TIME	TITLE	AUTHOR/S
PLATFORM SESSION: Invasive Plants and Bush Encroachment		
09:40-09:45	Landscape and small scale anthropogenic disturbances in facilitating alien plant invasion from the Camdeboo Municipality into the protected area	***Mmoto L Masubelele,*** *Dave M Richardson, Llewellyn C Foxcroft and Sue Milton-Dean*
09:45-09:50	Coppice regrowth in *Terminalia sericea* two years after harvesting	***Wayne Twine***
09:50-09:55	An investigation of the effect of fire frequency on soil seed banks in the False Thornveld of the Eastern Cape, South Africa	***Thembisile V Mabuza*** *and Keletso Mopipi*
09:55-10:00	The determination of optimal bush density in the Arid Sweet Bushveld in the Limpopo Province, South Africa	*A le Roux,* ***Jorrie J Jordaan,*** *A J Botha and G N Smit*
10:00-10:05	Effect of *Acacia mearnsii* on soil physical and chemical properties in the Tsomo Valley (Eastern Cape)	***Hloniphani P M Moyo,*** *Sikhalazo Dube and A (Wole) O Fatunbi*
10:05-10:10	The control of *Seriphium plumosum* encroachment in certain areas of the Grassland biome in the North-West Province	***J-P Wepener,*** *Klaus Kellner and Dieter Jordaan*
10:10-10:15	Herbicide treatments reduce seed germination and influence plant community composition	**Lisa Hebbelmann** and Justin du Toit
11:05-11:25	The way forward in combating the escalating *Campuloclinium macrocephalum* (Pompom weed) problem in South Africa: Are we winning this rangeland management battle?	***Danie J Krynauw***
11:25-11:45	Effects of browsing on growth, structure and physiological aspects of *Acacia grandicornuta* and *Combretum apiculatum*	***C Thandeka Mamashela,*** *Peter F Scogings and Alpheus M Zobolo*
11:45-12:05	Bankrupt seed-banks constrain bush-encroachment	***Justin C O du Toit,*** *Lisa Hebbelmann and Peter Wragg*
12:05-12:25	The effect of *Acacia karroo* trees on grass species composition, herbage yield and quality	***Neels C H De Ridder***
12:25-12:45	The assessment of plant diversity on and off both *Androstachys johnsonii* and *Colophospermum mopane* woodlands	***Maanda H Ligavha-Mbelengwa*** *and Vhalinavho P Khavhagali*
12:45-13:05	The cost of different application methods of the herbicide Bromacil on rangelands encroached by *Acacia karroo* at different densities	***Sikhalazo Dube,*** *Mota S Lesoli and A (Wole) O Fatunbi*
13:05-13:25	Germination potential of dispersed seeds of *Dichrostachys cinerea* by goats (*Capra hircus*)	***Julius T Tjelele,*** *Luthando E Dziba and Gilbert (H T) Pule*

Invasive Plants and Bush Encroachment

SESSION CHAIR: TERRY M EVERSON AND LUTHANDO E DZIBA

Thursday, 24 July 2008, 09:40 – 13:25

Platform and Poster Presentations

LANDSCAPE AND SMALL SCALE ANTHROPOGENIC DISTURBANCES IN FACILITATING ALIEN PLANT INVASION FROM THE CAMDEBOO MUNICIPALITY INTO THE PROTECTED AREA

Mmoto L Masubelele[1], Dave M Richardson[2], Llewellyn Foxcroft[1], and Sue Milton-Dean[3]

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Plant invasions affect virtually all ecosystems on earth. Even those pockets of land set aside as protected areas which are mandated for conservation of biodiversity are affected. Alien plants are a growing concern in protected areas, so much so that species beyond the borders of these areas have been shown to be moving into protected areas in Chile and South Africa. Although the above-mentioned parks have a long history of management, they appear to be still under threat.

