Interactive Vulnerability Map for Landusers

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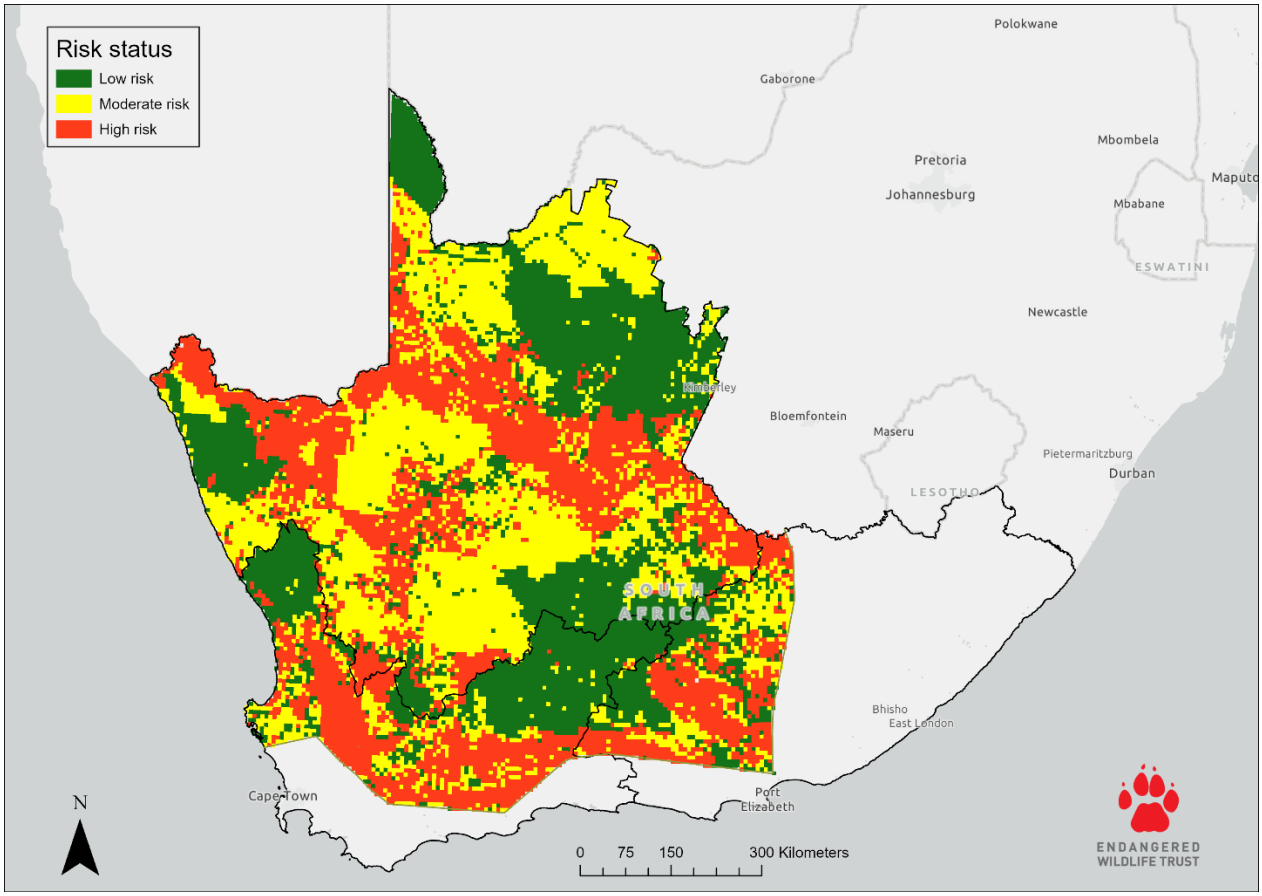

In support of sustainable land management in the Drylands.

1. Background

The vulnerability map was developed as part of the UNDP GEF5 Sustainable Land Management Project by the Karoo Forever Project which operates in the drylands. The tool aims to identify high risk areas for rain-fed Agriculture across 3 provinces. This tool enables landusers to view the risk status of their farming operation at a landscape level.

