TIME	TITLE	AUTHOR/S
POSTER SESSION: Land Transformation and Rehabilitation I (Session Chair: Klaus Kellner)		
15:20-15:25	Floristic variation between rehabilitated old fields in the Suikerbosrand Nature Reserve, Gauteng	***Daniel Koen***, *Liesl du Toit and Leslie R Brown*
15:25-15:30	Comparing enhanced and non-enhanced grass seed types in re-seeding rehabilitation practices	***Yvette Brits*** *and Klaus Kellner*
15:30-15:35	Rehabilitating transformed landscapes using cloned grasses	***Justin C O du Toit***
15:35-15:40	The influence of glyphosate soil residues on germination of oats and radish	***Lisa H Hebbelmann*** *and Justin C O du Toit*
15:40-15:45	Establishment of an indigenous seed production unit for the West Coast area	***Clement F Cupido***, *Nelmarie Visser, C Rheeder and J C Botha*
15:45-15:50	Influence of degradation on the short-term nutritive value of a semi-arid grassland	***Hennie A Snyman***
15:50-15:55	The influence of physical landscape and soil properties on the threshold of land degradation	***A (O) Wole Fatunbi*** *and Sikhalazo Dube*
15:55-16:00	The Emvogweni Trust Land Restitution Project – a model for land restitution projects in KwaZulu-Natal	***John Clayton***, *Trevor Dugmore and Alec van Heerden*

Land Transformation and Rehabilitation

SESSION CHAIR: KLAUS KELLNER

Poster Presentations

FLORISTIC VARIATION BETWEEN REHABILITATED OLD FIELDS IN THE SUIKERBOSRAND NATURE RESERVE, GAUTENG

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Plant communities are conceived as types of vegetation recognised by their floristic composition. The full species compositions of the different communities express their relationship to each other and the environment better than any other characteristic. As part of a process to enlarge the Suikerbosrand Nature Reserve, various farms located directly north of the current Reserve were acquired. Large sections of these farms were used for agricultural purposes by the previous owners. Since these farms were incorporated into the Reserve, all of the cultivated fields have been left fallow. This has resulted in these areas becoming degraded and dominated by various pioneer and weedy species such as *Tagetes minuta, Bidens pilosa, Datura stramonium* and *Xanthium strumarium*. Long-term data of the highveld grasslands indicates that these fields will eventually become *Hyparrhenia* dominated grasslands unless these fields are rehabilitated. In order to determine the most suitable and economically viable technique, four old fields were selected and different rehabilitation techniques applied to each. These fields will be monitored for changes in vegetation composition and density of species over a five year period. Initial data after the first growing season indicate that the different plant communities recognised are mainly due to differences in grass species composition. This was to be expected since selected areas were sown in with different grass mixtures. It also seems at this early stage as though the disking and seeding methods have yielded the best results. The data collected during this project will enable management to make scientifically based decisions on the most suitable technique to rehabilitate these old lands. This data could also prove useful in similar parts of the Gauteng Province.