Camdeboo National Park (CNP) has been recently proclaimed by South African National Parks. It has a unique setting with the park surrounding the Camdeboo Municipality. It provides the perfect opportunity to investigate the spread of invasive alien plants in relation to historic and current land use in a protected area surrounding a municipal area or district. We predict that (1) invasive alien plants will move from the town and disturbed peri-urban areas into the park and (2) that vegetation types nearest to dams, rivers and previously farmed and highly eroded areas will be invaded by more species of alien plants than less disturbed and drier environments. We predict that the greatest densities of invasive alien plants will occur in highly disturbed areas with high propagule pressure adjacent to the Camdeboo Municipality. Ecology of important IAP in the Camdeboo Municipality will be further investigated to understand the patterns of spread into the park. An invasive alien plant removal experiment in combination with post clearing rehabilitation will be carried out to evaluate the cost effectiveness of revegetation following alien clearing. Appropriate management prioritization approaches will be developed that will be appropriate for the CNP and similar environments.

COPPICE REGROWTH IN *TERMINALIA SERICEA* TWO YEARS AFTER HARVESTING

Wayne Twine

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This poster reports on coppice regrowth characteristics of *Terminalia sericea*, (a savanna tree species widely used for fuelwood by rural communities) two years after being felled. In April 2005, trees were felled in the Wits Rural Facility, Limpopo Province, as part of a fire-break clearing exercise. In April 2007, 65 of these stumps were revisited to measure coppice re-growth. Only single-stemmed trees were included in this analysis. Stump circumference, height and distance to nearest neighbouring tree were measured for cut individuals. The number of coppice shoots per stump was counted. The basal circumference and length of each of the 347 coppice shoots was measured. Stump and shoot circumferences were used to calculate basal areas. Harvested trees produced a mean of 5.3 coppice shoots, or 0.5 shoots per cm of stump circumference, over the two year period. The number of coppice shoots per stump increased linearly with increase in stump circumference, but was negatively affected by proximity to the nearest tree. The ratio of summed basal area of coppice shoots to basal area of the stump decreased with stump height. Both circumference and length of individual coppice shoots appeared to be negatively affected by inter-ramet competition (total number of coppice shoots). Shoots had reached a mean size of 3.5 cm in circumference and 78.6 cm in length after two years. Recommendations for sustainable coppice harvesting are made.

AN INVESTIGATION OF THE EFFECT OF FIRE FREQUENCY ON SOIL SEED BANKS IN THE FALSE THORNVELD OF THE EASTERN CAPE, SOUTH AFRICA

Thembisile V Mabuza[1, 2] and Keletso Mopipi[1]

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Fire plays a critical role in structuring plant communities by controlling bush encroachment, eradication of unwanted species and reduction of moribund grass. Fire also triggers germination by breaking seed dormancy through smoke and heat. However, some of the soil seed banks can be negatively affected by fire cues. A study was conducted to investigate the effect of fire frequency on seed germination. It was carried out on long-term fire trials established in 1980 at University of Fort Hare Research farm in the False Thornveld of the Eastern Cape. Six treatments were applied on twelve 50 m x 100 m plots arranged in a complete randomized design and replicated once. These comprised a spring Annual burn, Biennial burn, Triennial burn, Quadrennial burn, Sixennial burn and no burn. Fifty soil cores were randomly collected on a 50 m x 50 m transect from each plot in August 2007, 30 ml of the soil samples from each plot were spread on trays containing growth medium and seeds were allowed to germinate in a greenhouse. Emerging seedlings were counted every day for 13 weeks. The results indicated a significant treatment effect on seedling emergence ($P \leq 0.05$). The highest number of seedlings emerged from the sixennial burn and the lowest from the biennial burn. The results indicate that the longer the fire interval the larger the seed banks. Therefore fire frequency must be considered in the restoration of burned areas.

