Grassland Society of Southern Africa

60th Annual Congress

ANEW Hotel Hilton, KwaZulu-Natal, South Africa

21 - 25 July 2025

PROCEEDINGS

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Abstracts

BRITISH ECOLOGICAL SOCIETY
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Publishing with Society Journals Workshop

Advancing the publishing and peer-review skills of ecology researchers and practitioners

A full-day interactive workshop focused on advancing publishing and editing skills of ecology researchers and practitioners at all career stages. Sessions will explore the why, where, and how of publishing in peer-reviewed journals, with practical tips on selecting a journal, manuscript preparation, submission, navigating peer review, conducting peer-review and how to get involved in editorial roles within journals. In addition, we will cover why a lack of funding should never be a reason to not publish and how you can support the ecological community with your choice of journal. Participants will gain insights from editors, reviewers, and experienced authors—especially those working in African and Global South contexts. The workshop will also highlight the importance of co-designed research and stakeholder inclusion to enhance the relevance and impact of publications. Whether you're a student, professor, or a field-based practitioner, this workshop will help you confidently take your next steps toward publishing success.

Monday, 21 July 2025

09:00	**Registration/Meet & Greet**	
10:00	**Welcome and Introduction**	
10:10	**How to Fund Publishing Research4Life, BES Waivers, and navigating APCs**	*Adam Wheeler & Rowena Gordon*
10:45	**How to Get Published Choosing journals, peer review, bias, and ethics**	*Arley Muth & Rowena Gordon*
12:15	**Lunch**	
13:15	**Writing Workshop Manuscript structure, storytelling, clarity, and local case examples**	*Arley Muth*
14:25	**Co-Design in Research Stakeholder engagement, relevance, and inclusive science**	*Marc Cadotte & Errol Douwes*
15:25	**Tea**	
15:45	**How to Get Involved in Publishing Pathways from peer reviewer to senior editor or career editor**	*Arley, Marc, Errol, Rowena*
16:05	**Q&A and Panel Discussion Interactive discussion with local and international voices**	*Chair: Adam Wheeler*
16:35	**Wrap-up and Reflections Final thoughts and next steps**	

Strategies to protect, manage, and restore ecosystems to address societal and environmental challenges, benefiting both people and nature

Nature-based Solutions are being promoted as a silver bullet approach to mitigate disaster risk, enhance climate resilience, and improve development outcomes around the world.

New interventions are far-reaching, and often enmesh diverse actors, species, landscape elements, technologies, spatial scales, social institutional and policy processes. Yet, much of the evidence of how to translate principles into practice comes from the Global North, from urban, wetland and forestry interventions. What are Nature-based Solutions (NbS) in the Southern African context, and how do we make sense of their penetration into policy frameworks and the dynamic rangelands and grassland landscapes where we study?

What research framings, collaborations, and knowledge engagements are needed to understand the suitability and feasibility of NbS in reducing disaster risk and climate change vulnerability? What methodologies are required to evaluate claims that NbS can achieve desirable interlinked social, economic, and ecological outcomes together across diverse rangeland and grassland environments? How should we design research on rangeland NbS that integrates ecological concerns alongside questions around governance, social justice, market access and more?

This workshop invites participants from across social, natural and physical sciences and members of communities of place and practice to critically examine the debates and questions surrounding approaches to NbS – exploring their assumptions, promises, technical and scientific limitations, and implications for land politics and communal governance in diverse, productive equilibrium and non-equilibrium socio-ecological systems.

Accordingly, we invite you to join and contribute your own insights to this interdisciplinary research workshop on NbS in African Rangelands. The facilitators will draw on three recent and ongoing research projects into NbS interventions, namely the Resilient and Equitable Nature-Based Pathways in Southern African Rangelands (REPAiR -**https://repairproject.org/**), the Pastoralism, Uncertainty and Resilience (PASTRES - **https://pastres.org/**) project, and finally the Mega-Living Landscapes Research from the Convivial Conservation project (**https://www.convivialconservation.com/**). In particular, we hope to bring together disciplinary and thematic expertise spanning the social sciences (development studies, resource governance, political economy of climate adaptation, political ecology, human geography), natural sciences (rangeland ecology, biogeography, invasive species, botanical biodiversity and taxonomy) and humanities (anthropology, sociology, environmental justice).

Facilitators

Dr Amber Huff (Institute of Development Studies, University of Sussex) and Dr Adrian Nel (Geography, University of KwaZulu-Natal), with key contributions from Prof Kevin Kirkman, Dr Linda Pappagallo and Dr Frank Matose

GRASSLAND SOCIETY OF SOUTHERN AFRICA

REPAiR
Resilient and Equitable Nature-based Pathways in Southern African Rangelands

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INYUVESI YAKWAZULU-NATALI

SESSION CHAIR: SUSANNE VETTER

Tuesday 22 July 2025, 08:00 - 10:30

KEYNOTE ADDRESS: SUSTAINABLE SOCIETIES AND RANGELAND SYSTEMS

Timothy O'Connor

Pietermaritzburg, South Africa

The 60th anniversary of the GSSA denotes that this society has successfully served a professional community of applied natural scientists tasked with providing appropriate knowledge for management and policy decisions. The two main instruments of the GSSA have been an annual congress and the publication of a professional journal. Future success relies on the GSSA remaining a society of relevance to practitioners, and on attracting sufficient submissions to maintain the journal, both of which need support. A profile to enhance the success of each is developed within a context of resurrecting a largely dormant systems approach to rangeland ecology and management. A conventional approach to systems ecology has advocated a minimal but sufficient system structure for the issue at hand. But we are faced with many novel contemporary issues which are of more complex and multi-faceted than most faced in the past. To this end, an approach to defining the complexity of an ecosystem is presented in the context of some pressing, and complex, rangeland management issues. In so doing, the integral value of maintaining the society and its formal activities is highlighted.

PLATFORM PRESENTATION: BEYOND GRASSES - UNDERSTANDING THE CRITICAL ROLE OF FORBS IN SOUTHERN AFRICAN RANGELANDS

Sindiso Nkuna[1], *Craig Morris*[1,2]

[1]School of Life Sciences, University of KwaZulu-Natal, Private Bag X01, Scottsville 3209, Pietermaritzburg, South Africa.
[2]Agricultural Research Council – Animal Institute (ARC-API), Pietermaritzburg, South Africa

Forbs are a diverse and vital component of grassy ecosystems, offering numerous essential ecosystem services such as enhancing biodiversity, supporting soil fertility, and providing forage for herbivores. However, despite their ecological importance, herbaceous non-grass species are often overlooked in ecological assessments, with their significance and functional roles frequently under-evaluated. This study aimed to address this gap by examining the extent to which grassland forbs have been considered in research published in the Grassland Society of Southern Africa (GSSA) journals from 1966 to 2023. To accomplish this, we conducted a comprehensive search of the Taylor and Francis online database, using the term ‘forbs’ to identify articles where forbs were mentioned or studied. We included articles that discussed forbs regarding species composition, diversity, and responses to various environmental and management factors, such as grazing and fire. A total of 259 articles mentioned forbs at least once in the text, 35 abstracts included forbs, and four papers featured forbs in the title. These studies were predominantly conducted in mesic and semi-arid grasslands or savannas. The majority of articles either mentioned forbs or measured their abundance as part of a broader vegetation survey, with only a subset providing quantitative data on forb species composition and diversity. Notably, the number of studies focused on forb species composition has increased significantly in recent decades, highlighting a shift towards more detailed ecological assessments. Grazing pressure has been the primary disturbance studied for forbs, followed by fire and environmental factors such as climate variation and soil properties. Research has predominantly focused on how these disturbances affect the abundance and diversity of forbs, with findings indicating that forbs are generally more sensitive to grazing than grasses. However, despite this growing body of research, several key gaps remain. A major limitation is the inconsistent grouping or definition of forbs across studies, which has hindered comparative analysis and the development of consistent methodologies. Additionally, there is a lack of studies exploring the functional or phylogenetic diversity of forbs, limiting understanding of their ecological roles and contributions to ecosystem

processes. This study demonstrates that, while research on forbs in grasslands has advanced over six decades, there is still much to be done to standardise definitions, explore functional and phylogenetic diversity, and better understand the resilience and management of forbs in response to disturbances. Addressing these gaps will enhance our ability to manage and conserve grassland ecosystems, particularly in the face of growing threats from land-use change and climate change.

PLATFORM PRESENTATION: WHERE SHOULD WE FEAR THE "SECOND BITE" IN THE GRAZING LANDSCAPE?

Richard Fynn

Okavango Research Institute, University of Botswana, Maun, Botswana

A key factor influencing the design of high-density, short duration grazing management systems is to attempt to minimize selective grazing and prevent regrazing of tufts of palatable perennial grasses. Preventing regrazing of tufts is done by having short enough periods of occupancy of paddocks so that grazed tufts have insufficient time to regrow before the livestock are moved. This emphasis on avoiding regrazing originates from a perception that regrazing is bad for survival and productivity of palatable perennial grasses. Theory and evidence suggest, however, that the effect of regrazing of palatable grasses on their persistence and abundance depends on whether grazing was selective or non-selective. Under selective grazing, where only the palatable grasses are eaten, experiments show that regrazing leads to decreased productivity of the palatable grasses, whereas the unpalatable neighbours increase in productivity, leading to shifts in grassland composition from dominance by palatable grasses to dominance by unpalatable grasses (rangeland degradation). By contrast, however, under non-selective grazing palatable perennial grasses become very competitive when both they and their unpalatable neighbours are repeatedly regrazed. For example, in a controlled competition experiment, the palatable grass *Themeda triandra* Forssk, eliminated unpalatable grasses in non-selective clipping treatments, whereas the unpalatable grasses persisted under clipping in monoculture, demonstrating the strong competitive strategy of *T. triandra* under non-selective defoliation. This competitive strategy enables *T. triandra* to become dominant in grassland under regular non-selective defoliation, such as annual fire and more so under multiple mowing events each summer. In addition, *T. Triandra* was observed to increase greatly in abundance under focused non-selective grazing at Clive Buntings Stratherne Ranch near Dundee, KwaZulu-Natal, and similarly it dominates grazing lawns in the Transkei where grazing is intense but non-selective. The mechanisms underlying these effects of regrazing on competitive interactions among palatable and unpalatable grasses across the grazing landscape appear to be related to effects on root growth, where under selective grazing only the roots of the palatable grasses are reduced, greatly reducing below-ground competitive impacts on the unpalatable grasses, leading to increased productivity of the unpalatable grasses. Clipping experiments showed that *T. triandra* is more tolerant of defoliation than the unpalatable grass, *Aristida junciformis*, which means that it likely maintains better root growth under non-selective defoliation than unpalatable neighbours, giving it a competitive advantage. This evidence shows that it is not necessary to have grazing strategies based on short duration of occupancy in paddocks to avoid regrazing of palatable grasses. Instead, grazing strategies that promote non-selective defoliation through fire followed by focused grazing in priority paddocks are expected to give palatable grasses a competitive advantage, as was observed at Stratherne Ranch. Such approaches also avoid the problems of poor forage quality available to livestock under short-duration grazing. In conclusion, poor and incomplete knowledge of when and where regrazing of tufts negatively affects palatable perennial grasses has led to unnecessary grazing strategies to avoid regrazing, which lead to unintended consequences for animal performance.

PLATFORM PRESENTATION: HETEROSPECIFIC WOODY PLANT OVERSTORY EXACERBATES WOODY PLANT ENCROACHMENT IN SEMI-ARID SAVANNA OF SOUTH AFRICA: INSIGHTS FROM OVERSTORY-UNDERSTORY RELATIONSHIPS

Mthunzi Mndela[1], Thabiso Nkenkem[1], Humphrey Thamaga[2]

[1]University of Fort Hare, Alice, South Africa. [2]University of South Africa, Johannesburg, South Africa

Woody plant encroachment (WPE) has been a global concern for biodiversity conservation and rangeland productivity for over 150 years. Yet, little is known about how the overstory structure of adult woody plants drives woody seedling recruitment, potentially exacerbating WPE. We investigated the effect of monospecific and multi-

species overstory structure hereafter “conspecific (>90% Vachellia karoo) and heterospecific encroachment” on seedling and sapling densities, and species richness in semi-arid savanna of the Eastern Cape, South Africa. Using woody cover, we categorized conspecific and heterospecific encroachment into three levels: non-encroached control (<20%), moderate (>20-50%) and high encroachment (>50%). The overstory structure and encroachment level interacted significantly on seedling ($p<0.001$) but not sapling densities. Moderate and highly encroached heterospecific overstory attained 4 to 13-fold higher seedling densities relative to conspecific overstory. The overstory structure by encroachment level interactions were significant for seedling and sapling species richness ($p<0.001$), with highly encroached heterospecifics harboring more species than other treatments. A model incorporating overstory density, canopy cover, basal area, height and species richness explained 74% variation in seedling density ($p<0.001$), with overstory canopy cover ($\beta = 0.49$, $p = 0.012$) and species richness ($\beta = 0.38$, $p = 0.002$) being the best predictors. In conclusion, overstory adult woody plants promote WPE by promoting seedling proliferation, largely under high heterospecific encroachment. Our model revealed that seedling recruitment was driven largely by overstory canopy cover and species richness, signifying that canopy thinning and selective removal of certain overstory species may be crucial for combating WPE.

PLATFORM PRESENTATION: MEASURING ADAPTIVE DECISION MAKING IN LIVESTOCK GRAZING SYSTEMS IN THE SOUTHERN GREAT PLAINS OF NORTH AMERICA

Jenna Likins[1], Jason Sawyer[2], Urs Kreuter[1]

[1]Texas A&M University, College Station, Texas, USA. [2]East Foundation, San Antonio, Texas, USA

Adaptive management is increasingly recognized as a necessary approach for managing complex and dynamic grazing systems under environmental uncertainty. However, its implementation in livestock grazing systems is inconsistently defined, measured, and applied, limiting both research advancements and practical adoption. This study addresses this gap by developing and validating the Adaptive Management Index (AMI), a standardized instrument designed to quantify the implementation of adaptive management at the ranch level. Drawing from theoretical frameworks, the AMI is structured around four key phases of adaptive management: planning, monitoring, evaluation, and adjustment. A comprehensive literature review and expert panel evaluation identified 64 valid indicators to capture producer engagement in each phase. Data were collected through a mail survey of 2,100 livestock producers in the Southern Great Plains of Texas, resulting in 255 valid responses. Composite index construction techniques, including principal component analysis and multivariate regression, were used to create and validate the AMI. Findings reveal that while planning, monitoring, and adjustment are moderately practiced among respondents, the evaluation phase is underutilized. AMI scores were significantly associated with producers’ mental models of grazing system dynamics, indicating that adaptive management implementation influences perceptions of system interconnectivity. Demographic predictors of AMI included gender and ranching heritage, but not income, education, or land size. The AMI enables a more precise understanding of management complexity and provides a tool for assessing grazing strategies independent of grazing method. This study advances both the conceptualization and operationalization of adaptive management in grazing systems and offers a foundational tool for researchers, extension agents, and producers to promote learning driven decision-making that enhances resilience in social-ecological systems.

PLATFORM PRESENTATION: NATURE-BASED SOLUTIONS TO ECOSYSTEM IMPACTS OF BIOLOGICAL INVASIONS: EVALUATING THE ROLE OF MEGAHERBIVORES IN SUPPRESSING AND DISPERSING INVASIVE NON-NATIVE PLANTS IN SOUTH AFRICAN SAVANNAS

Londiwe Mokoena[1], Elizabeth Le Roux[2,3], Michelle Greve[1,4]

[1]Department of Plant and Soil Sciences, University of Pretoria, Pretoria, South Africa. [2]Center for Ecological Dynamics in a Novel Biosphere (ECONOVO) & Center for Biodiversity Dynamics in a Changing World (BIOCHANGE), Department of Biology, Aarhus University, Aarhus, Denmark. [3]Mammal Research Institute, University of Pretoria, Pretoria, South Africa. 4Department of Zoology , University of Pretoria, Pretoria, South Africa

Understanding the role of megaherbivores in managing novel ecosystems is increasingly important, especially as their populations decline globally. One potential function of megaherbivores that remains underexplored is their role as natural regulators of invasive plant populations. As climate change reduces the competitiveness of native species and facilitates the expansion of non-native species, there is growing interest in using nature-based solutions to manage biological invasions. This study aims to examine the role of megaherbivores in novel ecosystems by

investigating the impact of large herbivores on invasive plant dynamics. The research focuses on two main objectives: (1) to assess whether megaherbivores reduce the abundance of non-native species through herbivory and physical damage at the seedling and adult stage. Paired sites (megaherbivores present vs absent) were surveyed in multiple reserves in Gauteng and Limpopo. In each reserve, adult plants of focal invasive species were assessed visually for herbivory (0–100% of foliage consumed) and physical damage, including trampling, stem breakage and browsing. To assess impacts of megaherbivores on seedlings, plots were established near adult plants of the focal species. Within each plot, seedlings and saplings of the focal species, and herbivory on these, were recorded. We compared herbivory damage between adult plants, and density and herbivory of seedlings, in reserves with vs without megaherbivores. Preliminary results suggest that megaherbivores significantly increase physical damage to invasive plants. In areas where megaherbivores were present, tip browsing on adult plants was higher than in areas without them. Similarly, trampling damage was significantly greater in sites with megaherbivores compared to control sites. These patterns indicate that megaherbivores may suppress invasive plant populations by intensifying browsing pressure and physical disturbance, particularly at vulnerable life stages. This dual mechanism may be especially important in systems where invasive species benefit from reduced natural enemies. These results support the potential for megaherbivores to serve as a nature-based solution for managing biological invasions in novel ecosystems. As global change accelerates, restoring or maintaining populations of large herbivores could provide a cost-effective and ecologically grounded strategy to mitigate the spread of invasive species and enhance ecosystem resilience.

POSTER PRESENTATION: CHEMICAL CHARACTERIZATION AND ALLELOPATHIC EFFECTS OF *PTERONIA INCANA* ON NATIVE GRASS SPECIES

Tanki Thubela, Azile Dumani, Bulelwa Ngcangata

Dohne ADI, STUTTERHEIM, South Africa

This research aims to evaluate the allelopathic effects of *Pteronia incana* on neighbouring grass species in the Eastern Cape Province. The study will focus on identifying and characterizing the allelochemicals responsible for potential inhibitory effects on grass seed germination and growth. *Pteronia incana* plant material will be collected from the field, dried, ground, and subjected to traditional extraction techniques to isolate chemical compounds such as alkaloids, flavonoids, phenols, tannins, cyanohydrins, and terpenes. These compounds will be characterized using mass spectrometry and other spectroscopic methods. Laboratory and glasshouse experiments will assess the effects of different concentrations (25%, 50%, 75%, 100% solution of compounds, and 0% will be control) of *Pteronia incana* extracts on the seed germination percentage, root length, and shoot growth of the three selected native grass species. Treatments will be replicated into three, and controls will be established to ensure statistical reliability. These solutions will be applied where three native grass species are planted. The data will be analysed using Generalized Linear Models to assess the significance of extract concentration on seed germination rate, root length, and shoot growth. The results of this study will improve understanding of the allelopathic interactions between *Pteronia incana* and native grasses.

SHORT PRESENTATION: INFLUENCE OF WOODY PLANT ENCROACHMENT ON UNDERSTORY VEGETATION DEPENDS ON THE FUNCTIONAL TRAITS OF AN ENCROACHER: INSIGHTS FROM GLOBAL META-ANALYSIS

Thabiso Nkenkem[1], Mthunzi Mndela[1], Thamaga, Kgabo Humphrey[2]

[1]Fort Hare University, Alice, South Africa. [2]University of South Africa, Johannesburg, South Africa

Woody plant encroachment (WPE) is a global concern, threatening ecosystem services and the functioning of savannas. The influence of WPE on understory herbaceous vegetation has been studied extensively across different global ecosystems. The effects of WPE appear to be site-specific and inconsistent, ranging from negative to positive, possibly due to differential functional traits (FTs) of woody encroachers. However, there is a paucity of knowledge regarding how woody plant encroachers with differential FTs influence herbaceous vegetation globally. Thus, we conducted a meta-analysis of 60 international studies to assess the influence of N-fixation (leguminous vs non-leguminous), phenology (deciduous vs evergreen) and stature (shrubs vs trees) of woody plants on grass and forb cover, richness and density. Random effects models were used to compute Hedges' d standardised mean difference of the encroached and reference groups for each herbaceous vegetation attribute. Woody plant encroachment reduced grass cover irrespective of functional traits, whereas forb cover was primarily suppressed by deciduous

leguminous shrubs and increased by tree encroachers. Grass species richness declined significantly under the encroachment of deciduous leguminous trees. Conversely, forb richness was reduced by non-leguminous evergreen shrubs. The density of grasses responded negatively to leguminous trees; the opposite was true for forb density. Overall, grasses and forbs responded differentially to WPE, depending mainly on N-fixation status and stature of encroacher, suggesting that these herbaceous plant guilds employ differential mechanisms and strategies to cope with WPE. The results advance the understanding of how woody plant functional traits shape understory vegetation dynamics in global rangelands. This deeper insight contributes to improved management strategies to promote biodiversity, maintain ecosystem resilience, and ensure sustainable forage availability in these landscapes.

SHORT PRESENTATION: EFFECT OF SEASON ON MACRO AND MICRO MINERAL CONTENTS OF *SEARSIA* SPECIES HARVESTED IN THE NORTH-WEST PROVINCE FOR RUMINANT PRODUCTION

Onke Hawu, Khuliso Ravhuhali, Hilda Mokoboki, Cornelia Lebopa

Department of Animal Science, School of Agricultural Sciences, Faculty of Natural and Agricultural Sciences, North-West University, Mmabatho, South Africa

Minerals fluctuate within and among plants due to factors such as season, genetics, soil type, altitude etc. Minerals contribute to growth, enzyme activity, and immune functions in ruminants, thus influencing overall health, productive, and reproductive performance. The study assessed the effects of seasons on the mineral concentrations of *Searsia* species harvested in the North-West province. The leaves of S. *lancea* and S. *pyroides* were harvested at the North-West University Experimental Farm during autumn, winter, spring, and summer seasons. The leaves were analysed for the content of potassium (K), phosphorus (P), calcium (Ca), magnesium (Mg), sodium (Na), sulphur (S), iron (Fe), copper (Cu), zinc (Zn), manganese (Mn), and boron (B). All data were subjected to two-way analysis of variance. All statistical analyses were conducted at a significance level of $p < 0.05$. The highest K and Mg contents were produced in winter. *Searsia pyroides* had the highest Mg (3.38 g kg^{-1} DM) in winter compared to *S. lancea*. *Searsia lancea* had the highest P content (1.30 g kg^{-1} DM) when compared to *S. pyroides* in winter. The sulphur content did not differ between species, except in summer. *Searsia lancea* had the highest S content in winter compared to *S. pyroides*. The highest Cu content was produced in winter compared to other seasons. *Searsia pyroides* and *Searsia lancea* produced the highest Cu content (9.6 and 9.4 g kg^{-1} DM, respectively) compared to *S. lancea* in winter, which did not differ between species. The highest Mn content was produced in winter compared to other seasons of both species. *Searsia pyroides* had the highest Mn (78.8 mg kg^{-1} DM) in winter compared to *S. lancea*. In all seasons, both species had suitable K, Ca, Mg, Cu, and Mn contents required for livestock maintenance. However, the P, Na, and Zn content did not meet the minimum requirements and may limit livestock productivity. There is a need to provide mineral blocks or supplements to ruminants exposed to species that lack certain minerals.

SESSION CHAIR: NTUTHUKO MKHIZE

Tuesday 22 July 2025, 10:50 - 12:15

KEYNOTE ADDRESS: COMPETING NARRATIVES FOR LIVESTOCK DEVELOPMENT AND POLICY

Ian Scoones

University of Sussex, Brighton, United Kingdom

Extensive livestock producers and pastoralists in particular get a bad press. These are deemed unviable livelihoods, destructive of the environment and climate and the root of conflicts. Narratives – the way we understand and talk about the world – define policy pathways, yet they emerge through particular interests and positions. When not supported by conditions on the ground, they can result in major injustices. In this talk, dominant narratives that currently frame livestock development policy - around mobility, land and environment, climate, diets and markets are challenged with evidence from studies in pastoral areas around the world. A new narrative based on pastoralists' own knowledge and practice is suggested that is centred on variability, uncertainty, adaptability and flexibility. This, it is argued, can inform a very different approach to livestock development and policy, particularly in pastoral areas.

PLATFORM PRESENTATION: EFFECT OF DROUGHT ON COMMUNAL LIVESTOCK FARMERS IN MSINGA, KWAZULU-NATAL

Susanne Vetter[1], *Rauri Alcock*[2], *Victoria Goodall*[3,4]

[1]Rhodes University, Makhanda, South Africa. [2]Mdukatshani Rural Development, Msinga, South Africa. [3]VLG Statistical Services, Gqeberha, South Africa. [4]Nelson Mandela University, Gqeberha, South Africa

Despite the size of the informal small-scale farming sector and its livestock holdings in South Africa, there has been little detailed work to assess how livestock populations are affected by drought. South Africa experienced a major drought in 2015-2016. We analysed goat and cattle census data from the Msinga area in KwaZulu-Natal, which represent the livestock of some 3000 households. Cattle farmers in the study area lost 43% of the herd, compared to 29% for goats in 2015-2016. Larger herds suffered lower mortality rates, suggesting that owners of larger herds had better means to support their herds. Support to reduce drought losses and aid recovery should take into consideration the different capabilities and needs of small and large herd owners. Effects of high stocking rates and resource condition on mortality and herd growth were apparent during the drought year of 2016 but not the other years. While poor veld condition and high stocking rates may not have discernible effects on herd dynamics in many years, they appear to increase herd vulnerability to drought and impede post-drought recovery. In this and a previous (2003) drought, most die-offs appeared to have been concentrated in a short period, once forage and water resources became too scarce and far to reach. Recognising when this threshold is imminent would be useful for targeting strategic interventions. Cattle numbers took at least three years to recover to pre-drought levels, whereas goat numbers recovered within three years. Keeping goats is likely to be a less risky and more resilient livelihood option than cattle farming under changing climate and increasing bush cover, especially for more resource -limited farmers, including women.

PLATFORM PRESENTATION: FROM RESEARCH TO RANGELAND RESTORATION: A SYNTHESIS OF SIX DECADES OF GRAZING SCIENCE AND THE CASE OF HERDING FOR HEALTH

Gina Arena[1], *Heidi-Jayne Hawkins*[2]

[1]Conservation South Africa, Cape Town, South Africa. [2]Department of Biological Sciences, University of Cape Town, Cape Town, South Africa

Africa's rangelands provide critical ecosystem services and livelihoods yet face increasing pressures that demand adaptive grazing strategies. While a substantial body of regional research has advanced grazing science, there has been limited synthesis and empirical evidence of how this knowledge informs practice within complex communal rangeland systems. This study aimed to synthesise nearly six decades of grazing research published in the Grassland Society of Southern Africa's flagship journal to identify prevailing themes, conceptual trends, and persistent gaps. A further objective was to evaluate how well this body of research supports practical implementation in socio-ecologically complex rangeland systems, particularly in communal contexts. To illustrate the application of key recommendations, we present the Herding for Health model as an example of research-informed practice. Using natural language processing we evaluated 396 articles published between 1966 and 2023, spanning 469 study sites in 25 countries. The majority of studies focused on livestock production and sustainable rangeland use, predominantly examining rotational or continuous grazing, and burning, on working farms. In contrast, fewer studies addressed adaptive, intensive, or emerging practices such as herding or pyric herbivory. Conceptual advances in ecosystem theory have progressively reframed rangelands as integrated socio-ecological systems, yet this framing requires more empirical research focused on communal contexts. Drawing on this synthesis, we proposed key recommendations: clarifying management goals, applying adaptive management while aligning stocking rates with carrying capacity, incorporating wildlife where ecologically feasible, maintaining appropriate fire regimes, and implementing robust monitoring systems for productivity, biodiversity, and soil organic carbon. Although 94% of the reviewed studies were conducted in Africa, significant gaps persist in practice-oriented research, particularly for the wider Southern African Development Community. Notably underrepresented are community-based models that integrate indigenous knowledge, evaluate biodiversity impacts of grazing strategies, explore rewilding approaches, and investigate climate-fire-grazing interactions. In response, we present the Herding for Health (H4H) model–a joint initiative between Conservation International and Peace Parks Foundation–as a practical example through which critical research gaps can be examined and addressed. H4H applies a One Health and Ecosystem-based Adaptation approach to enhance collective governance and build local capacity, aiming to restore biodiversity-rich communal rangelands in and around protected areas, improve animal health, and strengthen pastoral livelihoods. Currently implemented across 952,539 ha in seven African countries, the model employs planned grazing using traditional herding practices led by trained professional herders, movable predator-proof bomas, and short-duration kraaling. Adaptive management is supported through continuous monitoring with ground-based and satellite tools. To date, over 11,600 pastoralists participate in the programme, with 5,600 directly benefiting from improved market access and livestock value-chain development (e.g., meat, wool, leather), generating revenues exceeding USD 8.4 million. H4H also provides targeted training and enterprise support to women and youth, indirectly benefiting over 58,000 people and contributing to inclusive rural economies. With an ambitious goal to scale to 10 million ha by 2030, H4H welcomes research collaborations that both inform and test implementation, bridging scientific inquiry with practical application to advance adaptive, inclusive, and climate-resilient rangeland management across the region.

SHORT PRESENTATION: CORRELATING UAV-DERIVED VEGETATION INDICES WITH BIOMASS AND SOIL NUTRIENTS FOR RANGELAND ASSESSMENT IN A COMMUNAL GRAZING SYSTEM

Gladness Mikateko Khoza[1,2], *George Chirima*[1,2], *Abel Ramoelo*[3], *Philemon Tsele*[2]

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Rangeland degradation caused by overgrazing and land use pressure threatens the sustainability of communal grazing systems and the livelihoods dependent on them. Key indicators of rangeland condition, such as above-ground biomass, vegetation health, and soil nutrient availability, are essential for evaluating forage quality and quantity for both domestic livestock and wild herbivores. Conventional methods of rangeland assessment often rely on labour-intensive field sampling and often fail to capture spatial variability across landscapes. Remote sensing

provides a bird's-eye view of the landscape, and tools such as unmanned aerial vehicles (UAVs) offer an efficient way of assessing these biophysical parameters at high spatial resolution and at multiple temporal scales. Grass nutrient and biomass assessments have been successfully done using satellite imagery in the wet season. However, limited studies have assessed nutrients and biomass using UAV, and fewer studies exist in the communal rangelands. The objective of this study was to explore the potential of UAV-derived vegetation indices (VIs) to predict grass biomass and correlate with soil nutrient concentrations in particular nitrogen (N), phosphorus (P), and potassium (K) in a rotationally grazed communal rangeland in Mpumalanga, South Africa. Field campaigns to collect data were conducted during the early wet season in November 2023 and peak wet season in March 2025 in Thorndale village, a communal area in Mpumalanga Province. Grass samples were collected using the clipping methods, while soil samples were collected from corresponding plots using an auger for laboratory analysis of macro-nutrients (N, P, K), and multispectral UAV imageries were acquired during the fieldworks. A suite of red edge-based and conventional vegetation indices were computed from the UAV imagery to assess their relationship with measured biomass and soil nutrients. Regression modelling was performed using random forest, support vector and linear regression to quantify the strength of correlation between UAV-derived metrics and ground observations. Preliminary results showed that random forest and UAV-derived VIs were moderately correlated with soil nitrogen (R^2 = 0.61), whilst the predictive power of VIs for phosphorus and potassium was lower (R^2 = 0.30 and 0.23, respectively). For biomass, all models performed poorly (random forest = 0.28, support vector = 0.38 and linear regression = 0.2). However, the models improved during the peak wet season when vegetation cover was higher. The poor results can be attributed to low nutrient levels, overgrazing and bush encroachment in the study area, although the conditions improved following a resting period that allowed the grazing camp to recover. The study demonstrates the utility of UAV-based remote sensing, especially red-edge and NIR-capable sensors, for monitoring key rangeland indicators with high spatial resolution. This approach offers a scalable method for assessing forage availability and soil nutrient status across heterogeneous communal landscapes. In conclusion, UAV-derived vegetation indices, particularly those incorporating red-edge and NIR bands, may be useful indicators for monitoring soil nitrogen dynamics in communal rangelands, while their utility for predicting phosphorus, potassium, and grass biomass remains limited under conditions of nutrient depletion and vegetation stress.

SHORT PRESENTATION: PRIVATE LAND, PUBLIC VALUE: A CASE STUDY OF BIODIVERSITY STEWARDSHIP ON AGRICULTURAL LANDSCAPES

Nyiko Mutileni

Agricultural landscapes are often seen as incompatible with biodiversity conservation, yet emerging stewardship models are challenging this dichotomy. This case study traces the biodiversity stewardship journey of ZZ2, a major agro-enterprise largely operating in Limpopo province, and its voluntary engagement in South Africa's Biodiversity Stewardship Programme. The aim is to demonstrate how the private sector can play a catalytic role in the protection of Threatened or Protected Critical Conservation (TOCC) areas through strategic collaboration, landscape-scale thinking, and voluntary certification schemes. Over the past decades, ZZ2 has worked alongside NGOs, provincial conservation agencies, and independent scientists to identify priority areas, secure conservation commitments, and implement ecological management plans within the commercial agricultural matrix. This case study synthesises the enabling conditions, institutional shifts, and lessons learned during this ongoing process. Key themes include the role of policy alignment, trust building with conservation authorities, and the use of certification to incentivised and validate biodiversity-friendly practices. While not presenting empirical data, the case study offers practical insights into how agriculture can transition from being a driver of habitat loss to a steward of ecological resilience. It highlights how voluntary mechanisms, when well supported, can expand South Africa's conservation footprint and build enduring partnerships between production and protection sectors.

SHORT PRESENTATION: HOW PREDATORY ANIMALS INFLUENCE SMALL RUMINANTS' GRAZING PATTERNS AND COMMUNAL RANGELAND UTILIZATION IN THE EASTERN CAPE?

Siphe Zantsi[1,2], Lwandiso Mdiya[2], Njabulo Dlamini[2], Mpumelelo Ntozakhe[2], Johan van Niekerk[2]

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Small ruminants are the most kept animals in communal rangelands and have multiple functions in households' livelihoods. These animals have a shorter gestation period, relatively easy to manage and are sold for income and

used for traditional ceremonies by rural households.

However, besides the commonly known threat of limited grazing forage due to insufficient land in communal areas, lately there has been a growing threat of predatory animals that attack and kill small ruminants for food. To gain more insights on this issue, we have conducted a survey in two villages in the Eastern Cape among 83 livestock farming rural households. One village, Matheko is situated in Mthatha under the King Sabata Dalindyebo Municipality and the other village, eJojweni is in Butterworth under the Mnquma Local Municipality. One-on -one and face-to-face interviews were conducted with both male and female household heads using the local language, isiXhosa following a semi-structured set of prepared questions. The questions focused on aspects of livestock production, availability and utilisation of rangelands as well as the frequency of predation, among other factors.