COMPARING ENHANCED AND NON-ENHANCED GRASS SEED TYPES IN RE-SEEDING REHABILITATION PRACTICES

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Restoration and rehabilitation activities are presently considered to be a major priority in environmental management, whether the activity implies the restoration of neglected cultivated pastures, degraded rangelands (grazing areas) due to overgrazing and climatic impacts, or the rehabilitation of the mining and industrial areas. However, these activities are not easily achieved, mainly due to the high input costs, including re-seeding activities. The latter includes the quality and effectiveness of the seed used, regarding the germination and establishment under natural field conditions. If techniques can be developed to enhance the effectiveness of germination and establishment rate of the seed where the restoration and rehabilitation activities are applied, a better cover, density and biomass yield can be expected, which will improve the rehabilitation process. It known that commercially available grass seed has a better germination rate and establishment rate in comparison with seed locally harvested seed (which might include many impurities, such as sticks and stones), but the availability of these seed types, especially of certain ecotypes adapted to specific environments, is poor. Advance Seed Company (Krugersdorp, South Africa) has taken commercial available grass seed to the next level by enhancing (coating) the seed with a multitude of different treatments to ensure better handling of the seed in re-seeding applications, as well as advantages such as a higher seed to soil contact, growth stimulants included in the treatment, higher seed purity and the protection of the seed against predation by ants and harsh chemicals in the soil, that might have an influence on the germination rate of the seed and the establishment of seedlings. Although the seed can be more expensive than non enhanced seeds in the initial stages of sowing, it may increase the germination, establishment and growth of grasses in the long-term. The objective of this study is to investigate whether or not certain enhanced grass seed types will have a better germination and establishment rate, fresh and dry above (leaves) and below (root) ground biomass yield (glasshouse trials), dry above ground biomass yields (natural fields trials) as well as if the predation of these seeds differ when compared to non-enhanced seed types. The grasses assessed include enhanced and non-enhanced seed types of *Chloris gayana* (Rhodes grass), *Cynodon dactylon* (Couch grass), *Digitaria eriantha* (Common finger grass) and *Eragrostis curvula* (Weeping love grass), supplied by Advance Seed Company and commonly used in grass seed mixtures for rehabilitation and restoration purposes. A number of seed enhancement treatments are being tested. The chemical composition of the enhancement treatment that is used in the coating process is only known by the seed technicians at Advance Seed Company. A number of different enhancement treatments, for especially *Eragrostis curvula*, are assessed. These include three different treatments of the seed. The treatments involves seed treated with plain enhancement, enhancement with organic insecticide on the base of the coat (i.e. insecticide between the enhancement and the seed) and enhancement with organic insecticide on the base of the coat and as an overspray (i.e. insecticide between the enhancement and the seed, as well as spraying the insecticide over the coated seed), respectively. Preliminary results of these experiments will be discussed and presented.

REHABILITATING TRANSFORMED LANDSCAPES USING CLONED GRASSES

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Transformation of natural landscapes, for example where exotic timber species are planted into grasslands, can result in the local extinction of many plant species. If such plantations are discontinued, many species will not re-colonise the area. Therefore, rehabilitation of these areas requires that locally extinct species be re-introduced. One method is to fragment grass tufts – collected from a local grassland – into individual tillers, and plant these tillers into the degraded area. This project aimed to determine the survival and subsequent growth-rates of various grass species planted into a recently-cleared pine plantation in the Nottingham Road district of KwaZulu-Natal.

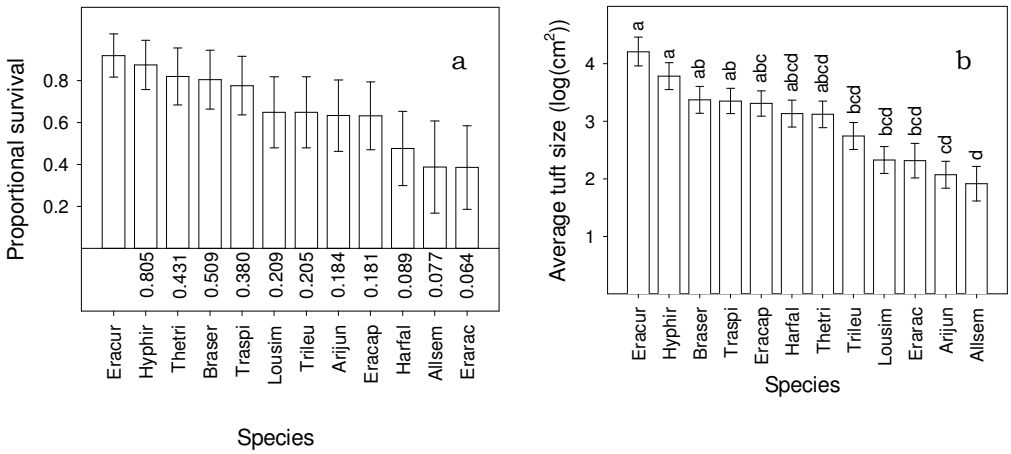

Figure 1: a) Proportional survival of the twelve species planted at Blue Crane Farm. Underscored values are odds ratios derived from logistic regression, using *Eragrostis curvula* (first column) as a reference; b) average tuft size of twelve species of nine-month-old grasses at Blue Crane Farm. Bars are standard errors. Columns sharing the same letter are not significantly different (P = 0.05). (Species codes are the first three letters of the genus and species respectively; see text for details)