THE DETERMINATION OF OPTIMAL BUSH DENSITY IN THE ARID SWEET BUSHVELD IN THE LIMPOPO PROVINCE, SOUTH AFRICA

A le Roux[1], Jorrie J Jordaan[2], A J Botha[3] and G N Smit[4]

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A study to determine the optimal bush density in the Arid Sweet Bushveld of the Thabazimbi district was done over a period of five years (1993 to 1997). Treatments consisted of seven plots, each 60 m X 200 m in size. A control plot, with a bush density of approximately 8000 trees or 20708 ETTE (Evapotranspiration Tree Units) ha^{-1}, was used as a benchmark, which represented 100% of the bush density of the study area. Six other plots were thinned to different bush densities, representing 75%, 50%, 35%, 20%, 10% and 0% (total clearing) of the bush density of the control site, respectively. Plots were thinned via cut stump treatments with a spray mix consisting of a 1% Picloram/Triclopyr solution in diesel, applied with rucksack sprayers during September 1992. Botanical surveys were conducted annually at each site in one permanent 5 m X 200 m transect to determine grass production and grass species composition in three sub-habitats (between trees, under trees and where trees used to be). Twenty topsoil samples were randomly collected per sub-habitat in each plot. They were pooled and a standard soil chemical analysis was done for each collective samples (two samples per plot in the 100% and 0% treatment, three samples in the others). Plots were grazed during each winter to prevent the accumulation of grass material.

Grass species composition in all treatments progressed towards higher succession. Long rest periods during the growing season resulted progressive changes in the grass layer in all plots. The grass layer changed from a pioneer stage, dominated by annual grass species, to a climax situation dominated by desirable species. The basal cover of the grass layer improved to the extent where most of the bare patches that occurred before tree thinning were covered.

In all the treatments, the dry matter production of the grass layer increased. The increased production could be ascribed to the long rest periods, as well as the decreased competitive effect of the woody component after selective thinning.

Grass production increased in large intervals between the 0% (all trees removed) and the 50% treatment (50% trees removed). Between the 50% and the 100% (no trees removed) treatment, grass production also increased, but the increases were smaller between each treatments. The highest increase in grass production was obtained in the in the 35% plot (approximately 4 000 ETTU ha^{-1}; 65% trees removed). In all treatments where more than 65% of the trees were removed, lower production advantages were ascribed to the loss of *Panicum maximum* due to sub-habitat changes. A tree density of approximately 2800 trees or 4063 ETTU ha^{-1} (the 35% treatment) appeared to be the ideal treatment.

No significant differences in soil chemical composition were noted between the distinguished sub habitats. Although insignificant, different nutrients occurred in higher concentrations under trees and at locations where trees were removed.

EFFECT OF *ACACIA MEARNSII* ON SOIL PHYSICAL AND CHEMICAL PROPERTIES IN THE TSOMO VALLEY (EASTERN CAPE)

Hloniphani P M Moyo, Sikhalazo Dube, A (Wole) O Fatunbi

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Invasive plants are known to alter the edaphic properties of an ecosystem through their encumbrance that often task the soil nutrient and other physico-chemical properties. Most times these species disrupt the balance among components of the ecosystem leading to reduced productivity, economic loss and degradation. *Acacia mearnsii* is a fast growing invasive tree species whose effect is attaining economic importance in many part of South Africa especially in the riparian ecosystem. The consequences of the invasion of this species has not been well defined, although it has been proven to remove substantial quantity of soil water, speculated to exact some allelopathic effect on grass and broad leaves species and affect the re-growth of

natural vegetation after removal. The mechanism for these effects has not been documented but the later speculation suggested that *A. mearnsii* invasion could have some effects on soil physico-chemical and biological properties. We therefore conducted this study with the aim of understanding the effects of *A. mearnsii* invasion on soil properties at Tsomo valley in the Eastern Cape of South Africa.

Surface soil samples (0-15 cm) were collected from five locations that have been invaded for up to six years. A nearby un-invaded location was also sampled for each of the five locations as a control for comparison. The samples were analyzed for, pH (H_2O), electrical conductivity (EC), and soil organic matter. Individual pH values for the samples differed but were not statistically different from each other. Presence of *Acacia mearnsii* and its litter did not have any significant ($P>0.05$) effect on soil pH, electricity conductivity and soil aggregate stability (Slow wetting, fast wetting and mechanical disintegration). There was negative correlation ($r = -0.420$) between pH and aggregate stability mean weight diameter for slow wetting. The presence of *Acacia mearnsii* had a significant effect on soil organic carbon. This can be attributed to the high organic matter content under the *Acacia mearnsii* stands that increased the organic matter percentage compared to the soils that were from 'outside' the *Acacia mearnsii* stands. We therefore concluded that the presence of *Acacia mearnsii* had no effect on soil physico-chemical properties, which imply that the observed reduced vegetation and species diversity in areas invaded by Acacia *mearnsii* are not due to altered soil physicochemical properties.