Most of our study participants were middle aged males who live in households of five persons mostly depending on state transfers. Our results show that small ruminants indeed, were the most kept livestock species, with each household owning an average of 70 flock of sheep, 15 flock of goats and 7 herd of cattle. Livestock is reared for multiple functions including sales, sales of wool and household traditional ceremonies. About 60% of our respondents mentioned that they had been victims of predatory animals mostly jackals and caracal. We learned that Jackals target lambs and kids as well as old and ill-animals in the rangelands. Animals that are left unattended, as is the case in most villages, such as in our study areas, are likely to be prey to predatory animals. One household in Butterworth lost 12 winner kids in one year to jackals. Caracal was mentioned mostly in Mthatha and it mostly prey domestic animals by sucking blood in kraaled animals.

These incidents of predatory animals make stock owners reluctant to let animals graze unattended especially in faraway parts of the rangelands where there is normally healthy forage and bushes for browsing. This has necessitated hiring of livestock herders, further increasing the cost of keeping animals. Those who cannot afford livestock herders let their animals graze in between the homesteads which leads to conflict with fellow villagers as goats may break in into planted gardens and animals grazing on the national road sideways causing road accidents.

It seems that predatory animals are driving grazing animals closer to residential areas which might lead to overgrazing and underutilisation in parts of the rangelands far away from residential sites. This is likely to cause ecosystem imbalances and reduction in communal ruminant herd.

SHORT PRESENTATION: "FARMING FUTURES: THE POWER OF RESEARCH AND COLLABORATION IN REVITALIZING COMMUNAL AGRICULTURE IN AMAKHUZENI, ALICE, EASTERN CAPE, SOUTH AFRICA".

Unathi Gulwa[1], Andiswa Finca[2], Sive Tokozwayo[1], Mthunzi Mndela[3], Patrick Rakau[4]

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Agricultural Research for Development (AR4D) and multi-stakeholder partnerships are fundamental aspects in addressing the challenges faced by small-scale and communal farming systems in Africa. AR4D is a rounded approach integrating research, development and innovation attempting to address the complex and interconnected challenges faced by smallholder farmers and rural communities in Africa. This approach emphasizes the importance of participatory research, interdisciplinary collaboration, capacity building and scaling-up and scaling out. Multi-stakeholder partnerships are necessary in the context of small-scale and communal farming systems in Africa as these partnerships involve the collaboration of various actors like smallholder farmers, extension services, research institutions, government agencies, private sector and civil society. These multi-stakeholder partnerships foster knowledge sharing, resource mobilization, and the co-creation of solutions that are tailored to the specific needs and contexts of small-scale and communal farming systems. The integration of Agricultural Research for Development (AR4D) and multi-stakeholder partnerships is crucial in addressing the complex challenges faced by small-scale and communal farming systems in Africa. This approach creates an enabling environment that can lead to the development of holistic, context-specific solutions that can contribute to the sustainable intensification of African agriculture and the improvement of livelihoods for smallholder farmers. AR4D is also envisaged as one of the methods that can be used to achieve some of the sustainable development goals (SDG's) and the national development plan 2030 (NDP 2030). This study explores the role of agricultural research for development (AR4D) and multi-stakeholder partnerships in enhancing small-scale and communal farming systems, with a focus on the Amakhuzeni communities in Alice, Eastern Cape, South Africa. Through a qualitative case study approach, the research showcases how collaborative frameworks involving local farmers, government agencies, academic institutions, and non-governmental organizations contribute to sustainable agricultural development and improved

livelihoods. The cases highlight the importance of participatory research, knowledge co-production, and inclusive decision-making in addressing systemic challenges such as limited access to resources, poor infrastructure, and climate variability. The study underscores the potential of well-coordinated partnerships to drive context-specific innovations, empower local communities, and strengthen resilience in smallholder agriculture.

POSTER PRESENTATION: INTEGRATING LOCAL KNOWLEDGE INTO PARTICIPATORY APPROACHES FOR SUSTAINABLE RANGELAND MANAGEMENT IN CATA AND GUQUKA

Andiswa Finca[1], Thantaswa Zondani[1], Unathi Gulwa[2], Mthunzi Mndela[3], Nobulungisa Mgujulwa[2], Patrick Rakau[4]

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There is growing recognition of the vital role indigenous knowledge plays in climate change adaptation and the sustainable use of natural resources. Indigenous knowledge refers to the cumulative understanding developed by communities over generations, rooted in local experiences and adapted to specific cultural and environmental contexts. Historically, this form of knowledge has been marginalized and often perceived by experts as inferior, unstructured, or unscientific. In South Africa, this legacy persists, with national land management policies frequently overlooking local knowledge systems, despite rural communities being key custodians of such knowledge. This exclusion has contributed to persistent challenges in managing communal rangelands. For example, the Conservation of Agricultural Resources Act of 1983 (CARA) promoted standardized control measures and strict stocking rates yet failed to consider the complexity of communal grazing systems. These top-down approaches have proven difficult to implement and sustain in collective land-use settings. The 2014 draft policy on the Sustainable Management of Veld (Range) and Forage Resources acknowledged the importance of interdisciplinary collaboration, but still does not integrate indigenous knowledge or local context into its frameworks. This disconnect limits the ability of communal farmers to apply their expertise in meaningful and policy-aligned ways. Research conducted in the villages of Cata and Guquka, located in Keiskammahoek and Alice in the Eastern Cape, highlights both the challenges and opportunities for revitalizing communal rangeland systems through participatory approaches. Historically shaped by rotational grazing, seasonal herding, and intimate spatial understanding of the land, these communities possess rich, yet increasingly vulnerable, local and spatial knowledge tied to land use, grazing patterns, and ecological change. However, this knowledge system is under threat due to an ageing farming population, reduced youth participation, and weakened agricultural extension services. This breakdown in has had direct consequences for the sustainable management and productivity of rangelands. To address this, Cata and Guquka are adopting participatory knowledge systems that bring together traditional practices and contemporary tools. Community-Based Rangeland Management Committees (CBRMCs) are being established as inclusive platforms where farmers, youth, women, tribal authorities, researchers, and extension officers collaborate to co-develop context-specific grazing strategies. These committees promote shared decision-making and revive collective governance structures. Knowledge exchange is further encouraged through learning exchange workshops, information and field days that facilitate intergenerational learning and strengthen local interest in sustainable livestock practices. Participatory GIS (PGIS) and creative documentation have also proven valuable by transforming community-generated narratives and maps into actionable planning tools. These methods help preserve indigenous knowledge, inform land-use planning, and ensure community voices are represented in policy dialogues. Youth involvement is being strengthened through innovative fodder flow initiatives, where young people are engaged in planting accessible and low-cost supplementary feed crops, directly supporting local livestock owners while offering meaningful entry points into the agricultural economy. The resilience and historical capacity of the Cata and Guquka communities demonstrate the transformative potential of integrating indigenous knowledge with participatory governance and innovation. When harnessed effectively, these approaches offer adaptive, locally grounded solutions to communal rangeland challenges and could serve as a sustainable resource management in South Africa.

SESSION CHAIR: SINDISO CHAMANE

Tuesday 22 July 2025, 13:15 - 14:35

PLATFORM PRESENTATION: EYES ON THE GRASSLANDS: HARNESSING CITIZEN SCIENCE AND INATURALIST FOR THREATENED SPECIES CONSERVATION IN SOUTH AFRICA

Suvarna Parbhoo Mohan

SANBI, Durban, South Africa

South Africa's Grassland Biome, a centre of plant endemism and a biodiversity hotspot, faces mounting pressures from urban expansion, agriculture, invasive species, and climate change. Despite its ecological significance, this biome remains under-protected and under-surveyed regarding plant taxa of conservation concern (TOCC). Addressing this gap in plant monitoring and data availability is the Custodians of Rare and Endangered Wildflowers (CREW) programme - a national citizen science initiative led by the South African National Biodiversity Institute (SANBI), and co-funded by the Mapula Trust and the Botanical Society of South Africa. CREW engages citizen scientists, Botanical Society members, community groups, and conservation partners in the monitoring and documentation of TOCC across South Africa, with an expanding footprint in the summer rainfall region. This presentation offers an overview of the CREW programme and its innovative use of the iNaturalist platform as a central tool for field data collection. iNaturalist allows for real-time georeferenced observations, seamless data sharing, and a growing community of identifiers and contributors. The use of iNaturalist not only enhances data quality but also fosters learning and connection among volunteers, species experts, taxonomists, and conservation practitioners. Importantly, the data collected by CREW citizen scientists is used to inform Red List assessments - a critical process for tracking species extinction risk - and to support biodiversity stewardship and protected area management. These contributions are particularly valuable in the Grassland Biome, where many species remain poorly known or insufficiently monitored.

PLATFORM PRESENTATION: ELEPHANT MEGACARCASSES DRIVE LOCAL PATTERNS IN PLANT DIVERSITY AND RICHNESS ACROSS BASALTIC AND GRANITIC SEMI-ARID RANGELANDS

Helga Knoetze[1], Dave Thompson[2], Deron Burkepile[3], Michelle Budny[4], Johan du Toit[5], Nate Lemoine[4], Courtney Reed[3], Izak Smit[6], Tercia Strydom[7], Aimee Tallian[8], Ryan Helcoski[5]

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There has been considerable research on the effects of living elephants on African ecosystem structure, function, and processes. Yet few studies have investigated the effects of elephant megacarcasses on the spatiotemporal heterogeneity of terrestrial ecosystems. Similar to the megacarcasses of whales that create communities of productivity, and functioning in the deep ocean, the nutrient pulses from decomposing elephant carcasses as a natural disturbance may play a similar role in African savannas where they are a localised source of nutrient enrichment that likely impacts local biogeochemistry and the community dynamics of vegetation. Our ongoing research in the Kruger National Park (KNP) has shown that elephant megacarcasses increase local nutrient pools in

explore richness and diversity patterns of plant communities across megacarcasses of different ages sampled on granitic and basaltic soils in KNP. Vegetation was sampled at 0 m, 2.5 m, 5 m, 10 m, and 14 m from the carcass along transects in each of the four cardinal directions. We found that soil type and distance from carcass, rather than carcass age, drive local plant diversity and richness dynamics. Plant species richness and diversity were generally lower closer to the carcass, and increased with increasing distance from the center, with the inverse pattern for species evenness. Lower species diversity is attributed to toxic concentrations of soil nutrients such as nitrate and ammonium towards the center of carcass sites. However, increased species evenness towards the center of carcass sites is ascribed to the dominance of certain species, such as *Urochloa trichopus*, *Cynodon dactylon*, and *Tribulus terrestris* with higher tolerance for elevated soil nutrient levels. Elephant megacarcasses represent a relatively unexplored and unique disturbance type. Their effects on vegetation species diversity patterns, demonstrated here for the first time adds to the spatial complexity of those semi-arid rangelands that still support megaherbivore populations. The widespread loss of megaherbivores and their carcasses across their native ranges reflects a loss of an important driver of plant community dynamics and landscape heterogeneity.

PLATFORM PRESENTATION: HUNGRY CATERPILLARS: MASSIVE OUTBREAKS OF *ACHAEA LIENARDI* IN HLUHLUWE-IMFOLOZI-PARK, SOUTH AFRICA

Debbie Jewitt

KZN Wildlife, Pietermaritzburg, South Africa. University of the Witwatersrand, Johannesburg, South Africa

Achaea lienardi (Boisduval, 1833), or Lienard's Achaea, is a polyphagous moth, occurring from southern Africa through central and eastern Africa to Eqypt. It is a fruit-sucking moth causing secondary damage to fruit, while the larval stage can cause significant defoliation of trees. They have been recorded on citrus, peaches, wattle, castor oil plants, *Eucalyptus* and several indigenous trees including *Ptaeroxylon*, *Sideroxylon*, *Pappea*, *Rhus*, *Maerua*, *Acacia* (*Vachellia* and *Senegalia*) and *Schotia*, amongst others. On 3 March 2025, a massive outbreak of caterpillars was observed in Hluhluwe-Imfolozi Park in KwaZulu-Natal, South Africa. The caterpillars were observed primarily on Tamboti trees (*Spirostachys africana* Sond.). The defoliation was clearly visible on Sentinel satellite imagery. Defoliation was not visible on imagery on the 8 February 2025, but extensive defoliation was visible by the 5 March 2025. By 17 April 2025 the vegetation had largely recovered. Satellite imagery for the last five years was examined but no similar large defoliation events were observed during this period. Climate data for the last five years (September 2019 to March 2025) were collated and examined to determine the conditions supporting the irruption. Variables included monthly mean, minimum, and maximum temperature, precipitation, mean relative humidity and solar radiation. The area experiences summer rainfall with hot summer conditions and mild winters. The early spring of 2024 (September) was wet, recording 150 mm of rain, compared to previous years ranging between 12-43 mm, triggering a flush of vegetation which continued into October. In November rainfall tapered off (45 mm of rain in November compared to the earlier years' average of 100+ mm). Rains were normal in December 2024, but it was the warmest December in the 5-year record, about 1-2 °C higher than previous Decembers. This likely accelerated insect metabolic rates. The winter of 2024 (June-August) was warmer (1-2 °C) and wetter than usual which may have boosted winter survival of the pupal stages. Rainfall spiked to 74 mm in June 2024, versus typically <20 mm in June. Extreme rainfall in the February of 2021 (308 mm) and 2023 (536 mm) due to cut off lows, led to extensive flooding, likely destroying young caterpillars or eggs during that period. Sustained rain and high humidity in January and February 2025 ensured good vegetation growth and prevented desiccation of eggs or larvae. Nighttime temperatures in February were 1-3 °C warmer than prior years promoting nocturnal moth activity, allowing them to fly and mate more frequently. The multiple climatic conditions acted in concert to create favourable conditions for the caterpillar irruption. This irruption coincided with historic outbreaks of the African armyworm (*Spodoptera exempta*) in the summer rainfall areas of South Africa where precipitation and humidity were found to be critical factors affecting armyworm outbreaks. Further research is required to determine specific criteria to enable predictions of future outbreaks.

PLATFORM PRESENTATION: ASSESSING LAND COVER CHANGE PATTERNS IN THE CITY OF TSHWANE WITH A FOCUS ON CHANGE DYNAMICS IN GREEN SPACES AND RIVERINE AREAS

Hazel Shirinda, Christel Hansen, Michelle Greve

University of Pretoria, City of Tshwane, South Africa

Natural areas in cities are important for maintaining biodiversity and supporting the well-being of urban residents through the provision of ecosystem services. In the City of Tshwane (CoT), much natural vegetation remains within the city borders, with much of that comprising grasslands and savannas. However, population growth, rapid urbanisation and the emergence of informal settlements have led to changes in land cover, and presumably in natural vegetation cover in the CoT. Therefore, this study examines spatiotemporal patterns and drivers of land cover changes in the CoT. We had four objectives: (1) characterise land cover changes in the CoT using land cover maps, (2) identify predictors of all land cover change in the CoT,(3) identify predictors of loss of natural vegetation, and (4) identify predictors of land cover change in riverine areas. To do this, 1990 and 2022 land cover in the CoT were compared to characterise changes in different land cover types across the CoT. We particularly honed in on land cover changes from natural vegetation to other land cover classes, and land cover changes in riverine areas, which are particularly ecologically sensitive. Statistical analyses were performed to assess how demographic variables, socioeconomic variables, topography and distance to rivers and urban green spaces affected land cover change between 1990 and 2022. We additionally assessed the drivers of land cover change in natural vegetation and along riverine areas. Between 1990 and 2022, 25.9% of the total land cover in the CoT changed. The most notable increases were observed for bare land (2902.9%), built-up areas (105.5%) and formal residences (95.6%). In contrast, recreational areas, natural vegetation and waterbodies declined by 41.7%, 20.6% and 16.5% respectively. Natural vegetation was most frequently transformed to built-up areas, formal residences, recreational areas and mines, while along riverine areas, increases in built-up areas, formal residences and bare land, and decreases in natural vegetation, cultivated land and informal residences were observed. Population density, unemployment and elevation increased the likelihood of land cover change across the CoT. These predictors were similar for land use change in natural vegetation, with the number of people living below the poverty line also increasing the likelihood of land cover change in these areas. In riverine areas, distance to green spaces had an additional positive association with land cover change. Our results indicate noteworthy increases in urban expansion, but a significant loss in natural vegetation, suggesting large-scale destruction of natural habitats and biodiversity losses. Additionally, we find that a variety of factors, including demographic, socioeconomic and abiotic, are associated with land cover change, including loss of natural vegetation. These changes highlight the need for policies for managing and conserving natural vegetation in the CoT to ensure their integrity and ability to provide essential ecosystem services and support biodiversity.

SHORT PRESENTATION: RANGE EXPANSION OF THE GRASSLAND'S BLOEMFONTEIN KARROID SHRUBLAND

Andri C van Aardt[1], Anisha Dayaram[2,3]

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Grasslands with their high biodiversity and various ecosystem services are threatened by agriculture, industrialisation, urbanisation and forestry. These threats will intensify in the face of climate change and an expanding population with higher demands for natural resources. It is therefore important that one understand and describe grassland ecology to provide information on how to maintain the balance between sustainable production and diversity. Grasslands in the Free State contains vegetation dominated by karroid-like components, which are severely fragmented and affected by habitat loss. The Bloemfontein Karroid Shrubland, endemic to the province, occurs on dolerite sheets. The soils are shallow and coarse textured resulting in poor infiltration and high runoff. Physiological drought is induced by high evaporation within a high rainfall area. This research investigated the refining of the coarser scale mapping of Mucina and Rutherford (2006) and that proposed by du Preez (2017). Currently the range of this endemic vegetation type in the Free State is unknown or conflicting. This will enable us to determine the threat status and protection level of the vegetation type as well as implement various management

strategies. The Braun Blanquet cover abundance scale was used to complete a visual estimation of vegetation cover in 227 plots of 16 m2. Classification was done in JUICE using a modified TWINSPAN and refined using Braun -Blanquet procedures. Preliminary results indicated different plant communities on different terrain units which all conform to the broader classification of Mucina and Rutherford (2006). Indications are also that the current maps need to be extended and new areas included.

SHORT PRESENTATION: LANDSCAPE TOPOGRAPHY AND SOIL ACIDITY DRIVES FLORISTIC COMPOSITION AND DIVERSITY IN SEMI-ARID MOUNTAINOUS GRASSLANDS PROLIFERATED BY AN EVERGREEN PERENNIAL TALL SINGLE-ENCROACHING SHRUB (*EURYOPS FLORIBUNDUS*) SPECIES

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Shrub encroachment, which is spreading at an unprecedented rate, continues to be a serious threat to grasslands worldwide, transforming vegetation patterns and influencing ecosystem functions. Despite this, the determinants of topography-driven changes in the structural growth patterns of encroaching shrub species, and the consequent impact on herbaceous vegetation across landscape gradients remain unclear, especially in semi-arid mountainous grasslands. This study examined the influence of landscape position on the structural characteristics of an encroaching shrub species,*Euryops floribundus* N.E. Br and its effects on floristic composition and diversity in semi-arid mountainous grasslands. Three typical communal grazing landscape sites (Tsengiwe, Upper Mnxe and Manzimdaka) were selected in mountainous grasslands in the north-central part of the Eastern Cape Province, South Africa. Each landscape site was demarcated into three landscape positions: downslope, midslope and upslope along an elevation gradient. At each landscape position, we randomly laid out six 10 m x 10 m plots to determine the characteristics of the tall, single encroaching shrub species *Euryops floribundus*, quantified the biomass production of the herbaceous vegetation and collected inherent soil samples in the topsoil layer. We observed a consistent pattern of increasing shrub density and declining shrub height of *Euryops floribundus* from downslope to upslope positions across the three landscape sites, and this pattern was notably significant at Manzimdaka. In particular, shrub density was 97% higher downslope compared to upslope, while shrub height decreased by 13% downslope compared to the upslope position. Furthermore, total stem number was 39% higher downslope relative to the upslope position at Upper Mnxe, and 49% greater downslope compared to midslope at Manzimdaka. Landscape position did not influence grass diversity across the three sites except for Menhinick's grass richness at Manzimdaka. Specifically, Menhinick's grass richness was 28% higher downslope than upslope at Manzimdaka, and the grasses were dominated by *Elionurus muticus*. Multivariate analysis revealed that as the soil pH decreases (becomes more acidic), the grass species richness tends to increase, indicating that soil acidity may be driving grass species diversity in the studied mountainous grasslands. These findings provide valuable insights into the ecological implications of an encroaching single shrub species in mountainous grasslands and offer essential information for developing management strategies for shrub encroachment and protecting grass diversity.

RESEARCH PROPOSAL PRESENTATION: LAND-USE EFFECTS ON FORB DIVERSITY AND LIFE-HISTORY TRAIT DISTRIBUTIONS IN MONTANE GRASSLANDS

Thandwayo Mbambo[1], Paul Gordijn2, Mariska te Beest[3,2], Michelle Tedder[1]

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Grasslands are ancient ecosystems with high plant diversity, maintained historically by frequent fires, grazing by megafauna, and soil conditions that limit woody encroachment. Despite their ecological value, grasslands are among the most threatened biomes globally due to agriculture, forestry plantations, mining, and urban expansion. In South Africa, these pressures have led to the widespread transformation of montane grasslands, which are known for their exceptional plant diversity and endemism. Forbs, which contribute most to grassland biodiversity, remain poorly understood — especially in terms of their life-history traits and responses to land-use change. This study

aims to assess how different land-use practices affect forb diversity and life-history strategies in a montane grassland at the Cathedral Peak Research Catchments. Specifically, we will (1) compare forb seedling recruitment and life-history traits between secondary grassland (previously afforested with Pinus patula) and adjacent primary grassland; (2) assess the influence of microclimate and soil properties on forb seedling establishment; (3) evaluate how disturbance type and time since disturbance (fire, mowing, grazing) affect species richness and composition; and (4) conduct a systematic review of historical land-use impacts on montane grassland ecosystems. For the field study, we will measure species and functional diversity across land-use types using species richness, composition, functional richness, and functional composition metrics over two growing seasons. Life-history traits to be recorded include seed weight, plant height, leaf dry weight, specific leaf area (SLA), and seed number. Microclimate variables will be measured with TMS loggers, and soil samples will be collected across slope gradients to assess edaphic influences on seedling establishment. Findings will improve understanding of how disturbance and land-use history shape forb community dynamics and functional traits in montane grasslands.

POSTER PRESENTATION: LONG-TERM POPULATION TRENDS IN AN ENDEMIC DWARF SUCCULENT IN THE SUCCULENT KAROO, SOUTH AFRICA

Helga van der Merwe[1,2], *Suzanne Milton*[1,3]

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The Succulent Karoo hotspot is well-known for its endemic range-restricted succulents. The Prince Albert vygie, *Bijlia dilatata*, in the Prince Albert Succulent Karoo is restricted to disjunct sites on quartzite pavements. Seven populations of *B. dilatata* were surveyed in 2002 (an above-average rainfall year) and in 2020 and 2021 (drought years which began in 2015), and again in 2023 (following drought-breaking rains). An additional site was surveyed in 2023. The elevations varied between 398 m above sea level (a.s.l.) along drainage lines to 715 m a.s.l. on a flat-topped mesa. We hypothesised that (1) there would be a variable decline in the populations following drought, (2) grazed sites at lower elevation would show greater vulnerability in the survival and reproduction compared to higher elevation ungrazed sites, and (3) *B. dilatata* would grow and reproduce better in shaded rather than exposed microsites. In 2002 counts and canopy diameter measurements of plants were made in 10 plots (2 m × 2 m) randomly selected in the centres of the populations at sites 1 to 7. In 2020 counts and measurements were made in edge plots using a 0.58 m diameter circular plot, and in 2021 counts and measurements were made on the same plots using a 2 m × 2 m quadrat. In 2023 the central parts of each population were sampled in ten 2 m × 2 m quadrats arranged at 4 m intervals along 3 to transects, each 60 m in length per site. In addition, populations were sampled in 2 m × 2 m plots centred on a subset of population edge plots. We used small portable data loggers to establish whether temperature and humidity at the soil surface differed with elevation and microsite (shaded vs open). From 2015 until 2020, weather data confirmed an unusually high number of days with maximum temperatures exceeding 40 °C, while rainfall from 2015 to 2022 was below the long-term mean. Positions of the sampling plots, edge or centre, did not significantly influence population density. Densities of live plants in the central parts of the populations ranged from 1.1 to 20.0 plants.m^{-2} in 2002 and decreased to 0.1 to 6.7 plants.m^{-2} by 2023. In 2023, more plants were found in covered microsites than in open sites and microsite had a significant effect on plant size with larger plants found in shaded microsites. However, plants in shaded sites had fewer seed capsules. Mortality was highest in small individuals and recruitment in all populations failed. Microsites, grazing intensity and initial population density influenced population structure. Shaded microsites stayed cooler and moister for longer following rain than open sites. Populations declined over the 21 years that included the drought, however, increased elevation mitigated population declines. Therefore, populations occurring at higher elevations should be included in protected area networks to increase the probability of species survival under a scenario of increased warming. Population declines during hot, dry conditions were exacerbated by increased grazing intensity highlighting the importance of land management for the long-term survival of this species.

SESSION CHAIR: KHULULIWE NTOMBELA

Tuesday 22 July 2025, 14:55 - 16:20

PLATFORM PRESENTATION: IN VITRO RUMINAL FERMENTATION AND METHANE EMISSION OF *ERAGROSTIS CURVULA* GRASS SUPPLEMENTED WITH *SEARSIA LANCEA* LEAF MEAL OR SILAGE

Jonathan Molele[1], Khanyisile Mbatha[2], Sanele Jiyana[3], Thamsanqa Mpanza[1]

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Ruminant animals are regarded as a major contributor to enteric methane emissions that have a negative environmental impact globally. Moreover, enteric methane emission represent up to 12% of the energy loss from the animals. Therefore, there is a need to manipulate rumen fermentation in order to attenuate enteric methane emission without affecting animal performance. Hence, the objective of this study was to evaluate the effect of supplementing *Eragrostis curvula* grass hay with *Searsia lancea* leaf meal or silage on *in vitro* gas production, methane emission and volatile fatty acid profile. Therefore, an *in vitro* study was conducted on grass hay only (referred as T1), grass hay supplement with 15% of leaf meal (referred as T2), grass hay supplemented with 30% leaf meal (referred as T3), and grass hay supplemented with 15% silage (referred as T4) and grass hay supplement with 30% silage (referred as T5). The substrates were incubated in separate serum bottles for 48 h each treatment was replicated four time and there were two runs. The results showed that supplementing grass hay with *S. lancea* leaf meal improved fermentation significantly ($p < 0.05$) from the first three hours to 24h of incubation. However, as incubation advanced to 48 h, T1 treatment had significantly higher gas production. On other hand, supplementing grass hay with 15% *S. lancea* silage improved gas production only for the first 3 h of incubation, where 30% supplementation had no effect. Methane gas emission in 24 and 48 h post incubation showed that supplementing grass hay with either leaf meal or silage significantly ($p < 0.05$) reduce methane emission. The reduction in methane emission of grass supplemented either with *S. lancea* leaf meal of silage could be attributed to plant secondary metabolite present in tree fodder. Supplementing Eragrostis grass hay with *S. lancea* leaf meal or silage did not affect volatile fatty acids production. Therefore, this means that *S. lancea* leaf meal or silage supplementation to grass hay did not disturbed the rumen microbes in the fermentation process of the incubated substrate. Hence, it is concluded that *S. lancea* leaf meal or silage can be strategically used to abate methane emission without interfering with ruminal fermentation. However, there is a need for an *in vivo* study in order to evaluate the animal performance in terms of production since methane emission is reduced due to *S. lancea* supplementation.

PLATFORM PRESENTATION: EVALUATING RED CLOVER TYPES AND THE LINK TO SYSTEM FIT IN MULTISPECIES DAIRY PASTURES – FIRST RESULTS AND INSIGHTS

Sigrun Ammann, Janke van der Colf, Dalena Lombard, Lethu Zulu

Western Cape Dept of Agriculture, George, South Africa

Multispecies pastures, including dairy pastures, have become common practice, with the aiming to achieve greater resilience, productivity and environmental sustainability. In multispecies pastures complementarity of the components becomes an important consideration. This means a more differentiated view of the different types within a species which are represented by different cultivars within each type. This is also the case for red clover

(*Trifolium pratense*), of which only the annual type has been available in South Africa until recently, which persists for 18 months at best. Trials established at Outeniqua Research Farm in 2023 aim at evaluating the cultivars belonging to different red clover types (annual vs grazing types (New Zealand and European origin)) and linking that to their suitability for multispecies pastures. Data is collected for yield, green leaf area post defoliation, flowering and persistence. Total yield for the first year showed some of the grazing type cultivars yielding similar to the annual types ($p<0.05$). The winter yield clearly revealed differences, where the annual types and the New Zealand grazing types yielded significantly more than the European grazing types (2.13 t DM ha^{-1} best annual type vs 0.92 t DM ha^{-1} best European grazing type). In spring there were no differences ($p<0.05$) between the best cultivars of each type, while in summer European grazing types yielded significantly higher ($p<0.05$) than the New Zealand grazing types and the annual types (5.60 t DM ha^{-1} vs 4.64 and 4.60 t DM ha^{-1} for the best cultivar of each of the three types). Flowering incidence in the annual types was significantly higher than in the other types ($p<0.05$). Green leaf area and ground cover after defoliation were significantly higher ($p<0.05$) for the European types followed by the New Zealand grazing types and the annual types lowest ($P<0.05$). This data to date already gives indications for system fit in terms of multispecies combinations. The different types have distinct seasonal yield patterns. Importantly the European grazing types exhibit significantly ($p<0.05$) higher ground cover and persistence, especially compared to the annual type. This links to an important aspect of multispecies pastures where the loss of components results in open spaces in the pasture which allows for weed ingression. The option to choose species combinations of similar duration reduces the chance of open spaces developing. The ground cover and leaf density of the European grazing types also reduces bare ground in the pasture. This is an important improvement to counter weed ingression and at the same time have a competitive yield contribution from the red clover component. Considering the seasonal yield distribution differences, early indications are that a combination of grazing types could result in a more favourable distribution. This will be investigated in future trials.

SHORT PRESENTATION: MORPHOLOGICAL AND PHYSIOLOGICAL RESPONSES OF LUCERNE (*MEDICAGO SATIVA L*) GENOTYPES IN SOIL ACIDITY

Sesethu Sokoko[1], Francuois Muller[1], Ntuthuko Mkhize[2], Julia Sibiya[2], Letty Masemola[1]

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Soil acidity is a major limiting factor affecting the production and sustainability of crops in most parts of the world. Acidic soils (pH<5.5) inhibit plant growth and development, restricting water and nutrient uptake. Most forage legumes particularly lucerne, have been reported to have low tolerance to acidic soils. Lucerne is a perennial plant, and it is characterized by a wide genetic variation for adaption to specific growth. However, lucerne is very sensitive to low pH, reducing its productivity and profitability in production systems. It is therefore important to find genetic resources that are able to perform better under acidic soil conditions. This project therefore aims to determine morphological and physiological traits of various lucerne lines screened in acidic soils under the following specific objectives: i) to evaluate the effect of acidic soils on root growth and elongation, (ii) to determine the cell membrane injury on leaves of lucerne lines under acidic soils and (iii) to evaluate the shoot growth of lucerne genotypes grown in acidic soils. These objectives were attained by screening six lucerne genotypes namely ARC1, ARC2, Pegasis, SA Standard, SA Select and Luzelle. The lines were grown in a net house trial in pots filled with acidic soil and hygromix as control. The trial was a 4x3 randomized complete block design (RCBD), each of the lucerne lines were replicated four times in each of the three soil pH treatments which were 4, 5 and 6. The results obtained indicated that there were lines which showed relatively better growth and improved specific morphological traits at both severe (pH4) and moderate (pH5) stresses. At pH4 and pH5 there were lucerne lines that had significantly high electrolyte leakage from leaves which indicated increased stress under acidic growing conditions. Therefore, we conclude that lucerne lines with elongated roots, enhanced shoot growth and low electrolyte leakage can be selected for further breeding programs because they show signs of improved tolerance to acidic growing conditions.

SHORT PRESENTATION: *RHIZOBIUM LEGUMINOSARUM* BIOVAR *VICIAE* ENHANCES GROWTH AND YIELD PARAMETERS OF VETCH VARIETIES

Mihle Inga Sokupa[1], *Khuliso Emmanuel Ravhuhali*[1], *Victor Mlambo*[2]

[1]North West University, Mafikeng, South Africa. [2]University of Mpumalanga, Mbombela, South Africa

Legumes play a vital role in animal production especially during the dry season where natural rangelands cannot sustain livestock dietary needs. The study was done to assess the effect of *Rhizobium leguminosarum* biovar *viciae* on morphology and yield parameters of vetch cultivars. The study was carried out at the North-West University trial farm (Molelwane), Mafikeng, in a pot medium. The soil was collected from different areas of Mafikeng mixed and poured to the same weight in 70 cm diameter and 30 cm deep plastic pots. Four vetch cultivars were inoculated with different levels of *Rhizobium leguminosarum* biovar *viciae*. The treatment factors were four vetch cultivars (Morava, Common vetch, Namoi and Haymaker plus) and five inoculation levels (0, 150, 250, 300 and 350 ml/50 kg bag of seeds) making a total of 20 treatments replicated 20 times with a seeding rate of 25 kg/ha. The study layout was a randomized complete block design (RCBD). Growth parameters were measured on a weekly basis. Biomass yield and root parameters were recorded at two harvesting stages which was done 30 and 60 days after planting at 5 cm above ground level. A two-way ANOVA was used to analyse data for growth and yield parameters using the general linear model (GLM) procedure of SAS. The effect of vetch cultivars significantly ($P<0.05$) affected plant height, number of leaves, number of branches, tap root, whole root weight, nodules and lateral roots from week two. Inoculant affected plant height, number of leaves, number of branches, tap root, whole root weight, nodules and lateral roots in all experimental period. There were significant ($P<0.05$) differences between vetch cultivars, inoculant, and interaction between the two on chlorophyll from week 5 after emergence. The number of pods per plant, pod length, seed per pods showed significant ($P<0.05$) differences among the cultivars. Namoi had the highest number of leaves, branches, biomass, and produced better roots parameters (tap root, whole root weight and nodules). The recommended industry inoculation level is 200 ml/ 50kg, in this study the highest growth and yield parameters were obtained between inoculation level 250 and 300 ml/50kg. In general, Namoi together with inoculation level 250-300 produced the highest values on growth and yield parameters. This showed the need to assess these varieties on a field trial.