Tufts of twelve grass species - *Alloteropsis semialata, Aristida junciformis, Brachiaria serrata, Eragrostis capensis, Eragrostis curvula, Eragrostis racemosa, Harpochloa falx, Hyparrhenia hirta, Loudetia simplex, Themeda triandra, Trachypogon spicatus,* and *Tristachya leucothrix* – were collected (with minimal disturbance) from a local grassland, fragmented into tillers, and kept on a mistbed for four weeks. They were then planted into a recently cleared pine plantation. Plants from all species were alive after nine months, although the likelihood of survival varied between species (Figure 1a). The rate of growth differed between species, with E. curvula and H. hirta being the most productive (Figure 1b). This study indicates that tuft fragmentation and re-planting is a useful way to re-establish locally extinct grass species into transformed habitats.

THE INFLUENCE OF GLYPHOSATE SOIL RESIDUES ON GERMINATION OF OATS AND RADISH

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Glyphosate is a non-selective herbicide that can kill annual and perennial plants, and is generally considered to be inactive in the soil owing to its ability to bind tightly to soil particles. However, some studies have suggested that glyphosate may have some residual soil activity, and may inhibit germination of seeds in the seedbank. We designed two experiments to examine the effects of Roundup®, a glyphosate-containing herbicide, on seed germination. Experiment 1 examined the effects of growth medium (sand or clay) and concentration of Roundup® solution (0, 2, 5, 14, 37, or 100%) on the germination of dicotyledonous (radish) and monocotyledonous (oats) seed. Experiment 2 examined the effects of concentration (0, 5, and 50%) and time of application

of Roundup® (-2, -1, 0, 1, and 2 days after planting) on the germination of oats. Data were analysed using logistic regression. For experiment 1, there was a significant effect of Roundup® concentration on the probability of germination (P=0.0009; Figure1a). Probability of germination did not vary across soil type or species. For experiment 2, again there was a significant effect of Roundup® concentration on germination (P<0.00005; Figure 1b), while the period of delay had no effect. We conclude that glyphosate inhibited the germination of radish and oats seeds. Further research is required to determine whether these effects could have important ecological implications.

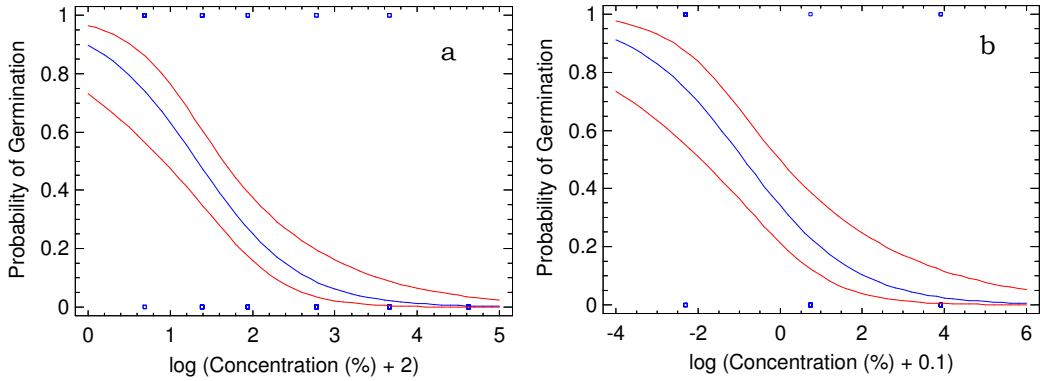

Figure 1. Relation between concentration of Roundup® and probability of germination of a) oats and radish seed and b) oats in experiments 1 and 2 respectively (see text for details). Red lines are 95% confidence intervals.

