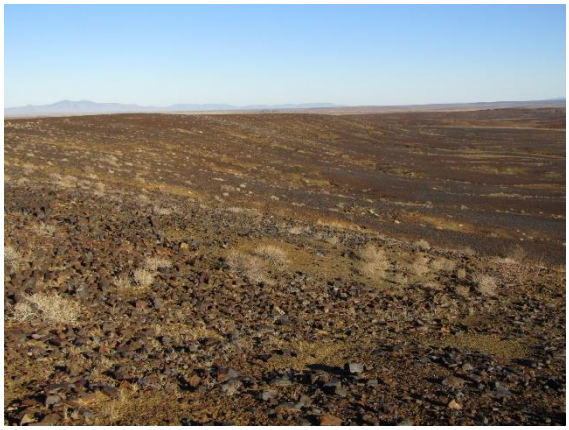
The Tankwa Karoo to Cederberg Wilderness Corridor

Ecological Management Guidelines

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Contents

Acronyms

CC	Carrying Capacity
CWA	Cederberg Wilderness Area
GCBC	Greater Cederberg Biodiversity Corridor
ha	hectare
LSU	Large Stock Unit
PE	Protected Environment
SSU	Small Stock Unit
TKNP	Tankwa Karoo National Park

1. Introduction

Tankwa Karoo to Cederberg Wilderness Corridor:

The objective of the corridor is to develop a physical linkage between the Tankwa Karoo National Park and the Cederberg Wilderness Area in partnership with conservation agencies, NGOs and landowners. The focus of the corridor is on maintaining and restoring landscape patterns and ecological processes while recognising and respecting the importance of historic as well as present cultural, social and economic drivers in the region.

The corridor linking the Tankwa Karoo National Park (TKNP) to the Cedarberg Wilderness Area (CWA) forms one element in a larger landscape conservation initiative – the Greater Cederberg Biodiversity Corridor (GCBC). The GCBC, a partnership between Cape Nature, SANParks, Wilderness Foundation Africa and World Wide Fund for Nature, seeks to introduce rural communities and landowners in the unique and diverse region to sustainable forms of land and natural resource use.

The objective of developing an ecological corridor linking the TKNP and the CWA is also aligned with the national imperative of establishing and strengthening ecological connectivity between protected areas (DEA 2016). The purpose of corridors of ecological connectivity is to provide a conservation compatible link between protected areas along which local scale ecological processes can occur. Through enabling processes such as migration, gene flow, seasonal movement in response to rain or temperature or in relation to the availability of grazing, it is hoped that over time the corridors will contribute to local level climate change adaptation and that this will contribute to the survival of a range of indigenous species. To achieve these conservation objectives, all land in the TKNP-CWA corridor has been proclaimed with the status of Protected Environment (PE) under NEM:PA; the Protected Areas Act (57 of 2003) as amended.

Beyond conservation objectives, it is envisaged that the Tankwa-Karoo to Cederberg Wilderness Corridor will simultaneously recognise historic and current cultural, social and economic drivers in the region. To this end the success of the initiative relies on the integrity of the partnerships that are formed with landowners, community leaders, municipalities, national and provincial government departments, non-governmental organisations and interested individuals and stakeholders.

2. Background

The Tankwa-Karoo to Cederberg Wilderness corridor is located south and east of Namaqualand in the Succulent Karoo (Figure 1.), a region which is globally recognised for its plant, reptile and insect diversity and endemism (Driver *et al.*, 2003). Patterns of biodiversity in Namaqualand are driven by physical (primarily geology, soil and rainfall quantity and seasonality) and biological (adaptive radiation and tolerance to herbivory) factors and has resulted in a high turnover in species composition across the landscape (see Desmet 2007).

The diverse flora of the region has been exposed for millennia to the activities of the nomadic Khoisan peoples and it is only in the last 250 years that the vegetation has been used extensively by farmers of European origin (Hoffman and Rohde 2007). Indigenous herders as well as European farmers introduced new species (sheep and cattle) to the area and have altered the patterns (nature, intensity and duration) of grazing and browsing pressure on indigenous plants[1].

No records exist of the composition and structure of the vegetation that existed on the land in the Tankwa-Karoo to Cederberg corridor prior to its exposure to contemporary farming methods *i.e*., what it looked like a three to four hundred years ago, or of the nature of the vegetation dynamics. It is thus not clear how the current vegetation differs today from how it was prior to the introduction of modern land management. This insight led John Acocks, in the early 1950s, to comment that "the role of heavy herbivory in the 19th and early 20th centuries needs to be evaluated".

