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13th NAMIBIAN RANGELAND FORUM

The role of biodiversity in rangeland management and policy

Venue: Neudamm Faculty of Agriculture and Natural Resources, Windhoek

Dates: 27-29 October 2009

Proceedings
(Programme & Abstracts)

Background:

The Namibian Rangeland Forum (NRF) is an unconstituted group, including farmers, extension workers and scientists, with a common interest in the ecologically and economically successful management of Namibia's rangelands. Being part of this group BIOTA hosts the 2009 forum. Linking to the major research interest of BIOTA, this year's forum will focus on the role that biological diversity plays in providing ecological services that contribute to rangeland health and productivity as well as the impacts of different types of rangeland management on biodiversity's ecological services. One of the objectives of the forum is to produce policy relevant findings. It therefore critically assesses the extent to which Namibia's draft Rangeland Management Policy and Strategy (NRMPS) promotes biodiversity.

BIOTA (Biodiversity Monitoring Transect Analysis in Africa) conducts integrated biodiversity research across several climatic gradients, one long one across the winter rainfall Cape Region into the summer rainfall region of northern Namibia, and a shorter transect across the very steep rainfall gradient from the central Namibian coast inland. A flyer on BIOTA is enclosed. BIOTA monitors changes in biodiversity and does research into human impacts on, and consequences of, biodiversity change, with the aim of improving management. One of BIOTA's approaches is to conduct standardised monitoring at observatories of one square kilometre. There are about 20 observatories in Namibia.

Biodiversity is essential for supporting our lives. It provides lots of species that we can use for products, such as grasses and bushes for our animals to feed on, wood for construction and energy, numerous foods and medicines. Valuable new uses are constantly being found for species that were previously thought useless or even considered a weed or pest. Biodiversity also regulates ecological support services that make it possible for us to survive on earth. It is biodiversity that is responsible for regulating the water cycle that brings us valuable rain, allows it to enter the soil and recharge the limited ground water without eroding away the soil. Biodiversity also keeps the nutrient cycles going, which maintain the fertility of the soil. If it were not for biodiversity, then some pests and diseases would proliferate and take over. For example, termites are kept in balance by mammals such as antbears and aardwolves, birds such as guinea fowls and francolins, reptiles such as chameleons and geckos, insects such as praying mantis and spiders, while many species of microorganisms also play their role hidden from our view because of their tiny size. Our water, air and soil are kept purified by biodiversity, unless we upset the balance through our mismanagement.

Why do we need to monitor our environment? It is necessary to recognize changes and their causes, and also to understand the extraordinary effects of episodic events. We need to recognize and understand these things in order to have sustainable development, as without it we don't know what management practices are sustainable. Since our memories may play tricks on us, and lessons may be lost if not recorded, we observe and record the status of indicator parameters. These are features that serve as indicator of the State of the Environment. Monitoring thus promotes enlightened decision-making and policies. The point about monitoring is that it needs to be continuous, and is based on repeated measurements that can be compared across long periods of time and large areas of country.

Monitoring produces information, but information on its own is useless unless it gets applied. We need to ensure that the results of monitoring get put to good use. The results of the monitoring should form the basis of wise decision making on how to manage the land. Hence BIOTA is involved not only with monitoring, but also with research to better understand people's incentives to mange land in particular ways and the consequences for biodiversity and hence also ecological processes that keep us alive. Your contribution towards this at the forum is gratefully appreciated.

13th NAMIBIAN RANGELAND FORUM

Programme & Index:

The role of biodiversity in rangeland management and policy

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The scale of grazing – its influence on rangeland quality, carrying capacity and herbivore population performance.

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The influence of scale on ecosystem responses and processes has often been poorly understood and infrequently addressed in ecological experiments. There is, however, a growing awareness that scale may have marked effects on ecosystem responses and processes. It is shown from a review of the literature that two major facets of scale: 1) herd size and density, and 2) total area available for foraging (home range extent), may have marked effects on ecosystem properties and animal performance. Herd size and density influences the degree of selective grazing, trampling and dung inputs, grassland structure, forage quality and nutrient cycling. The total area available for foraging influences resource heterogeneity and the ability of herbivores to adapt to spatial and temporal shifts in forage quantity and quality, which influences animal performance. At large scales, the ability to track stochastic pulses in forage quality driven by patchy rainfall and spatial shifts over the season in forage quality on rainfall and altitudinal gradients, enables herbivores to pursue an energy-maximizing strategy. Greater tracking of spatial and temporal shifts in forage quality in large-scale systems reduces the probability of returning to a specific foraging site each year and increases the ability to avoid local drought, which reduces negative grazing impacts on drought-stressed grassland. Thus greater resting of forage in large-scale systems, especially during drought, combined with grazing by large, dense herds, results in a stimulation of grassland production and the maintenance of grazed areas in a short nutritious state. Consequently, animal performance and rangeland quality are expected to be enhanced in large-scale grazing ecosystems. It is doubtful, therefore, that rangeland and animal performance responses to various grazing management treatments in small-scale experiments accurately reflect responses at much larger scales. Suggestions for designs of multi-scale grazing experiments are given.

The role of the soils in rangelands: Supporting biodiversity and biomass production

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The analysis of biodiversity and biomass production requires a profound knowledge about the abiotic ecosystem compounds. Soils as integrative elements reflect various environmental influences and are therefore a valuable indicator of abiotic diversity and resource availability. Moreover, soil as a major compartment of terrestrial ecosystems has a significant impact on the composition and the productivity of flora and fauna.

Namibian rangelands are characterised by a high number of soil units which provide a broad range of ecological settings. Combined with the different amounts of rainfall within the biomes and a high inter-annual variability of the precipitation these settings result in a wide range of productivity which mainly depends on the capture, storage and redistribution of water and the availability of nutrients.

This presentation will give a brief overview of the soil investigation concepts and approaches within the BIOTA-Southern Africa project with a focus on the Namibian rangeland soils. The main topics such as variety of soils, nutrient supply and especially the dynamics of soil water supply will be addressed on different scales, accompanied by general information on Namibian soils.

Quantitative measures of soil diversity were tested on a dataset of the BIOTA Southern Africa transect. The results show that soil variation has a strong correlation to biodiversity of higher plants. The activity of mound building termites is a key element in the small scale pattern of soil conditions and also creates nutrient hotspots. The nutrient supply and soil water dynamics of the matrix soils are mainly substrate driven and therefore strongly influences the vegetation pattern and the biomass production. The installation of soil moisture monitoring sites in the central savannah which produces times series will be presented and discussed. It provides a database which improves the understanding of soil water dynamics and its influence of the productivity as well as the understanding of processes such as bush encroachment and the development of bare patches.