THE CONTROL OF *SERIPHIUM PLUMOSUM* ENCROACHMENT IN CERTAIN AREAS OF THE GRASSLAND BIOME IN THE NORTH-WEST PROVINCE

J-P Wepener[1], Klaus Kellner[1] and Dieter Jordaan[2]

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Seriphium plumosum (previously known as *Stoebe vulgaris*), also known as bankrupt bush or slangbos, is commonly associated with degraded rangelands in the semi- arid and arid grasslands of South Africa. The encroachment of *Seriphium plumosum* into natural veld is a huge problem for farmers, especially in the Free State and North - West Provinces, as it reduces the grazing capacity of the veld. Bush encroachment into natural veld is a form of land degradation possibly induced by human activities such as overgrazing and wrongful management of fire, which leads to an imbalance in the ratio between the herbaceous and woody components in the grassland. The abundance of palatable, perennial grasses ("decreasers") is greatly reduced when the crown cover of *S. plumosum* exceeds 70%. Old abandoned croplands have the highest density of *S. plumosum*, which is often associated with patches of bare ground. Encroachment does not only refer to thickening of alien vegetation, but also refers to the thickening of indigenous woody species such as *S. plumosum*.

Farmers in the North - West Province have used different technologies to control *S. plumosum* encroachment. These include burning, hacking and the use of herbicides. One of the aims of this project is to evaluate the success of all possible control methods applied by land users in the study area. Results show that the long term success rate achieved with most technologies is limited, when a follow up control programme is not implemented. In sites where a non-selective herbicide application method (tractor mounted bulk sprayer) was used, both the densities of shrubs and decreaser grass species were reduced with an increase in pioneer species, indicating a disturbance and degradation of the land. At the sites where a soil applied herbicide was used for the control of *S. plumosum* the initial success of the control was very high, although it is still recommended that follow up control is implemented.

Due to the limited knowledge of the dynamics and phenology of *S. plumosum* leading to encroachment, the second aim of the study was to investigate certain aspects of the plant phenology, such as time of active growth, seed production and seed dispersal, to give guidelines as to when control should be implemented for the highest success rate of the control technique. With regard to the population demography of *S. plumosum*, it was determined that the period of active growth is from August to early March. The reproductive phase of *S. plumosum* lasts from December to the end of May. This implies that control should be done during the active growing period of the plant, for the herbicide to be effective and before the reproductive period of the plant commences to prevent seeds from being dropped.

HERBICIDE TREATMENTS REDUCE SEED GERMINATION AND INFLUENCE PLANT COMMUNITY COMPOSITION

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Herbicides are used selectively or non-selectively to kill plants. Glyphosate is a widely used herbicide about which there are two schools of thought, one of which supports evidence that glyphosate has residual activity in the soil having pre-emergence effects on germination and long term effects on treated plant communities, and the other does not. We predicted that glyphosate would reduce the germination of both monocotyledenous and dicotyledenous seeds. The application of glyphosate in increasing herbicide concentration showed that the decrease in gernimation is proportional to the increase in glyphosate concentration. When treated with glyphosate at varying times with relation to the day of planting, the age of the glyphosate in the soil was positively related to the proportion of seeds that germinated. The older the glyphosate, the lower the reduction in germination. The non-selective herbicide treatement affected both vegetatoin structure and plant community composition of three vegetation types, along a gradient of invasion. The non-selective herbicide (glyphosate) impeded grass establishment, but the selective herbicide (picloram) has no effect. Grass biomass influences further control of alien vegetation with fire. Therefore the selective herbicide should be used as an alternative to the selective herbicide glyphosate.Weed species (herbaceous alien invaders and others characteristic of degraded areas) dominated the plant community that established after glyphosate

THE WAY FORWARD IN COMBATING THE ESCALATING CAMPULOCLINIUM MACROCEPHALUM (POMPOM WEED) PROBLEM IN SOUTH AFRICA: ARE WE WINNING THIS RANGELAND MANAGEMENT BATTLE?