SHORT PRESENTATION: EVALUATION OF CLIMATE-SMART BRACHIARIA GRASS ACCESSIONS AS ALTERNATIVE FORAGE FOR LIVESTOCK PRODUCTION

Fortune Manganyi-Valoyi, Francuois Muller, Letty Masemola, Sesethu Sokoko, Nothando Nqcobo

Agricultural Research Council-Range & Forage Sciences, Pretoria, South Africa

Climate change continues to threaten sustainable agricultural productivity, particularly for livestock farmers. The rising interest in livestock development fueled by increased demands for animal products has led to the demand for productive and high-quality forages to bridge feed shortages. Feed shortages have a negative effect on the welfare of farmers and livestock production as a whole. However, climate-smart forages can serve as an alternative to fill up the feed shortage gap and improve livestock productivity. *Brachiaria* grass species are classified as climate-smart forages due to their adaptability to poor, fertile soils and drought tolerance. The study aimed to evaluate the adaptability and agronomic performance of *Brachiaria* grass accessions for their potential as alternative forage resources for livestock production. The experiment was carried out at Agricultural Research Council - Roodeplaat experimental farm as a randomized complete block design (RCBD). A total of 24 grass accessions replicated 4 times were evaluated for their potential under irrigation and dryland. The accessions consisted of 13 cultivars of *brachiaria brizantha*, 3 cultivars of *B. hybrid*,1 cultivar of *B. decumbens*, 3 cultivars of *B. humidicola* and 4 cultivars of *B. nigropedata* species. Seeds were germinated in seedling trays and then transplanted into a 2 × 4 m^2 plots with 12 plants per plot. Agronomic performance such as number of tillers, plant height, plant width and biomass yield were measured at 75% flowering for 3 consecutive years (2022-2024). No significant differences in biomass production were observed across all the accessions during winter season. However, the results show that majority of *B. brizantha* and hybrid species produces high biomass during autumn season for both irrigation and dry land compared to *brachiaria decumbens*, *humidicola* and *nigropedata* which produce highly during the summer season.

The annual yield was optimum in the first year of establishment, however it increases during year 2 for all the species expect for *B.decumbens*, which had a higher yield in year 1 (27 tons/ha under irrigation and 13 tons/ha dry land). *Brachiaria brizantha* had the highest biomass yield of 48 tons/ha under irrigation and 23 tons/ha under dry land in year 2. Hybrid species produced up to 37 tons/ha under irrigation and 18 tons/ha under dryland conditions in year 2. *Bachiaria nigropedata* species produced the highest yield in year 1 (16 tons/ha) under irrigation and 12 tons/ha in dry in year 2. *Brachiaria humidicola* produced the lowest biomass compared to other accession (4 tons/ha irrigation and 2 tons/ha under dry). The results show a significant increase in the DM yield from year 2 (2023) in most of the grass accessions, particularly in commercial accessions and this can be attributed to nutrient enrichment of the root crown in the first year for aggressive growth in the second year. Brachiaria grass accessions have the potential to serve as alternative forage resources because they can grow in both irrigated and dryland conditions. However, an animal feeding study is needed to evaluate their nutritional value.

SHORT PRESENTATION: INFLUENCE OF NUTRIENT-RICH PIG SLURRY AND LEGUME INCLUSION ON GROWTH PERFORMANCE, PRODUCTIVITY, AND CHLOROPHYLL CONTENT OF *BRACHIARIA BRIZANTHA* VARIETIES

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Communal livestock accounts for 30% of total's livestock production, ensuring food security and sustaining people's livelihoods. However, communal livestock farming depends largely on rangelands for feeding. Planted pasture reserves may be a panacea to supplement rangelands in smallholder livestock farming systems. However, pasture establishment demands more inputs including use of inorganic fertilizer which are expensive, and environmentally unfriendly. The study aims to determine the impact of pig slurry and legume inclusion on agronomic performance and productivity of different cultivars of *Brachiaria brizantha*. A 2 x 2 x 3 x 4 factorial experiment was conducted, with two varieties of *Brachiaria brizantha cv. Marandu and Brachiaria brizantha cv. MG4* planted as monocultures and mixtures *with Lablab purpereous* and each of these received three consecutive applications (hereafter dosages) of 0, 25, 50, and 100% pig slurry rates (PSR). The interaction between pig slurry rate PSR, application, variety and stand type was significant ($P < 0.001$) for tiller and leaf production. Significant differences between PSRs were noticeable after third application, with 100% pig slurry rate PSR increasing tiller and leaf production relative to other PSRs, more so for *B. brizantha cv MG4* relative *Marandu* in grass-legume mixtures compared to monocultures. Three-way interaction between PSR, stand type, and application was significant ($P < 0.001$) for chlorophyll content and plant height, with grass-legume mixtures attaining consistently higher chlorophyll content at 100% PSR compared to other PSRs from the second to the fourth application. On the other hand, plant height increased with slurry application, with 50 and 100% PSRs showing significant effects after fourth application compared to 0 and 25% PSR for both *B. brizantha* varieties. Biomass production per plant was significantly higher at 100% PSR compared to 0, 25 and 50% PSRs for both varieties regardless of legume inclusion. The results of the study showed that pig slurry, particularly 100% rate improves productivity, growth and performance of *B. brizantha*. Therefore, pasture establishment can be conducted via application of pig slurry to increase forage productivity to complement rangelands. Hence, for optimization of forage productivity, we recommend that farmers apply pig slurry at 100% rate.

SHORT PRESENTATION: ALTERING FORAGE LEGUME PLANTING DATE TO IMPROVE BIOMASS PRODUCTIVITY AND RESILIENCE

Lesego Motshekga[1], Kingsley Ayisi[1], Johannes Isselstein[2]

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Lack of good quantity and quality forage to meet the livestock feed demands limits the ruminant productivity and induce rangeland degradation in livestock production systems. In South Africa, supplementary winter feeding of ruminants is increasingly reliant on a narrow range of forage legumes dominated by Lucerne. The ongoing climatic changes, such as temperature directional shifts and precipitation seasonality and amounts, have a significant impact on forage production. A field experiment, laid in a split-split plot design with four replications was conducted at the University of Limpopo Experimental Farm, Syferkuil for two winter growing seasons 2018 and 2019, from June to

November each year. The purpose of this study was to assess the effect of planting date on biomass production and nutritional characteristics of annual clover and vetch cultivars grown in no-tillage for climate change adaptation in fodder production systems. The treatments studied comprised two planting dates (June and July); annual vetch and annual clover species with two cultivars as follows: Common vetch (Timok and Candy); Hairy vetch (Capello and Dr Baumans); Berseem clover (Ellite and Alex); Crimson clover (Opolska and Linkarus); Persian clover (Lazer and Resal). June planting date consistently produced significantly higher ($p < .0001$) biomass production as compared to the July planting date, possible due to the longer growing season. Biomass production of cultivars ranged between 996 kg ha-1 and 3821 kg ha-1; 958 kg ha-1 and 3713 kg ha-1, in 2018 and 2019 respectively. Resal, Alex, Laser, Elite and Dr Baumans were high producers, recording significantly higher shoot DM while Capello, Hanka, Timok, Linkarus and Opolska were low producers. It is therefore critical to choose the optimal planting date and cultivars with high thermo-tolerance adaptive capacity to maximize production and reduce feed gaps.

POSTER PRESENTATION: COMPARING TWO YEARS OF FORAGE LEGUMES AND WINTER CEREAL MIXTURES ON CEDARA RESEARCH STATION, KWAZULU-NATAL

Donna Berjak, Derryn Nash

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If a legume such as forage peas are grown in a mixture with a forage cereal that grows well in autumn/winter, the protein and energy components of the pasture are increased as well as possibly increasing dry matter (DM) yields compared with cereals alone. In 2023 and 2024, two cereal/legume trials were planted in the middle of March of each year. The first trial was grazing vetch with winter cereals; this was cut to simulate a grazing trial. The second trial was forage peas and winter cereals, which was cut to simulate a silage trial. All of these were run as dryland trials. The Cedara grazing vetch/cereal trial (Trial 1) of 2023 had good yields. There were three cuts over the season with a mean total yield of 5.38 t DM. ha-1, and a highest total yield of 6.57 t DM. ha-1. The top three yielding mixtures were Haymaker vetch + Wizard oats, Namoi vetch + Southern Blue stooling rye and Namoi + SSR 729 stooling rye yielding 6.57; 6.55 and 6.48 t DM. ha-1, respectively. In general, black and white oats and their mixtures had their highest yields in Autumn 2023. In winter, the stooling rye and mixtures with stooling rye and Barsaia mixtures had the highest yield. The Cedara grazing vetch/winter cereal trial (Trial 3) of 2024 had lower yields than 2023. Some of the cultivars planted, were the same as 2023, but others were different due to availability from seed companies. There were three cuts over the season with a mean total yield of 3.75 ton DM. ha-1, and the highest total yield was 4.76 ton DM. ha-1 the top three yielding mixtures were Namoi + Barsaia black oats; Namoi + SSR 789 stooling rye and Namoi + SSH 423 oats yielding 4.76; 4.64 and 4.02 ton DM. ha-1, respectively. The forage pea/cereal trial (Trial 2) of 2023 did reasonably well. There were two cuts over the season with peas and cereal in the first cut and only cereals in the second cut. The mean total yield of 3.96 t DM. ha-1, and the highest total yield was 5.18 t DM. ha-1. The top three yielding mixtures were Astronaute peas + Wizard oats, Morgan peas + Wizard and Jupiter peas + Wizard yielding 5.18; 4.91 and 4.69 t DM. ha-1, respectively. The forage pea/cereal trial (Trial 4) of 2024 had similar yields to 2023. The mean total yield was 4.03 t DM. ha-1, and the highest total yield was 4.52 t DM. ha-1. The top three yielding mixtures were Arvika peas + NCD Grazer stooling rye, Arvika peas + Barsaia black oats and R.I.F. peas + Wizard oats yielding 4.52; 4.44 and 4.20 t DM. ha-1, respectively. The higher yields of particularly the vetch/cereal trial in 2023 over 2024 can possibly be explained by the rainfall data. During the growing period of March to October we received 90mm more rain in 2023.

POSTER PRESENTATION: EFFECTS OF UTILISING A COVER CROP UNDER DIFFERENT GRAZING PRESSURES WITHIN A CONSERVATION AGRICULTURE SETTING

Rebecca Ellerbeck[1], Pieter Swanepoel[1], Johann Strauss[2,1]

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Cover crops can be utilized as forage to improve their economic feasibility within a cash crop rotation system. Due to insufficient summer rainfall, there is typically only one growing season in South Africa's Mediterranean region. Establishing a cover crop under dryland conditions necessitates replacing a cash crop, which is costly and results in lost income. Utilising cover crops for grazing can be economically beneficial and reduce establishment costs, but there is limited data on optimal grazing management practices. This study explored how a multispecies cover crop

responds to different grazing strategies within a conservation agriculture system. A multispecies cover crop was grazed by sheep under four treatments with increasing rotational stocking pressure. Each treatment used the same cover crop mix on 1 hectare, initially stocked with 8 sheep ha-1, later increased to 11. Treatment 1 had continuous grazing on 1 hectare. Treatments 2, 3, and 4 divided the hectare into 2, 4, and 8 paddocks, respectively, with sheep rotating through smaller paddocks. Plant cuttings were taken to measure herbage production, species composition, and forage quality throughout the season. The growth of the sheep and carcass data were used to compare the economic viability of each grazing strategy. Soil samples were taken before and after the grazing season. Preliminary results show no significant difference in sheep growth across treatments. All treatments produced mostly A2-grade carcasses. There was no significant difference in total herbage production between the treatments. Total herbage availability was significantly higher ($p < 0.05$) after grazing than before grazing during the first grazing cycle. There was no significant difference during the second cycle. Soil data showed that Mg, B, and cation exchange capacity were significantly higher ($p < 0.05$) after the grazing season than before. The lack of significant differences in sheep growth and total herbage production could be due to understocking. The greater available forage after grazing during the first cycle suggests that the systems are not being used to their full potential and can support more livestock. During the second cycle, this difference was not significant, probably due to a higher stocking rate applied in the second cycle. The improvements in the soil show that cover crops can be utilized for grazing without compromising their ability to improve soil parameters. We conclude that the system can support a higher stocking rate, which may lead to visible differences between grazing treatments. The effect of grazing was not detrimental to the system, suggesting that it is possible to generate an income through grazing while still gleaning the benefits offered by cover crops. The preliminary results of this study are limited to a single growing season, and further research is needed to clarify the findings.

POSTER PRESENTATION: FODDER BEETROOT VARIETIES' RESPONSES TO NITROGEN FERTILISERS AND THE SEASON: AGRONOMIC, MORPHOLOGICAL, AND NUTRITIONAL PROFILES

Zabesuthu Mngomezulu, Kwena Mokoboki, Khuliso Ravhuhali

North West University, Mmabatho, South Africa

Fodder beet leaves are a good source of protein and minerals for livestock, particularly during winter and spring when feed availability is low. The aim of this study was to determine the response of fodder beet varieties to nitrogen fertilizer and season on agronomic, morphological characteristics and nutrient profiles. The study was conducted at the North-West University field trial situated in the North-West province of South Africa. The field experimental design was in a 2 x 5 x 3 factorial arrangement in randomized complete blocked design (RCBD) with five (5) replicates. Treatment factors were two fodder beet varieties (Robbos and Bangor), five nitrogen fertilizer (0 kg N/ha; 25 kg N/ha; 50 kg N/ha; 75 kg N/ha; and 100 kg N/ha) and three planting seasons (winter, spring and autumn). Agronomic and morphological parameters measured were leaf length, leaf width, number of leaves, leaf greenness and chlorophyll content. Parameters in this study were analysed using a three-way and four-way analysis of variance. The 4-way interaction (season x week x variety x nitrogen fertilizer rates) effect significantly ($p<0.05$) influenced leaf length, leaf width and number of leaves. The results from this study revealed that 50 kg N/ha, 75 kg N/ha and 100 kg N/ha produced the best yield when compared to 0 kg N/ha and 25 kg N/ha among the seasons, Autumn produced better yield. Bangor outperformed Robbos. The 3-way interaction (season x variety x nitrogen fertilizer rates) effect significantly influenced NDF, ADF, ADL, EE, cellulose, hemicellulose, DMI, DMD, TDN, DE and ME of fodder beet leaves. The season x variety x nitrogen fertilizer rates interaction also influenced all amino acids profiles and mineral nutrient composition. Fodder beet under 50 kg N/ha, 75 kg N/ha and 100 kg N/ha had better nutritive values when compared to 0 kg N/ha and 25 kg N/ha. In comparison among seasons, the autumn and winter seasons had a better yield than summer. The highest morphological and agronomic parameters for leaves were obtained in autumn for the Robbos variety and in winter for the Bangor variety. Robbos and Bangor leaves exposed to all the nitrogen fertilizer rates under autumn and winter had better chemical constituents.

POSTER PRESENTATION: FERMENTATIVE PROFILE AND AEROBIC STABILITY OF BRACHIARIA GRASS MIXED WITH *MELIA AZEDARACH* LEAVES

Thamsanqa Mpanza, Jonathan Mulele, Francuois Muller

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Ensiling is common practice used to preserved access forage material to alleviate the effects of forage shortage on animal during the dry season period. Mixing grass with tree fodder can improve silage fermentation. Therefore, this study aimed to evaluate the fermentative characteristics and aerobic stability of Brachiaria grass mixed with *Melia azedarach* leaves at ensiling. Brachiaria grass was harvested at 50% flowering stage of growth and mixed with *Melia azedarach* leaves at three inclusion levels, 0%, 20% and 30%, on fresh mass bases. The inclusion levels of *Melia azedarach* leaves in Brachairia grass forms T1, T2 and T3, respectively. At ensiling 5% molasses was and LAB inoculant were added as additives. The forage mixture was ensiled in plastic bag with dimension of 600mm x 300 mm with 170 micron in four replicates, and were opened on day 3 and day 40 days. On ensiling day (day zero) samples in duplicates were taken to determine pH, where 40 g of fresh forage was mixed with 360 mL of distilled water, shaken vigorously for 1 minute and kept in the fridge overnight and filtered the following day with No 1 Whitman filter paper. This was repeated on day 3 and day 40 post ensiling. For dry mater determination, samples of fresh forage and silage on respective opening days were taken in duplicated and recorded for wet mass and dried in the oven till constant weight and recorded for dry mass from which dry matter was calculated. On day 40 post ensiling, silage samples were kept loosely in a plastic bag and subsamples were taken to recorded pH on day 2, 4, 6 and 8 after air exposure, determine aerobic stability. The result showed the mixing Brachiaria grass with *Melia azedarach* did not affect silage fermentative quality. All silages recorded a pH value below 5 within the first three days of ensiling. At day 40 the pH values ranged from 4.26 to 4.56, T1 having numerical higher pH (4.56), but not statistical significant ($p > 0.05$). Dry matter drops due to fermentation but it was within the range of recommended value of a well-preserved silage. Aerobic stability indicates the ability of silage to maintain good quality after air exposure. On day 8 of air exposure silage on T2 and T3 recorded a pH value above 5, indicating spoilage. Therefore, it is concluded that *Melia azedarach* can be included to Brachiaria grass up to 20% without negative effect to fermentative quality, however, such silage it is safe to be fed to animal within 7 days after opening.

STANDARD POSTER: GROWTH AND NUTRITIONAL QUALITY PERFORMANCE OF SELECTED FORAGE GRASSES IN LOWER AND UPPER MIDLAND ZONES IN KENYA

Peggy Karimi, Solomon Mwendia, Ruth Odhiambo, David Muuru, Micheal Peters

Alliance Bioversity and CIAT, Nairobi, Kenya

Sustainable intensification of livestock production in sub-Saharan Africa is constrained by limited availability of high-quality, site-adapted forages. Optimizing forage-based feeding systems requires the identification of cultivars that simultaneously deliver high biomass yield and superior nutritive value under varying environmental conditions. This study conducted a comparative evaluation of the agronomic performance and nutritional composition of five forage cultivars and hybrids in two contrasting locations in Kenya. A Randomized Complete Block Design (RCBD) was used to establish four *Urochloa* hybrids Camello, Cobra, Mestizo, Talisman and one *Megathyrus* spp Massai. Data for plant height and dry matter was collected after 8 weeks while nutritive traits including, crude protein (CP) yield, and metabolizable energy (ME) yield were also derived. Root biomass was determined at 265 days after establishment across the 2 sites. Significant site × genotype interactions were observed for several traits. Massai consistently exhibited superior agronomic performance, attaining the greatest plant height 0.87m and highest cumulative DM yield 8.78 t/ha in lower midland1. with statistically significant differences $p = 0.052$ and $p = 0.015$, respectively. Metabolizable Energy yield was also highest in Massai, particularly in the low mid 1 with a significant site effect ($p = 0.012$). In contrast, root biomass did not vary significantly among cultivars or sites $p = 0.922$, indicating uniform below-ground biomass. Despite variability in CP yield with Massai again showing the highest values, differences across cultivars were not statistically significant ($p = 0.099$). These results underline the adaptability and superior biomass accumulation potential of the Massai cultivar, particularly in high rainfall, highlighting its suitability for regions prioritizing high biomass and energy yields in forage systems.

Tuesday 22 July 2025

10:30 - 10:50

14:35 - 14:55

STANDARD POSTER: COMMUNAL RANGELAND CONDITIONS AND ITS DRIVERS IN MPUMALANGA PROVINCE

Matome Collen Rabothata[1], Oupa Keromecwe[1], Gilbert Pulle[2], Thabile Joyce Mokgakane[1], Norman Magoro[1]

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Rangeland degradation is a global phenomenon, but it is particularly acute in southern Africa's communal areas. Other than the natural causes such as climate change and variabilities, anthropogenic rangeland degradation is caused by an interaction of biophysical, institutional and socio-economic factors. Furthermore, grazing and climate (precipitation and temperature), alone or in combination, are also frequently mentioned as the drivers of rangeland degradation. However, the impact of different drivers differ across agro-ecological zones. Hence, the need to understand the nature of rangeland degradation, the drivers responsible for degradation in specific areas, and how to respond to these drivers, especially in communal areas. The aim of this study is to; 1) determine the condition of communal rangelands and extent of rangeland degradation in different agro-ecological zones of Mpumalanga province. 2) To determine the ecological and socio-economic drivers of rangeland condition and rangeland degradation among communal farmers in different agro-ecological zones of Mpumalanga province. Vegetation survey will be conducted using Line point Intercept method. Cover abundance on six (6) communal rangelands comprising 2 open access systems and 2 common property systems at each of the three agro-ecological zones (n = 24 communal farms). Vegetation parameter of importance include; species composition (n), species basal cover (%), canopy cover (%) bare ground cover (%), veld condition score (%) and grazing capacity (ha/LSU). The following parameters will be used as indicators to assess whether rangelands are in good condition or degraded. Socio-economic parameters driving rangeland degradation include; farmer's demographics, rangeland and livestock management practices, perception on the condition of their rangelands, the extent of rangeland degradation, perception on drivers of rangeland conditions and degradation, and general challenges with rangeland and livestock management in communal lands of the Mpumalanga province. This study will share light on the state of rangeland condition and the extent of rangeland degradation in different agro-ecological zones of Mpumalanga Province. Furthermore, it will provide insight on areas of high rehabilitation and restoration priority in various agro-ecological zones of Mpumalanga Province.

STANDARD POSTER: PARTICIPATORY RANGELAND CONDITION ASSESSMENT IN MATABELELAND SOUTH PROVINCE, ZIMBABWE. THE CASE OF BEITBRIDGE, GWANDA, AND MATOBO DISTRICTS

Richard Mwembe[1], Irenie Chakoma[2], Phibion Chiwara[3], Hatitye Muchemwa[4], Rutendo Nyahoda[4], Mutsa Mahanzu[4], Tendekai Mudimu[5], Godfrey Manyawu[2], Onious Mtetwa[5], Sikhalazo Dube[2]

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A participatory communal rangeland condition assessment, ground truthing and mapping exercise was conducted in

determine current rangeland condition, size, type, distribution, and governance systems that would inform scope of adaptable, participatory and inclusive interventions, and nurture sustainable rangeland management and livestock productivity in communal areas.

Using a multidisciplinary approach, multiple data collection methods, and tools were employed to collect quantitative and qualitative data. These included participatory rangeland condition assessment, vegetation surveys, Geographic Information Systems (GIS), and remote sensing.

Rangeland condition assessment revealed a poor to fair grazing condition dominated by bushes, bare patches, annual grass, nonpalatable, and invasive species. Palatable species such as *Urochloa mosambicensis* and *Panicum maximum* inhabited refugia locations. Land use mapping revealed a landscape dominated by rangelands (71.8%), dryland cropping (18.9%), and shrubs (9.1%) with surface water having <1% coverage. Key study findings revealed a fuzzy rangeland governance management system based on non-binding by-laws weakly enforced by a traditional leadership system. Multiple government departments shared legislative mandate with overlapping roles and responsibilities. Three types of grazing areas were reported by the communities: near home or within home; rainy season grazing areas; and relief grazing which is utilized during drought years. Animals are on a free-range system. However, some communities institute some form of grazing controls near cropping near crop fields. High levels of human-wildlife conflict due to competition for grazing and predation were reported.

A paradigm shift in rangeland management is the key to promote sustainable rangeland and livestock productivity in communal areas of Zimbabwe. Investments in Agro-Pastoral Field Schools, innovations in gully reclamation, bush thinning, reseeding using adaptable grass, and legume species interventions are key initiatives for inclusive community participation and ultimately socioeconomic transformation and environmental sustainability.

RESEARCH PROPOSAL POSTER: COVER CROP BIOMASS PRODUCTION AND QUALITY IN SEMI-ARID REGIONS OF SOUTH AFRICA UNDER RAINFED CONDITIONS

Olona Gabada[1,2], Diana Marais[1], Francuous Muller[3], Fortune Manganyi-Valoyi[3], Patrick Rakau[3]

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The water-limited environment of semi-arid regions of South Africa may not produce enough cover crops biomass and quality to generate benefits associated with cover crop use in more humid regions. Multiple cropping system have been reported to increase resource exploitation and biomass production; however, no research has been done in semi-arid regions of South Africa to identify the cultivar and cropping system that performs better in North-West (Potchefstroom), Gauteng (Roodeplaat) and Limpopo (University of Limpopo) province under rainfed conditions. Therefore, selecting the appropriate cropping system and cover crop cultivar is essential for optimizing biomass and attaining ecological advantage that can lead to cost reduction for farmers. This study aims to help farmers understand how cover crops can adapt to semi-arid environments of South Africa under rainfed conditions and in balancing agricultural practices with the need for sustainable resource usage. The objective of the study is to evaluate biomass, quality and growth performance of cover crops in mono verses multiple cropping systems. Sixteen crop treatments will be cultivated in 2025 at three sites. The 16 cover crop system will consist of 6 monoculture (bargrazer, barsweet, subtropies babala pearl millet, cowpea, vetch and turnip purple top), 4 two-species mixture (bargrazer and cowpea, turnip and vetch, bargrazer and babala pearl millet, babala pearl millet and turnip), 3 three-species mixture (babala pearl millet, bargrazer and cowpea, bargrazer, babala pearl millet and barsweet, bargrazer, barsweet and turnip), 1 four-species mixture (bargrazer, babala pearl miller, cowpea and turnip), 1 six-species mixture (bargrazer, babala pearl millet, barsweet, vetch and turnip) and a control. The winter cover crop system will consist of 7 monoculture (lotus, black oats, white oats, samurai radish, turnip spitfire, turnip purple top and vetch), 4 two-species mixture (radish stelling and radish nootdgecht, black oats and vetch, turnip and white oats turnip B and lotus), 1 three-species mixture (stooling rye early, mid and late type), 1 four-species mixture (white oats, black oats, turnip and vetch), 1 five-species mixture (stooling rye early type, stooling rye mid type, stooling rye late type, radish and lotus), 1 all 8 monoculture species mixture and a control. A 4×4 factorial experiment with 3 replications will be used in this experiment and will be put into an alpha lattice plot design with a plot size of 24×12=288 m^2 and the subplot size will be 3×2=6 m^2. Cover crops will be planted during the seed planting phase at ARC Roodeplaat, University of Limpopo Potchefstroom. The data will be randomly sampled three times using a 0.5 m×0.5 m quadrat in each sub-plot. The physiological traits such as plant height, width and ground

cover percentage will be measured. Above ground biomass inside the quadrat will be cut and weighed for fresh and dry biomass. The samples will be milled and analysed for nutritional (C and N), crude fiber and minerals qualities. This study will be beneficial to farmers by providing a better understanding of cover crop, its nutritional value and benefits in their areas.

RESEARCH PROPOSAL POSTER: ASSESSING ZEA MAYS L. GROWTH RESPONSE AND QUALITY OF NUTRIENT COMPOSITION OF KERNEL TO DIFFERENT COVER CROP TREATMENTS GROWN FROM TWO DIFFERENT AGROECOLOGICAL REGIONS.

Bandile Nsele[1], *Pascalia Gununu*[2], *Fortune Manganyi-Valoyi Manganyi-Valoyi*[1], *Mmatladi Mataboge*[2], *Patrick Rakau*[1], *Francuois Müller*[1]

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The incidence of food insecurity is high among rural South African households. Food insecurity is transiently attributed to seasonal production, especially of a staple crop like maize. Moreover, threats like climate variability and soil degradation has been resulting to substantial fluctuations in world maize production, especially in developing countries. Furthermore, more research has been done on the use of cover crops for soil rehabilitation and nutrient supplementation since it's generally known of its paramount benefits to soil health. Thus, their benefits also contribute in attenuation of severe impact cause by climate change. Cover crops with Fabaceae species may have a potential effect in nutrient replenishment and rehabilitation in the soil (through deposition of organic matter, improving flocculation in soil particles) of which will positively affect the production of a subsequent maize. In contrast, non-Fabaceae cover crop species can have a transient negative impact to subsequent maize crop through a utilization of available nitrogen in the soil. Moreover, more studies have been done on the effect of cover crops to maize, however, many outcomes are still contradicting and therefore the study aims to evaluate the effects of distinctive cover crop treatments to maize growth response and yield potentials. A one year season field experiment will be conducted on two different experimental sites with distinctive climatic and agroecological conditions namely, Cedara College of Agriculture which is located in KwaZulu-Natal province and Potchefstroom Agricultural College in North-West province. Experimental layout will be a Randomized Complete Block Design (RCBD) with 3 replicates and 16 winter cover crop treatments (encompasses of both monoculture and mixtures) per replicate. Both morphological (plant height, leaf area, root length, grain and biomass yield) and physiological parameters [nutrient quality, maize quality of metrics (such as protein content, starch, oil content, and carbohydrates)] will be quantified to screen the effects of the different cover crop treatments on maize. Furthermore, biological nitrogen fixation (BNF), biomass, nutrient composition, weed suppression from cover crops and soil nutrient status (including N, P, K, Ca, Fe, Mn, Mg, S and B) in the soil will also be quantified. All quantified parameters will be further analyzed using a One-way Analysis of Variance (ANOVA) and the means of the treatments will be compared using SPSS software. The means at $p<0.0.5$ will be separated using a Duncan's multiple range test. This study will be conducted to improve the soil health (through a reduction of use of herbicides and fertilizers) with reduced input costs yet anticipating for the high yields and will enhance agricultural sustainability, elevating farm profitability while keeping environment risks at it low levels.

RESEARCH PROPOSAL POSTER: INFORMING VEGETATION MANAGEMENT IN SOLAR PV PROJECTS: A LONG-TERM STUDY FOR EVIDENCE-BASED MITIGATION IN THE NAMA KAROO

Leigh-Ann de Wet, *Matthew Mamera*

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The retention of indigenous vegetation beneath solar photovoltaic (PV) panels to reduce ecological impacts and preserve the terrestrial biodiversity, is a common practice recommended under most solar PV developments in environmental consulting and research studies. This approach is based on the assumption that preserving ground cover helps maintain ecosystem functioning and reduces vegetation loss. However, there is a lack of empirical evidence on how indigenous vegetation and the soil properties functionality responds to the altered conditions

created by solar infrastructure. Development of solar PVs can sometimes coincide with areas with threatened species or habitats and it is assumed that these can be maintained or protected by retaining indigenous vegetation beneath panels. This project aims to investigate the long-term effects of PV panels on vegetation dynamics in the Nama Karoo biome. Vegetation and soil morphological properties (physical and chemical properties) will be monitored over time, beginning prior to construction and continuing for at least five years post-construction. The study will assess ecological changes beneath and around PV panels using standard vegetation sampling and analysis methods. By generating time-series data from an ecologically sensitive and under-researched region, this research will be able to support more evidence-based impact assessments and vegetation management practices in the renewable energy sector for integrated management practices. This research study hypothesizes that solar PV developments can be successfully integrated with best practices for improved terrestrial biodiversity management implementation actions for the conservation of indigenous vegetation.

RESEARCH PROPOSAL POSTER: DISTRIBUTION, MORPHOLOGICAL TRAITS AND NUTRITIONAL QUALITY OF INDIGENOUS GRASSES IN LOW AND HIGH RAINFALL AREAS OF SOUTH AFRICA

Ditebogo Malepe[1,2], *Julius Tjelele*[1], *Ngoako Letsoalo*[2], *Francuois Muller*[2]

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South Africa's diverse rangelands support a wide variety of indigenous grass species that play a critical role in sustaining both natural ecosystems and agricultural productivity. The productivity of these different indigenous grass species could be distinctly different based on the agro-ecological zone, environmental factors like temperature, light intensity, total rainfall, soil type, fertilization level, and by stage of maturity. Therefore, this study aims to investigate the distribution, morphological characteristics, and chemical composition of indigenous grasses across low and high rainfall regions of South Africa. The study will focus on five indigenous grass species: "*Megathyrsus maximus* (Jacq.) B.KSimon & S.W.L.Jacobs., *Themeda triandra Forssk*, *Urochloa trichopus (Hochst) Stapf, Cenchrus ciliaris L.*, and *Digitaria eriantha Steud.,"* which are found throughout the different rangelands in the country. These species are known for their resilience and adaptability in arid and semi-arid environments, and their contribution to both livestock productivity and ecological stability. Data will be collected in high rainfall areas (>500 mm/year) and areas with low rainfall (<500 mm/year) across the country. The selected grass species will be sampled simultaneously during the peak growing season to ensure the assessment of their optimal morphological and nutritional characteristics. Three composite specimens will be collected per area, resulting in twenty-four samples per species. In addition to grass species, soil samples will be collected at each site where the grass is collected to evaluate soil properties that may influence species occurrence and traits. Data collection will include recording the GPS location of each sampled plant to document its geographical distribution. Morphological traits such as the number of tillers, plant height, vegetative height, leaf blade length and width, and inflorescence length will be measured. For nutritional analysis, crude protein, fibre fractions, digestibility, and mineral content will be evaluated. We hypothesize that grass species in high rainfall regions will exhibit greater biomass production and higher nutritional content, whereas in low rainfall areas drought-adapted species will display distinct morphological adaptations such as reduced leaf area and deeper root systems to cope with water scarcity. Understanding these adaptations is critical for assessing rangelands resilience under future climate scenarios, particularly given projections of reduced precipitation and increase in temperatures in many parts of the country. By integrating distribution data with morphological and nutritional profiles, this study will assist identifying which species are most suitable for sustainable forage production under changing climatic conditions. Furthermore, the findings will contribute to improved rangeland management strategies, including the selection of appropriate grass species for reseeding degraded areas. This research aligns with national priorities for climate-smart agriculture and ecosystem-based adaptation and aims to inform both policy and practice.

STANDARD POSTER: SEASONAL CHANGES IN VEGETATION QUALITY AND QUANTITY OF A HIGHVELD WETLAND AND GRASSLAND ECOSYSTEM UTILISED BY UNGULATES

Daleen M. Steenkamp[1], *Willem M. Strauss*[2], *Michael J. Somers*[3], *Leslie R. Brown*[1]

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South African grasslands form part of the world temperate grassland biome and are characterised by the dominance of the vegetation by Poaceae, with other forb and woody species in between. Grasslands are characterised by a high plant biodiversity, encompassing diverse species compositions and varied vegetation structures. Grasslands experience patchy rainfall, extended dry periods and cold winter temperatures, resulting in seasonal and multi-annual fluctuations in forage characteristics. The survival of large herbivore populations, therefore, depends on their ability to adapt to these variations and meet their nutritional needs during each stage of the annual cycle. A critical factor in this adaptation is functional resource heterogeneity, which allows for optimal responses to temporal variation shifts. Functional heterogeneity can be defined as mixed ecosystems consisting of functional wet and dry season habitats. Wetlands, as functional dry-season habitats, play a crucial role due to their shallow water tables, which sustain forage production during moisture-limited periods. By acting as a reserve resource, wetlands provide animals with stable, high-quality forage during the late dry season, helping to buffer herbivore populations against food scarcity and potential population decline. This study aimed to examine the spatial and temporal variation in vegetation quantity and quality through systematic monitoring using a combination of surveys. Survey periods were approximately three months apart, coinciding with the four seasons. Over a one-year period, ten study sites (comprising five wetland sites and five control sites) were monitored. At each site, one-hectare plots were marked within which detailed vegetation surveys were conducted. A combination of survey techniques was used to capture the changes in vegetation quantity and quality that occurred across seasons. Changes in the following vegetation components were considered for the quantity survey: Above-ground biomass, Vegetation cover (basal cover), Vegetation density (crown cover), Species composition and Species frequency. Seasonal changes in vegetation quality were examined by measuring elemental nutrition and Crude fibre content. Findings from Disc pasture Meter (DPM) readings and GRS densitometer measurements revealed that wetland sites consistently exhibited significantly higher above-ground biomass compared to control sites across all seasons. However, no significant variation was detected between individual seasons. Increased temperature and environmental variability, specifically more frequent and intense drought spells due to climate change, are expected. The anticipated increase in temperature and environmental variability due to climate change, particularly more frequent and intense droughts, is expected to exacerbate challenges in forage availability. With shorter growing seasons and more erratic rainfall, large herbivores may struggle to meet their nutritional requirements throughout the year. Understanding the seasonal fluctuations in forage quantity and quality, along with the role wetlands play in influencing animal movement and utilisation patterns that reduce grazing pressure on terrestrial grasslands, can improve management strategies for preserving grassland ecosystems while sustaining viable herbivore populations.