Evidence of impact of bush encroachment on groundwater resources

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The impact of increasing densities of woody plants in Namibia's grazing areas on grass production has been well documented and research in this regard is ongoing. In this presentation, the significant impact of bush encroachment on the general water balance will be discussed.

The **Platveld Aquifer Study** area, covering some 1 million hectares of commercial farm land in the central north of Namibia, consists of the **Platveld Kalahari Aquifer Area** (PKAA), and in particular the **Platveld Kalahari Basin** (PKB). In this area no significant surface drainage patterns are developed, and it should thus be ideally suited for optimal recharge to groundwater. This evidently was the case in earlier times, with shallow waterlevels and free-flowing fountains recorded all over. However, declining water levels have been observed since the early 1930's, corresponding to both a changed abstraction pattern and to the increase in densities of certain woody plant populations over the investigation area.

Although changes in water usage have occurred over the past 50 years, abstraction volumes have not changed significantly. Drastic changes however have been recorded regarding livestock numbers and vegetation cover. The catastrophic impact that bush-encroachment has on deteriorating grazing conditions nationally, certainly has a similar, or even more drastic impact on groundwater resources. Some examples of water level reaction to rainfall in the Study Area indicate a clear inverse relationship between the volume of water available for recharge to groundwater resources and percentage canopy cover.

Declining water levels are evident not only in areas with high densities of various acacia species (e.g. *Acacia mellifera*), but also in areas where dense cover of *Colophospermum mopane*, *Terminalia prunioides* and *Dichrostachys cinerea* is causing a reduction of grazing potential. Evapotranspiration has been researched for *A. mellifera*, however, the water balance for some of the other potential encroaching species can only be assumed at this stage. Photographic evidence of extensive root mass development of some of these species has been collected and this supports the assumption that these species are opportunistic and very effective in utilizing available water. The collected evidence should be sufficient to motivate for further specific multi-disciplinary research in this field.

The dynamics of *Acacia mellifera*, implications for bush encroachment management

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Keywords: fire; seedling; sapling; mature shrubs; transitions

A recently proposed conceptual state-and-transition model describes transitions from open savanna to bush thickened savanna, based on limited data and observations. Fire is proposed as the major factor interrupting the transition, and small browsers, in particular lagomorphs, are proposed as modifying thicket density by thinning out seedlings and saplings. Recently initiated experimental research is testing the respective roles of fire, competition and browsing in interrupting or modifying this transition, which potentially occurs very infrequently and is dependent upon 3 consecutive well above average rainfall seasons. Seeds were planted in January 2008 in situations able to test 3 hypotheses (situations in square parentheses):
1. Fire interrupts the transition to bush thicket by killing seedlings and young saplings [burnt area and control with seedlings planted, and saplings and mature shrubs already present];
2. Competition with climax grasses is sufficient to interrupt the transition to bush thicket by weakening seedlings [seedlings growing next to and away from clipped and unclipped grass]; browsing of seedlings by hares (and other browsers) thins potential thickets out [seedlings growing inside exclosures and in controls].
Whilst one more season of data needs to be collected, and data analysis is not complete, the following tentative conclusions can be drawn:
Fire is the major factor interrupting the transition from open savanna to bush thicket, through its effect on killing seedlings, whereas it is generally ineffective in killing larger saplings and mature shrubs.
Competition between climax grass tufts and seedlings is insufficient to kill seedlings, rather a good climax grass cover is necessary for a fire.
Browsing of seedlings and saplings particularly by hares plays a role in thinning out thickets.
Evidence from field experiments supports the conceptual model.

Pilot restoration project in a key fertile valley of the Highland Savanna

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The rain use efficiency of some rangelands has been lowered by the legacy of historic degradation, thus reducing the effectiveness of grazing management in restoring rangeland health. Management that treats symptoms is usually too costly to apply over large areas, but if targeted at key productive landscapes may be worth the effort. During a workshop farmers of the Auas-Oanob Conservancy identified upland fertile valley systems as key features in their rangeland. Periodic waterlogging used to ensure that these valleys were dominated by perennial grass, but many of the valleys have been cut by gullies that drained them and allowed bushes to encroach. The pilot restoration site is in one such fertile valley with a slope of about 1:70. The gully system was treated in March 2007 with filters made of branches cut selectively from *Acacia mellifera* that was growing in dense stands nearby. The branches were packed at strategic locations, with the branches sometimes woven with wire and tied to nearby trees or steel posts. The restoration work along roughly 2 km of rills and gullies took about 100 person days to complete and used up 30 steel posts of 0.9 m length and about 900 m of fencing wire.

Half of the measured features were fenced to exclude cattle, both at the treated gully system and the unfiltered systems that acted as the control. The sampled features were measured, by landscape function analysis (LFA), with transects running across rills or gullies, and perennial grass densities were measured in 2009. When the changes in depth over the first two years at all measured features were analysed, they indicated slightly higher deposition at treated features, but none of these differences were significant ($P>0.05$) and fencing provided no demonstrable effect on deposition. The density of perennial grasses was lower underneath the filters in gullies or rills, probably due to the dense shade from the packed branches. However, there were almost twice as many perennial grasses above and below the filters within rills and gullies than outside rills and gullies. The perennial grass density was more than three times higher underneath branches placed alone on higher land between rills and gullies. This higher density of perennial grass under loose branches and nearby packed filters is likely to take over the filtering function from the branches that are decaying. This will hopefully flip the system from losing resources to capturing them and thereby allow self-repair to proceed.

Restoration work requires substantial resources and so it is critical to stop new incision early. Strategic surveillance of targeted vulnerable areas through the Ecosystem Management Understanding (EMU) process will allow rapid and cost-effective response. Factors that could lead to "nick points" can be removed from most productive, vulnerable areas. Prevention and early response are critical in extensive beef systems.

Engineering options may be required in places where the legacy of degradation is so immense that local bush packing (turning the problem into the solution) is impractical. In those cases, it is critical to be led by ecological assessment of the whole system in which the problem areas are a part and plan carefully an implementation strategy before any on-ground work is commenced.

The influence of thermo-chemical conversion on rangeland condition

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Bush encroachment is not a new phenomenon in Namibia. However, due to the growing challenges it poses on economic performance in especially the agricultural sector, many initiatives to combat bush encroachment have been assessed and a number of these have been tried rendering limited success to clear or thin bush with subsequent value addition carried out. To date, thermo-chemical conversion in the Namibian context concerns 'traditional' charcoal making mainly. However, thermo-chemical conversion offers a variety of technological and resultant product choices which largely remain unutilised in Namibia.