ESTABLISHMENT OF AN INDIGENOUS SEED PRODUCTION UNIT FOR THE WEST COAST AREA

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Poor management practices by livestock farmers usually result in grazing lands becoming less productive. The grazing lands of the Strandveld in the Western Cape Province are no exception and the deterioration of our natural capital has led to local extinction of palatable indigenous plant species and bare patches within the landscape. There are also large portions of old wheat fields which lie fallow and has the potential to become productive if restored with indigenous palatable species. Research has shown that is would take decades for rangelands to recover to full potential with passive rehabilitation through resting only. Seeding of palatable species is needed to speed up the process. Earlier attempts to increase the grazing capacity by the Department of Agriculture: Western Cape was focused on the production of seeds of drought resistant non-indigenous species was done in the past with mixed success as many of these fodder plants are now declared invasive species. The Nortier experimental farm near Lambert's Bay has been used to cultivate non-native plants such as *Atriplex nummularia*, *A. canescens* and *Medicago arborea*, as well as indigenous *Chrysanthemoides monolifera* for distribution to farmers, primarily as windbreak and fodder plants. The objective of this project is to establish a seed production unit at Nortier Experimental farm to supply indigenous seeds to West Coast livestock and game farmers for rehabilitation and veld improvement.

Currently the Worcester Veld Reserve is the only governmental institution in the Western Cape where seeds of palatable karoo shrubs and grass are produced and sold at subsidized prices, which make it affordable to farmers. Due to limitations, such as labour, the Veld Reserve cannot supply to the need of all farmers. Furthermore, the reserve only produce seeds of a limited number of species, such as *Tripteris sinuata* (bietou), *Eriocephalus africanus* (kapokbos), *Hirpicium integrifolium* (haarbossie) and *Cheatobromus dregeanus* (hartbeesgras). Potential palatable species which could be established for seed harvesting in the West Coast region are *Eriocephalus racemosa*, *Eriocephalus onobromoides*, *Chrysanthemoides monilifera*, *Ehrharta calycina (rooisaadgras)*, *Cheatobromus schaderii*, *Exomis microphylla*, *Manochlamys albicans* (spanspekbos/seepbos), *Tetragonia fruticosa* (slaaibos), *Hermannia scordifolia* and *H. heterophylla*. There is therefore a need to investigate the possibility of producing and supplying seeds of these species to landowners in the West Coast region for restoration of bare patches, rehabilitating abandoned old fields or boosting the grazing capacity of veld. Other possible clients could be road

builders or mining companies in the West Coast region that are expected to rehabilitate mine sites under the new legislation.

Ten percent of harvestable seed of these species will be collected by hand from the veld reserve annually whenever available. A portion of these seeds will be used to establish fields on 1.5 hectares of the reserve. This area will be irrigated when needed in times of drought to ensure their survival. Once these plants are established, seeds will be harvested either using seed harvesting equipment or by hand. Thereafter it will be cleaned and sold per kilogram to farmers at subsidized rates similar to Worcester Veld Reserve.

INFLUENCE OF DEGRADATION ON THE SHORT-TERM NUTRITIVE VALUE OF A SEMI-ARID GRASSLAND

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In calculating soil-water utilization on grassland, most researchers only express it in terms of the quantity of dry matter produced per unit water consumed, while its calculation in terms of crude protein produced per unit of water consumed, receives little attention at present. The latter calculation can make a large contribution to the estimation of short-term nutritive value of grasslands in a specific condition, given the quantity of rainfall received or water consumed.

The aim of this investigation was, therefore, to quantify the impact of different veld condition classes, viz. poor, moderate and good, on the soil-water balance and soil-water utilization (crude protein produced per unit of evapotranspiration), during four growing seasons (2000/01 to 2003/04). Evapotranspiration was determined by quantifying the soil-water balance equation with the aid of runoff plots and soil-water content measurements. Crude protein content calculated from N-content (Kjeldahl-method) of the leaves, stems and seed was determined.