STANDARD POSTER: EFFECT OF FIRE FREQUENCIES ON WOODY PLANT ENCROACHMENT IN HONEYDALE FARM, ALICE

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In this study, data collection was done at the burning trials of University of Fort Hare to explore different fire frequencies on woody plant vegetation. The trials comprised of unburned, annual, biennial, triennial, quadrennial and sexennial burns. Each treatment was replicated twice and each replicate measures 100 x 50m. A belt transect of 400m2 was laid along the length of each plot and all woody plants rooted within the transect were identified by species name. The tree height and canopy cover were measured using a hand-held measuring stick. The canopy cover was calculated using area of a circle and the analysis of variance was conducted to test the fixed effect of fire frequency and woody species type and their interaction using general liner model. The results showed that there was a significant effect of fire frequency (FF) on canopy cover of woody plants (P = 0.04). With annual burns having the least canopy cover compared to other fire frequencies. The density of woody plants also varied by fire frequency, with biennial and triennial burns promoting increase in woody densities while annual burns reduced both woody

cover and densities. Acacia karoo was the main encroacher, attaining significantly higher cover and density in biennial and triennial burns compared to other woody plant species. Overall, the effect of fire on controlling bush encroachment depended largely on the fire frequency, with annual fires holding great promise while triennial burns facilitated bush encroachment.

RESEARCH PROPOSAL POSTER: THE PERFORMANCE, PRODUCTIVITY, NUTRITIVE VALUE AND NITROGEN FIXATION OF COOL-SEASON FORAGES UNDER VARYING RATES OF PHOSPHOROUS: TOWARDS IMPROVED RUMINANT NUTRITION AND ANIMAL PERFORMANCE IN COMMUNAL AREAS OF THE EASTERN CAPE, SOUTH AFRICA

Noluvo Joyi[1], *Mthunzi Mndela*[1], *Andiswa Finca*[2], *Unathi Gulwa*[3], *Nobulungisa Mgujulwa*[3], *Patrick Rakau*[4], *Thantaswa Zondani*[2]

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Livestock production is a cornerstone to rural economy, food security and people's livelihoods. However, during dry season, grasses in rangelands undergo dormancy and become less productive and deficient in essential nutrients, leading to poor animal performance and productivity. Establishment of reserve pastures with improved forage species could be an alternative strategy. However, phosphorous (P) remains the most limiting nutrient in South African soils. Hence, P fertilizers are crucial for the optimization of plant growth, forage production and quality. However, the optimal P rate to maximize forage production needs to be ascertained. This study is designed to determine the optimal P rate and assess how various forage species respond to varying rates of phosphorous. Basal soil P status will be determined from 9 randomly collected samples prior to planting. A grass species, Oats (*Avena sativa*), broadleaved species (*Raphanus sativus*) and two forage legumes [Bird's-foot-trefoil (*Lotus corniculatus*) and Vetch (*Vicia sativa*)] will be planted in monocultures and grass-legume mixtures in communal gardens of Amakhuze communities in Alice, Eastern Cape. These monoculture and mixed plant stands will be assigned varying rates of 0, 25, 45, 65 and 85 kg P/ha, totaling 30 treatment combinations. Each of these treatment combinations will be replicated three times in plots of 2 × 2 m, totaling 90 experimental plots. These plots will be arranged as a randomized complete block design with 6 blocks and 15 plots per block. Grass tillers, and leaves, chlorophyll content, height, biomass production, N fixation and chemical composition will be determined at vegetative, reproductive and senescence stages. Tillers and leaves will be counted per plant for a total of three plants/plot, after which the chlorophyll content will be recorded using SPAD meter, followed by destructive sampling of the above and below-ground plant parts to determine biomass production and N fixation (with Oats used as reference plant). The crude protein, metabolizable energy, Acid Detergent Fiber, Neutral Detergent Fiber, macro and micro minerals will be determined. An additional experiment will be conducted where Oats will be planted at a large landscape scale in monocultures and mixtures with Vetch to study animal performance. Two well fenced croplands that are ±2 hectares in size will be broadcasted with Oats (monoculture) and Oats+Vetch (mixture). At vegetative stage, the stocking rate for smallstock and the botanical composition of the pasture will be determined. Thereafter, 10 sheep wethers will be weighed and placed in each cropland for grazing without access to concentrates or roughages. Another group of 10 sheep wethers of the same age and weight as experimental wethers will be used as a control group. The control group will graze in rangelands without access to any other feed type. After an appropriate grazing period, both control and experimental groups will be weighed, with some morphological traits measured to determine weight gain and growth performance. Each individual sheep will be treated as a pseudo-replicate. This study is a basis for devising animal feeding program and policy development to ensure sustainable livestock production and food security in communal areas.

STANDARD POSTER: DROUGHT-TOLERANT LEGUMES: A SUSTAINABLE SOLUTION FOR SMALL-SCALE SUGARCANE GROWERS

Naledi Zama[1], *Skhanyiso Khwela*[2], *Mncedisi Motaung*[2], *Emihle Ngonini*[2], *Anathi Magadlela*[1,2]

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Sugarcane (*Saccharum officinarum* L.) is an important crop growing in most countries, including Sub-Saharan Africa (SSA). In SSA, sugarcane is grown commercially and by smallholder farms. Considering that KwaZulu-Natal (KZN) is one of the major sugarcane producing regions in South Africa, we studied how climate shapes soil nutrients, pH

and exchangeable acidity in South African sugarcane plantations and assessed the responses of these soil variables to the addition of selected legume species. The aim of this study is twofold: firstly, to determine if climatic variables play a role in determining the soil chemical and nutrient status in the sugarcane plantations, and secondly, whether leguminous crops grown in these soils can enhance the soil nutrient and chemical status. In 2022, we conducted a greenhouse study at the University of KwaZulu-Natal, South Africa (29° 49' 4.43" S, 30° 56' 33.98" E) using soils collected from five sugarcane plantations located in the north and south of KZN. We used WorldClim data to extract maximum temperature and total precipitation (TP) for the previous year (2021) to determine how these climatic conditions are related to the soil conditions at the sugarcane plantation sites. We used Multivariate Adaptive Regression Splines (MARS) analyses to assess the influence of TP, vegetation type, elevation and site on all soil parameters. Our MARS analyses revealed that nitrogen (N), phosphorus (P) and potassium (K) had a strong non-linear relationship with TP. This was confirmed by the hinge function for TP at two thresholds (1053.8 mm and 1109.7 mm). Overall, MARS prediction suggested that total precipitation (above a threshold of 1053.8 mm) will decrease soil P, sugarcane plantation site will have a strong effect on soil N, and multiple conditions influence soil K. Using mixed-effects models, we found that legume species reduced soil N and P with *Vigna unguiculata* L. (cowpea) having the greatest reducing impact for soil N (log +1 scale: β = -0.029, SE = 0.0035, $p < 0.05$) and P (log +1 scale: β = -0.428, SE = 0.0419, $p < 0.05$). Soil K was heavily reduced by *Arachis hypogeae* L. (groundnut) (log + 1 scale: β = -0.616, SE = 0.0611, $p < 0.05$). Soil micronutrients (Ca and Mg) were increased by four out of six legumes. Notably, soil Ca increased in *Vicia villosa* Roth. (hairy vetch) (log +1 scale: β = 0.302, SE = 0.0957, $P < 0.05$) and *Vicia sativa* L. (common vetch) (log +1 scale: β = 0.351, SE = 0.0958, $p < 0.05$). We observed that sites in the KwaZulu-Natal Coastal Belt Grassland vegetation unit had a lower EA than sites in the Maputaland Coastal Belt unit. It is noted that EA was significantly reduced under all legume species at the same magnitude, but pH was increased under all legumes at different magnitudes, as supported by pairwise comparisons. We recommend *V. sativa* as a potential legume crop to increase soil fertility and soil pH. Further studies should investigate the previously reported drought tolerance potential of *V. sativa* in KwaZulu-Natal sugarcane plantations to better support smallholder farmers.

STANDARD POSTER: THE ASSESSMENT OF RANGELAND POTENTIAL THROUGH DETERMINATION OF SPECIES COMPOSITION AND FORAGE PRODUCTION IN TWO SELECTED VILLAGES OF CHRIS HANI DISTRICT, EASTERN CAPE

Nangamso Mlaza

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Rangeland condition is assessed through indicators such as species composition, diversity, and forage biomass production. Grass species diversity serves as one of reliable measure of rangeland condition, as different species exhibit varying responses to grazing pressure. Thus, grass species are classified according to their response to grazing (i.e. Decreasers, increasers and invaders). Forage biomass, which refers to the aboveground herbaceous production, is one of the key determinant of the rangeland's ability to support livestock. Estimation of the changes in the distribution of grass species is important because grass species composition and forage biomass play an important role as indicators of rangeland condition. Although research has been done on the aspect of rangeland condition but there still a gap in assessing the rangeland potential of the Chris Hani District through determination of grass sward composition and biomass production. This study evaluated the herbaceous layer by assessing species composition and forage biomass production potential to determine the ability of rangeland to meet livestock feed requirements. This evaluation seeks to understand the potential of these rangelands in terms of carrying capacity and sustainability of livestock animals without degrading the veld resource. The study was conducted in two rangelands sites; Esixotyeni, located within the Intsika Yethu Local Municipality, and Bullhoek, within the Enoch Mgijima Local Municipality, both falling under the Chris Hani District Municipality. Grass species composition was determined using a visual assessment within 20 m x 20 m quadrats, where species presence was recorded. The recorded species were classified according to their life forms, ecological value and acceptability to grazing herbivores. Forage biomass was measured using a disc pasture meter along a 50 m transect, with 50 readings taken in a straight line. A combined total of thirteen grass species were identified in the two sites, and at Esixotyeni, grasses such as *Aristida congesta*, *Digitaria eriantha*, *Eragrostis capensis*, *Eragrostis plana*, *Heteropogon contortus*, *Eragrostis obtusa*, *Sporobolus africanus*, *Eragrostis capensis,* and *Cynodon dactylon* were recorded, while at Bullhoek, dominant species included *Themeda triandra*, *Eragrostis chloromelas*, *Sporobolus fimbriatus*, *Eragrostis obtusa*, *Hyparrhenia hirta*, *Aristida congesta*. Forage production varied across sites, with Bullhoek yielding 462 kg

929 kg ha^{-1}, and 1537 kg ha^{-1} at the corresponding sites. The presence of both highly and moderately desirable species indicates rangeland potential, which, under appropriate management, can support sustainable livestock production. However, the recorded biomass levels remain below the recommended threshold of 1500kg ha^{-1} required for supporting livestock, while maintaining rangelands in good condition. The low biomass levels observed, particularly in Bullhoek, suggest overgrazing, which can lead to the decline of desirable species. To ensure sustainable livestock production, appropriate rangeland management interventions are necessary. This study will help in disseminating information to the farmers about the state of their rangelands and quality of species dominating these rangelands. This in turn assists farmers to make plans and strategies in developing a fodder-flow program that would ultimately give optimum and sustainable livestock

RESEARCH PROPOSAL POSTER: THE IMPACT OF DIFFERENT FIRE REGIMES ON PLANT-ARTHROPOD INTERACTIONS IN KWAZULU-NATAL SANDSTONE SOURVELD GRASSLANDS

Olieve Zuma[1], *Caswell Munyai*[1], *Rob Slotow*[2], *Sindiso Nkuna*[2]

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Fire is a natural and necessary disturbance in many grassland ecosystems, shaping community structure and function, which is crucial for maintaining biodiversity and ecosystem vigour. While the species-level responses of grassland vegetation and arthropods to fire are fairly understood, the impact of different fire regimes on functional diversity and plant-arthropod interactions, especially involving soil arthropods, remains poorly studied in the KwaZulu-Natal Sandstone Sourveld (KZNSS). The KZN SS is a highly endemic and critically endangered indigenous grassland, threatened by transformation and urbanization. Despite its vulnerability and poor conservation status, limited research has addressed how varying fire regimes affect plant-arthropod interactions in this region. Fire regimes in the KZN SS are diverse, differing in their seasonality, frequency, and intensity. Understanding their effects on plant-arthropod relationships can reveal how biodiversity and ecosystem processes respond to disturbances, as well as the grassland's capacity to sustain its functions. This study aims to assess how fire season, frequency, and intensity influence plant–arthropod interactions in the KZN SS. The objectives are: 1) To determine how different fire regimes influence the abundance and functional diversity of plant and soil arthropods; and 2) To assess the time required for plant and soil arthropod functional composition to recover after a fire. MODIS satellite fire history data will be used to characterise fire regimes. Soil arthropods (both epigaeic and hypogaeic) will be sampled using pitfall traps and Berlese funnels across the different fire regimes in five protected areas and five communal rangelands. Quadrat sampling will be used to assess vegetation structure, species abundance, and functional composition. It is anticipated that frequent burns, such as annual fires, may limit recovery time for both vegetation and arthropods, delaying the return of biodiversity and key ecosystem functions. In contrast, intermediate fire frequencies, such as triannual burns, may allow more complete recolonization and functional recovery. Early-spring burns are expected to be less intense and less disruptive to arthropods, whereas winter burns may be more intense. These seasonal effects could influence the resilience of ecosystem functions. By linking fire regimes to changes in functional group composition and vegetation dynamics, this study will display how ecological processes respond to fire disturbance. The findings will guide adaptive fire management strategies that balance conservation and sustainable use, helping to maintain biodiversity, support ecosystem services such as nutrient cycling and pest regulation, and reduce degradation risks in the endangered KZN SS.

RESEARCH PROPOSAL POSTER: EXAMINING PATTERNS OF ARTHROPODS AND PLANT TAXONOMIC AND FUNCTIONAL DIVERSITY ACROSS THE 100-YEAR FLOODPLAIN ALONG THE UMNGENI RIVER

Thembalinye Chonco, Sindiso Nkuna, Caswell Munyai, Rob Slotow

University of KwaZulu-Natal, Pietermaritzburg, South Africa

Floodplains are among the planet's most dynamic and intricate ecosystems, characterized by their rich aquatic and terrestrial ecotones, complex channel systems, high connectivity, and diverse vegetation in various successional stages. To fully understand how floodplain ecosystems function, it is essential to examine the relationships between vegetation, and arthropod communities. Floodplains are crucial in regulating water flow during floods and mitigating

flood risks. However, they are also among the most endangered ecosystems, having lost much of their natural functions. Recent catastrophic floods in KwaZulu-Natal highlight the urgent need for effective management strategies, particularly given the heightened flood risks that challenge existing approaches. This study aims to investigate the taxonomic and functional diversity of arthropods and plants within a 100-year floodplain compared to adjacent upland habitats along the uMngeni River, considering different environmental conditions. The objectives are 1) To identify drivers of arthropod and plant functional diversity along the 100-year floodplain and adjacent upland habitats, 2) To assess plant and mesofauna communities' functional trait disparity under various land use changes, 3) To determine interactions between invasive plant species and native arthropod functional diversity across different terrestrial zones of a 100-year floodplain. The study will address the lack of comprehensive data on arthropod biodiversity and its decline, compounded by climate change threats. The study will be conducted at Wakefields research farm, Hilton College estate, Fountainhill, Nkanyezini, The uMsunduzi-uMngeni confluence, uMzinyathi, and uMkhomas. These study sites are all under different land use changes. Sampling will be done along the river at 0 meters (downstream), 300, 600, and 900 meters. Additionally, sampling is to be done at 0 m and 300 m away from the river to upland areas. Two 30 m long transects spaced 10 m apart will be laid out horizontally at each sampling point. Every plant species will be recorded when a 1 m^2 quadrat is dropped at the start and end of each transect. Plant species composition will be estimated and recorded and then pitfall traps are placed on the same transects where the plant data was collected. Understanding the drivers of arthropod diversity and their functional roles is vital for prioritizing conservation efforts. By assessing plant and arthropod functional diversity in floodplains and adjacent uplands, the research aims to inform management strategies that reduce flood risks and enhance ecosystem resilience. Additionally, the study will explore whether habitats with higher quality and structural complexity, such as floodplains, support greater biodiversity amid human disturbances and regional climate change. Maintaining a diverse array of plant species in floodplains and upland areas is crucial for mitigating erosion and enhancing ecosystem resilience to extreme weather events.

SESSION CHAIR: ROBYN NICOLAY

Wednesday 23 July 2025, 08:00 - 09:45

PLATFORM PRESENTATION: SOUTH AFRICAN MESIC GRASSLANDS ARE RESISTANT TO DROUGHT BUT NOT WARMING

Michelle Tedder, Yonela Maziko, Sibonokuhle Mbambo, Ojo Theresa, Kevin Kirkman

University of KwaZulu-Natal, Pietermaritzburg, South Africa

Current climate change models predict increases in temperature, reduced frost and more variable rainfall with increased frequency of extreme weather events such as flooding and drought. Southern Africa is expected to experience more frequent drought, and the grassland biome expected to be significantly affected by this. A possible reduction in area of between 30 and 50% is predicted. Given the importance of the grassland biome from both an intrinsic and economic perspective this reduction could have serious economic and food security consequences. For these reasons it is critical to increase our understanding of ecosystem processes under drought-stress and warming. In winter 2019 a rainfall exclusion and warming trial was established in a good condition mesic grassland in KwaZulu-Natal, South Africa. Rainout shelters reduced the incoming precipitation by 53% and open-topped chambers increased daytime air temperature by 2°C. Species abundance data was collected annually. Rainfall manipulation had a marginal effect on species composition, however warming resulted in reduced abundance of several common forbs and the loss of numerous forb and grass species, also reducing species richness. Simpson's diversity was unaffected. These reductions in species richness reduce the ability of the grassland to recover from climatic perturbations and thus rainfall reduction coupled with warming presents a significant threat to grassland ecosystem services.

PLATFORM PRESENTATION: SAVANNA SOIL CARBON IS PRINCIPALLY GRASS-DERIVED AND STORED IN VULNERABLE PARTICULATE FRACTIONS

Heidi-J Hawkins[1,2], Michael D Cramer[2], Kimberley J Simpson[3], Sarah Raubenheimer[4,5], Elizabeth M Telford[6,3], Edith J Singini[4], Caroline ER Lehmann[7,6,8], Colin P Osborne[3], Brad S Ripley[4]

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Afforestation is increasingly promoted in savannas as a carbon storage strategy, yet we lack a clear understanding of how trees and grasses differentially contribute to soil organic carbon (SOC) and its distinct fractions. Given that soils store the majority of ecosystem carbon—and that SOC fractions vary in their persistence, saturation potential, and vulnerability to loss—it is crucial to understand how shifts in vegetation will influence both the amount and stability of SOC, particularly under future climate scenarios such as rising atmospheric CO_2. To address these knowledge gaps, we experimentally tested two ideas: that the combination of savanna grasses and trees results in the highest production of SOC than either individually, and that CO_2-fertilization enhances the competitive advantage of C_4 grasses over savanna trees under water-limiting conditions, leading to an increase in certain SOC fractions via the Microbial Efficiency-Matrix Stabilization pathway. We conducted an experiment at the Rhodes University Elevated CO_2 Facility with pots containing either a leguminous savanna tree, a C_4 grass (*Themeda triandra)*, both tree and grass, or unplanted, at ambient (400 ppm) or elevated (550 ppm) CO_2, giving a total of 145

pots positioned in a randomized design. We found that grasses, not trees, were the primary drivers of increased SOC in a savanna soil to a depth of 0.3 m, regardless of CO_2 concentration. Soils planted with grasses had 10% more carbon and 8% more nitrogen than those with trees. Isotopic analyses revealed that 50% to over 90% of this C was grass-derived. While we found no evidence of CO_2-fertilization enhancing SOC, our results offer compelling evidence that grasses drive SOC accumulation in this tropical savanna soil, primarily through belowground biomass inputs ($r = 0.44$; $P < 0.001$) and the formation of particulate organic carbon (POC; $r = 0.48$; $P < 0.001$). This POC has high sequestration potential but also high vulnerability to loss under disturbance and climate change. These dynamics differ starkly from clay-rich temperate grasslands where mineral-associated organic matter dominates. We conclude that afforestation efforts in savannas are misguided and climate mitigation efforts in savannas requires the conservation of both grass and tree components while recognizing their unique SOC dynamics.

PLATFORM PRESENTATION: INTRA-SEASONAL QUANTIFICATION OF ABOVE-GROUND GRASS CARBON STOCK IN SAVANNAH ECOSYSTEMS USING SAR DATA

Reneilwe Maake

Agricultural Research Council, Pretoria, South Africa

The need for quantifying and monitoring above-ground grass carbon stock (AGGCS), particularly of the grass layer, has gained global traction as many countries face the brunt of climate change. This study tested whether incorporating topographic variables, texture matrices coupled with radar indices, can improve the accuracy of predicting above-ground grass carbon stocks in savannah ecosystems. With Kruger National Park as the experimental site, we utilised the XGBoost algorithm to predict the above-ground grass carbon stocks. For the wet season, the Radar Vegetation Index (RVI) and texture-based models produced similar results with a ≤ 2% margin. The topographic-based model produced the lowest accuracies (R2 = 0.25, MAE = 11.7, RMSE = 8.9) compared to Radar Vegetation Index (RVI) and texture-based models. A similar pattern was observed for the dry season, where the Radar Vegetation Index (RVI) and texture-based models produced similar results with a ≤ 2% margin. Nevertheless, when all the variables were combined, the accuracies improved across both seasons (R2 = 0.56, MAE = 4.72, RMSE = 0.03, R2 = 0.61, MAE = 4.86, RMSE = 0.03), i.e. by approximately 16% and 21% for the wet and dry seasons, respectively. Nevertheless, the model based on the dry season (R2 = 0.61, MAE = 4.86, RMSE = 0.03) explained 61 % of the variation compared to the wet season model. In conclusion, integrating RVI, texture, and topographic variables shows potential in predicting above-ground grass carbon stocks in the complex Savannah ecosystems

PLATFORM PRESENTATION: EXPLORING TRADE-OFFS BETWEEN WATER AND CARBON LINKED TO WOODY ENCROACHMENT IN A NATIVE SEMI-ARID GRASSLAND, EASTERN CAPE

Craig Weideman[1], Anthony Palmer[1], Kathleen Smart[2]

[1]Rhodes University, Makhanda, South Africa. [2]EFTEON, Pietermaritzburg, South Africa

Woody encroachment has been widely documented in rangelands over the last century. It is generally believed that this increase in aboveground biomass leads to increases in C sequestration, which, due to deeper rooting systems and leaf area of trees, implies a cost in terms of water availability due to increased evapotranspiration. To explore the evidence for this hypothesised trade–off in functionality, we installed a pair of identical eddy covariance flux towers in a native semi–arid C_4 grassland and an adjacent encroaching *Vachellia karroo* woodland in the Eastern Cape, South Africa, with otherwise similar site characteristics, and compared carbon (C) and water budgets over the period September 2019 to February 2022.

The woodland was marginally more productive than the grassland, but these C gains were offset primarily by disproportionately large dry season respiration effluxes, resulting in the grassland sequestering 65% more C than the woodland (389 g m^{-2} vs. 235 g m^{-2}) over ~20 months of concurrent data. Differences in water use were negligible, however, with the woodland transpiring just 9% more water than the grassland (845 mm vs. 775 mm), equivalent to 78% and 70% of total rainfall (1103mm), respectively. Ecosystem water use efficiencies were essentially identical over the study period (2.7 g C m^{-2} [kg H_2O]$^{-1}$), with the grassland slightly more efficient in the dry season (2.6 vs. 2.5 g C m^{-2} [kg H_2O]$^{-1}$).

We found no evidence to support the hypothesis of a trade–off between C and water linked to encroachment at our sites. Given the complexity of ecohydrological and biogeochemical responses to vegetation shifts in these systems, however, and the wide variation in results reported in previous work, there is a clear need to replicate similar studies across broad environmental and climatic gradients towards improving understanding of these processes and developing coherent policy for rangeland management in the context of global change.

PLATFORM PRESENTATION: HOW ARE AFRICAN LIVESTOCK KEEPERS RESPONDING TO CLIMATE VARIABILITY AND CHANGE? REPORTING THE RESULTS OF A SYSTEMATIC REVIEW

Michelle North[1], *Nina Hunter*[2], *Rob Slotow*[3,4]

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Livestock agriculture is one of the mainstays of household livelihoods and food security in Africa, capable of utilizing marginal lands to produce high-quality protein for the household or as a source of income. Moreover, for mixed farmers, livestock can serve as draught power, a source of manure for improving fields, while also buffering variations in crop productivity. However, livestock farmers are also acutely vulnerable to climate hazards and implement a wide range of responses to reduce impacts, with varied success. The aims of this study were to describe the state of science on African livestock farmers' adaptation and coping strategies, to provide contextual evidence to support climate change adaptation projects and policies, and identify key gaps to inform future research. The literature describing how African livestock farmers are responding to climate-related hazards was assessed using a systematic review of papers published between 2014 and 2022, after which details relating to the geographic location of the study, the study authors, and key topics were extracted and analysed. Farmers' responses were extracted and categorised, noting climate and non-climate drivers, outcomes, and barriers and enablers. One hundred and eighty-six articles were included, describing 1089 responses from thirty-two countries, predominantly Kenya (n = 224) and Ethiopia (n = 210). Small-scale farmers of cattle, sheep, and goats, and with mixed crop-livestock systems, were most common (n = 773), with few studies documenting how commercial livestock farmers are adapting to the changing climate (n = 164). Most responses related to changing herd management (n = 437), feed or pasture management (n = 294), water management (n = 109), and diversifying livelihoods (both on- and off-farm, n = 437). Drought was the most reported climate driver (n = 567), followed by climate variability (n = 234), giving rise to shortages of feed or water for livestock, increased pests and diseases, and degradation of rangelands, which were cited as the primary motivators of farmers' responses. There were few instances of anticipatory, planned, and government-led adaptation (n = 41), with most responses implemented by private farmers (n = 1016), who frequently reported financial constraints and a lack of government support as being major barriers. While there is a sizable body of literature, notable gaps included any work in Central and Northern Africa, and the responses undertaken by large-scale commercial farming systems. In general, future research should focus on these gaps and on improving the depth of information collected, for example on barriers and enablers of adaptation, and tracking outcomes over a longer duration and including environmental sustainability issues, to better inform future interventions.

PLATFORM PRESENTATION: GROWTH PERFORMANCE, METHANE PRODUCTION AND EMISSION, BACTERIAL PROFILES, AND RUMINAL FERMENTATION PARAMETERS OF NGUNI STEERS FED *SERIPHIUM PLUMOSUM* LEAF MEAL

Motswapo Phoko[1], *Jones Wilfred Ng'ambi*[2], *Tlou Julius Tjelele2*

[1]Agricultural Research Council, Irene, South Africa. [2]University of South Africa, Pretoria, South Africa

This study evaluated the effect of *Seriphium plumosum* meal inclusion in diets on growth performance, methane production and emission, and bacterial profiles, of Nguni steers. Twenty-eight Nguni steers of 22-months old (300 ± 10 kg body weight, BW) were assigned to isocaloric and isonitrogenous diets containing 0, 10, 20 or 30 % of *S. plumosum* meal in a complete randomized design. The steers were adapted to the diets for 21 days before the actual data collection over a period of 90 days. Live weight gain was measured by-weekly, while methane emission was measured for 10 consecutive days from day 80 to 90 using a laser methane detector. Rumen fluid was

collected on day 89 using an esophageal stomach tube for DNA sequencing. Total genomic DNA was extracted from rumen fluid samples, and the hypervariable region of the 16S rRNA gene was amplified by PCR using bacterial universal primers. The amplicons were sequenced on an Illumina MiSeq platform, and the biological information was analysed using QIIME software. In vitro ruminal fermentation parameters were analysed by solubilising 50 g of diet samples in 500 mL 100% methanol. Four milliliters of reconstituted 50 mg crude extract per 1000 mL of distilled water was added to each incubation vial, which already contained 200 mg of substrate and was undergoing in vitro fermentation. Gas production, invitro organic matter digestibility, ammonia nitrogen and volatile fatty acids were carried out using standard procedures. Inclusion of *S. plumosum* meal levels in diets did not affect $p < 0.05$ live weight gain, methane yield, ammonia- nitrogen and bacterial population. However, diet affected $p < 0.05$ total gas production at 48 hrs, invitro organic matter digestibility and volatile fatty acids. The Spirochaetota, Actinobacteriota, Bacteroidota, ProteobacteriaSAR324, Verrucomicrobiota, Desulfobacterota, Patescibacteria, Patescibacteria, Verrucomicrobiota and Chloroflexi were dominant phyla in rumen fluids of Nguni steers, however, their relative abundance was not affected (P>0.05) by *S. plumosum* meal inclusion levels in the diets. It was concluded that *S. plumosum* inclusion in ruminants' diets can be strategically used as a climate-smart feed resource to reduce methane production and emissions by Nguni cattle.

PLATFORM PRESENTATION: ENVIRONMENTAL FACTORS INFLUENCING DISSOLVED ORGANIC CARBON CONCENTRATIONS IN AFROMONTANE GRASSLAND CATCHMENTS

Rowena Harrison[1,2,3], Johan van Tol[2], Philippe Amiotte Suchet[3], Mathieu Thevenot[3], Olivier Mathieu[3]

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Globally, montane grasslands and wetlands deliver a wide array of ecosystem benefits, including flood water retention, sediment stabilisation, maintenance of stream base flows, and habitat for unique vegetation and faunal communities. These grasslands are furthermore important carbon sinks. The understanding of the movement of soil carbon into water resources has gained considerable interest in recent years. However, despite the numerous research on the dynamics of dissolved organic carbon (DOC) from watersheds, particularly within the northern hemisphere, little work has been conducted on the influence of the hydrological connectivity of catchment flow paths and how these impact the storage and export of DOC. In particular montane grassland dominated catchments, and those in South Africa, have often been overlooked within research associated with the sources and dynamics of DOC. DOC is attributed to several environmental factors, including climate, hydrology, land cover and management, soil type, and topography. This study aimed to gain an understanding of the various environmental factors driving the temporal patterns of DOC export in Afromontane grassland catchments. Through the installation of piezometers as well as two UV–Vis high frequency probes installed within two Afromontane areas in the Cathedral Peak Research Catchments (named CP-VI and CP-IX), water samples were analysed for DOC. The average DOC concentration per day was calculated and used to compare DOC concentrations against the daily rainfall, daily average water temperature, daily average turbidity, daily average conductivity, and daily streamflow discharge. Results of the study show that DOC concentrations followed seasonal trends of precipitation as well as the connectivity of flow paths within soils between wetlands and stream networks. A statistical difference was recorded between terrestrial and wetland areas (CP-VI: $p = 0.043$ and CP-IX: $p = < 0.0001$) as well as between soils groups (CP-VI: $p = 0.001$ and CP-IX: $p = 0.041$), with the more saturated soil group (wetland areas) recording the higher dissolved organic carbon concentrations in both catchments. This study highlighted the highly variable and complex nature of DOC export within these Afromontane catchment areas over the study period. DOC concentration variability is closely linked to distinct DOC source zones and their hydrologic connectivity to the stream network through the soil profile. In particular, the drying and wetting cycles of individual wetland systems as well as specific saturation zones influenced both the baseflow connectivity as well as the overland flow during wetter periods and during rainfall events. The connectivity of wetlands to streams within both catchments plays a vital role in the attenuation and export of DOC within these watersheds. These results provided a basis from which to assess the potential consequences of changes that climatic conditions can have on DOC dynamics in these grasslands.

SESSION CHAIR: KEVIN KIRKMAN

Wednesday 23 July 2025, 10:05 - 11:55

PLATFORM PRESENTATION: STITCH WITH A GOLDEN THREAD: PASTURE OVER-SOW FOR MAINTAINED AND ELEVATED PRODUCTION WITH COATED SEED TECHNOLOGY AS A SECRET INGREDIENT

Jamie Young

Barenbrug, Pretoria, South Africa

The implementation of a pasture oversow, also referred to as a pasture stitch, is a familiar practice, widely adopted in pasture-based systems. The process of a pasture stitch is the introduction of a new grass into an existing pasture, with the ultimate aim of improving dry matter (DM) production, extending grazing rounds, and improving pasture persistency, all whilst keeping the land in production, rather than re-establishing. Perennial ryegrass is renowned for high DM production, outstanding nutritional value and quick growth and regrowth after grazing. However, ryegrass pastures show an inherent drop in production year-on-year at the hands of grazing management, climatic conditions and cultivar qualities. Outeniqua Research Station documented drops in production from year 1 to year 2, across cultivars, with an average drop in production of ~19% (ranging from 4% to 37% across cultivars). The goal with a pasture oversow is to subsidise this intrinsic loss, thus only needing to be, subsequently, 20% successful to return or exceed pastures original production potential. Specie and cultivar selection plays a significant role in optimizing your pasture, selecting quick, vigorous grasses that can compete with the existing sward. Hybrid- and Italian-type ryegrasses have a competitive advantage on a perennial ryegrass sward, with fast and rigorous growth as well as good winter production, ideal in an autumn pasture stitch. Such a selection fits into a year 2 or 3 pasture stitch rotation, only needing to last one to two years, before needing to completely re-establish the pasture. The first line of defence in your pasture armoury is preservation of the existing sward, with optimal management, followed by improvement by successful stitching-in with strategically curated species and cultivars, rounded off by reinforcement by using coated seed. The practice of seed coating has long since been used in the agricultural industry, but the use of extrinsic materials to adapted grass seed species, to ultimately contribute to improved germination and establishment may be the golden thread to a seamless pasture stitch.