The variety of technological options offered through thermo-chemical conversion includes combustion, gasification and pyrolysis. The resultant products are ash, woodgas and wood liquids, and charcoal. These products can also be used as precursors to energy and non-energy products, whereby products like fuel, biochar and fertilisers are rendered.

In a recent cost-benefit analysis the possibilities to utilise encroachment bush in thermo-chemical conversion processes (among other issues) to thereby (i) improve rangeland condition; (ii) ameliorate income from rangeland, and subsequently, (iii) socio-economically and technologically develop Namibia, have been investigated.

This presentation thus attempts to present the main results of the cost-benefit analysis and review as many as possible thermo-chemical conversion initiatives, future or already implemented, that could be useful in managing Namibian rangeland.

Quantifying farmers' perceptions and willingness; as well as availability of encroaching aboveground Acacia bush biomass on CCF commercial farmlands in north central Namibia

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The study was aimed at investigating certain key social and environmental aspects related to aboveground bush biomass on Namibian north-central commercial farmlands - and highlights on the identified requirements for effective bush thinning operations.

Social aspects were investigated with a questionnaire survey conducted on 51 farms in the Grootfontein, Otjiwarongo, Outjo and Tsumeb districts during June - September 2007. The survey revealed that 92.15% of the farmers depended on diesel powered generators for electricity production. The use of renewable energy technology (e.g. solar, wind) was not widely employed. About 96.07% of the respondents regarded bush encroachment as a problem, with the average encroachment rating per farm recorded to be 66.33 ± 5.07%. About 84% of the farmers attempted bush thinning by making use of different methods. Electivity analysis showed that most farmers interviewed preferred to use chemical application and manual harvesting with E = 0.235 and 0.220, respectively. About 70% of bush clearing operations were conducted by the owners and staff of the farms. The level of involvement by contractors and other individuals remained low at 21% and 9%, respectively. The majority of farmers (representing 50% of the responses) identified the lack of capital investments as the major impediment towards aboveground bush biomass use. Farmers considered the cost of 278 ± 31.87 Namibian dollar (NAM$) as being economically feasible in thinning a 1 hectare bush encroached area. The average economically feasible cost identified was lower than the actual cost of NAM$350 – 370 applicable to bush thinning during 2007. Findings on methods of financing showed that most farmers (representing 50% of the responses) preferred to cover their own expenses. Identified target areas where assistance may be required, were highest in the harvesting (34%), chipping (21%) and training/awareness (17%) categories. Overall, results revealed that both technical and capacity aspects should be strengthened for an effective bush thinning operation.

Environmental aspects were investigated with a vegetation survey conducted on the Cheetah Conservation Fund (CCF) farms *Elandsvreugde* (#367) and *Cheetah View* (#314) in the Otjiwarongo district. A data set comprising of 238 circular plots (each 113.14m^2) collected during the period 2003 – 2007 was used for analysis. Plots consisted of two previously completely cleared sites and three natural (non-thinned) sites. The survey revealed that the encroaching woody species density was dominated by *Dichrostachys cinere*a (37%), *Acacia reficiens* (24.4%) and *A. mellifera* (17.7%). Other species such as *A. fleckii* and *A. tortilis* were not commonly found. The *D. cinerea* species was mostly abundant in non-thinned sites, whereas *A. tortilis* occurred mostly in the recently completely cleared areas (e.g. Plot 1). Woody species diversity was highest in the non-thinned sites such as plot 3 (H' = 0.64) and plot 4 (H' = 0.63). The recently completely cleared plot 1 had the least woody diversity index (H' = 0.49). Comparisons of tree/shrub density among all study sites were not significant. Cylindrical aboveground biomass volumes for plot 4 were significantly different (higher) than those for any other studied site (F = 11.60, df = 4, p = 0.000). Using a harvesting scale of approximately 80%, findings have shown that harvestable aboveground biomass yields were 5.38 ±1.50 dry tons/ha (excl. moisture content). Tree/shrub densities were found to be lower than figures reported in the literature. Possible reasons for these differences may be methodological differences between various studies. Overall results revealed that standardization survey techniques and stratification over different habitat types, with a particular focus on aspects such as adequate sample size and variability in vegetation, should be considered for future surveys. Aboveground bush biomass could be considered a potential energy resource, however, the crux of this issue is restoring the savanna to its natural productivity without significant negative effects to the environment.

The role of bio- and landscape diversity in farming strategies - the case of the Keetmanshoop commercial farms.

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Introduction. This is a descriptive empirical analysis of land use strategies of commercial farmers with a focus on the role of bio and landscape diversity. The study aims at investigating the links between the ecological characteristics and dynamics of the rangeland and the management strategies of ranches. This is of particular interest if on-farm conservation should be fostered in the 40% of the Namibian territory used as private ranches for livestock production.

Methods. The case study was carried on mainly in 2005 among 22 commercial farmers of the Keetmanshoop area, Karas region. We conducted a small appraisal of farmers' perception of the rangeland resources and of rangeland dynamics and assessed elements of decision making in land use. For this purpose, we used a series of open and structured questions to herd and rangeland management as well as a series of exercises designed to conduct a cultural domain analysis.

Results are articulated around three axes: 1. the temporal use strategies; 2. the spatial use strategies; 3. regeneration strategies.

1. The temporal component of land use in the rotational systems considered refers to the timely movements of animals. Results show that 37 different plants corresponding to 20% of the plants identified in the near-by BIOTA observatory were cited. Yet, species are not used as indicator for range management: in most cases indicators are related to biomass, differentiating only between shrubs and grasses.
2. The spatial component assumes that the location of stock on the farm has an importance. Results show that different veld types appear at the farm level. Farmers understand soil-vegetation interaction through this concept and associate particular ecological and production characteristics to each type. Veld type as well as production-related parameters and breed characteristics enter in the spatial land use strategies.
3. Regeneration strategies are linked to the perception of the farmers on degradation and regeneration ecological processes. Those are not species based but rather distinguish only between main vegetation types: perennial versus annual grasses and dwarf versus higher shrubs. Factors perceived to impact on the vegetation of a rangeland include land use practices and rainfall.

Implications:

- ⇨ At landscape scale, there is a need for an official recognition of veld diversity and an assessment of rangeland vegetation other than with the use of biomass standards. Such a perception is supported by farmers' knowledge. The veld type concept, when related to the concept of key resources (Scoones 1998), can be helpful in the design of land attribution and farms structure or at least for farm management.
- ⇨ At the smaller scale, the capacity to monitor biodiversity is restricted. The benefits of biodiversity for production, especially of grasses, are not well known. A study of the role of biodiversity in farming systems themselves would be necessary to improve scientific understanding and increase awareness and knowledge among farmers of the benefits of biodiversity.