Though the percentage crude protein content of grassland in good condition was generally lower ($P<0.01$) than that of grassland in poor condition, crude protein production was still significantly ($P<0.01$) higher when expressed as total quantity of aboveground phytomass produced. Soil-water utilization declined significantly ($P<0.01$) with grassland degradation. Grassland in good condition averaged a soil-water usage of 0.29 kg crude protein ha^{-1} mm^{-1} during four growing seasons, compared to the only 0.08 kg crude protein produced ha^{-1} mm^{-1} from veld in poor condition. Over the four growing seasons grassland in good condition evapotranspirated on average 22% more water than grassland with poor vegetation composition. The higher surface runoff occurring in grassland in poor condition, due to less vegetation cover, caused soil-water content to be much lower than that of grassland in good condition.

The results illustrate that the important requirement for sustainable grassland production in semi-arid climates, is effective soil-water management, which is only possible when veld is in good condition. Although farmers cannot control the rainfall on their farm, they can directly and/or indirectly influence its effectiveness, since grassland condition is influenced by management practices. Soil-water utilization is a convenient and suitable tool to evaluate the short-term productivity of a grassland ecosystem in terms of nutritive value.

THE INFLUENCE OF PHYSICAL LANDSCAPE AND SOIL PROPERTIES ON THE THRESHOLD OF LAND DEGRADATION

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In grassland science the study of land degradation has been confined to the issues of vegetation change and climate modifications, without much cognizance to the issues of physical landscape and soil properties. This study examines the effects of innate soil physical, chemical and biological properties on the observed land degradation at Tsolwana Game Reserve in South Africa. Twenty three land degradation sites were selected for evaluation across the 8 500 ha game reserve. A land degradation index was generated for each site using the multidimensional analysis technique based on six indicator variables. The amount of soil loss due to different erosion types was measured, while the severity of soil erosion and degree of landscape slope were scored on a

scale of 1 to 5 across the sites. Representative soil samples were collected from each site and analyzed for the pH, EC, total Ca, Mg, K and Na; particle size fractions, aggregate stability and soil organic C content were also determined.

The soil pH tends to increase with increasing land degradation but the difference between categories was not substantial. The EC ranged from 51.0 to 185.3 *u*S cm^{-1}, with the highest value on non-degraded soil. The organic C content of soils around the sampled sites ranged from 4.0 g kg^{-1} to 32.7 g kg^{-1}. The soil organic C content was higher at the non-degraded sites compared with the extremely degraded portion. Soils in most of the sites have high sodium content (99 mg kg^{-1} to 285 mg kg^{-1}), hence they are easily dispersed and susceptible to water erosion. Sand fraction was significantly (P >0.05) higher in the extremely degraded lands, while silt content was significantly (P>0.05) higher in the non-degraded lands. The observed positive correlation (r=0.886 P>0.01) between the degree of landscape slope and erosion severity implied that soil erosion is more severe on steep slopes compares to gentle slopes .This could be due to a more rapid soil particle movement down the steep slopes. The estimated soil loss over time across the 23 sampled sites, ranged from 59.3 t ha^{-1} to 449.7 t ha^{-1}. Results from this study showed that the innate soil properties and landscape characteristics have contributed significantly to the observed land degradation at the Tsolwana game reserve.

THE EMVOGWENI TRUST LAND RESTITUTION PROJECT – A MODEL FOR LAND RESTITUTION PROJECTS IN KWAZULU-NATAL

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The Emvokweni Trust is the representative body of the Gumbi Clan land restitution claim which is nearing settlement in the Magudu/Mkuze area in northern Zululand. The claim, once finalised will cover some 35 000 ha of the most productive beef and game ranching real estate in KZN.

After extensive consultations, the Trust has committed to continuing with, and where possible, to improving upon the land use options pursued by the commercial enterprises run by previous occupants. As a result some 6000 ha have been allocated to livestock production. The balance will be run as an eco-tourism enterprise.

This poster details the livestock production strategies to be developed and implemented for the management of an Nguni Breeding Herd, a Trust commercial herd and a subsistence livestock production system.