PLATFORM PRESENTATION: DETERMINING DRIVERS OF IMPROVED FORAGE QUALITY IN FORAGE HERB PASTURE MIXTURES UNDER GRAZING

Janke van der Colf, Sigrun Ammann, Dalena Lombard, Lethu Zulu

Western Cape Department of Agriculture, Research and Technology Development Services, Directorate: Plant Sciences, George, South Africa

A farmlet study recently conducted in the southern Cape has shown that mixtures containing legumes and forage herbs improved milk yield compared to traditional kikuyu-ryegrass (*Cenchrus clandestinus-Lolium* spp.) pastures. Although it was hypothesized that this improvement was driven by the improved forage quality of such mixtures, data was not yet available to confirm this. The objective of this paper is to unravel the interactions and correlations between milk yield, pasture composition and forage quality parameters of three pasture mixtures. The study consisted of three pasture types viz. 1) KIKRYE: traditional kikuyu-ryegrass system 2) FESC_PL MIX: Tall fescue (*Festuca arundinacea*), plantain (*Plantago lanceolata*) and red clover (*Trifolium pratense*) mixture and 3) LUC-HERB

allocated a 5 ha farmlet that was grazed by a mini-herd of Jersey cows. Forage quality and botanical composition samples were cut on monitor strips (1 per 0.5ha) pre-grazing. As expected forage quality and in turn milk yield for KIKRYE were strongly correlated with the seasonal oscillation between ryegrass and kikuyu as the dominant pasture component. Both non-fiber content (NFC) and DMI were strongly positively correlated with milk yield, and tended to increase when ryegrass was the dominant component, and decrease as the % of kikuyu increased. The forage quality parameter most strongly correlated (r=0.71) with milk yield for FESC_PL MIX was metabolizable energy (ME) content. The component most strongly correlated with ME was plantain (r=0.71). Further analysis showed that once the contribution of plantain dropped to below 60%, the ME content of pasture dropped below the minimum requirement of 10.5 MJ ME/kg DM for a high producing milk cow. In the CHIC_LUC MIX, all forage quality parameters had moderately low (r<0.50) to low (r<0.30) correlations with milk yield. None of the pasture components had sufficient correlations (r<0.40) with forage quality parameters to discern a clear pattern. Potential reasons for this are that relationships in this case are either non-linear, or a more complex model will be required to predict interactions due to the rapid spatial and temporal changes that occur in this mixture. Results indicate again that kikuyu is thus the main constraint to the milk yielding ability in traditional kikuyu-ryegrass systems, particularly in terms of ME and DMI. Plantain was found to be a good species to increase ME and DMI in pastures, but would need to be maintained at above 60% in pastures to reap these benefits

PLATFORM PRESENTATION: BIOMASS PRODUCTION OVER THREE YEARS OF MULTISPECIES COMBINATIONS OF THREE FUNCTIONAL GROUPS

Sigrun Ammann, Janke van der Colf, Dalena Lombard, Lethu Zulu

Western Cape Dept of Agriculture, George, South Africa

Multispecies pastures for dairy production are extensively used in the southern Cape region to improve resilience and forage quality, especially during the warmer months of the year. Complementarity when deciding on species combinations is an important consideration to ensure functional mixtures that can achieve improved biomass production, are selected. A trial conducted at Outeniqua Research Farm from autumn 2022 onwards consisted of combinations of a grass, a forage herb and red clover (RC) (*Trifolium pratense*) as the legume. The grass was either Tall fescue (TF) (*Festuca arundinacea*) or Cocksfoot (CF) (*Dactylis glomerata*), while the forage herb was either plantain (P) (*Plantago lanceolata*) or Chicory (C) (*Cichorium intybus*). Biomass and botanical composition based on dry matter were determined at each harvest. The first three years had a total of 27 harvests. The highest producing combinations for the first year were CF/P/RC, TF/P/RC and RC ($p<0.05$) with 19.2, 18.9 and 18.4 t DM ha^{-1} respectively. The botanical compositions at the end of year 1 was 34% CF, 21% P, 44% RC for treatment CF/P/RC and 22% TF, 24% P, 52% RC for treatment TF/P/RC. The combinations with chicory yielded significantly lower ($p<0.05$). For the second year the same three-way combinations were in the highest yielding group together with CF/P and TF ($p<0.05$) with 19.5, 18.5, 18.2 and 16.9 t DM ha^{-1}. In terms of composition the grass component remained relatively constant for the treatments CF/P/RC and TF/P/RC however the red clover increased to above 60% while the plantain reduced to below 10% in the second year. The CF/P combination consisted of 75% cocksfoot and 17% plantain. During the third year the three-way combination were no longer in the top yield group ($p<0.05$) and had lost most of their broadleaf components to below 10%. The highest yielding treatments in year three were CF/P (17.0 t DM ha^{-1}) with the same composition as in year 2; TF (16.4 t DM ha^{-1}); TF/C (14.6 t DM ha^{-1}) although the chicory component was at zero, and CF (14.5 t DM ha^{-1}) ($p<0.05$). The results show that plantain as part of the three-way mixture yields higher than chicory, and that the three-way mixture is only superior for biomass while the broadleaf component, plantain and red clover, is above 60%. For dairy systems it is thus important to development management strategies to maintain the plantain and red clover components in the pasture either through annual undersowing or using cultivars that have improved persistence.

PLATFORM PRESENTATION: INTENSIVE DAIRY PASTURES: NITROGEN DYNAMICS AND REQUIREMENTS

Neil Miles

Irrigated intensive pastures are the mainstay of dairy farming operations in the eastern, southern and south-western regions of South Africa. These pastures are mostly based on ryegrass and/or kikuyu, with species such as clovers,

derived from the soil by pasture plants, and N fertilizer remains a key driver in the optimization of pasture yields, and thereby farm profitability. The generally poor predictability of legume growth has led to limited reliance on legumes as the sole source of N for intensive pastures. Importantly, in terms of their N economy, pastures are by no means 'closed systems', with significant amounts of N being lost by various pathways including volatilization, leaching and excretal deposition in roadways and milking yards. Such losses imply an unavoidable requirement for fertilizer N additions in order to ensure long-term pasture productivity. Furthermore, with perennial pastures retaining relatively high levels of organic matter in their rooting zones, appreciable amounts of N become available for pasture growth through mineralization of organic matter - though environmental conditions (temperature, moisture) govern this microbially-mediated process. These considerations create formidable challenges in the prediction of the amounts and timing of fertilizer N requirements for pastures. In this paper, consideration is given data from both local and overseas studies reflecting pasture responses to fertilizer N, the extent of N losses from pasture-based dairy systems, and the contributions of organic-matter N to pasture growth. Attention is also drawn to aspects in urgent need of research inputs.

PLATFORM PRESENTATION: EFFECTS OF LEAF STAGE AND RESIDUAL HEIGHT ON RYEGRASS PRODUCTIVITY AND PERSISTENCE IN DAIRY SYSTEMS

Jane Holliday

INTELACT SOUTH AFRICA, Hilton, South Africa

Pasture harvest per hectare and cow is a key profit driver of pasture-based dairy. Energy costs have increased dramatically, emphasising the importance of high-yielding quality pasture grown under irrigation. Weak pastures and the time taken to reestablish them negatively affect profit. Effective grazing management of dairy cows on perennial ryegrass pastures is critical for optimising pasture utilisation, persistency, and animal performance. Leaf stage at grazing, irrigation scheduling, and post-grazing residual height affect the productivity and longevity of both diploid and tetraploid perennial ryegrass cultivars in rotational grazing systems. Ryegrass plants grazed at different leaf stages influence regrowth potential, forage quality and persistence. Residual height affects tiller density, root reserves, and sward recovery. Results indicate that grazing at the 2.5- to 3-leaf stage supports optimal regrowth and persistence when paired with conservative residual heights that preserve photosynthetic area and growing points. Tetraploid cultivars, while often preferred for palatability and intake, have slightly lower tiller densities and require more careful residual management to maintain sward integrity. Diploid cultivars exhibited greater resilience to lower grazing residuals and variable soil moisture. Leaf stage and residual height must be considered in pasture management strategies to improve both pasture longevity and dairy productivity, and therefore profit.

SESSION CHAIR: ERROL DOUWES

Wednesday 23 July 2025, 12:55 - 13:25

PLATFORM PRESENTATION: RESTORATION CHALLENGES IN ARID ECOSYSTEMS

Suzanne Milton

South African National Environmental Observation Network, Arid Lands Node, Kimberley, South Africa

Grazing and trampling damage in arid ecosystems (<200 mm rain/year) may persist for decades, centuries or even millennia. My evidence for this is based on vegetation cover and composition and soil hardness data, historical and archaeological evidence, and studies of vegetation dynamics over 38 years in the Prince Albert Succulent Karoo. Livestock reduction or removal generally fails to improve rangeland composition or cover. Some small-scale restoration trials at Wolwekraal Nature Reserve in this environment over the past decade have successfully led to establishment of cover and diversity, but most have failed. I present data and discuss reasons for variable outcomes of such interventions as mini water catchments, brush packing and reseeding. These include absence of seed, loss of seed to wind and predators, seed morphology, waterlogging, water loss, lack of follow-up rains, soil hardness, soil perturbation, and lack of shelter from frost and sun. All these challenges are possibly exacerbated by increasing air and soil temperatures in summer. In conclusion, natural vegetation in arid areas such as the Karoo needs protection, grazing management that minimises scarring by water points, roads and barriers, and major investment into restoration following vegetation loss, soil compaction or destabilisation caused by alternative energy infrastructure, tourism expansion and mining developments.

SHORT PRESENTATION: EFFECTIVENESS OF INTEGRATED SHRUB MANAGEMENT AND RESTORATION TECHNIQUES ON REHABILITATING SHRUB-ENCROACHED RANGELANDS OF SOUTH AFRICA

Monelisi Makanya, Kanyisa Jama, Mthunzi Mndela, Sinalo Malindie

University of Fort Hare, Alice, South Africa

Shrub encroachment (SE) drives rangeland degradation worldwide, threatening biodiversity and forage productivity. The reversal of the catastrophic effects of SE depends largely on the efficacy of restoration. Hence, we evaluated the effects of cutting and uprooting a vigorous encroacher (*Pteronia incana*) with or without reseeding mixtures of grasses (*Panicum maximum* and *Eragrostis curvula*) on herbaceous vegetation recovery at Peddie rangelands, Eastern Cape Province, South Africa. The following treatments were applied: 1) uprooting and reseeding (UPR), 2) uprooting only (UPO), 3) cutting and reseeding (CR), 4) cutting only (CO), and 5) untreated control (CTL), each replicated three times in north and south slope aspects. The interactive effects of treatments and slope aspect were significant on graminoid canopy (p = 0.007) and basal covers (p = 0.002). Graminoid cover was highest in all treatments compared to control, with CR exhibiting relatively higher cover in both north and south facing slopes. Restoration treatments independently increased plant density, richness, and diversity compared to the control. Slope aspect, treatment, and species interacted significantly (p = 0.029) on biomass production (BP), with CO in the north aspect attaining two-fold higher BP of non-reseeded grasses compared to other treatments. Responses of reseeded species varied by slope aspect, with *P. maximum* attaining 2-fold higher BP in CR and UPR in the north than the south slope, whereas *E. curvula* had higher BP in CR in the south than the north slope. Overall, shrub clearing was beneficial on restoring diversity and plant densities regardless of the restoration method. However, BP and vegetation covers depended on the interactive effects of shrub clearing method, reseeding, and slope aspect. Thus, the decision on the restoration of herbaceous vegetation should be informed by the vegetation attributes of

SHORT PRESENTATION: RAISING AWARENESS OF PASTURE RELATED AND NATURAL RESOURCES MANAGEMENT PROJECTS TO ENCOURAGE YOUTH INVOLVEMENT IN AGRICULTURE AND FARMING ACTIVITIES

Nobuntu Matyholo-Spapa

Eastern Cape Department of Agriculture, Stutterheim, South Africa

There are economic benefits of agriculture in increased incomes and job creation that will further lead to rural poverty alleviation on long-term basis. Eastern Cape is mostly rural and have high unemployment rate (32.9% in South Africa and 42% in Eastern Cape). Encouraging the youth involvement in projects is a sustainable development. Innovative technology is required to encourage Youth. Youth is not involved in agricultural activities and refuse to do hard work in farming. Youth like leisure and entertainment so there are businesses like landscaping, plant land for hire grazing animals, baling projects, parks and photography gardens that are for leisure, but can generate income. The objectives of this study have been conducted to raise awareness of how pasture and range management can be show cased to extension as they are close to farmers and youth. The second objective is to share opportunities that can enhance job creation amongst the youth. The dissemination process has involved distribution of posters in Amathole District Municipality in three local municipalities namely Amahlati, Peddie and Raymond Mhlaba. Presenting all possible projects and care of the environment in meetings have been done. Big brochures have been mounted in these three target areas, presented in information, field days and municipality meetings since most youth trust politics and community leaders for information sharing floors. There have been 50% interest by the extension to share the information to encourage youth by identified during these meetings. These meetings have given a chance to identify enthusiastic youth who are currently running businesses and have been the needs assessment floor. Needs identified have been analysed and solutions to the challenges have been addressed via training, information sharing on funding, establishment of the projects because there are financial implications involved in them. A database of project funders have been developed and support on how to access these have been packaged. The project may be an initiative to encourage renovation of Parks and Botanical gardens that will open job opportunities, sport and leisure. These can also generate income for the municipality and be used for infrastructure.

POSTER PRESENTATION: REVERSING DESERT ENCROACHMENT IN THE NORTH WEST PROVINCE OF SOUTH AFRICA

Eric Stoch[1,2], *Roman Tandlich*[2]

[1]North West Umbrella FIre Protection Association, Potchefstroom, South Africa. [2]Stenden University, Port Alfred, South Africa

Climate change and land degradation in South Africa's North West Province have accelerated the encroachment of the Karoo and Kalahari deserts, threatening both environmental stability and community livelihoods. The North West Umbrella Fire Protection Association (NWUFPA) has launched "Restoring the Balance," an innovative program that combines ecological restoration with community development to combat desertification and build regional resilience.

The program implements a comprehensive landscape restoration approach, integrating strategic tree planting with grassland rehabilitation. Indigenous and fruit-bearing trees, including drought and fire-resistant species such as Marula, Baobab, Spekboom, and Wild Olive, are planted alongside productive Mango, Citrus, and Fig trees. Native grassland restoration complements the tree plantings, creating a multi-layered ecosystem that enhances soil stability and provides grazing opportunities for both wildlife and livestock.

The environmental impacts of the initiative operate across multiple scales. At the local level, extensive root systems of trees and grasses combat wind erosion and strengthen soil structure, while increased vegetation coverage creates favourable microclimates. The enhanced plant density contributes to improved air moisture content, potentially influencing local rainfall patterns. At the ecosystem level, the program promotes biodiversity by establishing diverse habitats that support both grazing and browsing wildlife species while maintaining crucial pollinator populations.

The socioeconomic dimension of the program addresses pressing community needs through sustainable resource

while managed wood harvesting supplies materials for construction and fuel. The restored grasslands offer sustainable grazing areas for livestock, strengthening traditional pastoral livelihoods. This integrated approach ensures that environmental conservation directly supports community well-being and economic development.

NWUFPA's program distinguishes itself through comprehensive capacity building, incorporating fire management training and water conservation strategies. Local communities receive education in sustainable land management practices, including rotational grazing techniques and grassland management, ensuring long-term program viability. The initiative's water conservation component includes innovative techniques to maximize water efficiency and maintain a reliable supply for vegetation establishment and maintenance.

The program's holistic approach to restoring environmental balance while improving community livelihoods presents a replicable model for arid regions facing similar challenges. By addressing both ecological degradation and socioeconomic needs, "Restoring the Balance" demonstrates how targeted interventions can create lasting positive change. The initiative's emphasis on indigenous species selection, grassland restoration, community engagement, and integrated resource management provides valuable insights for similar projects globally.

As climate change continues to impact vulnerable regions, this program offers a practical framework for building resilience through nature-based solutions. The combination of traditional environmental conservation with community development objectives creates a sustainable pathway toward a greener, more prosperous future for the North West Province and its residents. Through careful ecosystem restoration, community empowerment, and sustainable resource management, NWUFPA's initiative provides a blueprint for restoring balance to degraded landscapes while ensuring the well-being of future generations, preventing loss of life, livelihoods and food security.

SESSION CHAIR: KHULULIWE NTOMBELA

Wednesday 23 July 2025, 13:25 - 14:35

PLATFORM PRESENTATION: ASSESSING THE SPREAD OF *POROPHYLLUM RUDERALE* AS AN EMERGING WEED AT THE BUFFELSDRAAI FOREST, KWAZULU-NATAL, SOUTH AFRICA

Monica Ndlovu[1,2], Errol Douwes[1,3], Nokuphila Buthelezi[1,3]

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The introduction of organisms outside their native ranges remains a global environmental challenge due to the invasive potential of certain taxa, that demonstrate rapid growth and distribution, when arriving in new areas. *Porophyllum ruderale* (Yerba porosa) native to North and South America, was first recorded at Buffelsdraai, KwaZulu-Natal South Africa, as an observation on iNaturalist in March 2022. While not a categorised invasive species in South Africa, subsequent observations on iNaturalist suggest that *P. ruderale* may pose a weed risk in this area, and beyond. This study aimed to assess the distribution and potential spread of *P. ruderale* at the Buffelsdraai Landfill Site. The study sought to i.) determine the density and distribution of *P. ruderale* within the study site, and ii.) understand which areas are more likely to be invaded. An experimental in-field sampling approach was adopted, as well as mapping and recording of *P. ruderale* on iNaturalist. Field visits took place in summer (October 2023 to February 2024) when the plants were flowering. To estimate plant density, 29 out of 31 management blocks within the study site were visited. Within each management block, a 30 m x 30 m sample plot was demarcated. A 0.5 m x 0.5 m quadrat was randomly thrown, ten times within the sample plots. The *P. ruderale* plants within the quadrat area were counted. Although present within 90% of management blocks, the mean density across sample plots (0.48 plants/m²) had a high variability (SD = 1.21). Some sample plots showed high concentrations (maximum density of 5.4 plants/m²) while in others the species was absent (median density across all sample plots was 0.0 plants/m²). Management blocks 0, 1, and 10 were identified as blocks with highest risk of future invasions. *P. ruderale* is reported to have naturalised in regions such as the Galapagos, southern California, Europe and Asia, largely due to accidental introduction. It is also recorded as invasive in the Hawaii Islands and Indonesia. These tendencies for invasion raise concerns for regions where the species has been recently introduced. At Buffelsdraai, although *P. ruderale* was not present in all sample quadrates, it is widely spread. Anecdotal evidence suggests that densities are highest in previously disturbed areas, *viz.* where grass had been cut. The rapid rate of spread is likely rapid due to i.) high seed production, ii.) the plant's rapid growth and flowering cycle, and iii.) rapid colonisation of disturbed areas. The spread of *P. ruderale* across the study site appears to be strongly correlated to and influenced by human activities. Early control efforts are recommended to prevent further invasions within and around the site. Importantly, the potential impacts in South Africa, including risks to agriculture, point to a knowledge gap that must be addressed. Further research is needed to understand and highlight potential ecological impacts, rates or spread in different areas, economic risks, and optimal means for control.

PLATFORM PRESENTATION: EVALUATION OF TWO HERBICIDES AS A CONTROL METHOD FOR *PHYMASPERMUM ACEROSUM*, AN INDIGENOUS ENCROACHER IN MESIC GRASSLANDS OF KWA-ZULU NATAL

Michelle Keith[1,2], J.M. Goodall[3,2], Ed. T. F Witkowske[2]

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Increasing woody plant density, expansion and encroachment into grasslands, at both a regional and temporal scale, is of major concern globally and within South Africa. Identifying an effective species-specific herbicide and application rate for regionally limited indigenous, or native novel encroacher species is complex. *Phymaspermum acerosum* (DC.) Källersjö. (Asteraceae), an indigenous multi-stemmed densely leafed perennial shrub, has become a significant encroacher in the KwaZulu-Natal (KZN) mesic grasslands. No registered herbicides have yet been identified or evaluated as an effective, ecologically sensitive and cost-efficient control method of *P. acerosum*. Using a randomised block design, the efficacy of a single foliar application on active (post-fire) coppicing *P. acerosum* of two herbicides, triclopyr 480 g l^{-1} EC and metsulfuron methyl 600 g kg^{-1} WG, at four concentration rates were evaluated within two encroached trial sites in the moist grasslands of the KZN midlands. Following identical treatment protocols, the herbicides were applied in November 2018 and 2020, and both the quantal response (or mortality rate) and the regrowth of the surviving plants, were monitored for 20 months' post–treatment. A MANOVA was applied to assess differences in plant size parameters pre-treatment and a one-way ANOVA for unequal *n*, to assess the quantal response across the nine treatments for both trials. Despite significant differences in plant canopy and basal diameter size between trials, the mortality rate for both herbicides, at all concentration rates, was above 80%. Metsulfuron methyl 600 g kg^{-1} WG was found to be more effective at lower concentration rates and more cost effective than triclopyr 480 g l^{-1} EC. Herbicide treatments greatly reduced both the number and height of stems of plant coppice regrowth when compared to untreated control plants. Identifying a specific, effective and cost efficient herbicide for a relatively unknown indigenous encroacher plant in a multi-year trial, will greatly assist landowners in the control of *P. acerosum* and assist in the registration of the herbicides with the S.A. Department of Agriculture, Registrar of Agricultural Remedies.

PLATFORM PRESENTATION: OPTIMISING THE FREQUENCY OF MECHANICAL CONTROL FOR BRACKEN FERN (*PTERIDIUM AQUILINUM*) IN KWAZULU-NATAL SANDSTONE SOURVELD GRASSLANDS

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Bracken fern (*Pteridium aquilinum*), although indigenous, is an encroacher in South Africa's grasslands, and a serious threat to biodiversity. In eThekwini Municipality, controlling this fern is a priority, especially in the fragmented and threatened KwaZulu-Natal Sandstone Sourveld (KZNSS) grasslands. The fern's invasive tendencies appear to be exacerbated by anthropogenic disturbance and can transform natural grassland into species-poor monocultures. The resulting negative impacts on biodiversity, ecosystem function, and public health mean that management agencies must implement control measures. Finding ways to optimise the expensive and labour-intensive controls is essential, especially due to the plant's ability to regenerate from underground rhizomes. This study, undertaken by practitioners, aimed to identify an optimal frequency for mechanical control of *P. aquilinum* in the KZNSS within eThekwini Municipality. An assumption, based on other published research, was that plant density and growth are suppressed with regular cutting of the bracken fern stems. Six natural, managed grassland sites within eThekwini Municipality, each with no prior herbicide application or recent burns, were selected. Treatment and control patches were identified on each site. Cutting of the plants (either hand pulling or brush-cutting) within treatment patches, were applied at three temporal frequencies, namely, at 4, 8, or 12 weeks. A 1 m² quadrat was used to demarcate where stem counts and average frond heights were measured at monthly intervals. Reductions were calculated as a percentage relative to initial values. A Kruskal–Wallis test was used to assess differences between control done at each temporal frequency. Median stem and frond height reductions varied with treatment frequency. The 8–week

treatment achieved the highest median stem reduction (62.75%) and superior cost-efficiency (4.48% reduction per visit). The 4-week treatment yielded the greatest frond height reduction (61.05%) but showed no corresponding stem reduction, possibly due to premature regrowth. The 12–week frequency performed moderately. There was no significant difference among frequencies (Kruskal-Wallis p = 0.052), though visual and cost-efficiency data suggested trends favouring the 8–week cycle. Despite a lack of statistical significance, the 8–week frequency indicated the most consistent and efficient reduction in bracken stem density. A 4–week cutting cycle may seem optimal but is expensive as teams must work on many sites. Cutting at 12–week intervals risks substantial regrowth and likely provides time for rhizome reserves to be replenished. The findings align with other studies that confirm how repeated mechanical disturbance can exhaust rhizome energy stores. Importantly, local conditions may influence the optimal cutting frequency, so assessing regrowth patterns is important at different sites. The results suggest that control of *P. aquilinum* every 8 weeks can effectively balance suppression and operational efficiency in KZNSS grasslands, by maximising rhizome depletion and minimising labour costs. Future research should include the feasibility of biological control, as well as remote sensing for monitoring rates of spread. The susceptibility or resilience of grassland fauna and flora should also be investigated for a deeper understanding of how these are impacted by P. aquilinum.

SHORT PRESENTATION: IMPACTS OF *LANTANA CAMARA* INVASION ON HERBACEOUS VEGETATION IN THE KWELERA COMMUNAL RANGELANDS, EASTERN CAPE

Sibulele Mboniswa, Kanyisa Jama, Mthunzi Mndela

University of Fort Hare, Alice, South Africa

Rangelands cover over 70% of South Africa's land surface, and they support livestock production, biodiversity, and rural livelihoods, with an estimated economic value of ZAR 30 billion annually. However, they face increasing threats from invasive alien plant species, with at least 71 identified as significant invaders in South Africa. Amongst others, Lantana camara is the prominent invader, threatening herbaceous biodiversity and productivity. This study assessed the impact of *Lantana camara* invasion on herbaceous vegetation composition, diversity, ground cover, and biomass in the Kwelera communal rangelands of South Africa. Three invasion levels (uninvaded, moderately invaded, and highly invaded) were identified in communal and privately owned rangelands. Nine 10 × 10 m (n = 3 plots per invasion level) were marked randomly to characterise *L. camara* invasion levels. In each plot, three quadrats (1 m x 1 m) were sampled to determine species composition, vegetation covers and biomass. General Linear Models were used to assess the effect of fixed effects invasion levels on herbaceous vegetation indicators. Results showed a significant ($p < 0.05$) decline in graminoid cover, plant density, species richness, and biomass with increasing invasion levels. *Eragrostis plana, Melinis repens, Tristachya leuconthrix, Sporobolus africanus, Cynodon dactylon, and Paspalum dilatatum* were the most dominant grasses recorded in all the invasion levels compared to others. Highly invaded areas exhibited low species diversity compared to other invasion levels. Of the species found in highly invaded areas, only 30% were palatable grass species, with 26% found in moderately invaded areas. The decline in palatable species and total productivity highlights the negative implications of *L. camara* on livestock grazing potential and rangeland biodiversity. Effective control and restoration strategies are therefore essential to recover herbaceous vegetation and sustain ecosystem services in invaded rangelands.

SHORT PRESENTATION: SEASONAL USE OF *PARTHENIUM HYSTEROPHORUS* BY DOMESTICATED GOATS IN NORTHERN KWAZULU-NATAL, SOUTH AFRICA

Silungile Dlamini[1], Zivanai Tsvuura[1], Manqhai Kraai[2]

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Rangelands are vital to the livelihoods and well-being of millions of communities across South Africa, contributing to household income, social status and food security. In communal areas of South Africa, rangelands are primarily utilised for crop and livestock farming, with livestock farming being the most widespread human activity. However, the degradation of communal rangelands by invasive alien plants (IAPs) poses a serious threat not only to biodiversity but also to livestock farming by reducing the forage available to livestock. This, in turn, threatens the food and financial security of the communities depending on livestock farming. Despite these challenges, the specific impact of IAPs on livestock and communal farmers is not extensively studied. Without this knowledge, understanding the extent to which communal farming is affected by IAPs and how communal farmers adapt to these

challenges is limited. This study, therefore, aimed to investigate the effect of *P. hysterophorus* on goat feeding behaviour in the Madwaleni and Manzaneni communal areas of Nongoma municipality in KwaZulu-Natal, South Africa. The study assessed the quantity and quality of food available to livestock versus *P. hysterophorus* using the quadrat sampling method and estimated the quantity of *P. hysterophorus* consumed by goats in comparison to other vegetation using direct observation. The study also assessed goat mortality by counting the number of goats owned and recording the number of deaths, symptoms or suspected causes of death observed by the livestock owners prior to death. The results showed that *P. hysterophorus* is abundant throughout the year, with the fresh and dry plants being most abundant in the early wet season, followed by the dry season. The results also showed that even though goats feed on *P. hysterophorus* throughout the year, it accounts for only 15.83% of bites taken by goats in the dry season, when vegetation is scarce, and 2% and 4% in the early wet and late wet season, respectively, when other vegetation is also abundant. Additionally, farmers reported higher mortality of goats in the early wet season and the dry season. While *P. hysterophorus* might be less used as forage, its dominance may indirectly contribute to the lack of grass. As many studies have shown that this weed suppresses the growth of surrounding vegetation, contributes to and poses toxicity risks to livestock.

SHORT PRESENTATION: DETERMINING THE EFFECTS OF RESTORATION INTERVENTIONS ON *STOEBE VULGARIS* (ASTERACEAE) ("BANKROTBOS; SLANGBOS") ENCROACHMENT IN GRASSLAND AND SAVANNA RANGELANDS

Yondela Norman, Nigel Barker, Peter le Roux

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The encroachment of woody plants in savanna and grassland ecosystems negatively impacts their ecological functioning, biodiversity and capacity to provide ecosystem services. In the context of African rangelands, the primary cost of woody plant encroachment is the reduction of grazing capacity and water retention and supply. In South Africa's rangelands, one such woody encroacher is the indigenous species *Stoebe vulgaris* (Linnaeus), commonly known as Bankrotbos (Bankrupt Bush). *Stoebe vulgaris* is an unpalatable woody shrub of the Asteraceae family that has rapidly spread across the Grassland and Savanna biomes. The spread of *S. vulgaris* in terms of spatial distribution and density was likely brought about as a result of climate change impacts, whereby the increase in temperatures has led to a decrease in frost events that would normally have suppressed the establishment of S. vulgaris seedlings. Furthermore, *S. vulgaris* has been observed to proliferate in nutrient-depleted old lands and in over- and underutilized rangelands, outcompeting the native grass sward through shading, an extensive root system and allelopathy. The encroachment of *S. vulagris* has been suggested to decrease livestock production by around 65%. In areas that are severely encroached, (~30 000 plants/hectare), this species forms a "green desert" where few other species grow underneath their canopies, thereby reducing grazing capacity and biodiversity. A variety of control methods are currently implemented to lower the density of *S. vulgaris* on rangelands, including the use of fire, mechanical removal and chemical treatment with herbicide. These control methods, however, are often time-consuming, labour-intensive and expensive, especially on a larger scale. While much of the literature focuses on management and removal, there are almost no studies on the restoration and rehabilitation of encroached areas. Here we review the current state of knowledge on the impact of this species on economic activities and biodiversity, and summarize the published findings on the management and control of this species. This paper focuses on the notion of restoration as defined by the Society for Ecological Restoration as "the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed.". Based on that notion, we have identified gaps in our knowledge of S. vulgaris ecology and management and restoration actions. Furthermore, we discuss preliminary data collected from plots that were manually cleared of *S.vulgaris* and the implications for restoration interventions in S. vulgaris-encroached rangelands. The paper explores additional restoration interventions that could be applied to *S. vulgaris*-encroached landscapes, such as the reseeding of indigenous climax grass species and the cultivation of orphan legume crops, which can be a potential alternative to achieving ecological restoration while also addressing food security and nutrition.

SHORT PRESENTATION: SHRUB INVASION DRIVES HERBACEOUS VEGETATION DEGRADATION IN SEMI-ARID RANGELANDS OF THE EASTERN CAPE PROVINCE OF SOUTH AFRICA

Cwayita Kapiyana, Mthunzi Mndela

University of Fort Hare, Alice, South Africa

Shrub invasion is a global concern for biodiversity conservation, and rangeland productivity. Since the early 1900s, a dwarf shrub from the Asteraceae family, *Pteronia incana* has invaded vastly in Grassland and Thicket biomes of South Africa. However, it is unclear how this shrub affects herbaceous vegetation and whether its effects are modulated by topography in the Eastern Cape Province, South Africa. We addressed the question "How does herbacoeus production, diversity, cover, and composition differ along the slope at different invasion levels?". Three 1 -hectare blocks were delineated at the top, middle and bottom slopes in Lower Mgwalana and Qeto communal rangelands from which three 10 × 10 m plots were assigned to characterise three replicates of open, moderate and high invasion levels of < 20%, > 20-40%, and > 40% shrub cover, respectively. We determined shrub cover and density in each plot and assessed herbaceous vegetation in three 1-m^2 quadrats per plot. The analysis of covariance (ANCOVA) using general linear mixed models (GLMMs) was used to assess the main effects of invasion level (n = 3), slope position (n = 3), and their interactions and shrub cover as a covariate on species diversity, herbaceous density and richness. We further performed a regression analysis between the cover and density of *P. incana* and herbaceous canopy cover, litter and soil covers using Jamovi software version 12.3. In total, 22 grass species were recorded, with their total abundance declining with shrub invasion while the opposite was true for forbs. The abundance of decreaser species declined with shrub invasion from 41 to 8.3% in the bottom slopes, whereas it increased with shrub invasion from 27.5 to 70.3% in the middle and from 28.6 to 40.9% in top slopes and two grass species (*Digitaria eriantha* and *Eustachys paspaloides*) showed high tolerance to shrub invasion. Furthermore, graminoids cover varied significantly (P<0.001) with shrub invasion and was found to be 59.44±5.26% higher in open areas (OAs) of the bottom slope compared to 21.67±7.44% in moderately invaded sites (MIS), and 9.00±7.44 at highly invaded sites (HIS). Conversely, cryptogam, litter and bare soil covers were higher in HIS relative to OAs. Plant density varied by invasion levels only in the bottom slope, whereas species diversity showed differences in the middle and top slopes, with both vegetation attributes being highest in OAs compared to MIS and HIS. Overall, shrub invasion facilitated herbaceous vegetation degradation, calling for restoration interventions including shrub eradication and minimal disturbance of cryptogam to stimulate passive restoration. It was then concluded that increase in *P. incana* invasion has a detrimental effect as it promotes bare patches and reduces the effectiveness of rangelands to support wildlife and livestock.

SHORT PRESENTATION: ASSESSING THE INVASION POTENTIAL OF *MAHONIA OIWAKENSIS* HAYATA AND THE FEASIBILITY OF ERADICATION IN SOUTH AFRICA.

Thulisile P. Jaca[1], Mbali A. Mkhize[2]

[1]Pretoria, Pretoria, South Africa. [2]South African National Biodiversity Institute, Pretoria, South Africa

The genus *Mahonia* Nutt. is a member of the Berberidaceae family and is the second largest genus after *Berberis.* This woody, shade-tolerant shrub, native to China, is considered a high-risk invader that could potentially invade the savanna and forest biomes if allowed to spread. Currently, it is not listed as an invader under South African legislation. *Mahonia oiwakensis* is known to have naturalised at several sites in the Gauteng and KwaZulu-Natal (KZN) provinces, with an additional introduced but non-spreading population in the North West representing further invasion risks. The invasion risk of the species needs to be assessed, as some members of the genus *Mahonia* can be aggressive invaders, for example, *M. aquifolium*, which is an aggressive invader in forests in central Germany. To assess the risk of invasion and collate relevant literature on *M. oiwakensis*, a formal risk analysis was conducted for this species using the South African Risk Analysis for Alien Taxa. We further conducted bioclimatic modelling using species distribution models to predict the potential distribution of M. oiwakensis in South Africa using native and introduced occurrence data gathered from the Global Biodiversity Information Facility and local databases. To understand the feasibility of eradication, an integrated management approach involving mechanical and chemical control was tested on an invasive population (1 ha) at Faerie Glen Nature Reserve, Morelerakloof Nature Reserve and the Central Drakensberg, Cathkin Park area. Management efforts began in 2019

in Gauteng and 2023 in KZN province, respectively and were conducted annually, resulting in a significant reduction in the number of reproducing individuals over a five-year period. Risk analysis results and the species distribution model indicate that *M. oiwakensis* has a significant potential to be invasive in South Africa. It can thrive in a variety of habitats, including natural savanna, disturbed areas, roadsides and river banks. In South Africa, it is still limited in distribution, populations are still small and therefore need to be regulated and managed before it becomes a major problem. The treatment proved effective, with no resprouting observed, although some plants were missed due to dense native vegetation and some emerging seedlings from the soil seedbank. The study estimates that local extirpation of *M. oiwakensis* at the known sites could be achieved with minimal investment over the next decade. *Mahonia oiwakensis* is horticulturally significant and is sold in nurseries. While the full extent of its cultivation in South Africa remains unclear, thereby limiting its viability as a national eradication target, the species' demonstrated invasive risk and the positive management outcomes support site-specific extirpation as a practical goal.