Application of an ecological-economic rangeland management model for interactive role-plays, scientific analyses and training purposes

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The ongoing degradation of savannah ecosystems has significant long term ecological and economic consequences. One of the central management parameters of livestock farmers is the adjustment of stocking rates depending on different factors such as rain, biomass production, the state of the livestock, costs, and herd composition.

We used an eco-hydrological model to simulate the vegetation dynamics in the Omaheke region/Namibia depending on environmental conditions. By dynamically linking this model to an agent-based economic model we are able to include decisions of land users. The ecological-economic model was used (1) to identify optimal land use strategies under different environmental, ecological and socio-economic conditions by running simulation experiments, (2) as a tool to conduct empirical experiments in order to deepen our understanding of the rationale of farmers, and (3) to develop a user friendly computer tool which allows farmers to experiment in a playful way with different management options.

Simulation and empirical analyses show that mal-adapted management strategies as well as high financial pressure lead to sub-optimal outcomes. Our approach produces context specific information for stakeholders as a means to support their search for solutions to achieve biodiversity maintenance as well as rural development objectives.

The training tool – a preview of which is launched at the Namibian Rangeland Forum (NRF) – is a computer farming simulation game. It is a simplification of reality which shows specific interactions between management decisions, production systems, environmental variations and/or changes on ecological consequences as well as the qualitative impact on the farming income. The programme is planned to be extended in future for instance to consider also the impact of grazing rotation in more detail. We present this early version of the tool at the NRF because we highly appreciate feedback that, if possible, will then be included in the final versions of the software.

Key words: rangeland management, ecological-economic model, training tool, Omaheke, companion model

Cooperative rangeland management of neighbouring resettled farms

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Livestock production under natural rangeland conditions forms the backbone of the agricultural industry and plays a significant role in the livelihoods of a large section of the people of Namibia. Rainfall in Namibia is very low and variable and is expected to decline and become more variable in future with the impact of climate change. The major challenge facing livestock farmers in the country is thus to develop and implement strategies to reduce their vulnerability to the adverse impacts of climate change.

Land reform is a reality in Namibia and the government intends to settle at least 15 million hectare of currently white-own commercial land with previously disadvantaged black farmers by 2020. Under the current government land resettlement model, multiple families are resettled on a farm formerly owned by a single farmer. These farmers find it very difficult to apply proper rangeland and livestock management practices due to limited number of camps and other infra-structure. Conflicts very often arise regarding the pumping of water and the use and maintenance of infra-structure on the farm. These farms were initially planned and developed for central decision-making by a single person. Currently, various units are allocated to different farmers and central decision-making is not possible any more, resulting in inadequate flexibility of farming practices (e.g. mating and weaning seasons, rotational grazing, etc.) to be applied. This leads towards increased rangeland degradation, inadequate improvement of farm productivity and subsequent increased vulnerability to droughts.

This presentation shares experiences gained by three resettled farmers on the farm Onjossa in the Erongo region over the past 12 months. Farmers agreed to merge smaller herds into bigger ones and to use all their camps together. This allowed for more camps per herd and shorter grazing and longer resting periods. Once farmers signed a memorandum of agreement, livestock of all the farmers were evaluated and sorted, with the support of the mentors. Mating seasons were introduced and high quality bulls were made available from stud breeders in the country for the duration of the breeding season. Important husbandry practices like vaccination, branding, dosing, castration, etc. were performed on all the animals. This presentation further describes the process used to set up the joint management approach; present some achievements to date and highlight challenges faced by such an approach.

The influence of patch burning in the Thornbush Savanna

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Although fires have shaped savanna rangelands for millennia, most farmers have controlled lightning induced fires on their farms for past decades, with resultant change in rangeland condition. A few farmers have tried to apply prescribed burning to portions of their farms, mainly to try controlling bushes that have thickened on the land, while very few apply patch burning for biodiversity. The application by farmers of prescribed patch burns provided an opportunity to measure the effect of the fires on five patches of rangeland spread over three farms in Namibia's Thornbush savanna. Four of the patches, burnt for bush control, were roughly 100 ha each, while the other, burnt for biodiversity, was about 10 ha. The beginning and end of 50-m transects were permanently marked in patches destined to be burnt, in nearby unburnt controls and, on one of the farms, in strips of 30-40m width destined to become firebreaks by grazing cattle within temporary electric fencing.

Plants of four different categories nearest to sample points spaced 2.5 m along the transects were marked and measured in the growing seasons before and after the fires, but only if they occurred within 5 m of the point. The plant categories were:
(i) perennial grasses of at least 5 cm living basal diameter;
(ii) woody plants taller than 0.5 m;
(iii) woody plants shorter than 0.5 m; and
(iv) current season seedlings of woody plants.
The patches were burnt with a head fire towards the end of the dry season.

There was almost no mortality amongst the taller bushes, with the fires only reducing their heights on two of the farms. Taking *Acacia mellifera* in the burnt zones as an example, the height reduced by medians of 2%, 72% and 68% at each of the three farms, while the canopy diameters increased by approximately 20% on two of the farms. It seems that the regrowth spreads out more from bushes that were burnt down. A considerable number of smaller plants died, even in the unburnt controls, probably due to the exceptionally long dry season in which the fires were applied. In the case of *Acacia mellifera*, only one seedling (3%) survived in an unburnt zone, while 65% of saplings survived in the unburnt zones, with no clear pattern of difference between zones among the three farms. For most perennial grass species the mortality was higher in the burnt patches and firebreak.

On the farm where patch burning was done for biodiversity, soil augured to 15cm was collected at three burnt patches and used for radish bioassay to determine overall fertilities. The lengths of intercepted dung were measured along 50m transects as an index of herbivore pressure. The fresh mass of radish plants grown on soil from a patch burnt two years previously was much higher than those grown on soil from the nearby unburnt control, presumably resulting from dung and urine of cattle and game attracted to the burnt patch. The dung cover one year after the most recent fire, when compared to that in the unburnt zone, was seven times higher in the firebreak and three times higher in the burnt patch. Radishes grown on soils of firebreaks and more recently burnt patches were heavier than those grown on soil from unburnt controls. The burning of small patches appears to create nutrient hotspots. However, the use of fire after such a premature end to the rainy season may be inappropriate for most rangeland management objectives. Rather than being applied regularly, fire should only be used strategically, and only after season's of above average rainfall when an abundance of forage and fuel is likely and perennial grasses could regrow on residual moisture from the previous season in case of insufficient rain after the fire.