Altogether four risk factors that are most relevant to farming in these three primarily arid and semi-arid provinces are combined to provide three risk categories. Properties may vary at a local level, given the variation in environmental and topographical features at the local level, so discretion is advised when adopting strategies to reduce risk and mitigate the impacts of the risk factors.

In addition, one must bear in mind that in the Drylands, variability in rainfall is the norm – droughts are also the norm, so all planning needs to take these two factors into account. It is beneficial for landusers to familiarize themselves with the wet-dry rainfall cycles of the region and know where the "norm" within these cycles is, and where they find themselves in the cycles. The farming risk is increased in drylands by variables such as erratic rainfall, extreme climatic events (flooding/drought, heat/cold), which increase the erosion risk and the risk of damage to low lying infrastructure.

Monitoring early drought warning systems and the various rainfall prediction platforms can also add value and ensure proactive measures are taken early on as dry periods are entered, or ahead of extreme rainfall events.

2. What the layers consist of

The risk map is comprised of 4 core layers, which have been combined using the Fuzzy overlay tool in ArcGIS Pro v2.9.3. The map encompasses the Northern Cape, Western Cape and the more arid western areas of the Eastern Cape provinces of South Africa. The IUCN aridity index (0.3) was used to delineate the area included in the tool.

A. **Grazing Capacity 2018**: The National Grazing Capacity Map for South Africa developed by the Department of Agriculture, Forestry and Fisheries, is the grazing capacity of the veld expressed as number of hectares per large stock unit. A homogeneous unit of vegetation expressed as the area of land required (in hectares) to maintain a single animal unit (LSU) over an extended number of years without deterioration to vegetation or soil. It is very important to remember that the grazing capacity values indicated on the map are long term values of veld that is in a relatively **good condition**, thus can only be used as a guideline in farm planning and grazing management.

B. **Land Capability 2016**: The National Land Capability Map for South Africa developed by the Department of Agriculture, Forestry and Fisheries, is comprised 30% of soil capability, 40% climate capability and 30% terrain capability. The land capability map comprises of 15 land capability evaluation values (with the value of 1 being the lowest possible value and 15 being the highest possible value). Land capability is defined as the most intensive long-term use of land for purposes of rainfed farming determined by the interaction of climate, soil and terrain.

C. **Areas of biome stability (Climate change):** Areas of biome stability in the face of climate change, under a range of climate scenarios, according to niche modelling results using statistically downscaled future climate scenarios only. Reassess vulnerability to climate change for the biomes of South Africa according to the latest available science. Each biome has a characteristic 'climate envelope' or a range and pattern of temperature and rainfall values within which it occurs. Our understanding of climate control of vegetation types dictates that, as the climate changes, an area that is currently climatically suited to one biome might become climatically suited to another, inducing climate-related stress in components of the biome. If such changes were to occur over a long period of time (many thousands of years), and if natural habitat were predominantly intact, the ecosystems and species that make up the biome would likely be able to undergo adaptation and spatial shifts in response. However, with changes in climate projected to occur over relatively short periods (decades) and the current state of significant natural habitat loss, degradation, and fragmentation, it is more likely that disruptive change (such as population declines and even extinctions) would occur, especially in areas of future climatic unsuitability.

D. **Land degradation:** During the Land Degradation Assessment in Drylands (LADA) project, the South African National Assessment of Land Degradation and Conservation was done between 2008 and 2011. 728 Contributing specialists throughout the country contribute their knowledge and experience on land degradation and sustainable land management during a series of 34 Participatory Expert Assessment (PEA) Workshops. Variables on the state of land degradation (the extent, degree, and rate of degradation processes) were combined with the level of impact of these degradation processes on ecosystem services to provide a unique Degradation Index (DI) for each type of degradation identified by the contributing specialist for each mapping unit as defined by the LADA Land Use Map for South Africa. The DI values range from 0 to 100, for all degradation types identified. The higher the DI value, the more degraded the area are.

3. How to interpret the map & what it means for SLM and farming

Areas deemed a high risk are indicated in **red**, moderately at risk in **yellow** and low risk in **green**.