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The problem caused by the category 1 alien invasive weed, *Campuloclinium macrocephalum* (Pompom weed) is progressively becoming worse in South Africa. This invasive plant of grasslands and open savannas has captured the attention of concerned persons over the past few years, and is considered by many to be one of the worst emerging weeds that South Africa has ever had to contend with. This weed, being a perennial, hardy and adaptable plant, establishes itself well in a variety of vegetation types and habitats. Added to this is its ability to produce large amounts of seeds, in a manner very similar to that of annual weeds. Pompom weed also seems to flourish and establish under good rainfall conditions, such as those experienced during the past summer season or two.

Pompom weed threatens rangelands in two main ways. Firstly, it has a serious impact on the biodiversity of veld, as it out-competes and replaces many indigenous plants. This is a serious concern from a conservation viewpoint. Secondly, it drastically lowers the grazing capacity of invaded veld, where it often becomes the dominant plant. Pompom weed is not utilized by large herbivores, and therefore causes a drastic decline in the feed value of invaded veld.

Herbicides have been registered to control Pompom weed, but implementation of the herbicide-based control programs has been slow, with the present rates of spread mostly negating the control efforts. Research on finding suitable biological control agents is in progress, but releases of such organisms may still be years away. A priority is also to find more suitable herbicides, and suitable application periods. This is a difficult issue, as the scope of possible suitable herbicides is very limited. Mechanical control has been ruled out as a valid control option, because of the weed's considerable regenerative abilities.

The Pompom weed problem is evidently not one that can be tackled in a casual way. If this important alien invasive weed is to be controlled effectively, drastic, coordinated and serious actions need to be taken. Proposals in this regard will be made.

EFFECTS OF BROWSING ON GROWTH, STRUCTURE AND PHYSIOLOGICAL ASPECTS OF *ACACIA GRANDICORNUTA* AND *COMBRETUM APICULATUM*

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Very little is known about plants growing in savannas, especially how woody plants respond to browsing and variations in resources. It is assumed that growth rate and concentrations of defenses are inversely related, but will be affected by resource availability. For that reason, research was conducted to investigate the effects of browsing on *Acacia grandicornuta* and *Combretum apiculatum.* Research was conducted at the Nkuhlu experimental exlcosures (Kruger National Park) on these two species. The exclosures are designed so that there are three broad levels of browsing pressure: no mammal herbivores excluded, elephants and giraffes excluded and all mammal herbivores bigger than hares excluded, all of which incorporate the catena from sodic footslope to sandy crests. The focus was on heavily browsed plants between the heights of 0.7-1.7 m. Ten individuals per species per treatment (full, partial and no exclosure) were sampled and height and basal circumference were measured early and late in the wet season. Five new shoots per tree were marked; these shoots were re-measured at intervals to monitor their growth. The results showed that there was a positive effect of browsing since *A. grandicornuta* in the no exclosure and *C. apiculatum* in the partial exclosure had longer shoots compared to the full exclosure (Figure 1) (98.62 mm for *C. apiculatum* in the partial exclosure) *Acacia grandicornuta* thorns were longer under browsing (24.7 mm in the non exclosure) than those in the full exclosure (13.7 mm). A nursery experiment was conducted to see the effects of browsing as affected by water availability. Potted seedlings of *Combretum apiculatum* were given to goats to achieve a range of browsing intensities in October (0, 30, 60 and 90%). Plants were weighed before and after browsing to estimate the amount removed, and were separated into three groups that were watered every 3, 7 and 10 days for four months. Plants were re-measured, harvested, separated into morphological parts (roots, shoots and leaves) and each part weighed. Browsing had an effect on shoots of plants that were watered biweekly (non-linear response) and those watered weekly (negative response); water had a positive effect on leaves, shoots and stem circumference.