The influence of high stocking density followed by rest on grass density and soil moisture in the Camelthorn Savanna

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There is still a lot of controversy around trampling as a rangeland management tool. Some promote animal impact for a variety of benefits including removal of old plant material, invigoration of existing plants, mulching the soil surface with trampled vegetation, favouring establishment of new plants, returning nutrients to the soil surface and breaking soil crusts that interfere with seed germination and rainfall absorption. On the other hand, others warn that trampling tends to result in lower infiltration rates where it destroys stable soil aggregates and leads to a deterioration of soil structure. Those who promote trampling all agree that it must be followed by sufficient rest to allow recovery after trampling. An innovative farmer, Jan Labuschagne, has gained considerable experience with trampling, through his adaptive management. His observations suggested that brief trampling after good rain, on soil with the right texture and organic matter content, conserved soil moisture, possibly by breaking the capillary connections that suck moisture from lower layers in untrampled soil. Therefore Gypsum blocks were buried at 10, 25, 50 and 80cm depths, both in and outside exclosures, replicated five times on each of three farms where livestock rotate rapidly through many paddocks. Vegetation in and outside exclosures was measured by point-centred quarter (PCQ). Initial results from the gypsum blocks are inconsistent among replicates and correlate poorly with soil moisture determined by weighing on augered samples. However, a few examples with greater consistency hinted that the infiltration was greater on trampled sites from where evaporation was less. The density index of plants – mostly annual grasses – was significantly ($P<0.05$) higher outside most of the exclosures. This increase of annual grasses on trampled sites may be responsible for subsequently sucking more water out from the soil, resulting in higher grass productivity from trampling (if followed by sufficient rest), but not in moister soil by the end of the growing season.

Observations by Jan Labuschagne suggest that if trampling is applied strategically in relation to rainfall events and soil conditions, and if followed by sufficient rest in the growing season, then trampling could be used over localised areas for improving rangeland condition. His management applications of the tool of trampling including the following:

- Only apply intensive trampling where the soil organic matter content is high or where there is abundant standing dry grass to trample down into the mulch layer.
- Only apply trampling to sandy soil in the growing season, when it is moist (if soil organic content is sufficient).
- Reduce the stocking rate on loamy soil in the growing season, to avoid compaction.
- Avoid trampling after good rains on soil where few perennial grasses grow, as the extra soil moisture tends to favour bush growth. Rather trample such poor paddocks after the first rain of the season, to encourage perennial grass emergence.
- Farm mainly with Damara and Van Rooi sheep that provide a better trampling service, mixed with limited Dorper genes to provide the larger animals demanded by the market.
- Control jackals to a limited extent and sacrifice the loss of a few sheep, so that the herd bunches well and mothering instincts continue to be selected for.

Trampling is a complex tool and should be differentiated between its variables of type of animal, stocking density and timing, season, soil texture, soil moisture profile and organic matter content of the soil. Farmers willing to apply the tool of animal impact need to bear in mind that long rest should be provided after the trampling and that animal performance may be sacrificed to some extent.

Helminth management in sheep for healthy rangeland

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Sheep and goat production is threatened by the development of resistance among helminth parasites to anthelmintic chemicals. This leads to a vicious circle if higher dosages of more toxic chemicals are applied more often. The toxicity of the chemicals furthermore threatens dung beetles, which provide critical services such as maintaining the health of rangeland soils and clearing away fresh dung that would otherwise harbour parasites and flies. There are Namibian farmers who manage to produce healthy livestock without the use of any toxic chemicals. They tend to treat the root causes, thus preventing the conditions that favour parasites. By leaving their animals out in the rangeland they avoid the close contact between dung and animals that would otherwise occur during kraaling. This requires good control over jackals and other small predators. The ways they achieve this include conservation of wild animals to provide favoured prey for the predators; hunting down of individual problem animals; regular maintenance of jackal-proof fencing; raising puppies with lambs to imprint them to become guard dogs; narrow breeding seasons to avoid providing predators with year-round lambs; and the use of indigenous sheep breeds with strong mothering and herding instincts. A few farmers even welcome low densities of jackals for the selective pressure they apply by removing the sick and weak animals from the herd and maintaining mothering and herding instincts. One farmer in South Africa strictly prevents his sheep from seeing any domesticated dogs, and he no longer experiences any loss to predators. However, more farmers apply their own selection by selling or slaughtering individual animals with high parasite loads. Farmers who practice rotational grazing are able to interrupt the life cycle of parasites so that the larvae which hatched after sheep were removed from a paddock find no host and die before the sheep return to the paddock. There are also a few farmers who treat the root cause of aggressive handling of their livestock by applying methods of stress-free herding, based on animal behaviour.

When farmers are still forced to overnight their livestock in kraals, there are ways to administer toxic chemicals that minimise their negative effects, and there are non-toxic treatments that will at least avoid harm to non-target species. One of these treatments involves the use of Effective Microorganisms (EM), which can be used to ferment cheap organic matter, such as barley waste obtained from Namibia Breweries, into a product known by its Japanese name of “bokashi”. Eighty sheep belonging to each of five farmers in the Rehoboth District were marked and divided into four groups of twenty. Forty of the sheep are fed daily by the farmer with about 100g each of bokashi. Twenty of these sheep are also dosed with 40ml of straight EM twice a year. Out of the forty marked sheep that do not receive the bokashi supplement, twenty continue to be treated in the normal way that the farmer used to treat them, usually by applying chemical anthelmintics a few times per year. The remaining 20 sheep serve as control, with no treatment against internal parasites at all. All marked sheep are weighed every 2nd month and egg counts performed on dung samples.

Neither the toxic chemicals conventionally applied by the farmers, nor the EM treatments, appeared to make much difference to the liveweight changes and parasite loads in the dung of the sheep. Despite the lack of evidence from the research, at a workshop the farmers were very enthusiastic about the EM. They notice improvements that are not detected by the research, such as the meat quality they observe when slaughtering their sheep. They agreed to continue with bokashi after the project, and discussed how they would organise themselves to purchase the ingredients. The cost of ingredients and materials for the EM treatments was approximately N$21 sheep / year. One of the farmers even used EM to successfully treat animals that were weakened by ingesting poisonous plants.

Bridging the gap – para-ecologists in action. A film project to promote capacity development and awareness raising.