4. Suggested approaches for building resilience

Suggestions for approaches to improve resilience are made, however these are merely suggestions, landusers are advised to consult with agricultural experts to develop holistic plans to improving sustainable land management and building resilience of their farming operations (including environmental, livestock production and financial aspects).

When considering approaches to mitigation risk factors, landowners need to understand what the risk drivers in their area mores specifically on their properties are. To mitigate effectively for risks, the origin or cause of the risk needs to be identified and clearly understood. This is very much a case of treating the cause and not just the symptom. Approaches to mitigating risks and developing rangeland resilience will depend on the type of risk. For example, a driver of degradation may be drought, but the cause (direct pressure) could be poor management/overgrazing.

There are factors that play a role in risk levels not included in this tool. Importantly, due to its semi-arid climate and the predictions for climate change, the Northern Cape is generally considered to be a high-risk region for agriculture. However, the southwest of the region, and those riverine areas dominated by *Prosopis* (not included in this tool) appear to be considerably more at risk. Landowners should consider actively removing infestations of *Prosopis* and other riverine-dominating alien invasive species, where possible. This would be in addition to other measures such as e.g., diversifying their income, making use of environmentally sustainable farming techniques.

The one factor everyone has control over is their management approach. How aspects of the farming business are managed, what aspects are managed and when management measures are implemented are entirely up to the land user. A well-thought-out management plan that informs an annual plan of operations is one of the most formidable tools in ensuring that any farming operation remains viable. The management plan should be based on clear goals and objectives, and ideally take an adaptive approach to managing the environmental, production, financial and social aspects of any farming operation. If the management plan must be a written plan that is reviewed periodically so that lessons learned can be incorporated into practice. The management plan goes hand in hand with the second most formidable tool, namely a good record keeping system. Both tools inform farming efficiency, which is key to ensuring the long-term viability of the farming operation while managing resources sustainably.

Some approaches to consider helping build rangeland resilience and reduce the impact of risk factors in the drylands
Click here National Norm to see the National Grazing Capacity Norm for your region.
Have the grazing capacity of your farm assessed to determine if your property falls within the recommended National Norm of the area. Grazing capacity varies from farm to farm and even from camp to camp, depending on variables such as topography and veld condition. It is therefore very valuable to have your veld assessed by an expert.
Avoid crisis management by adapting livestock numbers timeously according to fodder availability. Adjust stocking rates proactively – before fodder runs out, and not reactively, after fodder has run out. The grazing capacity of veld is dynamic and will vary between seasons and during periods of above average and below average rainfall.
All herbivores including game, horses and donkeys **must be included when determining your stocking rate**. If this is not done, you will likely exceed the carrying capacity for your farm as these extra animals have a big impact on the availability of fodder in the veld. The *total* number of animals should not exceed the recommended grazing capacity.
Stock the farm at below the recommended grazing capacity (80%) so that veld can be managed conservatively, and reserve camps can be maintained to feed livestock during dry periods.
Do not exceed winter (dry season) grazing capacity at any time of the year. This allows a level of grazing that at no time exceeds the actual or ecological carrying capacity of the veld. This helps ensure that both veld and livestock stay in a good condition.
Identify camps in need of special attention and manage accordingly. These may be areas suffering from unexpected events e.g., hail damage, or habitats such as wetland/water source areas, or camps that are particularly degraded.
Implement rotational grazing that allows for effective rest periods. Rest is most effective during the growing season. This will be the rainy season and will be most effective when enough rain is received at the right time in the season. Plants build up reserves and also reproduce during this time (flower and seed). Seedbank + rain + rest = seedlings and young plants.
Monitor palatable plant species to ensure that the rest periods are facilitating flowering, seed setting and recruitment of seedlings in each habitat type. If this does not happen, they won't be able to build up a seed bank and when these plants die, unpalatable species will replace them.
Restock conservatively following droughts to allow the veld to recover sufficiently before replenishing herds entirely. The plants need to replenish their reserves, develop growth points, and grow and reproduce (flower and set seed) before being put under grazing pressure.