In an attempt to collate and consolidate the collective insights of current expertise on the matter, perspectives of selected individuals[2] were derived from a field trip (1 day) to the area and workshop (1 day) in September 2020.

1. Ecological Perspectives

The geology of the western corridor is dominated by quartzites and supports the Swartruggens Quartzite Fynbos, and Swartruggens Quartzite Karoo vegetation types. They transition to mudrock and sandstone-based soils across the bulk (75%) of the corridor to the eastern end which is dominated by the Tanqua Karoo vegetation type (Figure 2). This portion of the corridor is broken by occasional dolerite outcrops and quartz patches as well as the Tanqua Wash Riviere vegetation type supporting alluvial soils, which are associated with the flow of water and which change over time as erosion and deposition of sediments takes place (Mucina & Rutherford 2006). Little is known about the spatial distribution of soils of different depths, but it is clear from casual observation that soil depth does vary.

The Tankwa-Karoo to Cederberg corridor runs largely east-west spanning approximately 80km and varies in width but is generally less than 10km wide (Figure 1). Topographically it spans a large U-shaped valley with higher altitudes in the eastern and western ends and a low-lying and gently undulating central stretch. Few climatic or rainfall records exist for the Tankwa-Karoo to Cederberg corridor although the climate of the main valley of the corridor has been described as hyper-arid.

[1] This has largely been through the introduction of fencing, the artificial provision of water, and at times supplementary fodder, as well as through systems of spatial and temporal management of animals through transhumance and/or camping. The goal in most of this management has been economic return from animal production rather than ecological considerations of the vegetation.

[2] See Annex 1.