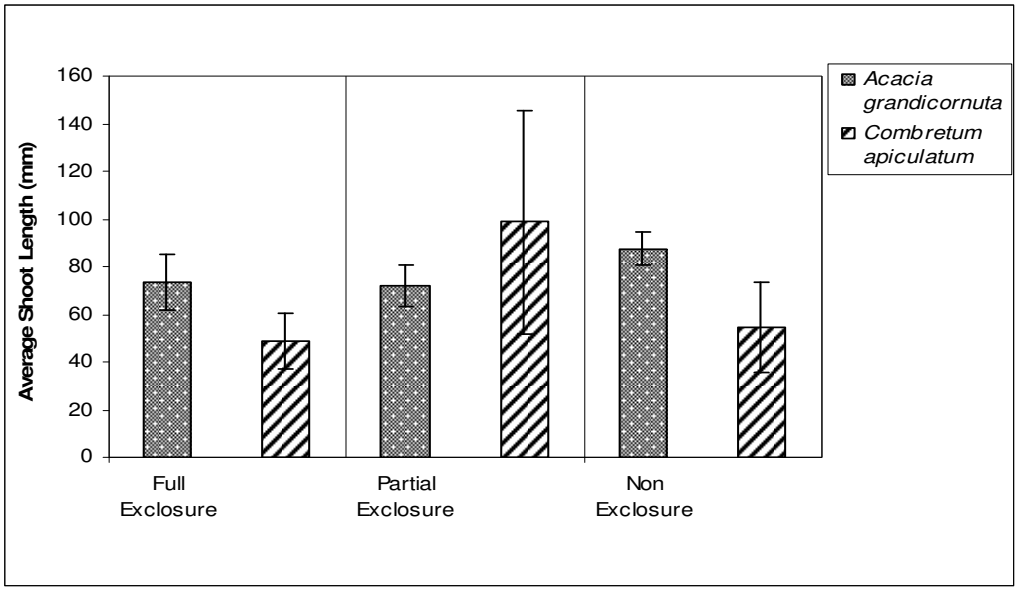

Figure 1: Average Shoot Length (mm) for *A. grandicornuta* and *C. apiculatum* in different exclosures.

BANKRUPT SEED-BANKS CONSTRAIN BUSH-ENCROACHMENT

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The seeds of many African Acacias can remain dormant in dry soil for many years, being prompted to germinate by favourably moist conditions. Thus, periods of particularly wet weather in arid regions might cause prolific germination of Acacia seeds; this cohort of plants could then establish and grow, resulting in 'bush encroachment'. The South African portion of the Kalahari received heavy, prolonged rain during the 2005/06 season, affording an opportunity to test this rain-induced mass-germination hypothesis by assessing seedling density and determining whether or not seedling density was related to spatial variation in rainfall. Seedling density was estimated near 15 rain gauges scattered across 54 500 ha of Tswalu Kalahari Reserve. Only under the canopies of Acacia mellifera were appreciable numbers of seedlings found (0.427 □ 0.013 conspecific seedlings m-2). Elsewhere, all Acacia seedling densities were lower than 0.06 m-2. Further, there was no relation between local rainfall and seedling density. These results indicate that rainfall of this magnitude does not necessarily induce mass germination of Acacia seedlings in this area. A second hypothesis – that the Acacia seed-bank is very small, precluding mass-germination – was tested the following year. The size of the Acacia seed-bank in the top 5 cm of the soil was estimated at 22 sites across Tswalu (in total 646 quadrats). Only 25 seeds were found (>97% of all quadrats had no seeds), these being A. mellifera (12 seeds), Acacia erioloba (10 seeds), and Acacia haematoxylon (3 seeds). This hypothesis was accepted, and we conclude that seed-bank size is an important driver of Acacia recruitment in the southern Kalahari.