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Capacity development and involvement of local, indigenous communities around the world in applied research activities is a tool to bridge the gap between scientific and indigenous knowledge which can brighten the future for them and for the generations to come. Using this opportunities effectively and productively can be beneficial for all the parties involved by helping land users to better understand the effects of climate change and land use on their natural resources in order to jointly develop adaptation and mitigation strategies for the future.

With this in mind, in April 2009 the South-African and Namibian para-ecologists conceived and made the film “Bridging the Gap – Para-Ecologists in Action”, in order to show how they bridge the gap and facilitate the exchange between local knowledge and academic science. In the documentary, the eight para-ecologists from various rural communities in South-Africa and Namibia introduce their every day’s activities in the field of research and knowledge exchange to the broader public. The film aims to encourage other organizations, agencies, research projects and land user communities to get involved in rural capacity development as a contribution to the sustainable development of our society.

The concept development and production of the film itself was a great learning opportunity and has been part of the para-ecologist training course in April and May 2009 in Nieuwoudtville / South Africa. In the talk we will present the participative film project as part of the capacity development component. We will present the aims and target groups of the film, how we conceived, planned and filmed the documentary and discuss the major learning experiences of the process were. The 20 minutes-long film will be screened on one of the evenings during the conference and free DVD copies are available on request.

Towards a National Rangeland Policy and Strategy for Namibia

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The alarming state in which much of Namibia's rangelands are, its inability to support a substantial portion of the nation and concomitant increase in poverty levels and the impact of land degradation on the national economy, is well known. Currently, the degraded state is most pronounced in the form of soil erosion, bush encroachment, loss of perennial grasses and deforestation. Effects on ecosystem processes from current unsustainable livestock management practices include: (1) negative impacts on the water cycle with bare and/or capped soils resulting in poor infiltration of water into the soil, high evaporation rates, high run-off, and erosion; (2) negative impacts on the mineral cycle where the soil surface is repeatedly grazed bare, resulting in little or no conversion of soil surface litter into organic matter in the soil; and (3) loss of biodiversity due to these hostile conditions in which many perennial plants are lost, leaving behind a largely annual grass community dominated by a few species. With this current situation of Namibia's rangelands and the current and potential impacts thereof on the livelihoods of a large number of Namibians in mind, it is of paramount importance that something drastically and urgently be done. It was against this background that the Ministry of Agriculture, Water and Forestry (MAWF), in cooperation with the private sector and non-governmental organizations, developed a draft Rangeland Management Policy and Strategy (NRMPS). This document should serve as framework and guideline towards implementing strategies that will: 1) enable rangeland users and managers to manage their rangelands in such a way that productivity and biodiversity is restored and maintained; 2) reduce vulnerability of rangeland users and managers to the adverse impacts of climate change and seasonal environmental variation; significantly contribute towards improving the livelihoods of people that are directly or indirectly dependent on rangelands; and serve as basis for monitoring the effect of bush encroachment on underground water levels.

This presentation will discuss: 1) the rationale for having a national rangeland management policy and strategy; 2) major goals and objectives of such an initiative; 3) the basic principles of sound rangeland management; and 4) how these principles could be applied under different situations on the ground.

The controlled fodder flow grazing management strategy (Dames, 1996) and "grass fed beef production": a sustainable, proven, environmentally friendly, extensive animal production model for the semi-arid and arid environments of southern Africa.

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Almost the whole of Namibia receives a long term average rainfall of less than 500 mm per annum and can therefore be classified as Semi-Arid and Arid rangelands. The low and often unpredictable rainfall makes the planning and execution of sustainable animal production models extremely difficult and management in such environments is often driven by short-term decisions in a "reactive" mode. Management decisions are often led by short-term weather patterns and fodder flow management is very difficult.

The development and subsequent refinement of the controlled fodder flow grazing management strategy by Dames (1996) could be seen as a real time solution towards more effective fodder flow control and better drought tolerance in the above mentioned areas. The strategy was developed from interim results from a long term grazing experiment at the Adelaide research station in the False Thornveld of the Eastern Cape. In this trial the effects of animal number, distribution and type on rangeland and animal performance is tested. Initially the Controlled fodder flow grazing management strategy was based on one third of grazing to be rested annually and the other two thirds to be grazed rotationally. After implementation on various farms in South Africa, it was refined to the point where 50% of the grazing is rested annually while the other 50% is grazed. In other words a specific grazing area receives biannual full year resting from August to July and is subsequently grazed for a year following the yearlong resting.

This flexible management strategy proved to be extremely successful in practice with numerous examples in the Northern Cape, North West and Free State Provinces of South Africa. Farmers practicing the strategy have been recognized nationally with various awards e.g. The ARC's best performing stud in South Africa 2007 (Op Die Aarde Bonsmara). They also received the Voermol award for best Beef farmer in South Africa during 2008. In communal rangelands various successful operations implemented the strategy. The best performing example is probably the Maketlele land care project, initiated and developed by the NW DACE and now part of the Northern Cape Province. Veld condition and animal production improved significantly at Maketlele since the incorporation of the strategy into their grazing management despite stocking rates much heavier than Departmental norms.

In general, carrying capacity at all locations where the strategy has been implemented increased between 30 and 50% within 5 years of implementation. This can be seen from the increase in animal numbers in commercial projects and better animal performance in communal projects. The higher grass production subsequent to yearlong resting has been proven at the Nooitgedacht research station, at Ermelo, South Africa.

Grass fed beef production is a low cost beef production model ideally suited to the arid and semi arid rangelands of Southern Africa with sweet and mixed veld. It is a niche market with a growing demand world wide and in South Africa. Small framed cattle with special reference to indigenous African breeds and their crosses is ideally suited to the production of grass fed beef due to the fact that they can be easily finished on natural rangelands without the need for grain (no grain is allowed in true grass fed beef production). Grass fed beef and game meat is regarded as the most healthy red meat on earth. The healthy aspects include a much longer shelf life, 4 times higher Vitamin E, 3 times higher Omega 3 fatty acids , 10x lower E coli counts and much higher CLA as compared to grain fed beef(www.eatwild.com). It has properties that significantly reduce the chances for heart attacks, cancer and modern lifestyle diseases. The South African market for grass fed beef is growing and well known retailers like Pick 'n Pay and Woolworths are offering it to the public especially in Gauteng Province. Brand names like "Kalahari Beef" etc are used to market the products. A-grade prices are fetched for B-grade grass fed beef cattle. Namibia and Botswana are exporting grass fed/free range beef to the EU.