SESSION CHAIR: NALEDI ZAMA

Wednesday 23 July 2025, 14:55 -15:40

PLATFORM PRESENTATION: SAVANNA WOODY DENSITY REDUCES SOIL PHOSPHORUS IN THE MUNYWANA CONSERVANCY, SOUTH AFRICA

Naledi Zama[1,2], Kevin Kirkman1, Charli De Vos[3], Ross Goode[3], Sindiso Nkuna[1], Dale Wepener[3], Michelle Tedder[1]

[1]University of KwaZulu-Natal, Pietermaritzburg, South Africa. [2]Sol Plaatje University, Kimberley, South Africa. 3Phinda Private Game Reserve, Mkhuze, South Africa

An increase in shrubs or woody species is likely to significantly affect grass productivity and soil nutrients, directly or indirectly. Various land use management practices or poor management have resulted in the degradation of savanna ecosystems in mesic regions that are subject to woody bush encroachment. The Munywana Conservancy (MC) is considered a “disturbance-driven savanna” because it receives an average mean annual precipitation of approximately 815 mm, allowing trees to grow and exclude grasses. These unstable systems require disturbances such as browsing and fire to maintain grasses within the system. In the absence of disturbances, a closed canopy state is expected. The rate of shrub encroachment is understood to be connected to environmental factors, including precipitation variability and fires, which may influence woody plant density. The drivers of increasing woody density are well studied, whereas the influence of woody density on soil properties and nutrients is not. We aimed to determine the effects of woody density on grass fuel load (GFL), soil organic matter (SOM), pH, and soil phosphorus (P) – a known limiting nutrient for primary production and other biological processes. Firstly, we hypothesised that woody density would significantly suppress GFL above a threshold of 2500 trees/ha. Secondly, we hypothesised that woody density would significantly influence changes in SOM and decrease soil pH. Considering that leguminous woody trees are the most dominant woody component on the conservancy, we also hypothesised that woody density would affect soil P, as P is a requirement for biological nitrogen fixation in leguminous trees. To test the hypotheses, twenty-seven monitoring sites across the MC were selected for soil sampling and woody tree density assessments in 2020. To address the first hypothesis, we used a segmented regression model. The second set of hypotheses was analysed using either linear mixed models or generalised linear mixed models. The results from the segmented regression indicated that the slope of the grass fuel load before the woody density threshold was estimated at $\beta = -0.254$ ($t = -1.015$, $p = 0.321$), suggesting a non-significant effect. The change in the slope beyond the threshold was estimated at $\beta = 0.933$ ($t = 0.671$, $p = 0.509$), also suggesting a non-significant effect. Similarly, woody density did not significantly influence SOM at $\beta < 0.001$ ($t = 0.938$, $p = 0.359$), and pH ($\beta < 0.001$, $t = 0.116$, $p = 0.909$). Additionally, total woody density decreased soil P, and both legume woody species did not affect soil P. The models support that increasing clay content increased soil P; however, soil P was significantly reduced through an interaction between *Vachellia nilotica* woody density and clay ($\beta = -0.985$, $t = -3.258$, $p = 0.003$). Unexpectedly, woody density did not influence GFL, SOM or pH changes. Greater *V. nilotica* densities on clayey soil produced P-limiting conditions, because of their high P requirements. We conclude that the monitoring sites associated with high soil clay and *Vachellia nilotica* density are likely to have reduced soil P levels, which may influence the availability of other soil nutrients.

PLATFORM PRESENTATION: INVESTIGATING WOODY VEGETATION DYNAMICS OF THE ABANDONED CROPLANDS IN THE SEMI-ARID SAVANNA RANGELANDS, LIMPOPO PROVINCE, SOUTH AFRICA

Bukho Gusha, Lesego Motshekga, Sinawo Koti, Masibonge Gxasheka

University of Limpopo, Polokwane, South Africa

This study assessed woody vegetation composition and structure in the abandoned croplands and compared it with that of a natural rangeland within the same biophysical characteristics. Two contrasting land-use namely, abandoned cropland and adjacent natural rangeland, were selected in Sencherere village near Turfloop. In each land use, six 10 m × 10 m plots were randomly established for data collection. Woody vegetation was sampled by identifying all trees that were found in each plot, and measuring tree height, crown dimensions, and lowest browsable height. Species diversity, richness, and evenness were estimated using Menhinick's, Shannon-Wiener, and Pielou's indices. Data was analysed using R version 4.4.0 software. The study reports that abandoned cropland was dominated by *Vachellia robusta* (45.71 %) and *Dichrostachys cinerea* (27.71 %), while natural rangeland was dominated by *Dichrostachys cinerea* (59.41%) and *Vachellia karroo* (22.77 %). Natural rangeland had significantly higher tree density (1,683 ± 708 trees ha^{1}) than abandoned cropland (600 ± 210 trees ha^{1}) ($p < 0.05$), but trees in abandoned cropland were taller (mean = 1.82), had broader crowns (mean = 2.27) and had high grazing value. Woody species diversity and evenness were significantly lower (mean = 0.46 & 0.38) in abandoned cropland than in natural rangeland (mean = 0.69 &0.74). These results suggest that even though rapid growth is reported in abandoned croplands, they may not be available for livestock feed as they grow taller and use the available soil resources. The practices from the past may continue to produce persistent effects in woody vegetation growth, structure and composition after agricultural practices have been ceased. Therefore, a sustainable management plan is required after cropland abandonment in order to restore vegetation structure that can benefit livestock production.

PLATFORM PRESENTATION: ASSESSING BROWSE QUALITY: WHAT SHOULD WE MEASURE?

Peter Scogings

Centre for Functional Biodiversity, University of KwaZulu-Natal, Pietermaritzburg, South Africa

Large mammal herbivores that feed on trees and shrubs (i.e., browsers and mixed-feeders) alter woody species composition. Traits that deter or repel herbivores, or reduce their abundance, enable some plant species to persist more than others. Structural traits, such as spines, thorns, small leaves and dense branching limit herbivore access to nitrogen and limit bite rate or mass. How those limitations affect animal performance and ultimately population dynamics is unknown. Digestibility-reducing compounds limit post-ingestive nitrogen availability and limit daily intake. Numerous studies have shown that these compounds can negatively affect animal performance and regulate herbivore populations. The perception that browse is more digestible than grass is flawed by its origin in methods appropriate for grasses, not browse. A series of studies over ~15 years on diet selection of domestic goats spanning three South African sites varying in soil, rainfall and woody species suggested that, against expectations, goats preferred high-tannin species over spinescent species. However, those studies also confirmed that condensed tannins reduce digestibility, reduce nitrogen availability, and have negative effects on animal performance. Why did condensed tannins not explain diet selection according to expectations? Part of the answer is that methods commonly used to quantify condensed tannins (e.g., acid-butanol assay) cannot reveal subtle differences in phenolics, and commercial standards for quantification are limited (and usually not appropriate). Ideally, purified extracts of tannins from each study species should be used instead of commercial standards. Condensed tannins are a group of end-products of the flavonoid biosynthesis pathway. They are high-molecular-weight flavanol polymers. The other flavonoids are low-molecular-weight phenolic compounds. A study of six woody species representing two broad functional groups in African savannas, fine-leaved spiny species and broad-leaved spineless species, showed that each species had a unique phenolic profile. The study also revealed that preferred species were characterized by flavones, while unpreferred species were characterized by flavonols. A subsequent study of 70 woody species in relation to diet preference of black rhino in five protected areas in southern Africa showed the same pattern. How browsers and mixed-feeders sense some types of phenolic compounds and not others while

searching for preferred species is unclear. However, there is mounting evidence showing that volatile organic compounds (mainly terpenoids) are important pre-ingestive chemical cues in determining which plant species are preferred by large mammal herbivores. Available (digestible) nitrogen, species-specific tannin standards and metabolomic analyses of phytochemistry should be included in routine assessments of browse quality to gain improved insights into the nutritional value of trees and shrubs.

SESSION CHAIR: ANDREW FOWLER

Wednesday 23 July 2025, 15:40 -16:40

PLATFORM PRESENTATION: GRASSLAND WATERSHEDS IN TRANSITION: MONITORING CHANGE FOR TO ENSURE SUSTAINABILITY

Michele Toucher[1,2], Alistair Clulow[2], Kent Lawrence[1], Susan Janse Van Rensburg[1]

[1]SAEON, Pietermaritzburg, South Africa. [2]CWRR, UKZN, Pietermaritzburg, South Africa

Of the 22 Strategic Water Source Areas (SWSA's) across South Africa, 13 are located within or overlap significantly with the grassland biome. SWSA's are regions that produce disproportionately high runoff relative to their area and are therefore critical for national water security. Understanding how hydrological responses in grassland catchments will be altered by land degradation and global change is essential for long-term water management. The Cathedral Peak research catchments located in the northern uKhahlamba Drakensberg World Heritage site, South Africa, provide a valuable platform for such investigations. Located within the grassland biome and Northern Drakensberg SWSA, these catchments have a long hydroclimatic record, from 1948 - 1994, and then 2011 to present - combined with various land management treatments, enabling detailed global change and degradation impact assessments. The site includes a pristine fire climax grassland catchment, alongside catchments historically subjected to commercial afforestation and varied fire management regimes. These experimental catchments were pivotal in South Africa's hydrological and ecological research, and provided the evidence base for much of the country's water, forestry and environmental policy. Monitoring ceased in 1994, but was resumed in 2011 by the South African Observation Network (SAEON), which installed a comprehensive equipment array for monitoring climate, water, carbon and vegetation creating a platform for integrated change monitoring.

With over a decade of new data available, a comparison between the historical (1950 - 1994) and current (2013 to present) periods was undertaken. Mean annual temperature has increased by 1.1°C, with minimum temperatures rising more than maximum temperatures. Rainfall remains highly variable, with no statistically significant trends, though 2018 was the driest year on record.In the 1990s, the pristine grassland catchment had an average runoff response ratio of 0.43, which increased to 0.58 in the current period—suggesting climate-driven changes in the catchment water balance. Using a paired catchment approach, the pristine grassland catchment (biennially burnt) was compared with a fire-excluded catchment that has undergone woody encroachment. Evapotranspiration was significantly higher in the encroached catchment, especially during dry winter months, due to the evergreen nature of trees compared to seasonally dormant grasses. The tree canopy intercepted 29% of event rainfall, and over time, the runoff ratio declined relative to the grassland catchment.

These findings underscore the importance of land management practices in sustaining runoff from grassland SWSAs. Global change, woody encroachment and altered fire regimes can reduce water yields and shift hydrological processes. Therefore, protecting intact grasslands and implementing appropriate management strategies will be critical for securing water resources under conditions of climate change and landscape transformation.

PLATFORM PRESENTATION: IMPLICATIONS OF BRACKEN FERN INVASION FOR WATER YIELD IN SOUTH AFRICA'S GRASSLAND WATER SOURCE AREAS

Alistair Clulow[1], *Michele Toucher*[1], *Byron Gray*[1], *Kent Lawrence*[2], *Susan Janse van Rensburg*[2]

[1]Centre for Water Resources Research. [2]South African Environmental Observation Network

The grassland biome of South Africa is a crucial provider of water for the country. However, decades of overgrazing and unsustainable land management practices have led to widespread degradation of areas within the biome. Degradation can manifest as a reduction in ground cover, change in species composition, invasion of a dominant native species or of a non-native species, and/or erosion of the soil – all of which can significantly alter hydrological processes and catchment water yield. *Pteridium aquailinum*, commonly known as bracken, is a dominant invader in the grassland biome. Despite its widespread presence and further invasion of grasslands, the hydrological impacts of bracken remain poorly understood.

The Cathedral Peak research catchments, located in the northern uKhahlamba Drakensberg World Heritage site, South Africa, provide a valuable long-term platform to investigate these impacts. Located within the grassland biome and Northern Drakensberg Strategic Water Source Area, the Cathedral Peak catchments have a long hydroclimatic record, from 1948 - 1994, and then 2011 to present - alongside various land management treatments. Following a wildfire in one of the catchments, known as CPIII, which was previously planted to commercial forestry, bracken invaded the catchment. With the resumption of monitoring across the catchments in 2011, CPIII was instrumented to determine the hydrological influence of bracken. The initial focus has been on determining the influence of bracken on evapotranspiration (ET) relative to a near-pristine grassland in a neighbouring catchment as the ET component is a significant portion of the hydrological cycle in South Africa.

The bracken canopy was dense in summer, and began to brown in autumn following senescence and complete die off in winter. The canopy response of the bracken in spring was slow, with initial greening being evident from October. The bracken, similar to the grassland, has a highly seasonal ET. The highest ET occurred during the warmer wet periods of summer and spring. Relative to the near-pristine grassland, summer and winter ET from the two vegetation types was similar. In the transitional seasons, the grassland responded quicker in spring and thus had a higher ET, while the bracken continued to transpire later into autumn. Overall, the annual average ET over the bracken was higher than the grassland.

These findings suggest that bracken invasion may alter the seasonal distribution and increase the overall magnitude of evapotranspiration, potentially affecting streamflow and water availability downstream. As land degradation and species invasions continue to reshape South Africa's strategic water source areas, understanding the hydrological consequences of vegetation change is critical for sustainable water resource management.

PLATFORM PRESENTATION: INNOVATIVE WATER RESOURCE MONITORING – RELEVANCE TO RANGELAND MANAGEMENT AND INTEGRATING DRONES AND CITIZEN SCIENCE INTO MANAGEMENT

Mark Graham[1], *U Maharaj*[2], *T Pike*[2]

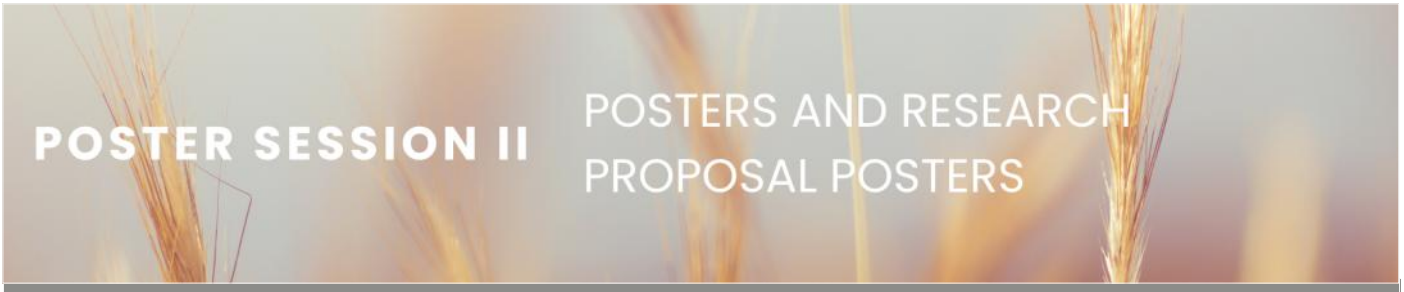
[1]GroundTruth. [2]Centre for Water Resources Research

Accurate and comprehensive data regarding water body characteristics are required for the effective management of South Africa's terrestrial and aquatic ecosystems. Key parameters such as water depth, Total Dissolved Solids (TDS), temperature, and turbidity provide critical insights into channel and reservoir profiles as well as water quality and how catchments are being managed. However, traditional methods for collecting this data often face significant challenges, including high costs, technical complexities, potential safety risks associated with manned operations, and limitations in achieving adequate spatial and temporal data coverage. Therefore, innovative approaches that leverage technological advancements are required to overcome these challenges.

The aim of this workshop will be to highlight the use of unmanned vessels for aquatic and terrestrial ecosystem monitoring, focusing on an integrated system comprised of Unmanned Aerial Vehicles (UAVs), Unmanned Survey Vessels (USVs), and Internet of Things (IoT) enabled sensors. During the workshop, the team will delve into how

this these technologies can be used for the acquisition of critical aquatic data. The UAV component facilitates safe and rapid deployment, and the USV is equipped with a suite of IoT sensors specifically configured for high-resolution bathymetric mapping and the measurement of water quality parameters such as temperature, TDS and turbidity.

Participants that attend the workshop will gain insight into the operational principles, practical applications, and significant advantages of this integrated approach. The workshop will feature a practical demonstration illustrating the UAV-USV tethering and deployment strategy, offering a first-hand experience of the system being utilised for data collection. Furthermore, the team will demonstrate how the datasets that are generated can be processed, visualised, and interpreted to inform and/or support more effective, data-driven water resource management decisions within the Southern African context. This session will be beneficial for participants interested in the future of environmental monitoring and the practical application of modern technology in the field.



Wednesday, 2 3July 2025

09:45 - 10:05

11:55 - 12:35

STANDARD POSTER: THE EFFECT OF INDIVIDUAL ACACIA KARROO TREES ON GRASS AND SOIL LAYER IN THE SEMI-ARID SAVANNAS OF THE EASTERN CAPE, SOUTH AFRICA

Thabo Magandana[1], *Solomon Beyene*[2]

[1]DRDAR, Stutterheim, South Africa. [2]University of Fort Hare, Alice, South Africa

The objective of this study was to investigate the influence of individual *A. karroo* on soil and herbaceous layer. The study was conducted at the University of Fort Hare farm located in Alice in the Eastern Cape Province, South Africa. A total of thirty *A. karroo* plants were selected randomly, of which ten trees each having heights of (>1.5 – 2m, >2 – 2.5m or > 2.5m). Two transects radiating out of the tree trunk to open grassland were marked at each woody stand in the north and south directions. Each transect was divided into two sub-transects to represent the under canopy and outside canopy zone. In each sub-transect, a 0.5 x 0.5 m quadrat was laid to record grass and soil data. The occurrence of *Cymbopogon plurinodis* was significantly ($p<0.05$) higher (59.83%) under the canopy zones that are > 2m – 2.5m than trees that are > 2.5m (28.81%) and those that are >1.5 m– 2m (28.99%). The tuft diameters of *C. plurinodis* were significantly ($p<0.05$) smaller on the open habitats of >1.5m – 2m trees. The tuft diameters of *Sporobolus africanus* were significantly ($p<0.05$) smaller under canopies of >2m – 2.5m trees in winter. The tuft diameters of *Themeda triandra* were significantly lower on the open habitats of >1.5 m – 2m trees in summer. Although the occurrence was higher under tree canopies it was lower under >2.5m trees than open habitats in both seasons. The grass biomass production was significantly ($p<0.05$) lower under the canopies and open habitats of >1.5m – 2m of the *A. karroo* trees in winter than summer. The >2 – 2.5m canopies had the highest biomass production than the >1.5 – 2m and > 2.5m trees. The *A. karroo* trees had positive effects on herbaceous layer. The more palatable grasses were under canopies of the *A. karroo* than open habitats. *T. triandra* contributed to higher dry matter production under canopies. The canopies improved biomass and basal cover because of improved soil

RESEARCH PROPOSAL POSTER: ECOLOGICAL BENEFITS AND CHALLENGES OF *PASSERINA RIGIDA* (UNWELE) IN COASTAL AREAS

Sive Tokozwayo

Eastern Cape Department of Agriculture, Stutterheim, South Africa

Passerina rigida commonly known as Gonnabas or Dune Gonna, is a South African indigenous shrub species endemic from the Eastern Cape, KwaZulu-Natal, and Western Cape Provinces. This plant belongs to the *Thymelaeaceae* family. *Passerina rigida* is a multi-stemmed rigid shrub with the height ranged from 1 to 2 m. The ascending branches are conical in shape due to many branchlets that are pendulous when fertile. The flowers are yellow and bright yellow berries are borne subterminally. The leaves are narrowly lanceolate to ovate, and the apex is acute, with the main vein visible as a blunt keel. The species plays a crucial role in preventing soil erosion particularly in sandy and rocky coastal areas. The plant provides habitat and food sources for insects, birds, and small mammals while contributing to carbon storage and climate resilience. Well-adapted to dry, nutrient-poor soils and coastal conditions. However, it poses challenges, as it may spread aggressively, reducing grazing capacity and

communal rangelands, and its dominance can negatively impact overall forage availability. Moreover, where it occurs in high densities, it may increase fuel loads and alter coastal fire regimes. This study aims to provide Tsholomnqa farmers with essential information on the ecological benefits and challenges associated with *Passerina rigida.*

STANDARD POSTER: FIRE MANAGEMENT IN COMMUNAL RANGELANDS: A FOCUS ON TRIBAL AND KHOI-SAN COMMUNITIES IN THE NORTH WEST PROVINCE OF SOUTH AFRICA

Eric Stoch[1,2], HRH Kgosi Thari Maotwe[1], HRH Kgosi Ponatshego Mothibi[1]

[1]North West Umbrella Fire Protection Association, Potchefstroom, South Africa. [2]Stenden University, Port Alfred, South Africa

The sustainable management of communal rangelands is essential for the economic and environmental resilience of Tribal and Khoi-San communities in the North West Province of South Africa. These landscapes, vital for livestock farming, biodiversity conservation, and cultural heritage, face increasing pressure from climate change, land degradation, socio-political challenges, and policy constraints. This paper explores the intricate dynamics of communal rangeland governance and utilization within these indigenous communities, drawing on traditional ecological knowledge (TEK) and modern conservation practices to foster sustainable land use.

Rangeland management in Tribal and Khoi-San communities is deeply rooted in traditional land stewardship principles. However, external pressures such as land tenure uncertainties, overgrazing, invasive species, and shifting climate patterns have disrupted these customary systems. The integration of indigenous knowledge with contemporary land management strategies offers a pathway to enhance resilience and productivity. The Sendai Framework for Disaster Risk Reduction underscores the necessity of inclusive, community-led approaches to mitigate risks and build adaptive capacity.

In the North West Province, the North West Umbrella Fire Protection Association (NWUFPA) has pioneered collaborative initiatives with Tribal and Khoi-San leadership to address fire risks, an escalating threat in rangelands due to prolonged dry seasons. This model emphasizes capacity building, fire safety education, and cooperative governance, ensuring that local communities actively participate in safeguarding their environment. Such initiatives highlight the importance of collective action in preserving communal rangelands.

Despite these efforts, challenges persist. Political conflicts, bureaucratic hurdles, and resource constraints hinder the full realization of sustainable rangeland management. Furthermore, socio-economic factors, including unemployment and marginalization, contribute to land mismanagement and conflict over resources. Addressing these issues requires an integrated approach that includes policy reforms, enhanced support for community-based conservation, and strengthening partnerships between traditional authorities, government agencies, and conservation organizations.

This paper advocates for a holistic framework that recognizes the socio-cultural, ecological, and economic dimensions of communal rangelands. By leveraging traditional practices and modern interventions, Tribal and Khoi-San communities can enhance the sustainability of their rangelands, securing their livelihoods while contributing to broader environmental goals. The findings contribute to global discussions on indigenous land management, resilience-building, and sustainable development within marginalized communities.

STANDARD POSTER: IGNITING RESILIENCE: YOUTH, WOMEN, AND PEOPLE WITH DISABILITIES AT THE FOREFRONT OF FIRE-AFFECTED RANGELAND RESTORATION IN THE NORTH WEST PROVINCE, SOUTH AFRICA

Megan Mokwena[1], Eric Stoch[1,2]

[1]North West Umbrella Fire Protection Association, Potchefstroom, South Africa. [2]Stenden University, Port Alfred, South Africa

The restoration and rehabilitation of fire-affected rangelands in the North West Province of South Africa are critical for the environmental and socio-economic well-being of diverse stakeholders, including emerging farmers, communities governed by Communal Property Associations (CPAs), small villages, commercial farmers, and those

residing within game reserves and protected areas. This paper explores the dynamics of veld restoration and rehabilitation across this diverse landscape, emphasizing the crucial role of youth, women, and people with disabilities, including the deaf community, in fostering long-term sustainability.

For generations, land management practices within these diverse communities have been shaped by local knowledge and experience. However, the escalating impacts of climate change, exacerbated by overgrazing and the encroachment of invasive species, have disrupted these finely balanced ecosystems, leaving them increasingly vulnerable to the devastating effects of wildfires.

Recognizing the urgent need for a more resilient approach, this research emphasizes the critical importance of inclusive and collaborative restoration efforts. These initiatives must empower all members of these diverse communities, including marginalized groups, to actively participate in the recovery process.

In response to this pressing challenge, the North West Umbrella Fire Protection Association (NWUFPA) has forged strong partnerships with emerging farmers, CPA leadership, small village councils, commercial farmers, and representatives from game reserves and protected areas. These collaborative efforts prioritize the active engagement of youth, women, and people with disabilities. Through carefully designed training programs and capacity-building initiatives, NWUFPA empowers these vital community members to play a leading role in the rehabilitation of fire-affected rangelands. Notably, NWUFPA is currently implementing four projects, each involving 30 youth participants, in a one-year learnership program funded by the Further Education and Training (FET) Sector Education and Training Authority (SETA) and NWUFPA itself.

- **Youth:** Youth are engaged in fire prevention and early detection programs, ecological monitoring, and the development of innovative restoration techniques. They are equipped with the knowledge and skills to become stewards of their land, ensuring the long-term sustainability of rangeland ecosystems.
- **Women:** Recognizing the vital role of women in traditional land management, these initiatives empower women through training in fire safety, sustainable land-use planning, and income-generating activities linked to rangeland restoration, such as eco-tourism and the production of indigenous medicinal plants.
- **People with Disabilities:** The inclusion of people with disabilities, is ensured through the development of accessible fire safety training materials, including sign language interpretation, the use of visual aids, and the provision of assistive technologies.

Despite these proactive efforts, several challenges persist. Limited financial and technical resources, political complexities, and bureaucratic obstacles hinder the full realization of restoration and rehabilitation initiatives. Addressing these issues necessitates an integrated approach that includes policy reforms, increased support for community-based conservation initiatives, and strengthened partnerships between all stakeholders, including emerging farmers, CPA leadership, small village councils, commercial farmers, representatives from game reserves and protected areas, governmental agencies, and environmental organizations.

This paper advocates for a holistic framework that acknowledges rangeland restoration's socio-cultural, ecological, and economic dimensions.

STANDARD POSTER: IMPACT OF LAND DEGRADATION ON SOIL SEED BANK DENSITY AND SPECIES COMPOSITION IN RAYMOND MHLABA SEMI-ARID COMMUNAL GRAZING LANDS OF THE EASTERN CAPE, SOUTH AFRICA

Lungisa Qayi

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South African communal rangelands are affected by degradation especially in the Eastern Cape. Rangeland degradation is the decrease in grass production or ground cover and increased soil erosion, ultimately leading to the land productivity loss. Vegetation succession depends on the availability of suitable propagules in the soil, thus knowledge of soil seed banks is essential to formulate effective strategies for restoring the vegetation of degraded sites. The aims of this study were to investigate soil seed banks, their relationship with above ground standing vegetation and their potential significance for vegetation restoration across degradation gradients namely the non-degraded (ND), moderately degraded (MD) and severely degraded (SD) conditions. For this purpose, a site with a size of 0.5 ha was identified from each condition class. The three sites occurred adjacent to one another, and this

class. Three plots (50 m x 30 m) were established in each site to record vegetation and soil samples for the study. In each plot, a total of three soil samples were collected (30 cm x 30 cm excavated to a depth of 5 cm) giving a total of nine soil samples per condition class. Collected soil samples were thoroughly mixed after removal of all roots and plant fragments, and spread evenly over sterile hydro mix in plastic plant pots to a depth of 5 cm. The pots were placed in the greenhouse, watered daily, and examined weekly for six months to record soil seed bank germination, species composition and density. Also, the species composition of the above ground herbaceous plants was recorded from three 1 m x 1 m quadrats to examine the relationship with the soil seed bank. Results showed that the mean germination, seedling, young growth densities of most graminoids and non-graminoids showed significant differences ($p < 0.05$) between the three land degradation conditions being lowest at the SD site. The soil seed bank botanical composition comprised of 25 species representing graminoids (54%) and non-graminoids (46%) flowering plants. Results on seed bank species richness indicated that the number of both graminoid and non-graminoid species was high at the ND sites ($p < 0.05$) compared to the MD and SD sites. Non-woody taxa dominated samples from all soil seed banks on all land degradation condition classes. Sorenson's Index values were low (SI < 0.5) in all degradation sites. The study concludes that soil seed banks alone may not be adequate to restore severely degraded rangelands, because they may not contain sufficient and viable soil seed banks with regeneration potential. However, these seeds might assist in gradual restoration of degraded lands over long periods, but these

STANDARD POSTER: GRAZING COVER CROP MIXTURE TO IMPROVE MILK QUALITY ON DAIRY COWS DURING WINTER AND EARLY SPRING SEASONS

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Grazing cover crops provides additional advantages, when cover crops regrow after grazing, they push more sugars into the soil through root exudates in exchange for nutrients. This process helps build soil carbon to levels that can even exceed those of virgin soil. Providing an additional feed source for livestock, particularly during winter and early spring when feed is scarce or in short supply. Performance and milk quality of dairy cows also decline during winter and early spring which lead to loss of returns to farmers. The objective of the study was to feed cover crops to dairy cows in order to improve animal performance and quality of milk produced during winter and early spring seasons. The study was conducted at Mjonaiza farming at Dundee Kwa-Zulu Natal province. The Three hector of land was planted with winter cover crop mixture consists of 54% grasses, 22% Vetch, 20% radish and 4% legume. Animals were allowed to graze on the camp when the cover crop mixtures was 10% flowering. The following quality parameters: average milk yield (MY), Fat percentage (FP), protein percentage (PP), Somatic Cell Count (SCC) and MUN were recorded for the period of three Months of grazing (October-December). The results shows that the average milk yield, Fat percentage and protein percentage in the month of October were 10.6 kg; 3.81%, 3.34%, 66 and 13.58. November were 15.6 kg; 3.8 %, 3.45 %, 143 and 14 and 15.4kg, 4.06%, 4.44%, 170 and 11.33 in December respectively. This results indicate a significant increase of average milk yield and protein percentage from October to November (10.6 to 15.6 kg and 3.34% to 3.45%) with a slight decline in December (15.6 to 15.4 kg) and MUN also followed the same trend. Somatic Cell Count (SCC) shows a positive an increase in October to December (66 to 170), this show a positive results because any SCC lower than 100.000 indicate the healthiness of the udder. Also there was a significant increase of Fat in protein percentage (3.8% to 4.06%) in November to December. These findings support the objective of this study, indicating feeding of high quality forages, such as cover crop mixture results in quantity and quality milk production.

STANDARD POSTER: MODELLING HABITAT SUITABILITY AND POTENTIAL DISTRIBUTION OF INVASIVE GRASS SPECIES IN SOUTH AFRICA TO INFORM MANAGEMENT STRATEGIES

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Effective management of invasive alien species (IAS) relies on knowledge of the targeted species' potential distributions and habitat preferences. Therefore, a detailed understanding of species distribution is vital for

biodiversity managers to develop suitable control strategies. A comparative analysis of generalized linear model (GLM), boosted regression tree (BRT), random forest (RF), flexible discriminate analyses (FDA), and their ensemble were performed to ensure the highest predictive performance of the suitable habitats for *Briza minor, Cenchrus clandestinus, Cynodon nlemfuensis, Cortaderia selloana* and *Paspalum urvillei* using GBIF records. The results showed that the GLM, BRT, RF, and FDA had an area under curve (AUC) closer to one and ensemble models had an area under curve (AUC) of 0.95, 0.95, 0.90, 0.92 and 0.92, for *Briza minor*, *Cenchrus clandestinus, Cynodon nlemfuensis, Cortaderia selloana* and *Paspalum urvillei* respectively, in modelling the habitat suitability of the five alien grass species. The results obtained from different algorithms used for Species Distribution Modelling (SDM) indicate an excellent performance in projecting the potential distribution of the target grass species. The results obtained for *C. selloana* showed that most parts of the country are suitable. From the results of this study, it is concluded that the habitat suitability of all grass species will increase under climatic change scenarios. Finally, it is suggested that SDM be incorporated into invasive species management initiatives.

STANDARD POSTER: DEVELOPING BASELINE DATA OF SOIL PROPERTIES AND MICRONUTRIENTS OF A RECENTLY ILLEGAL ESTABLISHED MINE AT THE RANGELAND OF SCHOEMANSKLOOF

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The mining sector is a very lucrative industry which most of the time outcompetes agriculture afar economical hence it become easy to opt for it. With all the economic benefits mining has an adversely impact to environment, ground water, human health and even to the heritage. It is crucial that the significance impact of any development to the soil is thoroughly examined before commencing. Therefore, the process of changing land use from rangeland to mining should not be an overnight decision as there are many environmental, social and heritage regulations that should be met. This research aims to assess soil physiochemical properties and micronutrients on different slope and depths of recently illegal established mine at the rangeland in order to develop the baseline data that will be reference in future. The study was conducted at Schoemanskloof, Ehlanzeni District in Mpumalanga, with coordinates 25 ° 45' 44" S and 30 °,65' 86" E. The experiment design was laid out as a 4 × 2 factorial design in random complete block design (RCBD) and each experimental treatment was replicated 5 times. The first treatment factor was slope and it constituted four different treatments namely upper slope, mid slope, lower slope and cultivated (bottomlands) and the sampling was done on two different depth of 0-15 cm and 15-30 cm. The CEC of the cultivated land was significant higher in both soil depth, 6.22 and 6.25 $cmol_c$/kg respectively, compared to all slope with upper slope at 15-30 cm having the lowest of 0.79 $cmol_c$/kg. There was a linear correlation of high Cu, Zn and Mn; 3.7, 2.3 and 65.9 mg/kg respectively compared to other slope with midslope at 15-30 cm having the lowest concentration of 1.1, 0.4 and 3.07 mg/kg respectively. Better physiochemical properties and high concentration of micronutrients under bottomlands was attributed to the application of fertilizer which enhanced biomass production and the accumulation of organic material above the slope. Whereas the midslope, with its gradual gentle slope, has been experiencing overgrazing for decades thus depleting the soil quality and current it has been the first target for the illegal mining. The depletion of soil quality and nutrients on the upper slope is enhanced by the uncontrolled contaminants from illegal mining which needs urgent scientific measures to be employed to curb further degradation. With time the contaminants might increase down the slope reducing soil quality of the rangeland and consequently destroying the entire natural grassland ecosystem. This data should be utilized as the specific baseline empirical data to develop frameworks and guidelines on how to change the rangeland to mine without compromising the ecological process and further to mitigate land degradation which subsequently leads to climate change.