THE EFFECT OF *ACACIA KARROO* TREES ON GRASS SPECIES COMPOSITION, HERBAGE YIELD AND QUALITY

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The encroachment of *Acacia karroo* (Thorn) trees in the Sweetveld areas has widely been seen as undesirable by the farming industry. Farmers believe that Thorn trees are highly competitive to grass production. In the hope of increased grass yield, farmers spend large amounts of money to eradicate this so-called problem. These methods can vary between mechanical; chemical; and or physical plant removal practices, all of which is costly to perform. The main aim of these practices is to ultimately increase grass production; animal performance; and farming profit.

Earlier research work undertaken during 2002, has proven that average to low Thorn tree populations increased grass production. These results also revealed that palatable grass species contributed higher percentages of the biomass produced under canopies and that the opposite was true within open areas where unpalatable grasses contributed more.

Another finding was that the animals proved to be biased towards palatable species resulting in more pressured grazing within and amongst trees, avoiding open areas. Areas were heavily selected by animals because of species and quality, therefore creating an illusion of decreased grass production under and surrounding trees.

Although initial results proved that Thorn trees do not effect grass production negatively and that only under very dense stands was marginal differences measured during dry seasons, this visual illusion still had most of the farming sector in disbelieve. To further prove these results a second demonstration site was picked during 2005. At this site it was also believed that Thorn trees negatively effected grass production. Enclosures were randomly distributed before grazing commenced. Samples were taken within four different tree density classes (within clumps of trees, in open spaced areas; under tree canopies facing north; and under tree canopies facing south). After the camp was grazed and the animals removed, biomass samples were taken from the inside of the enclosures (ungrazed) and the outside of the enclosures (grazed). Samples were dried and weighed to determine biomass produced and analyzed to determine quality. Results again proved that the Thorn tree population at this site did not jeopardize grass production in any way. It would not be justified to eradicate any Thorn trees at this site, instead, these trees should be seen as beneficial to the farmer and his farming enterprise. To make better use of this source of browsing animals such as goats and game could be possibilities. These animals could utilize this

plant species to the financial benefit of the farmer, and succeed in controlling re-growth and thickening as an extra bonus.

THE ASSESSMENT OF PLANT DIVERSITY ON AND OFF BOTH *ANDROSTACHYS JOHNSONII* AND *COLOPHOSPERMUM MOPANE* WOODLANDS

Maanda H Ligavha-Mbelengwa[1] and Vhalinavho P Khavhagali[2]

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The assessment of plant diversity on and off both *Androstachys johnsonii (A. johnsonii*) and *Colophospermum mopane (C. mopane*) stands was conducted. Both these two plant species grow on sandy and loam soils at Makuya Nature Reserve. Species quantification included identification, counting and recording per quadrat of about 2 m x 2 m on six plots. Differences in species diversity and abundance on and off both *A. johnsonii* and *C. mopane* stands were observed. Plant diversity was found to be higher on the plots that were away from both the stands of *A. johnsonii* and *C. mopane* on loam soil than in the stands that were under *A. johnsonii* and *C. mopane* on sandy soil. However, on sandy soil, plant diversity was also high under *C. mopane* stand but low on both under and away *A. johnsonii* stands. Loam soil stands are more fertile than sandy soil stands; it is therefore not puzzling to observe numerous plant species on loam soils than on sandy soils. On the other hand fewer species under *A. johnsonii* than under *C. mopan*e on sandy soil is probable sign of presence of allelochemicals in soils under *A. johnsonii* than those under *C. mopane*.

THE COST OF DIFFERENT APPLICATION METHODS OF THE HERBICIDE BROMACIL ON RANGELANDS ENCROACHED BY *ACACIA KARROO* AT DIFFERENT DENSITIES

Sikhalazo Dube[1], Mota S Lesoli[1] and A (Wole) O Fatunbi[2]