Economists like Prof Johan Willemse from the University of the Free State believe that grass fed beef is the lowest risk alternative for sustainable beef production in Southern Africa, because the risk in financial sustainability for grain fed beef is rising and it is forecasted that it will become more and more difficult to produce grain fed beef in a financially sustainable way due to the fact that a larger and larger chunk of maize available for meat production will be utilized for mono gastric meat production (chicken and pork) and mono gastric animals are up to 300% more efficient in conversion of grain to meat as compared to ruminants (beef, sheep, goats).

Therefore the well proven controlled fodder flow grazing management strategy incorporated into "grass fed beef production" could be seen as a sustainable, environmentally friendly production model for extremely healthy red meat from arid and semi-arid rangelands of Southern Africa.

Cooperation in the commons: evidence from a cross-cultural field experiment on common-pool resource management

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The presentation reports on some major results obtained from a series of economic experiments carried out in the Namaland in Namibia and the Namaqualand in South Africa. The experimental set-up aims to mimic a typical common-pool resource dilemma communal farmers are faced with in their everyday lives. However, in contrast to standard experiments, our experimental design is framed according to the grazing situation in semi-arid regions, and thus has features of path-dependency of previous use, spatial resource availability and non-linear revenues. We analyse farmer's propensity to cooperate and find substantial differences between Namibia and South Africa which we attribute to the different historical developments the communities experienced. We further analyse the preferred choice among three real-life institutions: rotation, lottery and a regulation rule. A huge majority of people in both areas chose the rotation rule and it seems that this choice was driven by a combination of advancing self-interest and, in Namibia, good network connections within the village. However, rule breaking, especially in Namibia was highest with the rotation rule which led to lower earnings and worse grazing conditions.

Can land taxes be a tool for rangeland conservation? – Application of bio-economic modeling for on-farm conservation

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– Introduction and aim

In the context of the land reform, land taxes have been designed and implemented in Namibia for all privately owned agricultural land. Land valuation was carried on throughout the country to create a basis for the taxation. During the process of land tax design, concerns were raised about the financial burden that the tax represents. Will the tax lead farmers to change their farming strategies and would this change impact on veld management and veld condition? Another question concerned the possibility of developing a taxation system, which would reward good veld maintenance or veld conservation. Answering these questions is the aim of this contribution. First we conduct a positive impact analysis and in a second step, we develop two alternatives of rangeland condition-differentiated taxation schemes and compare impacts of the actual and the alternatives on stocking strategy and veld condition.

– Methods

We use a bio-economic model, based on optimization techniques and programmed in GAMS. The advantage of this tool is that the impacts of rainfall, a major driver of the socio-ecosystem, and of stocking decisions are explicitly modeled. Bio-economic models represent management decisions and the ecological dynamics of the veld. Resources, objectives of the decision making and possible activities are inputs in the model and outputs consist in the optimal land use strategy in terms of stocking rates over time to suit the defined objectives for the modeled farm. Rangeland ecology is incorporated in the model using the concept of state-and-transition.

– Results

We first found that at the actual level, the fixed tax does not lead to a major change in farming strategies, nor has an impact on the veld condition, according to modeling results. Second, thanks to a shadow price analysis, we were able to calculate land values for the rangeland, depending on its condition, that is in which ecological state the rangeland is in. Values for a system involving only Dorper monoculture in southern Namibia vary between 21 NAD/ha for healthy states to -78 NAD/ha for degraded states. Based on this, we third found that the rangeland condition-differentiated tax schemes create an incentive for the modeled farmer to change its strategy and increase conservation on the farm. This is especially the case when resting in rainy years is favored, as in the scheme rewarding good practices, as opposed to the scheme penalizing bad practices.

Conclusions

The land tax at its actual level would not lead to changes in the land use strategies of farmers. Incentive tax design can bring the same amount of income to the state and foster on-farm conservation.

The practicalities of implementing the NRMPS from a legal perspective

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There is a plethora of research that indicates the existence of degraded pastures and farming lands in Namibia. The solutions to such a dilemma often fail because of an unfavourable socio-economic, legislative and policy environment. Namibia is signatory to various international, African and regional environmental legal instruments. While the Namibian Constitution does not guarantee the right to a healthy environment, it enjoins Government to adopt policies aimed at the protection of the environment. In addition the Ombudsman has the mandate to investigate complaints regarding the misuse or abuse of natural resources. However some provisions of the Constitution, or a lack thereof, may inadvertently compromise these clauses. The Namibian Government has made a pledge already in 1992 through its Green Plan to promulgate laws that would support the sustainable use of land. Despite this commitment coupled with its international and national obligations, there is not a single law to date that deals explicitly with the conservation and management of rangeland. There are a number of pre-and-post independent statutes, policies and strategies currently on the law books of Namibia that deal indirectly with the issue. While they may highlight land degradation as a serious problem, none of these laws provide direct guidelines on how to deal with the degradation of rangeland. In addition they contain gaps that beg the necessity of rangeland policy (NRMPS). Furthermore the lack of, or the partial implementation of, existing laws might also be a major stumbling block in the implementation of a future rangeland policy. It is therefore imperative to consider measures to the effective implementation of the proposed NRMPS. There are generally two ways through which land degradation may be controlled, *viz* direct or indirect controls. Direct controls means to set standards or to prescribe or prohibit certain actions by the land user. To control unsustainable management of rangeland, the government can for instance prescribe what the carrying capacity on a particular farm should be. The question that arises in this context is to what extent direct implementation of the NRMPS will affect the concept of land ownership? The key to a practical rangeland policy is control of land use, and there is a close relationship between control of land use and ownership of the land, since the owner's use of his land may be extensively curtailed or limited by means of direct land use control measures, such as the prescription of how many cattle or livestock a farmers may keep on their land. This approach therefore presents a clash between the owners' right to property as guaranteed by the Constitution and a conservation policy. A less direct way to influencing environmental behaviour and promoting the economically efficient and equitable use of rangeland in the country, is the application of economic incentives (indirect controls). Economic incentives or measures such as land taxes (done by Ms Domptail); subsidies; environmental bonds; compensation; benefits and market permits, would endeavour to correct market signals which lead to environmentally damaging activities. Both approaches have merits and demerits, but one has to strike a balance between the two competing interests, namely the land owner' rights and the need to conserve and protect the environment.