RESEARCH PROPOSAL POSTER: IMPACT OF DIFFERENT COVER CROP MIXTURES ON SOIL HEALTH: A FOCUS ON MICROBIAL BIOMASS AND ORGANIC MATTER DYNAMICS IN DIVERSE AGRICULTURAL SYSTEMS

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Cover crops are primarily grown to cover the soil and prevent it from degradation. They offer several benefits to

agricultural soils, including enhanced soil health, improved water retention, reduced soil erosion, and increased soil microbial diversity. Previous research has highlighted positive effects of cover cropping on soil microbial biomass, organic matter decomposition, and overall soil health. This study aims to evaluate the impact of cover crop mixtures on soil health under diverse climatic conditions in South Africa by (i) measuring soil organic carbon levels in soils incorporated with various cover crop treatments, and (ii) characterizing the microbial diversity associated with these treatments. A 4x4 lattice design will be used to allocate 16 different cover crop treatments across 48 subplots located at three research stations in ARC - Cedara (KwaZulu-Natal), University of Limpopo research farm (Limpopo), and Potchefstroom Agricultural College (North West). The treatments consist of legumes, grasses, and broadleaves (brassica) species to assess their potential to enhance soil health over time. Rhizospherical samples will be randomly selected on all 48 plots from three different trials, and a composite bulk sample will also be collected. Soil organic carbon will be measured using the Walkley-Black method. Microbial diversity will be assessed on rhizospheric soil samples through high-throughput 16S rRNA and ITS amplicon sequencing at the ARC-BTP Core facility. These molecular approaches will enable characterization of bacterial and fungal communities in relation to crop functional group composition and regional environmental variables. The findings will provide valuable insights for promoting sustainable agricultural practices and advising South African farmers on optimizing cover crop strategies to improve soil quality and productivity.

RESEARCH PROPOSAL POSTER: INVESTIGATING THE POTENTIAL IMPACTS OF COVER CROP INTEGRATION IN ENHANCING SOIL QUALITY, CASH CROP PRODUCTION, AND CLIMATE RESILIENCE IN SOUTH AFRICA

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Climate change and soil degradation threaten sustainable agricultural productivity, particularly in vulnerable regions. Integrating cover crops into existing agricultural systems presents a promising approach to enhancing soil health, improving crop yields, and increasing system resilience. This research aims to optimize region-specific cover crop integration to improve soil quality, cash crop production (*Zea mays*), and climate resilience in selected provinces of South Africa, namely Gauteng, Limpopo, North-West, and KwaZulu-Natal. The study will be conducted at four research sites: Agricultural Research Council (ARC) Roodeplaat Experimental Farm, University of Limpopo Experimental Farm, Potchefstroom Agricultural College, and ARC Cedara Experimental Farm. At each station, two main plots of 576 m² will be established, each subdivided into 48 subplots of 12 m² to accommodate winter and summer cover crop treatments. These will include a range of grasses, legumes, and broadleaf species. Baseline soil chemical and physical properties data will be collected before the establishment of cover crops and monitored throughout the project, which spans three growing seasons from 2025 to 2027. Initial soil preparation will involve conventional ploughing due to the historical cultivation of the sites, followed by minimum tillage practices in subsequent seasons. Cover crops will be followed by *Zea mays* L. as a cash crop in rotation to assess short- and medium-term benefits on soil and crop performance. Soil samples will be collected using a soil auger and soil iron core samplers at various depths (0 – 30 cm) each season to monitor changes in soil micro and macronutrients and soil physical properties such as soil texture, soil dry bulk density, soil aggregate stability and some hydrological attributes. Crop production data will also be collected using a quadrat method (0.25 m^2) to assess the production of rotational systems, and the target crop parameters will be dry biomass yield, crude protein, fiber contents, starch content (%), and macronutrients. Data analysis will be performed using appropriate statistical analysis software, with Analysis of Variance employed to test for significant differences among treatments for individual response variables. Where significant differences are detected, mean separations will be conducted using the Least Significant Difference test at a 5% significance level ($p < 0.05$). To establish a deeper understanding of the overall impacts of cover crop integration, multivariate analyses which include principal component analysis and non-metric multidimensional scaling will be used to analyze the multifaceted soil responses of cover crop integration on soil quality indicators. Building on these analyses, this study seeks to provide evidence-based recommendations for the integration of cover crops to address key challenges such as climate change, soil degradation, and low resilience, thereby contributing to sustainable and climate-smart agriculture in South Africa.

RESEARCH PROPOSAL POSTER: EVALUATION OF INDIGENOUS GRASS SPECIES FOR FORAGE POTENTIAL USE UNDER WATER LIMITED CONDITIONS IN SOUTH AFRICA – A PROPOSAL

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There are several tropical and subtropical grasses that are in areas that receive less than 600mm of rainfall per annum. These could be developed to improve pasture species or local ecotypes could be used to improve existing commercial genetic resources. With climate change predictions indicating that scenarios of increased temperatures, droughts, and erratic rainfall will increase in the future, it is essential to plan for the development of improved pasture genetic resources for use under these marginal conditions. This study aims to evaluate drought tolerance in commercial and indigenous ecotypes of three grass species namely *Panicum maximum*, *Digitaria eriantha* and *Cenchrus ciliaris*. To achieve this, three objectives will be investigated:

1. Evaluating germination and seedling establishment of selected grasses under increasing temperature and osmotic stress. Seeds will be sown in petri dishes and placed in germination chambers calibrated to four different temperatures temperature (15˚C to 30°C) with applications of three osmotic treatments (0MPa, - 0.1 MPa, -0.3MPa). Germination will be recorded daily for 20 days.
2. Determining the impact of moisture stress and seed burial depth on seedling emergence and early seedling growth. 15 seeds of each genotype will be planted in pots watered to 100% and 50% capacity. In each water treatment seeds will be planted at 1, 2, 3, 4 and 5 cm depths. Seedling emergence will be counted daily, and seedling morphology will be monitored for 30 days.
3. Evaluating the effects of dryland, irrigation and 30% rainfall exclusion on the growth, development (morphological and physiological), agronomic potential and nutritional quality of the grasses. A field plot trial will be stablished where the different grass genotypes will be planted in three treatment blocks in $10m^2$ plots. After establishment the plants will be characterized based on their growth performance (shoot height, tiller numbers), biomass yields and nutritional quality over a two year growing period.

RESEARCH PROPOSAL POSTER: EVALUATION OF SUMMER AND WINTER FORAGE COVER CROPS ON RUMINAL DRY MATTER DIGESTIBILITY, FERMENTATION CHARACTERISTICS, AND MICROBIAL POPULATION DYNAMICS: AN IN-VITRO STUDY

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The inconsistent availability of quality forage throughout the year remains the major constraint on ruminant livestock production for smallholder farmers in Southern Africa. This study aims to evaluate the *in vitro* ruminal dry matter digestibility (DMD), total gas production, volatile fatty acids (VFAs), ammonia (NH_3), methane (CH_4), pH levels, and microbial growth populations of various cover crops in the subtropical regions of South Africa (SA) across different seasons. Does the integration of cover crops into crop-livestock systems enhance forage availability and supplementation for ruminant animals, and what effect does this crop species have on ruminal dry matter digestibility, fermentation characteristics, and microbial populations? Cover crops exhibiting high digestibility will enhance animal production and ensure sustained feed supply. Cover crops forage will be grown at five research stations with different agroecological conditions in SA. The locations are Syferkuil, Limpopo Province, Cedara, Kwazulu-Natal Province, Irene, Gauteng Province, Nooitgedacht, Mpumalanga Province, and Agricultural Research Council Potchefstroom, Northwest Province. Cover crops will be sown in April and October for winter and summer trials in 2025 and 2026 growing seasons. The trial will include monocultures and mixtures of sixteen treatments during winter and sixteen treatments during summer with no tillage . The experiment will be arranged in a 4×4 lattice square design replicated three times with a plot size of 24m × 24m and sub-plot of 4m × 3m. Cover crops will be harvested at 8 weeks of the vegetative and 12 weeks of the flowering growth stage post-planting. *In vitro* incubations will be conducted using rumen fluid collected from Boer goats at Irene Research Farm in Gauteng, SA, using a stomach tube and an electric vacuum pump . Rumen fluid will be strained and filtered through four layers of

cheesecloth into a prewarmed flask to maintain a temperature of 39°C. DMD will be determined after 48 hours (h) of digestion and drying for 72 h in the oven at 60°C. Fermentation characteristics will be assessed by measuring VFAs production, pH levels, and NH_3 at 0, 4, 8, 12, 24 and 48 h. The proportion of carbon dioxide (CO_2) and CH_4 will be calculated using equations based on stoichiometric laws and the oxidation state of chemical balance and the proportion of VFAs products. Microbial identification and quantification will be analysed using 16S and 18S Ribosomal ribonucleic acid(rRNA) gene sequencing. All analyses will be conducted using Statistical Analysis Software (SAS, 9.4). Duncan's multiple range test will be used to separate means at a probability level of $p \leq 0.05$. This study will provide insight into the potential of cover crops as a sustainable fodder resource for improving feed efficiency and reducing the environmental impact of ruminant livestock production systems. The findings will help to influence future *in vivo* studies and the development of optimal feeding regimes that include cover crops.

RESEARCH PROPOSAL POSTER: GROWTH PERFORMANCE RESPONSE OF GOATS FED ON WINTER AND SUMMER COVER CROP MIXTURES

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Forage scarcity in rangeland systems is exacerbated by seasonal dormancy, droughts, and dry winter months, which limit summer grass growth and limit land carrying capacity. While many livestock species, especially indigenous or well-adapted breeds can tolerate these harsh conditions with minimal production losses, nutritional stress remains a concern. Goats, which typically give birth during the winter season face increased physiological demands due to the simultaneous presence of pregnant and lactating does. These reproductive stages require higher levels of dietary energy, protein, and minerals to support milk production, and overall maternal health. When forage availability and quality are compromised, as is common under drought or overgrazing conditions, livestock often struggle to meet their nutritional needs. In response, smallholder farmers frequently rely on browse species and tree fodder as alternative feed resources, particularly during periods when herbaceous vegetation is limited. Incorporating summer cover crop mixtures as an alternative forage source can enhance feed availability and quality during this period, potentially improving growth performance and reducing pressure on overgrazed rangelands. Numerous studies have shown that cover crops are highly effective in controlling weeds, boosting yields, and enhancing forage quality. Furthermore, cover crops contribute to improved nutrient cycling, reduce leaching, and offer valuable winter and summer forage for livestock. This study aims to evaluate the growth performance of goats fed with winter and summer cover crop mixtures. The trial will be conducted at the ARC, Irene Experimental farm, Gauteng province, South Africa using using a Randomised Complete Block Design (RCBD) with 16 subplot treatments, replicated 3-times. The winter treatment consists of a mixture of three clover species, five grass species, and seven radish species. The summer treatment includes a blend of three grass species, cowpea, and turnip (Harmoth Purple Top).The cover crop mixtures will be hand-harvested at an advanced stage of maturity for both winter and summer samples for nutritional analysis. The feeding trial will run for period 12 weeks per season, containing of a two-weeks adaptation stage and followed by 10 weeks of data collection stage. the harvested samples will be analysed for the following: Dry matter (DM), ash content, crude protein (CP), crude fibre (CF), ether extract (EE), neutral detergent fibre (NDF), acid detergent fibre (ADF), acid detergent lignin (ADL), amino acid composition (AAC), mineral content (DMC), fatty acid profile (FATD), Tannin concentration. The experimental diet will be selected based on the nutritional results. The feeding trail will consist of 12 indigenous goats, divided into 6 group per treatment. The experimental animals will be fed the experimental diet and hay grass as a basal diet for the duration of the trial. The average daily gain (ADG), body weight gain (BWG) and feed conversion ratio (FCR) will be measured before and after the feeding trial. Using cover crop mixtures provides extra grazing opportunities, minimizing the need for supplemental feed and reducing related expenses. These mixtures offer a more nutritionally balanced diet for livestock compared to single-species pastures, which can result in improved animal health and increased productivity under the on-going climate change.

STANDARD POSTER: PERCEPTIONS OF COMMUNAL FARMERS ON THE EFFECT OF *LANTANA CAMARA* ON FORAGE PRODUCTION AND HUMAN LIVELIHOODS IN COMMUNAL RANGELANDS OF KWELERA, EAST LONDON IN EASTERN CAPE

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Invasive alien plants are plants that are purposely or accidentally introduced into areas outside of their natural habitat by humans. Invasive alien plant species cause undesirable impacts on local plants biodiversity by reducing the diversity of local species, water availability, and degrade soil nutrient quality. *Lantana camara* is a flowering plant native to the American tropics and it belongs to Verbena family. In South Africa the species is listed as a category 1b species, requiring control. The aim of this study was to assess perceptions of communal farmers on the effect of *Lantana camara* on forage production and human livelihoods in communal rangelands of Kwelera, East London in Eastern Cape. The study was based on questionnaire surveys. Results showed that most respondents (95%) are aware of invasive alien species, such as *Lantana camara* and *Cestrum laevigatum*, which are causing significant damage to native species. The respondents were able to distinguish the extent of *Lantana camara* invasion, with 89% reporting that it highly invades their area. However, a significant proportion (90%) of local respondents took an initiative to control *Lantana camara* with different methods that included uprooting, fire and chemicals. Many respondents (80%) recommended uprooting as an effective approach compared to other methods. Thus, local people can play a significant role in decision making regarding invasion management and control in communal rangelands.

STANDARD POSTER: GROWTH AND ADAPTIVE CHARACTERISTICS OF TAGASASTE (*CHAMAECYTISUS PALMENSIS*) TREE LUCERNE SEEDLINGS IN RESPONSE TO VARYING WATER AVAILABILITY

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Drought is the most harmful and globally recognised abiotic stress affecting plant morphology and biophysiological processes that significantly limit plant productivity. The frequency, duration, and intensity of drought are aggravated by the marked changes in climate, altering rainfall and vegetation patterns, leading to sporadic livestock feed availability. The study seeks to characterise the adaptation ability of Tagasaste (*Chamaecytisus palmensis)* under different water limitations. To carry this out, varying water limitations (well-watered control, re-watered, and water limited) were imposed at different plant ages (8,9, and 10 months), and for different durations (7,14,21, and 28 days) under a controlled environment. Thereafter, biomass distribution (root and shoot mass), relative water content (root water and leaf water content), electrolyte, root length, shoot length, and shoot width were measured. The results have shown a wide range of morphological adjustments adopted by Tagasaste (*Chamaecytisus palmensis*) to cope with water-limited conditions. The biomass allocation favoured roots as opposed to shoots, shoot length, leaf mass, and stem thickness were reduced under water limitation, with a significant increase in root length. The relative water content was slightly higher on roots as compared to leaves, and there were no significant changes across age groups. The Electrolyte leakage was significantly more at water-limited conditions as opposed to re-watering, indicating. A successful study will help in the selection of drought-hardy cultivars. In conclusion, Tagasaste (*Chamaecytisus palmensis)* seedlings have shown various morphological adjustments in response to water limitation. These results help us to understand the response of lucerne to water stress and assist in laying a foundation for plant breeding programs to develop well-adapted and more extensive cultivars.

STANDARD POSTER: CLIMATE CHANGE INDUCED DISASTERS IN THE GREAT LIMPOPO TRANS FRONTIER AREA, AN ANALYSIS OF COMMUNITY LEVEL CARBON SEQUESTRATION STRATEGIES IN CHIREDZI DISTRICT OF ZIMBABWE.

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The paper discusses the response strategies to climate change induced disasters by people of marginalized communities in protecting large forests and woodlands for carbon stock calculations for possible incentives in the future. It demonstrates that forests protection in marginalized communities of Chiredzi has had immediate benefits to community level actors. The aim of the paper is to show the extent community people in marginalized communities engage in forests protection as a key strategy for carbon sequestration. Carbon reduction incentives have contributed to reducing deforestation and ecological balance which is a long-term benefit. There is evidence that sustainably managed ecosystems, protected woodlands and forests have immediate multiple benefits to communities that include timber and non-timber forests products, forage for livestock and firewood. The potential of non-timber forest products in contributing towards food security and livelihood development has not been fully exploited in the past because communities have not been allowed ownership of the forests. Similar trends have also been observed in other parts of the country and in different regions. The paper contends that over a period of time the impacts of climate induced droughts and floods are felt on household level livelihoods, including shortages of water, food and income leading to extreme poverty, malnutrition, as well as social challenges. The most affected people at the community level are women and children. Climate change induced disasters in Chiredzi district continue to increase destroying crops and infrastructure. The growing threat of forest degradation and uncontrolled veld fires demands a focus on carbon sequestration on indigenous woodlands in these marginalized communities. In this regard the paper argues that a sustainably managed environment is a precondition for sustainable agricultural production in meeting household-short term needs. Food and income requirements can be achieved through climate smart agriculture, and non-timber forest products commercialization. It is the paper's position that this helps to secure livelihoods, reduce incidences of poverty, promote uptake of good environmental practices. This enables communities to adapt and survive in the advent of climate change induced disasters.

STANDARD POSTER: FIRST RECORD OF *PASPALUM GUENOARUM* ARECHV. (PANICOIDEAE: POACEAE), RAMIREZ-GRASS IN GAUTENG PROVINCE OF SOUTH AFRICA

Moleseng Moshobane

SANBI, Thohoyandou, South Africa

Numerous species of the grass family (Poaceae) have been distributed to regions and countries outside of their native range due to their use and trade as forage crops, grain crops, and ornamental grasses. *Paspalum guenoarum* Arechv, (Poaceae) (Ramirez-grass) is a perennial tussock, leafy grass up to 1.0 m tall, with short basal rhizomes. In this study, we present the first record of *P. guenoarum* in the Gauteng province of South Africa. This new record increases the number of alien grasses introduced to South Africa to 257. More effort is needed to study the diversity and structure of invasive alien grasses in South Africa and to investigate their impacts on native biota.

STANDARD POSTER: RANGELAND CONDITIONS AND GRAZING CAPACITIES OF LIVESTOCK FARMS POST-DROUGHT IN THE DIFFERENT BIOMES OF SOUTH AFRICA

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South African rangelands experienced a severe multi-year drought from 2015 through to early 2020. Approximately 590,000 km^2 of rangelands were severely affected by drought, leading to a significant decline in rangeland productivity and an increase in livestock mortality across most provinces in South Africa. This study aimed to

understand variability in grazing capacities and stocking rates in terms of land tenure, Department of Agriculture grazing capacity norms, field surveys, and perceptions under and post-drought conditions in the grassland, savanna, and Nama-Karoo biomes in South Africa. In-person interviews and field surveys were conducted with 85 farmers across the three biomes. Grazing capacity did not differ significantly across tenure systems in the Grassland and Savanna biomes ($p>0.05$), but significant differences were found in the Nama-Karoo ($p< 0.05$). Over >60% of farmers in the Nama-Karoo biome rated their rangeland condition as poor as a result of drought. Land requirements from the field survey in the Nama-Karoo (20–121 ha/LSU) were four times lower than the Department of Agriculture's recommended grazing capacity norm. This means farmers in the Nama-Karoo stock their farms less than the recommended Department grazing capacity norms. The grassland and the savanna biome sites also showed signs of quick recovery, highlighting that the general drop in GC is only temporary. The study concludes that due to rainfall and vegetation production variability in these biomes, the Department of Agriculture should adopt flexible, climate-responsive grazing capacity guidelines since the current grazing capacity norms do not cater for the large decline in GC during drought, which could lead to overgrazing.

RESEARCH PROPOSAL POSTER: UTILISATION OF COMPETITIVE GRASSES TO REHABILITATE RANGELANDS INVADED BY PARTHENIUM WEED (*PARTHENIUM HYSTEROPHORUS*) IN SOUTH AFRICA

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Many South African rangelands are severely degraded due to poor land management practices, further exacerbated by the invasion of plants such as parthenium weed (*Parthenium hysterophorus*, Asteraceae), which often form dense monocultures. Covering over 45,000 km^2 of land in subtropical regions of South Africa, parthenium weed displaces native vegetation, diminishing land productivity, and threatening the livelihoods of rural communities. To address this, we aim to determine suitable candidates for the rehabilitation of communal grazing lands invaded by parthenium weed by introducing competitive grass species that are able to suppress the weed while providing nutritious fodder. The objectives of this study include: (i) assessment of the suppressive potential of selected native grass species on parthenium weed in glasshouse pot trials, to incorporate them into a grass seed rehabilitation mix; (ii) assessment of the suppressive efficacy of sown grass species mixtures in reducing parthenium weed growth and density under field conditions; (iii) monitoring of the short-term impacts of these grass species on parthenium weed seed banks; (iv) determination of the outcomes of grazing restriction and feasibility of grassland rehabilitation under unrestricted conditions. In a greenhouse experiment to assess grass competition on parthenium weed, seedlings were potted using a ‘target technique’, where parthenium weed was placed centrally, and surrounded by four individuals of a grass species. The test species include *Cenchrus ciliaris*, *Cynodon dactylon*, *Digitaria eriantha*, and *Panicum maximum*, selected based on prior evidence of weed suppression. Subsequently, a grass seed mix will be developed, incorporating species that are suppressive, known for grazing resilience, and palatability. Field studies will be conducted in rural rangelands in KwaZulu-Natal and Mpumalanga provinces, where the seed mix will be sown into sites invaded by parthenium weed. The experimental treatments will include (i) selected suppressive grass mix only, (ii) grass suppressive mix with palatable and grazing-resilient species, and (iii) variations of livestock grazing access (open access, partial access, and complete exclusion). Sampling will assess species composition, biomass, and soil seed bank analysis. Overall, this research aims to contribute to a protocol aiding parthenium weed control through grassland rehabilitation. An ecological management approach aims to reduce the impacts of parthenium weed to improve livestock grazing and, therefore, livelihoods and food security. Findings will contribute to recommendations for best land practice guidelines for managing parthenium weed in grasslands in severely invaded rural communities. Such outcomes may also be of interest beyond South Africa.

SESSION CHAIR: MICHELLE TEDDER

Thursday 24 July 2025, 08:00 - 09:30

PLATFORM PRESENTATION: CELEBRATING 75 YEARS OF INSIGHT FROM THE UKULINGA VERY LONG-TERM GRASSLAND EXPERIMENTS

Kevin Kirkman[1], *Craig Morris*[1,2]

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Two of the world's oldest grassland experiments were established by J.D. Scott in 1950 on mesic grassland at Ukulinga Research Farm, University of KwaZulu-Natal, South Africa. The Burning and Mowing Trial (BMT) tests combinations of four summer mowing times and 11 dormant-season burning and mowing regimes (on 13.7 × 18.2 m plots, three replications), originally designed to identify optimal defoliation and fire management strategies. The Veld Fertiliser Trial (VFT) uses a 4 × 2^3 factorial design with three replications to test four nitrogen levels (from ammonium sulphate or ammonium nitrate), two phosphorus levels, and two lime levels (on 2.7 × 9 m plots), initially aimed at assessing whether mineral fertilisers could increase grassland productivity. We celebrate 75 years of knowledge from these long-term experiments by examining their scientific impact, the unique insights they have provided into grassland management, and their role in education and collaborative research. Citations of all peer-reviewed papers were sourced from Google Scholar (which includes both scholarly and grey literature), with detailed metrics for the 10 most-cited papers from each trial obtained from Scopus to assess broader reach. Key themes and authorship patterns were also analysed. Since inception, 25 BMT and 24 VFT papers have been published, with output accelerating markedly after 2000, cited 1,652 times (median 59) and 1,440 times (median 35), respectively. Six papers from each experiment have over 100 citations, some exceeding 200. The 10 most-cited papers from each trial have reached a diverse audience, collectively cited in 458 journals by 1,172 authors across 79 countries. Both experiments have attracted wide international collaboration, with South Africans leading authorship on BMT (52%) and VFT (75%) publications, alongside substantial contributions from Germany and the USA. Research has examined treatment effects on soil and ecosystem processes, vegetation (composition, diversity, productivity), invertebrates (ants, grasshoppers), soil microbes, regional and continental comparisons, and remote sensing. These studies have confirmed and expanded understanding of grassland ecology and management, shaping fire management dogma, particularly the importance of regular dormant-season burning to maintain healthy and diverse grasslands. Two key lessons have emerged: removing fire, a natural evolutionary force, can cause an irreversible shift to woody vegetation; and fertilising grasslands is economically unviable and ecologically harmful. Interactions between disturbances (e.g. summer × dormant-season defoliation, N × P) have been important drivers of grassland change. The Ukulinga experiments have fostered valuable international, interdisciplinary collaborations, enabling comparative research that reveals consistent ecological patterns alongside distinct regional and continental responses, advancing global grassland science. They have also been vital for both university and informal education and training, and serve as a demonstration site informing policy and conservation efforts. As key sites for research and education, the Ukulinga very long-term experiments should be maintained to advance understanding and address emerging questions.

PLATFORM PRESENTATION: MESOSCALE VARIATION IN THE PLANT–SOIL NEIGHBOURHOOD OF A SOUTH AFRICAN MONTANE GRASSLAND

Clinton Carbutt[1,2], Alan Manson[2], Timothy O'Connor[3], Sphesihle Mkhungo[4]

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Variation is an intrinsic property of natural systems influencing ecological processes. We investigated mesoscale variation in the plant–soil neighbourhood of a South African montane grassland. We measured variation in plant species composition and cover, above-ground plant biomass ("biomass"), and nutrient content by plant functional type (PFT) across three seasons (spring–summer–autumn). We aimed to attribute biotic variation to abiotic variables such as soil depth, and soil chemical and physical properties. Variance in species composition across plots was 10%. Forbs constituted 73% of species richness, whereas grasses contributed 93% of biomass. C_4 grasses *Themeda triandra*, *Tristachya leucothrix*, *Heteropogon contortus* and *Harpochloa falx,* and the C_3 grass *Koeleria capensis*, were dominant species that consistently contributed the highest cover and by inference the most biomass. Grass biomass was positively correlated with soil depth while forb biomass was negatively correlated with soil N and C. Plant richness and diversity did not share a significant relationship with biomass. PFT and seasons, but not their interaction, influenced biomass. Results suggest that grasses and forbs exhibit highly divergent resource strategies to adapt to flammability. Grasses show a trade-off prioritizing biomass over nutrients. This low-nutrient investment approach conserves nutrients as standing dead cover is highly susceptible to losses through fire in the dormant season. Forbs, by contrast, invest more heavily in nutrients than biomass, accumulating higher levels of nutrients in autumn to facilitate recycling of nutrients in large below-ground storage organs prior to senescence. The exception was N and P herbage concentrations. These peaked in spring across PFTs, attributed to changes in plant phenology or pulses of microbially-mediated soil mineralization stimulated by warming and precipitation. The abiotic and biotic variables we measured did not account for all the site variation. Knowledge of legacy effects associated with historical land-uses and disturbance regimes (fire, grazing and mowing) proved to be essential for interpreting site variation. Studies of mesoscale variation are an essential prerequisite to assessing future disturbances or manipulations, such as a nutrient-addition experiment. Understanding patterns and processes of variation in a tightly coupled plant–soil neighbourhood is essential to improving grassland management and conservation as these variables represent the diversity–productivity relationship on which ecosystem and human health depend.

PLATFORM PRESENTATION: ASSESSING THE IMPACTS OF CHANGING ELEPHANT DENSITIES ON WOODY VEGETATION STRUCTURE AND BIOMASS USING FIELD DATA WITH L-BAND SAR TIME SERIES, IN PRIVATE RESERVES WITHIN THE GREATER KRUGER NATIONAL PARK, SOUTH AFRICA

Mike Peel[1], Konrad Wessels[2], Izak Smit[3]

[1]ARC, Nelspruit, South Africa. [2]George Mason University, Fairfax, USA. [3]SANPARKS, George, South Africa

The numbers of African elephants (*Loxodonta africana*) have reduced significantly outside conservation areas, while they have increased sharply inside some protected areas, especially in Southern Africa. In the Greater Kruger National Park ecosystem (KNP and surrounding protected areas) in South Africa, elephant numbers have increased exponentially in past decade. This increased density is expected to cause a reduction in woody cover , aboveground biomass stocks, with significant management impacts. Some private reserves adjacent to KNP have had few to no elephants for up to 100 years, but have been systematically removing their fences during the past 25 years, and as recently as 2018, followed by an influx of elephants and observed impacts on trees. The present study capitalized on the unique circumstances and a combination of rare, long-term systematic field surveys of vegetation structure, aerial counts of elephants, in addition to a dense time series of ALOS2 PALSAR-2 Synthetic Aperture Radar (SAR, ScanSAR) satellite data (2014-2023) to quantify the spatio-temporal impacts of increased elephant densities on woody cover and above ground biomass density (AGBD). A total of 11 reserves with 5 different elephant access scenarios were investigated. Elephant densities increased rapidly in reserves that removed their fences in 2018, while they increased slowly in reserves with access since the 1990's. According to the annual SAR cover products,

While two reserves where elephants gained access in 2018 experienced a 40-50% reduction in woody cover and 50 -60% loss in AGBD, while two reserves without elephants had < 6% and 15% loss respectively from 2016 to 2023. The study highlights a potential management trade-off between protecting elephants and conserving carbon stocks or biodiversity. This is the first paper to our knowledge to directly link changes in elephant density to SAR-estimated changes in woody vegetation structure and AGBD, corroborated by field measurements. The SAR-based methods can provide a reliable tool for monitoring changes in savanna woody vegetation to inform wildlife management and carbon-related initiatives in Africa.

PLATFORM PRESENTATION: GRAZING MANAGEMENT SYSTEMS ACROSS BIOMES IN SOUTH AFRICA

Khululiwe Ntombela

Agricultural research Council : Range & Forage Sciences, Pretoria, South Africa. University of the Western Cape, Cape Town, South Africa

Natural rangelands are affected by diverse challenges that include rainfall variability, soil erosion, forage production, bush encroachment, competition of natural resources for human use, resource exploitation and natural resource policy advancements. These challenges concurrently affect the management of natural rangelands by livestock farmers, therefore raising a pivotal need for appropriate grazing management practices for sustainable livestock production. Grazing management studies across South Africa often distinguish between two general grazing management practices, namely, (1) rotational grazing, characterized by fenced paddocks with fixed or pre-determined time frames and (2) continuous grazing on communal land where more often than not, which often lack fencing. Due to the complexity and diversity of our dynamic rangelands, there is a need for a detailed understanding of grazing management practices beyond these dualistic descriptions. Therefore, the aim of this research was to investigate grazing management practices by livestock farmers in five biomes of South Africa. A total of 100 semi-structured interviews with livestock farmers were conducted with farmers operating in the Grassland (n=26), Savanna (n=33), Nama Karoo (n=27), Succulent Karoo (n=10) and Albany Thicket (n=4) biome. Interview questions were focused on the type of grazing management system, the context wherein which the grazing system is applied, desired goal for chosen grazing system and justification(s) for choice of grazing system. Results from this research showed there is a diversity in grazing systems that make up either rotational or continuous grazing systems. For rotational grazing systems, the three-block camp grazing systems dominated, but other more flexible and modified camping systems including the use of smaller camps were identified. On communal lands, herding was the dominant management practice. This approach also showed considerable variation in terms of seasonal use and daily herding duration. The temporal and spatial grazing movement was described by livestock farmers to be advantageous in avoiding overgrazing, increasing preferred plant species, allowing plant regrowth, protection against predators and stock theft. What was common in all biomes was that the grazing management systems extended beyond the boundaries of the farm. In this case, transhumance between farms (owned or leased by the farmer), along altitudinal gradients where uplands are grazed in summer to avoid cold winter temperature or between areas with different seasonal rainfall patterns. This study highlights that both grazing and rangeland management extends beyond farm boundaries and comprises of a complex combination attributes. These grazing management practices combine planning, adaptive management of grazing over temporal and spatial landscapes. Therefore, this study proposes that with the current changing landscape environment and climate variability, flexible livestock mobility strategies including rotational grazing, herding and transhumance may be effective and should be supported by policy due to their flexible nature of decision making.

PLATFORM PRESENTATION: UNDERSTANDING BUSH ENCROACHMENT IN SEMI-ARID SAVANNAS. A LONG-TERM STUDY ON TREE DEMOGRAPHY INDICATES A KEY ROLE OF ELEPHANTS IN PREVENTING TREES FROM DOMINATING

Anthony Swemmer, Mightyman Mashele

SAEON, Phalaborwa, South Africa

Bush encroachment remains one of the primary causes of reduced forage production in savanna ecosystems, and may exacerbate this problem as global climate change intensifies. Factors that limit the abundance of woody plants in savannas (herbivory, fire, climate and atmospheric CO_2) act through modification of the demographic processes of savanna tree populations. Quantifying these is therefore key for a full understanding of bush encroachment.

some short-term research has been conducted on tree demography, there are few long-term studies that have investigated the effect of the above factors on local savanna demographics. This is a critical gap that is challenging to address with short-term studies, as savanna trees are often long-lived and recruit episodically. To address this, a long-term demographic study was initiated in the central lowveld of South Africa. 2 984 individual trees and shrubs were tagged in permanent plots at 5 sites. Elephants were absent from 1 site, and all large herbivores excluded from half the plots at another 2 sites. Fire was absent from 4 sites and infrequent at the 5th. Individuals taller than 30cm were measured and tagged, and monitored annually. Seedlings were counted annually. From 2012 to 2024 annual mortality varied from 0 to 9.1%, with only a weak effect of rainfall (despite a severe drought from 2016-2019). Tree size and elephant were better predictors of mortality, with mean rates 2-3 times higher at sites with elephant. Annual height increases were higher at sites with higher rainfall or no elephants. Seedling recruitment was highly variable, with a clear reduction during the drought. Grass biomass production within the plots was strongly correlated with rainfall, but negative effects of grass competition had less effect than the direct, positive effect of rainfall on tree seedlings and saplings, in years of high rainfall. Over 13 years, tree density and height were stable or declined in plots exposed to elephants, but increased significantly for those protected from elephants. These results suggest that elephant may have played a key role preventing bush encroachment in the past, and that they are currently preventing any increases in tree abundance that may have occurred in response to recent increases atmospheric CO_2 and large rainfall events (at least in parts of the greater Kruger National Park).

PLATFORM PRESENTATION: LANDSCAPE OF RESEARCH PUBLISHED IN AFRICAN JOURNAL OF RANGE & FORAGE SCIENCE DURING THE PERIOD 2008 TO 2025

Moleseng Claude Moshobane

South African National Biodiversity Institute, Thohoyandou, South Africa. Sefako Makgato Health Sciences University, Ga-Rankuwa, South Africa

This study presents a bibliometric analysis of research productivity in the *African Journal of Range & Forage Science*, focusing on publication trends, authorship patterns, institutional affiliations, and thematic focus. A total of 498 articles were analyzed, comprising contributions from 1,288 authors. The proportion of international co-authorship was 26.71%, indicating a moderate level of global collaboration. The average number of citations per document was 9.209, reflecting the journal's academic impact within the field. Notably, 66 authors produced single-authored articles, while the most prolific contributors were O'Connor T.G., Kirkman K.P., and Hoffman M.T. In terms of institutional representation, the University of KwaZulu-Natal led with 184 publications, followed by the University of Cape Town (n = 100) and the University of Pretoria (n = 66). South Africa emerged as the dominant contributing country, followed by Brazil and the United States. Keyword analysis revealed a strong research emphasis on "vegetation," "dynamics," and "management," highlighting the journal's focus on rangeland ecology and sustainable forage practices. This analysis provides valuable insights into the publication landscape of range and forage science in Africa, and underscores the journal's role in advancing ecological and agricultural research on the continent.