Maintaining or improving the best possible vegetation cover is regarded as one of the most important means of buffering against highly fluctuating weather and creating resilience.
Soil can be improved by **allowing the buildup of organic material** on the ground, which leads to better water infiltration resulting in a denser plant cover, more food and less erosion.
S**elect breeds that are adapted to the environmental conditions**. What you would like to farm with, what the market requires and what the environment will dictate all need to be reconciled to ensure the sustainable utilization of resources with the most efficient and productive livestock.
Select for individual animals that prove themselves with good mothering instincts and their ability to raise lambs. There is no room for animals that do not produce at optimum levels.
Develop a written management plan on which to base your long-term goals and from which you can develop your annual plan of operations. This will help guide your activities and ensure that you plan for extreme events such as droughts.
Maintain good record keeping systems (financial, livestock etc.). Poor record keeping will not help identify where the production system is inefficient. Inefficiency can lead to bankruptcy in today's harsh farming environment.
It is highly recommended to **have a production audit carried out** with an expert to ensure that your production system is as efficient as it can possibly be. Work with or help set up a study group so that you can compare your production to the regional norm and compete against yourself to continually find ways to improve your farming operation.
Diversify income streams within but also outside the agricultural sector to reduce your dependency on the natural resources. Explore opportunities to diversify your income, such as tourism, including agrotourism, eco-tourism or adventure tourism in your region (see diversification wheel).
Remember that r**ealistic expectations and planning** are key to sustainable land management and reduce the pressure during times of reduced income/increase expenditure.
Definitions
Veld condition is the condition of the vegetation in relation to certain characteristics such as the species composition, cover, productivity, palatability and nutritional value.
Grazing capacity is the ability of a specific piece of veld to produce food, therefore the number of animals a farmers can keep in a camp or on the farm, without deterioration of natural resources (soil, plants etc.). Grazing capacity depends on the condition of the veld. Remember that offspring must also be taking into account when determining stocking rate.
Stocking rate is the number of animals that a farmer can keep for a specific period on a certain area of the veld (camp/farm).
Grazing capacity is how many animals you can keep on the farm. **Stocking rate** is how many animals you are really keeping on the farm at any point in time.

5. Resources

There are a wide range of resources and excellent sources of information, available both in hardcopy and on digital platforms. Below are just some of the resources that will add value to landusers in the process of improving their management approaches. Many of these were also used as reference material for the suggested approaches to mitigation measures.

Some of the resources available to landusers that provide valuable information that can be used in their planning processes		
Agri SA	https://agrisa.co.za/	A federation of agricultural organisations in South Africa
Caring for Natural Rangelands	Coetzee, K.	University of KwaZulu-Natal Press ISBN 1-86914-071-0

Cape Farm Mapper	Cape Farm Mapper: https://gis.elsenburg.com/apps/cfm/	Western Cape Department of Agriculture
Smart Drought Management for Livestock Farmers.	Du Pisani, L. 2019	Wilpro Printers ISBN 978-0-9947174-6-7
Elsenburg Agricultural Institute	www.elsenburg.com	Western Cape Department of Agriculture
Karoo Veld: Ecology and Management	Esler, KJ, Milton SJ & Dean WRJ. 2006.	Comprehensive information on all aspects of Karoo ecology and management. Briza publications, Arcadia. ISBN 1 875093 55 9
Endangered Wildlife Trust	EWT Resources	An NGO focussed on conserving threatened species and ecosystems in southern and East Africa.
International Agricultural Academy for Africa	https://i3a.co.za/	Offer online accredited training opportunities in a range of agricultural disciplines.
Karoo Forever: Sustainable Land Management resources	https://karooforever.org.za/en/	Website maintained by the Endangered Wildlife Trust - Drylands Conservation Programme
National Wool Growers Association	www.nwga.co.za/	Information on production technology to assist with the promotion of sustainable and profitable wooled sheep farming.
Red Meat Producers Organisation (RPO)	https://rpo.co.za/	An independent producers organisation that promotes the sustainability and the profitability of the red meat industry in South Africa.
Infopak: Basic guidelines to Veld Management - Central Karoo.	infopak	Compiled by Nelmarie Saayman, Directorate: Plant Sciences Elsenburg