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The encroachment of woody plants into grassland is a global problem. Different methods have been used to control bush encroachment and most of them have been ineffective in the total elimination of bush encroachment. They are a number of chemicals that have been used in controlling bush encroachment. Consequently, large volumes of potentially hazardous chemicals, produced by various industries and agricultural operations, are entering the ecosystem. Bromacil, a broad spectrum herbicide, is used to control undesirable woody plants on noncropland so as to increase the carrying capacity of the veld. The active ingredient (bromacil) is carried into the root zone by rain. It is readily absorbed through the root system and is then translocated to foliage. The leaves then become yellow and abscise. When new leaves are formed, they also turn yellow and abscise. This process continues until the tree no longer has reserves to initiate re-growth and so it dies. A study was undertaken at the Honeydale research farm of the University of Fort Hare in the Eastern Cape to estimate the costs of three application methods of bromacil. Honeydale research farm is 520m above sea level and is about 32.8º S and 26.9º E in a semi-arid False Thornveld of the Eastern Cape, receiving mean annual rainfall of 480mm. In South Africa bromacil is traded as BushWacker and it is applied as a spray, spread dry just before or during the period of active growth, preferably when rain can be expected for soil activation or aerial application of granules (5kg.ha^{-1}).

Two paddocks, one of low and the other high density *Acacia karroo*, were identified. In each paddock 6 x 200m^2 plots were marked. Bromacil was applied to *Acacia karroo* plants in the marked plots; 2 of the plots were subjected to liquid spraying; the other 2 to granular spreading and the remaining 2 were used as controls. Teams working were monitored as was the amount of herbicide used in each plot. The cost of aerial application was known before hand. Total cost of each method per hectare was calculated, it included labour and chemical costs, furthermore, it was ascertained that the minimum area that can be aerially sprayed is 50 ha.

The result indicated that, on a per hectare basis, it was more expensive to apply hand apply granules in the high density plots (R2700.ha^{-1}) compared to either spraying liquid (R675.ha^{-1}) or aerial spraying (R600.ha^{-1}). Under low tree density aerial spraying, the cost of which does not

change with density, was more expensive compared to hand application of granules (R389.ha^{-1}) compared to either spraying liquid (R207.ha^{-1}). The cost of water used in the mixing was minimal and was not included in the calculations.

We conclude that the full economic implications of the application methods can only be fully comprehended when the biophysical components are assessed such as mortality rate of *Acacia karroo* plants and biomass accumulation of the herbaceous materials. Hand application (spreading and spraying) may be more important for smaller invasions while aerial application may be suitable for larger areas.

GERMINATION POTENTIAL OF DISPERSED SEEDS OF *DICHROSTACHYS CINEREA* BY GOATS (*CAPRA HIRCUS*)

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Woody plant encroachment is one of the major challenges to livestock production in southern Africa because it affects the herbaceous layer and may ultimately reduce the carrying capacity of grazing lands. Herbivores can act as dispersal agents through the consumption of pods of certain woody plants and dispersal of seeds via faeces. However, it is not known to what extent goats promote woody plant encroachment, specifically in *Dichrostachys cinerea*. The objective of this study was to determine the recovery and germination potential of *D. cinerea* seeds that pass through the digestive tract of goats. The study was divided into two parts. In the first part, indigenous goats were offered 1500 *D. cinerea* seeds mixed with the basal diet (ram lamb and ewe pellets) and in the second part, indigenous goats were gulvaged with the same number of seeds. Faeces were collected twice daily for the duration of the experiment and seeds recovered from faeces. Germination tests of damaged and undamaged seeds were conducted in 12 cm square plastic dishes containing one disc of germination paper and 5 ml distilled water. Total seed recovery for all the goats for part two (33.1%) was significantly higher than part one (9.9%). The highest number of seeds recovered was on day two (13.4%) and three (2.2%) for parts two and one respectively. The germination percentage of undamaged seeds for part one (6.2%) was significantly higher than part two (3.9%). There were significant differences found between scarified control (73%) and undamaged seeds (6.2%) as well as damaged (2.5%) seeds of part one. In part two, there were significant differences between scarified control (44.5%), undamaged (3.9%) and damaged seeds (3.0%). The passage of seeds through the digestive tract of goats does not break physical dormancy. Despite the low germination percentage obtained in this study, goats may be regarded as one of the contributing factors to woody plant encroachment specifically in *D. cinerea*.