SESSION CHAIR: SUSI VETTER

Thursday 24 July 2025, 09:50 - 11:55

KEYNOTE ADRESS: FIRE IN AFRICAN GRASSLANDS AND SAVANNAS – A PRÉCIS OF 58 YEARS OF RESEARCH

Lynne Trollope

Winston Smuts Watts Trollope was driven by passion and a love of grass. He was a founder member of the Faculty of Agriculture at the University of Fort Hare in Alice in 1970. He spent 35 years of his academic career studying grass and the role of fire in the management of vegetation. Winston was a committed conservation ecologist researching fire behaviour and the practical application of prescribed burning regimes that were ecologically sensitive for habitat management for both domestic livestock systems and wildlife management. He committed a further 18 years to researching and developing fire management plans while he was Head of the Research and Development section of Working on Fire, South Africa and Working on Fire International. In 2018, “in recognition of a significant lifetime contribution to fire ecology and management in grasslands and shrublands” he was the first international fire ecologist to be awarded the prestigious Henry Wright Lifetime Achievement Award by the American Association of Fire Ecology.

Fire has been mankind’s companion and foe since the dawn of time. It’s a fundamental element of the planet, like air, shaping the patterns of life and thus is regarded as a natural ecological factor of the environment that has been occurring since time immemorial, particularly in the savanna and grassland areas of the African continent. Our opinion of fire has changed often, but fire itself is the same. The real challenge from fire is *to understand it and the earth we live on*”. Winston spent nearly 60 years in fire research and understanding the legacy of fire. How to apply it, how to manage it safely and what effects did different types of fire, fire intensity and fire frequency have on the ecosystem. He recognised that there are fire dependent, fire tolerant and fire sensitive plants, that fire is a useful tool in controlling invasive plants, both alien and indigenous and is pivotal in managing bush encroachment.

The guiding principle in his research and the application of fire was always that fire is a good servant but a bad master!

PLATFORM PRESENTATION: INTERACTIVE EFFECTS OF PRESCRIBED FIRE AND LIVESTOCK GRAZING ON *SERIPHIUM PLUMOSUM* IN SOUTH AFRICAN SOUR BUSHVELD

Carissa Wonkka[1], Michele Clark[2,3], Urs Kreuter[4], William Rogers[4]

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Woody encroachment is a predominant threat to grassland systems globally, leading to herbaceous biomass loss and declines in grassland biodiversity. In various grasslands and savannas in South Africa, *Seriphium plumosum*, an encroaching woody plant, has been reducing grassland diversity and displacing valuable forage species. A combination of fire and grazing has proven a cost-effective approach for halting further shrub encroachment and reducing woody plant abundance in some ecosystems. However, the effects of fire and grazing on *S. plumosum* have not been thoroughly studied. We established a full factorial, randomised experiment to evaluate interactive effects of fire and cattle grazing on *S. plumosum* height, stem count, and canopy cover as well as grass and forb

cover. We conducted the experiment at the Ukulima Farm research centre in the northern Waterberg district of Limpopo province. Sixteen 100 m^2 plots were established across a grazed area and randomly assigned one of four treatments (ungrazed, not burned; ungrazed, burned; grazed, not burned; grazed, burned.) There were no interactive effects between fire and grazing. However, fire reduced *S. plumosum* height, stem count, and canopy cover, while not impacting grass and forb cover, although this treatment effect was not significant 24 months after a single treatment. This suggests that although fire holds promise for *S. plumosum* management, follow-up treatments are necessary to contain expansion of the shrub or reduce current densities. Additional research into the effects of altering components of the fire regime, such as seasonality, intensity, or frequency, in combination with grazing is necessary to develop effective management.

PLATFORM PRESENTATION: IMPACT OF FREQUENT EARLY-SEASON FIRES DYNAMICS IN THE PENDJARI BIOSPHERE RESERVE (BENIN, WEST AFRICA)

Elodiade Houindote[1], D. Paolo Lesse[1], Thierry D. Houehanou[2], François Muhashy Habiyaremye [3], Luc Janssens De Bisthoven[3], Marcel R.B Houinato[1]

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Fire plays a key role in the evolution of ecosystems; however, more frequent fires can have negative impacts on biodiversity and the regeneration of plant communities. This study aims to improve the management of early fires in the Pendjari Biosphere Reserve (PBR) by analyzing their spatio-temporal frequency and their effects on vegetation dynamics. Specifically, we (i) assess the state of knowledge on vegetation fires in Africa; (ii) examine the spatio-temporal frequency of management fires in the PBR and local perceptions of their effects on vegetation in surrounding communities; (iii) analyze the dynamics of vegetation responses to different fire types in the PBR using MODIS-NDVI data from 2001 to 2023; (iv) determine the impact of early fires on the soil seed bank potential in the PBR; and (v) evaluate changes in plant communities under early fire regimes in the PBR. A systematic review revealed limited research addressing the impacts of frequent fires in West Africa. To address this gap, a literature review (1960–2022) and satellite fire data from NASA FIRMS were used. Statistical and spatial analyses were conducted using Excel, QGIS, and R. Analysis of MODIS imagery (MODIS Collection 6 Burned Area product – MCD64A1) from 2001 to 2019 indicated that approximately 61.76% of the PBR's area is affected annually by early fires, with fire density ranging from 0.03 to 9.98 fires/km². Local perceptions point to a decline in key woody species such as *Parkia biglobosa* and *Vitellaria paradoxa*, attributed to the intensification of fires. The analysis of vegetation dynamics using the Normalized Difference Vegetation Index (NDVI) from 2001 to 2023, combined with the Autoregressive Integrated Moving Average (ARIMA) model, forecasts a gradual decline in dense vegetation by 2050. Furthermore, the study of the soil seed bank revealed a dominance of Poaceae and therophytes, while the regeneration of woody species remains limited. Between 2017 and 2022, floristic surveys confirmed a shift from dense to open vegetation formations, along with a significant reduction in the abundance of several herbaceous and woody species. These results highlight the urgent need for adaptive fire management strategies, particularly through the implementation of rotational fire regimes, to mitigate negative impacts on biodiversity and enhance ecosystem resilience in the face of climate change and human pressures.

PLATFORM PRESENTATION: STEM FALL AS A RELIABLE INDICATOR OF BACK FIRE SPREAD IN GRASSLAND

Matthew Danckwerts[1,2], Guy Midgley[1], Heath Beckett[1]

[1]Stellenbosch University, Stellebosch, South Africa. [2]MJ Danckwerts Consulting (Pty) Ltd., Adelaide, South Africa

Post-hoc physical indicators of wildfire pattern and spread (fire pattern indicators) are used by experts to determine origin, spread, and behaviour of fires in forensic wildland fire investigations, often conducted in contemplation of litigation. These indicators also have the potential to be used by researchers and practitioners as simple, cost-effective field indicators. The fields of fire forensics are under-developed for wildfire systems and is largely anecdotal, however, there has been increased research interest of late, with several peer reviewed studies recently

published. This has been driven by a growing need for the development of a reliable scientifically and evidence-based practice. The presence of unburnt undercut grass stems (usually flowering culms) lying on burnt ground (stem fall) is one such fire pattern indicator (FPI), which requires empirical validation. Undercutting refers to the process where flowering culms of grasses are undercut by a back fire and blown back by the wind (or gravity in the case of a slope) to fall into the already burnt area, where they remain unburnt. As a back fire progresses, the flames lean over the burnt ground, preheating the fuel by radiation only, with no upward convective heat transfer. The flames will first ignite the grass tussocks in its path at, or near the base, collapsing the flowering culms. Culms that fall ahead of, or adjacent to the flame front (*i.e.,* on unburnt ground) are burned, while undercut culms that are blown, or fall behind the flame front, into the already burnt fire scar, often remain unburnt, and point in the approximate direction the fire approached from. The validity and reliability of this indicator was investigated across 141 monitoring plots (10 × 10m) within 7 landscape-scale prescribed fires in Eastern Cape mesic montane grassland. These plots were distributed across seven prescribed burn sites such that heading, backing and flanking fire spread types were equally (roughly) represented, amongst the plots. For each plot, fire spread type (head, back, flank) was directly observed, while the number and orientation of unburnt culms lying on burnt ground was recorded post-fire. The distribution of unburnt undercut culm data was found to be exponentially distributed and positively skewed. Statistical analysis (Wilcoxon rank sum) revealed significant differences in culm densities across fire spread types ($P<0.001$), with unburnt culms present in 86.4% of back fire plots, 40% of flank fire plots, and only one instance out of 52 head fire plots (<2%). These findings indicate that undercutting of grass culms (stem fall) is an almost unequivocal diagnostic feature of back fires in grassland, with strong potential for use as an indicator of back fire activity in fire research and forensic investigations. Importantly, however, the absence of stem fall should not be used as definitive evidence of head fire passage, as culms may not have been present in the grass sward prior to burning. This study represents an important step toward the validation of wildland fire pattern indicators (FPI's) and the establishment of a reliable, empirical forensic science for wildfire investigations.

PLATFORM PRESENTATION: THE IMPACT OF MICROHABITAT VARIABILITY ON THE DEMOGRAPHIC PARAMETERS OF *PROTEA ROUPELLIAE* IN THE SOUTHERN DRAKENSBERG

Londiwe Gule

South African Environmental Observation Network, Pietermaritzburg, South Africa

In the high-altitude grasslands of the southern Maloti Drakensberg, *Protea roupelliae* faces threats from changing fire regimes, which are increasingly influenced by global climate change. The recent severe fire events appear to represent an increasing trend, threatening the long-term survival of this species. This study addresses two critical questions: Are *Proteas* surviving current fire regimes? And will they survive into the future? Drawing on a unique long-term historical dataset established in 1979, this research explores the demographic trends of *P. roupelliae* in response to fire and microhabitat variability. We make two predictions: (1) individuals in rocky microhabitats experience reduced fire damage and thus higher survival rates, particularly among juveniles; and (2) increased fire intensity over time, exacerbated by climatic changes, has led to declining population resilience in open grassland settings. The study will use historical and recent demographic data, paired with fire history and climatic datasets, to evaluate fire impact across life stages and environmental gradients. Findings from this research will highlight the importance of rocky refugia for survival and regeneration, suggesting that microhabitat variability plays a protective role. *P. roupelliae*, as emphasised by other local studies, contributes significantly to ecosystem structure and biodiversity in montane grasslands. Understanding its fire response is crucial for conservation planning, ecosystem management, and resilience forecasting under global change. This study contributes a valuable long-term dataset to the field of fire ecology and underscores the urgent need for adaptive fire management strategies in high-altitude African grasslands.

PLATFORM PRESENTATION: BURNT BUT NOT BROKEN: POST-FIRE RECOVERY OF KALAHARI GRASSES AND IMPLICATIONS FOR FIRE MANAGEMENT

Bridgette Mc Millan[1], *Michelle Greve*[2], *Susanne Vetter*[1]

[1]Rhodes University, Makhanda, South Africa. [2]University of Pretoria, Pretoria, South Africa

Fire is a key ecological process in savanna systems, yet its impact on the recovery of many grass species remains understudied in arid savannas. This study investigated the recovery dynamics of dominant Kalahari grass species following a fire; with the aims of assessing 1) how fire affects recovery of the structure and biomass of different Kalahari grass species, and 2) to determine whether fire causes a shift in community composition. We hypothesised that fire will reduce total biomass, and that the recovery rates would vary among the grass species, with some exhibiting fire-adapted traits. We surveyed nine fire scars (from fires that occurred from 2021-2024), each with 6 paired, burned and unburned 30 metre X-shaped transects (54 total). The grass species were sampled in 1m2 quadrats, measuring biomass, height, crown circumference, and herbivory levels. Linear mixed-effects models (LMMs) were used to test the species-specific response to fire. The community composition on and off the fire scars were analysed by Non-metric Multidimensional Scaling (NMDS)and a Distance-based Redundancy Analysis (db-RDA). The total grass biomass in the burned plots showed signs of recovery to levels comparable to the unburned plots by 24-36 months post-fire. Results suggest that this pattern varied across species, with some showing slower or even incomplete recovery. Fire facilitated the growth of grass species like *Centropodia glauca*, and *Eragrostis pallens* (14%, and 6% biomass increase per month, respectively), while it had no effect on the growth of other species like *Schmidtia kalahariensis*, and *Aristida congesta*. The NMDS revealed that there were some compositional shifts between the burnt and unburnt transects, with partial recovery over time. This suggests that while the biomass returns quickly, the structural traits and species composition may lag. The db_RDA revealed that the key drivers of species composition was herbivory, the size of the area that burned, and height of the vegetation. This data is part of a long-term dataset, which will be expanded by another field sampling later this year, to capture an additional year of post-fire recovery to help refine and strengthen the results. These interspecific differences in post-fire recovery underscore the need for species-specific considerations in fire management and restoration planning. By capturing the temporal growth dynamics across multiple species, this study provides crucial insights into how savanna grasses respond to fire over time, reinforcing the importance of incorporating ecological variability into conservation strategies in fire-prone landscapes.

PLATFORM PRESENTATION: THE SHIFTING MOSAIC CREATED BY PATCH-BURNING MOVED CATTLE AROUND A HETEROGENEOUS LANDSCAPE

Devan McGranahan

USDA Agricultural Research Service, Miles City MT, USA

Prescribed fire increases forage nutritive value and soil health metrics, and cattle given access to burned areas tend to gain more weight than those that graze rangeland pastures without fire. But rangeland ecosystems are characterised by inherent heterogeneity that can lead to spatially uneven grazing activity across the landscape in which extended, intense focal grazing can degrade forage resources. Grazing management offers a variety of solutions to control the spatial-temporal distribution of cattle, each requiring some outlay of materials, time, and cost. Here I analyse the spatial distribution of cattle over four years under three management schemes—rotational grazing, in which cattle are moved among fenced paddocks; continuous season-long grazing, with no other management intervention; and patch-burning, in which different, spatially-discrete patches were burned in each year—as quantified by dung pat density around repeatedly-sampled points in mixed-grass prairie in the USA Northern Great Plains. Despite being restricted to one-quarter of the pasture at a time, cattle in rotationally-grazed pastures tended to deposit more dung at points with higher nutritive value, suggesting a persistent ability to exert forage-driven spatial preferences despite the paddock system. In continuous season-long pastures, a spatial preference for grazing hotspots emerged and persisted in space and time. Conversely, in pastures with discrete, annual patch burns, grazing hotspots were ephemeral and spatially dynamic. In a novel statistical comparison of bottom-up, inherent environmental heterogeneity due to soil type differences against top-down, disturbance-driven heterogeneity imposed by patch burning, bottom-up processes alone were relatively weak drivers of forage nutritive value and spatial distribution of grazers that was overridden by the mosaic created by spatially-discrete fires. Taken

together, these results suggest that in addition to the benefits to livestock production and ecological function provided by prescribed fire in rangelands, implementing such fires in a spatially discrete manner that creates a shifting mosaic can "pull" grazing animals through the landscape, perhaps with greater effectiveness than fences can "push" them.

SHORT PRESENTATION: FUNCTIONAL TRAITS RESPONSES OF C_4 BUNCHGRASSES TO DIFFERENT FIRE RETURN INTERVALS IN SEMI-ARID SAVANNA OF SOUTH AFRICA

Siphenamhla Moss, Mthunzi Mndela

University of Fort Hare, Alice, South Africa

The study was conducted at the University of Fort Hare, Alice, and involved fire trials established in the 1980s. *Themeda triandra, Sporobolus fimbriatus, Digitaria eriantha* and *Cymbopogon plurinodis* were assessed for adaptability to varying fire frequencies. Biomass, tillering, flowering, and growth-related traits were estimated from unburned, annual, biennial and quadrennial burned plots, which were replicated twice. The results showed that varying fire frequencies significantly affected the functional traits of the studied bunchgrasses. The results suggested that the studied bunchgrass species have different strategies for coping with fire frequencies in the semi-arid savanna. *Themeda triandra* produced comparatively low biomass in all fire frequencies compared to unburned, whereas *Cymbopogon plurinodis* produced higher total biomass in the annual burned. However, *T. triandra* produced approximately two to three times as many tillers per plant and three to five times as many reproductive tillers in biennial and quadrennial burned. Similarly, *S. fimbriatus* had twice as many reproductive tillers in biennial burned areas as in unburned and annual burned areas. We concluded that bunchgrasses respond differently to frequent fires depending on the fire frequency, with biennial and quadrennial promoting vegetative and sexual regeneration through increased tillering and flowering. Understanding these responses is crucial for managing and conserving fire-prone ecosystems, as it can help identify species that are more resilient to different fire regimes. Further research is needed to explore the underlying mechanisms driving these functional trait responses and their implications for ecosystem dynamics.

SHORT PRESENTATION: SHRINKING WINDOWS: THE IMPACT OF CHANGING WEATHER PATTERNS ON FIREBREAK PREPARATION IN GRASSLAND ECOSYSTEMS

Heidi Coetzee[1], *Eric Stoch*[1,2]

[1]North West Umbrella Fire Protection Association, Potchefstroom, South Africa. [2]Stenden University, Port Alfred, South Africa

Fire plays a crucial role in maintaining the ecological balance of grassland ecosystems. The increasing unpredictability of weather patterns due to climate change is significantly reducing the window period available for prescribed burning and firebreak preparation. We explore the challenges posed by these shrinking firebreak windows and the implications for biodiversity and conservation efforts.

Prescribed burning is a widely recognized fire management tool used to reduce fuel loads, promote ecosystem health, and create strategic firebreaks to mitigate the spread of wildfires. Firebreaks serve as critical barriers to slow fire spread, protect vulnerable habitats, and provide safe zones for firefighting operations. Changing weather conditions—marked by irregular rainfall patterns, prolonged droughts, increased wind speeds, and temperature fluctuations—are constraining the number of viable days available for firebreaks. Landowners, conservationists, and fire protection associations must adapt fire management strategies to ensure the continued efficacy of prescribed burning.

The North West Province highlights tangible impacts of climatic changes on firebreak preparation. Evidence from fire protection associations and farmers suggests that the annual window for firebreak implementation is decreasing. The North West Umbrella Fire Protection Association (NWUFPA) has recorded a minimum extension of 87 days in the fire season, emphasizing the urgency of adapting fire management practices to align with emerging climatic realities.

In response to these challenges, fire management teams are incorporating advanced technologies such as artificial intelligence, predictive modelling, and satellite fire observation systems into firebreak planning. By leveraging real-time data and historical climate patterns, these innovations enhance the ability to forecast fire behaviour and optimize firebreak scheduling. Traditional knowledge and experience remain integral to decision-making, but technological advancements provide an additional layer of precision and adaptability.

Moreover, collaboration between governmental bodies, private landowners, conservationists, and local fire protection agencies is paramount. Fire protection associations are playing a key role in facilitating training programs, disseminating research, and fostering community-based fire management practices. Regulatory frameworks also need to evolve to accommodate the shifting fire season, ensuring that prescribed burning remains a viable and effective tool.

The impact of these climatic changes extends beyond fire management. Biodiversity conservation is directly affected as fire plays a role in maintaining certain ecosystems while threatening others. Species that rely on periodic fires for habitat regeneration may suffer from altered fire regimes, while increased fire intensity and frequency could lead to habitat degradation and loss. Understanding these ecological dynamics is crucial for developing conservation strategies that align with fire management efforts.

In conclusion, the decreasing number of available days for firebreak preparation necessitates a proactive and integrated approach to fire management in grassland ecosystems. By leveraging modern technology, fostering inter-agency cooperation, and adapting traditional fire management practices, it is possible to maintain biodiversity, protect ecosystems, and enhance the resilience of fire-prone landscapes in the face of climate change. Addressing these challenges requires a dynamic and multi-disciplinary approach, ensuring that conservation goals are met while mitigating the risks associated with an extended and intensified fire season.

SHORT PRESENTATION: POST-FIRE COMMUNITY COMPOSITION OF DRAKENSBERG AMATHOLE-AFROMONTANE FYNBOS (GD6): A COMPARATIVE STUDY OF GD6 BEFORE AND AFTER THE 2023 FIRES

Jubilant Vongani Sithole[1], *Andri Cornë van Aardt*[1], *Anisha Dayaram*[2,3]

[1]University of the Free State, Bloemfontein, South Africa. [2]South African National Biodiversity Institute, Pretoria, South Africa. [3]Restoration and Conservation Biology Research Group, School of Animal, Plant and Environmental Sciences, University of the Witwatersrand, Johannesberg, South Africa

Natural fire regimes are responsible for the distribution and ecological characteristics of some of the biomes of the world, such as the grassland, fynbos and savannas. Fires are a natural phenomenon in grassland and fynbos ecosystems and have an influence on the functioning and resilience of these ecosystems. However, not all fires are the same and their effect on the environment may differ based on the fire regime, which is influenced by fire frequency, fire intensity, fire type, and the seasons in which the fire occurs. This study investigates the recovery of fynbos components within the Free State grassland following a large fire event in the Golden Gate Highlands National Park (GGHNP) on October 1, 2023. The fire provided a unique opportunity to observe the regeneration of the Gd6 fynbos communities in a fire-driven ecosystem. Both the grassland and fynbos are fire driven ecosystems and fire is an important factor for the structure and composition of the vegetation. However, there is a discrepancy between when these ecosystems should burn. The regular burning of the grassland may affect the fynbos components within the grassland. There is a significant difference between the fire regimes of the fynbos (burning every three to ten years) and grassland (burning every one to four years) which might affect the fynbos elements found in the grassland. The Drakensberg Amathole-Afromontane Fynbos (Gd6) similar to the renosterveld fynbos typically experiences fire during the dry summer months, in contrasts with GGHNP where fires typically occur in the dry winter months. Renosterveld fynbos predominantly occurs on arid landscapes with clay rich fertile soil which covers the bedrock. However, the soil properties of Gd6 are unknown. The aim of this study was to determine recovery of plant communities, in the second growing season after the fire. A total of 96 sample plots that were previously surveyed in 2023 before fire were surveyed again after fire in 2025 to determine how the community composition has changed. All vascular plant species were recorded in 10 x 10m sample plots using the Braun-Blanquet cover abundance scale. Collected data were captured in VegCap and imported into JUICE where a TWINSPAN analysis was performed. The analysis resulted in two communities with five sub-communities in contrast to the four communities and three sub-communities that were found in 2023.

SESSION CHAIR: ROBYN NICOLAY

Thursday 24 July 2025, 12:55 - 13:40

PLATFORM PRESENTATION: WHAT COUNTS AS SEQUESTERING CARBON IN GRASSLANDS? A LOOK INTO THE IPCC'S METHODOLOGY FOR REPORTING CARBON REMOVAL UNDER THE UNFCCC

Lisa Matthews[1,2], Kent Buchanan[3], Mathilde Hagens[2], Ina Möller[1]

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Grasslands, along with croplands, forests, and wetlands have entered the realm of climate policy as sites of carbon sequestration. South Africa, as a party to the United Nations Framework Convention on Climate Change (UNFCCC) reports on their greenhouse gas (GHG) emissions and mitigation activities, including carbon sequestered in grasslands, in their Biennial Transparency Report. When 'counting' this carbon, parties make use of the IPCC Guidelines for National GHG Inventories. A defining feature of this guidance is the tiering of calculation methodologies for increased flexibility of countries with varying degrees of data availability: tier 1 is the simplest, tier 2 intermediate and tier 3 complex and data intensive. South Africa uses tier 1 to determine soil carbon stock changes, relying on a provided list of global default factors based on different management practices and levels of degradation of grasslands, supplemented with some tier 2 country-specific soil data. The broad category of 'grassland' collapses pasture, rangeland, eroded lands, old fields and Grassland, Fynbos, Succulent Karoo, and Nama Karoo biomes. As South Africa reports carbon sequestered in grasslands as climate mitigation this study investigates the calculation methodology to see how it determines which activities 'count'. A case study was conducted on South Africa's reporting of carbon sequestration in grasslands through a document analysis on the IPCC Guidelines for National GHG Inventories, South Africa's Biennial Transparency Report, National GHG Inventory 2000 – 2022, and other policy documents. The results show that IPCC's tier 1 method focuses on reporting changes in land use (e.g. cropland to grassland). Reporting on changes in grassland quality such as restoration of erosion require more detailed data and are not currently included. In the tier 1 method, only introducing irrigation, fertiliser and species improvement would be recognised as sequestering carbon above nominally-managed conditions. Increases in carbon due to these 'improved' management practices are based on a range of grasslands globally, but none specific to South African biomes. The default 'improvement practices' also create additional emissions through increased electricity, inputs, and livestock. In contrast to improving and restoring grasslands, the major source of carbon sequestration reported in the national inventory was due to grassland conversion into thicket and open woodland. Contributing to this conversion is in the significant challenge of widespread bush encroachment and invasive alien species. Without collecting and integrating more local data to move to a tier 2 method, 'counted' mechanisms of carbon sequestration may be limited to rangelands becoming pastures or woodier. IPCC's tier 1 calculation represents grasslands as a globally homogenous and passive carbon sink, while locally these landscapes are recognised as heterogenous and multifunctional socio-ecological systems. Any practices intended to sequester carbon should be context-specific, take into account all functions provided by country-specific landscape and align with local knowledge. We encourage grassland scientists to critically engage with carbon sequestration practices, policies, and projects and dig into the details of the underlying calculation methodologies, data sources, and assumptions to limit potential tradeoffs, and ensure alignment to sound management practices when making use of grasslands as carbon sinks.

PLATFORM PRESENTATION: SEASONAL DROUGHT VARIABILITY ASSOCIATED WITH EL NIÑO-SOUTHERN OSCILLATION (ENSO) PHASES IN SOUTH AFRICA'S SUMMER RAINFALL REGION

Tshedza Matladi[1,2], *Stephan Steyn*[2]

[1]Agricultural Research Coouncil, Pretoria, South Africa. [2]University of the Free State, Bloemfontein, South Africa

The El Niño–Southern Oscillation (ENSO) is a dominant driver of climate variability affecting rainfall and evapotranspiration across South Africa's summer rainfall region. This study investigates the seasonal relationship between ENSO phases and drought occurrence using the three-month Standardised Precipitation–Evapotranspiration Index (SPEI) at seven locations representing interior, lowveld, and coastal regions. AgERA5 reanalysis data (1979–2024) were used to compute SPEI values, while ENSO phases were classified using the Oceanic Niño Index (ONI). Chi-square tests of independence were applied to assess statistical associations between ENSO phases and categorical drought classes. Results indicate that ENSO–drought linkages vary by season and region, with significant associations ($p < 0.05$) observed during midsummer (December–February), particularly in interior sites such as Bloemfontein and in lowveld areas including Mbombela. Spring and autumn exhibited weaker or non-significant relationships, underscoring the seasonal specificity of ENSO impacts. Coastal locations such as East London and Gqeberha showed minimal drought response linked to ENSO phases. Visual summaries using pie charts revealed that El Niño phases were associated with increased frequency of dry season categories, while La Niña phases corresponded with wetter conditions. These findings demonstrate that the three-month SPEI is effective for detecting seasonal drought patterns associated with ENSO, with relevance for early warning systems, climate-informed agricultural planning, and drought preparedness across agroclimatically diverse zones of South Africa.

PLATFORM PRESENTATION: DEVELOPMENT AND VALIDATION OF A REANALYSIS-BASED CLIMATE DATABASE FOR SOUTHERN AFRICA

Stephan Steyn[1], *Tshedza Matladi*[1,2]

[1]Department of Soil, Crop and Climate Sciences, University of the Free State (UFS), Bloemfontein, South Africa. [2]Agricultural Research Council, Institute for Soil, Climate and Water, Pretoria, South Africa

Reliable, long-term climate data are essential for detecting regional climate change, assessing climate variability, and supporting applications such as evaluating potential changes in fire danger, rangeland production, and biome shifts. The reliability of climate analyses in southern Africa is often constrained by issues affecting the quality of station-based records, including instrument failure, station relocations, and incomplete metadata. These challenges are compounded by the sparse distribution of stations in many regions, which limits the effectiveness of quality control procedures such as gap-filling and spatial interpolation. In response, a new climate database was developed using AgERA5, a global reanalysis dataset tailored for agricultural and environmental applications. The database includes daily time series for key near-surface climate variables – maximum and minimum temperature (Tmax, Tmin), relative humidity (RHmax, RHmin), vapour pressure (VP), wind speed (WS), solar radiation (SR), precipitation (Pr), and reference evapotranspiration (ETo) – from 1979 to 2024, at a spatial resolution of 0.1° (~9 km), spanning all land-based grid points between 20–35°S and 15–35°E. Custom Python scripts were developed to automate data downloads from the Copernicus Climate Data Store, perform variable extraction, assign elevation using a digital elevation model, and calculate evapotranspiration using the FAO56 Penman-Monteith method. Processing was performed on the University of the Free State High-Performance Computing Cluster to manage the computational load. The climate database can be updated regularly, typically every six months or as required. A user-friendly interface assists with the identification and extraction of the nearest climate time series to a user-defined location. Validation against daily station records from eight sites across multiple climate zones showed strong agreement for Tmax, Tmin, RHmin, SR, and ETo, particularly at daily to monthly scales. Lower correspondence was observed for RHmax, WS, and Pr at a daily scale, reflecting known challenges in both observational representativity and reanalysis model performance. A spatial validation case study of an easterly low-pressure system over Botswana on 19th January 2013 demonstrated good agreement between AgERA5 outputs and remote sensing observations in terms of the distribution of temperature, precipitation, vapour pressure, and solar radiation. While reanalysis datasets remain dependent on the quality and availability of assimilated station data, the resulting climate

time series provide a valuable supplement where long, consistent station records are unavailable. This dataset offers continuously updatable, spatially detailed, and methodologically robust climate records suitable for agricultural and ecological applications across southern Africa.

SESSION CHAIR: ZOE BROCKLEHURST

Thursday 24 July 2025, 14:00 - 14:45

PLATFORM PRESENTATION: THE SOCIAL-ECOLOGICAL IMPACTS OF RANGELAND CARBON CREDIT PROJECTS IN SUB-SAHARAN AFRICA

Sarah Schumann[1], *Hayley Clements*[1], *Matthew Child*[2]

[1]Centre for Sustainability Transitions, Stellenbosch University, Cape Town, South Africa. [2]Centre for Wildlife Management, University of Pretoria, Pretoria, South Africa

Rangelands, comprising natural and agricultural grassy ecosystems, cover approximately 43% of Africa, where they are keystones of biodiversity, carbon storage, and livelihoods. Globally, these ecosystems face increasing pressures, eroding ecological functioning, livelihood resilience, and the public good of carbon sequestration. Carbon markets for the mitigation of climate change, particularly through nature-based carbon credits, are seen as having the potential to incentivize sustainable land management practices that enhance carbon storage, biodiversity conservation, and rural development. Whether this potential is being realised remains understudied. This study examines the extent to which nature-based carbon projects in Sub-Saharan African rangelands contribute to biodiversity conservation and sustainable development outcomes beyond their climate mitigation objectives. To explore this, the study includes: 1) a literature review on the carbon credit mechanism in Africa; 2) a comparative analysis of the various carbon standards' requirements; 3) examination of reported social and ecological impacts from 30 verified rangeland carbon projects; and 4) an assessment of the alignment between reported impacts and contextual factors such as land-use and biome characteristics. Results indicate that most projects report positive environmental, social, and economic outcomes that extend beyond climate requirements. The most commonly reported outcomes include the restoration of degraded ecosystems, increased employment, training, and income from carbon revenues. However, a dominance of afforestation/reforestation carbon projects in Africa's rangelands show that these projects may be incongruent with biodiversity conservation outcomes as projects plant non-indigenous species or monocrop plantations. Additionally, a prevalence of projects in transformed rangelands demonstrates that the potential for nature-based carbon removals projects in intact rangelands has not yet been realised. The modest scale of registered and verified projects compared to those still under development highlights the nascent maturity and limited accessibility of appropriate nature-based carbon project types in the region. By assessing the current implementation of the market-based mechanism in Africa's rangelands, the ability of carbon credits to simultaneously achieve conservation and development outcomes may be limited at this time. Ways to enable the nature-based carbon market in Africa's rangelands are discussed and include addressing the financial and institutional barriers to appropriate, nature-based carbon projects in these social-ecological systems.

PLATFORM PRESENTATION: MODELLING SOIL ORGANIC CARBON AT MULTIPLE DEPTHS IN WOODY ENCROACHED GRASSLANDS USING INTEGRATED REMOTELY SENSED DATA

Sfundo Mthiyane[1,2], *Onisimo Mutanga*[1], *Trylee Matongera*[3], *John Odindi*[1]

[1]University of KwaZulu-Natal, Pietermaritzburg, South Africa. [2]WILDTRUST, Pietermariztburg, South Africa. [3]University of Nottingham, Nottingham, Malaysia

Woody plants encroachment into grasslands has considerable hydrological and biogeochemical consequences to grassland soils that include altering the Soil Organic Carbon (SOC) pool. Consequently, continuous SOC stock assessment and evaluation at deeper soil depths of woody encroached grasslands is essential for informed

management and monitoring of the phenomenon. Due to high litter biomass and deep root structures, woody encroached landscapes have been suggested to alter the accumulation of SOC at deeper soil layers; however, the extent at which woody plants sequester SOC within localized protected grasslands is still poorly understood. Remote sensing methods and techniques have recently been popular in SOC analysis due to better spatial and spectral data properties as well as the availability of affordable and eco-friendly data. In this regard, this study sought to quantify the accumulation of SOC at various depths (30 cm, 60 cm, and 100 cm) in a woody-encroached grassland by integrating Sentinel-1 (S1), Sentinel-2 (S2), PlanetScope (PS) satellite imagery, and topographic variables. SOC was quantified from 360 field-collected soil samples using the loss-On-Ignition (LOI) method and spatial distribution of SOC across the Bisley Nature Reserve modelled by employing the Random Forest (RF) algorithm. The study's results demonstrate that the integration of topographic variables, Synthetic Aperture Radar (SAR), and PlanetScope data effectively modelled SOC stocks at all investigated soil depths, with a high R^2 values of 0.79 and RMSE of 0.254 t/ha. Interestingly, SOC stocks were higher at 30 cm compared to 60 cm and 100 cm depths. The horizontal reception (VH), Slope, Topographic Weightiness Index (TWI), Band 11 and vertical reception (VV) were optimal predictors of SOC in woody encroached landscapes. These results highlight the significance of integrating RF model with spectral data and topographic variables for accurate SOC modelling in woody encroached ecosystems. The findings of this study are pivotal for developing a cost-effective and labour-efficient assessment and monitoring system for the appropriate management of SOC in woody encroached habitats.

PLATFORM PRESENTATION: SOIL CARBON FINANCE IN SAVANNA SYSTEMS - THE ROLE OF NGO'S

Andrew Whitley, Zoe Brocklehurst

Wildlands, Pietermaritzburg, South Africa

This presentation draws together the threads of the two research studies (Ms Schumann and Mr Mthiyane) as well as highlighting field work occurring in RSA to finance rangeland improvement. We outline Wildlands' field work, partnerships and preliminary findings from various assessments. We focus on economic incentives for improved management of rangelands and thus greater carbon sequestration, as well as highlight other ecological co-benefits. Our key partners (NGO's) are Meat Naturally, Conservation Outcomes, and Peace Parks Foundation and together we aim to find workable and real-life solutions to fund conservation and support the upliftment of communities in grassland systems.