided.

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Papers

Approaches to improve seed production of *Jatropha curcas* L.

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Jatropha curcas L. (Euphorbiaceae) potentially can become one of the world's key energy crops. The seeds can produce crude vegetable oil that can be refined into high quality biodiesel. Low numbers of female flowers, limited branching and inadequate pollination are the major factors that limit seed production and thus oil yield of *J. curcas*. To understand the breeding system of *J. curcas*, bagged vs. open and self vs. cross pollination were studied. Fruits from open-pollinated flowers were significantly more numerous, larger and heavier than those produced from autogamous self-pollinated flowers. Cross-pollinated flowers had significantly higher fruit set than self-pollinated flowers. However, supplemental cross- and self-pollination did not significantly increase fruit set. Flowers exposed to single and multi visits by honeybees set significantly more fruits than those which received no visits, indicating that honeybees are effective pollinators. Benzyladenine and hand-pruning produced significantly more branches than the control and other treatments (TIBA, Dikegulac and MH) after 90 days. Dikegulac, BA and TIBA treatments significantly increased shoot length. These results suggest that fruit production in *J. curcas* can be boosted by manipulating biological processes of pollination and growth.

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Antibacterial activity of *Podocarpus* species

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Extracts of four *Podocarpus* species commonly used in traditional medicine were screened for *in vitro* antibacterial activities. The extracts were tested against Gram-positive (*Bacillus subtilis* and *Staphylococcus aureus*) and Gram-negative bacteria (*Escherichia coli* and *Klebsiella pneumoniae*) using the microdilution bioassay. Extracts from each species exhibited significant antibacterial activity with minimum inhibitory concentration (MIC) values of less than 1 mg/ml. Petroleum ether, dichloromethane and ethanol extracts of *P. henkelii*, *P. latifolius* and *P. elongatus* exhibited the highest inhibition against *B. subtilis* with an MIC of 0.098 mg/ml. Ethanol leaf extract of *P. latifolius* showed greater antibacterial activity against *S. aureus* (0.098 mg/ml). Inhibition of growth of Gram-negative bacteria was exhibited by petroleum ether, dichloromethane and ethanol extracts of *P. latifolius*, *P. henkelii* and *P. elongatus* with an MIC value of 0.39 mg/ml. Poor antibacterial activities were observed in aqueous extracts of these species, with the most significant MIC value being 1.56 mg/ml. Plant parts that showed greater antibacterial activities were the leaves, stems and aril (epimatium).

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***In vitro* pharmacological evaluation of three *Barleria* species**

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Petroleum ether, dichloromethane and 80% ethanol extracts of different parts of three *Barleria* species (*Barleria greenii*, *B. prionitis*, and *B. albostellata*) were investigated *in vitro* for their biological activity. Antibacterial activity was evaluated using the microdilution assay against two Gram-positive (*Bacillus subtilis* and *Staphylococcus aureus*) and two Gram-negative (*Escherichia coli* and *Klebsiella pneumoniae*) bacteria. Anti-inflammatory activity was evaluated using the cyclooxygenase (COX-1 and COX-2) assays. All the extracts showed broad-spectrum antibacterial activity with minimum inhibitory concentrations (MIC) ranging from 0.059–6.25 mg/ml. The dichloromethane extract of *B. greenii* root showed the highest activity against *B. subtilis* and *S. aureus* with MIC values of 59 and 230 µg/ml respectively. Petroleum ether extracts of *B. greenii* root and stem, *B. albostellata* leaf and stem, as well as *B. prionitis* root exhibited good inhibition of prostaglandin synthesis in both assays (>70%). These results demonstrate the therapeutic potential of these plants as antibacterial and anti-inflammatory agents.

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The role of hawkmoth pollinators in mediating divergence and maintaining species boundaries after secondary contact in *Gladiolus longicollis*

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Pollinator mediated selection in plants is considered by some to be a very important driver of speciation. We document the variation in tube length of a hawkmoth pollinated plant *Gladiolus longicollis* across its geographic range. Variation in tube length seems to be determined by variations in the pollinator assemblage which has a bimodal distribution of tongue length. We show that *Gladiolus* tube lengths fall into two relatively discrete categories: long or short with few intermediates and that these correspond to hawkmoth populations

that have predominantly long or short tongues respectively. At a contact zone between these two floral morphs, we find few individuals of intermediate length. Distinct floral morphologies at this site are probably maintained by a combination of differences in flowering phenology, intermorph incompatibility and adaptation to distinct pollinator guilds.

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Evidence for volatile signalling between leaf-rust infected and uninfected wheat

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Plant communication describes the interaction between neighbouring plants whereby information is exchanged between them. Based on earlier biochemical studies, a putative communication event between wheat infected with leaf rust and uninfected wheat was evident. Using a carefully planned experimental setup, the transfer of a putative volatile signal from infected to uninfected wheat was investigated. Results indicated that when infected with leaf rust, uninfected wheat seedlings placed in close proximity exhibited a strong defence response in the absence of the pathogen. Slight variations were evident between the volatile signal produced by the infected resistant (IR) and infected susceptible (IS) plants, leading to a different response in the uninfected plants. After exposure to the volatile emissions of the infected plants, the uninfected plants were also infected with leaf rust. The activation of the defence response in these plants was confirmed with microscopic analysis of the fungal infection structures.

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“Where there is a spark is there fire?: The importance of ignitions in determining fire regimes in southern Africa”

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Seasonal patterns of burning, fire size distributions, and total burnt area all can impact the vegetation and ecology of a savanna/grassland system. These aspects of a fire regime are influenced by the frequency and timing of ignition events. We know that humans ignite fires in very different ways from the pattern of ignition that might occur due to lightning alone, but it has been difficult to investigate how this influences the fire regime and vegetation in a system. We simulated different possible ignition regimes and explored the consequences for the pattern of burning in a model savanna/grassland system. Human-dominated fire regimes are associated with early-season burning, and smaller fires, lightning-dominated fire regimes are associated with late-season burning, and larger fires. We explore how many early-season ignitions would be necessary to burn the same area as large, late-season lightning fires, and at what point ignitions become saturating in a system. This work provides insights into the relative importance of people and lightning as sources of ignition in different parts of Africa, and how long people have been able to have a significant impact on fire regimes in these systems.

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The effect of meta-topolins on micropropagation of ‘Williams’ banana (*Musa* AAA sub group Cavendish)

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