Land degradation monitoring and assessment methods: A review

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Land degradation is an increasing problem in many parts of the world. Success in fighting land degradation requires an improved understanding of its causes, impacts, degree and acquaintances with climate, soil, water, land cover and socio-economic factors. Therefore, land degradation monitoring and assessment is a primary goal in decision support systems for reversing degradation. Scientists around the world identified this problem early on and developed several monitoring and assessment methods for land degradation. This study explores and reviews existing land degradation monitoring and assessment methods used globally, regionally, locally and at field/farm level in an attempt to recommend sustainable approaches applicable to Namibia. Results of this study lead to the conclusion that there are several approaches for assessing and monitoring land degradation worldwide. Expert opinion, field measurement, field observation, land user´s opinion, productivity changes, remote sensing and modelling approaches act as basal studies for other approaches used to assess and monitor land degradation at different levels. The first distinction that has to be made is land use, land types and scale. Methods or techniques need to be cautiously selected, taking into account suitability, applicability and adaptability to local/farm levels. These assessments coupled with stakeholder participation leads to higher adoption of proposed techniques ultimately aiding land use, restoration planning and prioritization of projects. Furthermore, researchers have reported that statistical methods, ordination, and modelling approaches are costly, complicated, and time consuming. Therefore a lack of experienced personal and availability of resources are some of the main barriers to successful assessment and monitoring systems. This review also revealed that, stories of failures in using different monitoring and assessment methods are very few which is somewhat surprising. Does that means everything works?

Rangelands as catchment ecosystems

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Rangeland ecology is steeped in the traditions of plant community dynamics of pasture or veld types and their internal dynamics. Attention to managing veld types has proved to be very important in raising landscape productivity and agricultural production. What has yet to be fully understood and harnessed is the promise of a more hierarchical, catchment-based understanding of rangelands. Two key issues demonstrate this promise.

Firstly, veld types are not permanent features of the landscape as vegetation maps might suggest. Instead, physical landscape succession processes driven by broadscale erosion, transfer and deposition fundamentally change the spatial conditions for plant growth over time. Thus, at the edges, “apples” can become “oranges” and vice-versa and grazing management needs to attend as much to the relationships between desired veld types and their neighbours as the internal dynamics of individual veld types. A good example of this is when floodplains contract and the more bushy adjacent vegetation expands to take up vacated space. These dynamic edges are very useful for “early warning” monitoring.

Secondly, some key processes related to drainage patterns not only link adjacent veld types, they unify whole catchments. Thus, if a river channel cuts down because a rock bar across it snaps, lowering the base level, gulley erosion of most fertile parts of each successive veld type will proceed all the way to the top of the catchment. This process may run through whole farms, not just camps. It is a good example of why farmers need to collaborate in maintaining the health of the connected network of valley floor systems from main rivers and their floodplains all the way back to upland dambos. This incision-driven drying out of rangeland catchments is a pressing, overlooked global issue and is driving bush encroachment as water-ponding surfaces no longer pond effectively. Affected catchments – especially the most arid catchments - experience downward spiralling of rain use efficiency and greater drought vulnerability. This is clearly of national and global importance in the context of climate change and ever increasing populations.

What does it need to repair the condition and productivity of Namibian rangelands?

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Mismanagement of the natural rangelands of Namibia, based mainly on a lack of appropriate knowledge, is playing havoc with the productivity of the livestock and game sector of the national agricultural economy. Effects are well-known and range from severe loss of rangeland productivity due to bush encroachment on millions of hectares of savanna rangelands, to the halving of the national commercial cattle herd, to an estimated loss of foregone beef income of N$700 million per year (in 2004).

While the extent of the crisis is clear, remedial measures are not. In 2008, at the request of organized commercial agriculture, a committee of technical experts and stakeholders in rangeland management identified some major principles of sustainable rangeland utilization, which were to be integrated into a National Rangeland Management Policy, currently with Government. These principles, in no particular order, are:

- Know and understand the natural resource base and its indicators.
- Plan the farm (ranch) so that forage is utilized effectively
- Allow forage, especially the perennial grasses, effective rest after defoliation.
- Apply adaptive forage management for farm animals.
- Restore the rangeland at every possible opportunity.
- Make pro-active provision for the next drought.
- Monitor rangeland utilization and use records to inform grazing management.
- Take care of the soil, especially the top layer of soil.
- Take care of underground water resources.

The application of these principles will certainly slow the rate of rangeland degradation and even reverse it, as restoration is a critical element of sustainable rangeland management. However, this specific principle lacks detail and innovative ideas on how degraded rangeland can be restored and rehabilitated to its former condition and productivity; in the short, medium and long term.

Some short-term measures that may contribute to rangeland restoration are:

- Avoid degradation in the first place.
- Correct balancing of stocking rates with carrying capacities.
- Selective thinning of invasive bush species.

Medium- and long-term measures include the following:

- Contingency planning and opportunistic management to face challenges and exploit opportunities.
- Restore the botanical composition of the grass sward.
- Improve soil cover so that top soil conditions improve and the water cycle recovers.

These are just some of many specific suggestions that would restore degraded rangelands. It is hoped that the members of the Namibian Rangeland Forum gathered here today can identify many other strategies during the subsequent brainstorming session. These inputs should then be brought to the attention of the relevant authorities to back up with extension, research, monitoring and material support and be publicized amongst the farming community to implement. *After the shock of recognition, it is time to face the challenge of restoration!*

Field visit to research sites at Neudamm

Dave Joubert

A visit will be paid to the Neudamm sites where research into the dynamics of *Acacia mellifera* are being conducted (page 7). At the site burnt last year, and another burnt last week, the effects of fire will be visible. At the unburnt sites evidence of hare browsing will be pointed out, while the effects of hare exclusion will become apparent at the exclosures. The research into the effects of perennial grass on vigour of *A. mellifera* seedlings will be explained and discussed.

Burnt rangeland recovers in the growing season after the fire

The cage (above & below) excludes small browsers, such as hares

A burnt *Acacia mellifera* seedling was a victim of the fire

Field visit to restoration site and untreated control

Ibo Zimmermann, Kuniberth Shamathe & Justus Kauatjirue

Participants of this field visit will be able to witness the results of the pilot restoration project in the Auas-Oanob Conservancy (page 8). A walk along the treated gully system will allow viewing of, and discussion on, the strategic placement of filters made from chopped branches of *Acacia mellifera*. Some "before treatment" photos will be passed around, to provide an impression of the changes that have taken place. Visitors will also be able to view the exclosures, both at the treated gully system and at one of the untreated controls.

A gully head is packed with branches

Same site as top left, 18 months later

Wire is woven through branches in the filter and tied to nearby trees

One branch got turned 180^0 by the water flow, but the wire held it within the filter

Grasses filter a gulley as branches rot

A filter row between two gullies

Namibia’s draft National Rangeland Management Policy and Strategy is a separate document that appears from here onwards in the printed version. Electronically, it appears as two separate files, named NRMPS_cover and NRMPS_contents.