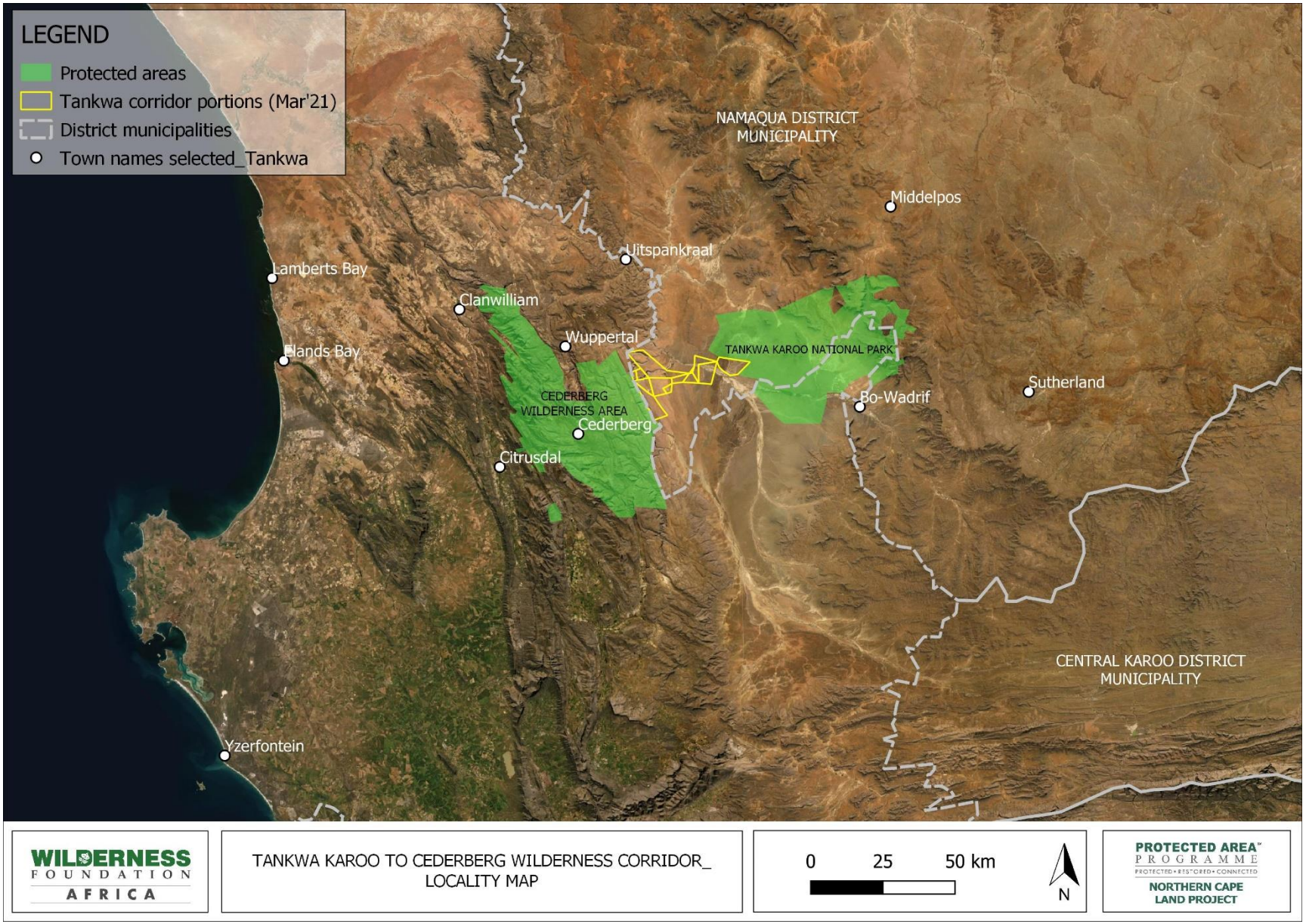

Figure 1. The Tankwa Karoo to Cederberg Wilderness Corridor in relation to the CWA and the TKNP.

On the farm Elandsvlei, along the Tankwa River which flows through the corridor from east to west, the average annual rainfall has been recorded as 72mm, but an average ranging from 100mm to 170mm was considered more appropriate to consider for the full extent of the lower lying reaches of the corridor. Rainfall increases with altitude at both ends of the corridor and the western end in the Cedarberg has higher rainfall than is found in the Roggeveld mountains to the east. A rain shadow effect appears to enhance the altitude induced rainfall gradient in the west.

In addition to being low, rainfall in the region is episodic and the growth response of the vegetation follows this episodic rhythm. For this reason, management actions (including rest) which take place within one to four months of rain have the greatest impact on the vegetation. Rain falls in both the summer (patchy short duration downpours) and the winter (softer longer duration frontal rains) and the seasonality of rain is thought to have different ecological consequences, although this has not been well studied. Local knowledge suggests that summer rains favour the growth of grasses (annual and perennial) while winter rains favour the growth of perennial shrubs.

Temperatures in the region get hot with summertime daytime averages in the mid-30˚Cs while the mean daily minimum in July is around 5˚C. Morning frost in winter is not uncommon.

Due to the absence of baseline information[3] on the cover, composition and relative abundance of plant species in the five vegetation types found in the corridor, it is difficult to classify the current status of each of these vegetation types in the corridor. There was however consensus from the workshop that there are species missing in each of the vegetation types and it was felt that the plant cover, particularly of perennial shrubs, is reduced, in some areas substantially. To this extent it is fair to say that each of the vegetation types is to some extent degraded. For this reason, a key feature of future management of the vegetation of the corridor will be to restore the veld where possible and to monitor changes overtime in an effort to establish a new set of “baselines” or desired states.

The eight-year period from 2012 to October 2020 had below average rainfall and the landscape, particularly the Tanqua Karoo vegetation type, had very sparse cover (<1%) and most visible plants were ephemerals or annuals. The other vegetation types had better cover (10 to 40%), but there was consensus that all vegetation types required considerable “rest” from large mammal herbivory which was largely agreed to be the primary cause of the “appearance of degradation”. The duration of the rest from large mammal herbivory was not discussed in detail as it would depend on many factors.

Large mammal (mainly sheep, with some cattle) ranching is the primary land use that has taken place over the past century in the Tankwa-Karoo to Cederberg corridor. These farming practices were seen as the driving cause of loss of species, especially perennial plants, loss of species abundance and loss of plant cover. It is uncertain how ranching was managed in the first half of the 20th century but by the mid-twentieth century a transhumance system had

[3] *I.e.,* knowledge of the vegetation from the pre-modern farming period.

been implemented where livestock were moved off the land for a few months each year (August to October) to reduce the effects of herbivory on the vegetation. As more and more people occupied the land, and there was less land for each person, the system began to break down. The result was that by the 1970s there was limited transhumance, and most people were simply using a five or six camp system and resting one camp for 12 months in a cycle. None-the-less, it was apparent to most farmers that even at 70% of the officially recommended stocking rate[4], the land was not recovering from any losses and indeed may have been continuing to degrade.

One insight into the perceived degradation was that farmers tended to use the condition of the animals, rather than the condition of the vegetation, as indicators for their management. In the eyes of local farmers, the land, in the current cadastral configurations, is no longer commercially viable from a stock farming perspective without providing supplementary feed or additional grazing. Those living close to the river are able to grow their own crops for this purpose, or to use the buiteveld[5] but in the absence of additional grazing, workshop participants suggested that a maximum of 50%, and preferably less, of the officially recommended stocking rate should be applied to the land. If possible, complete rest for a few rainfall seasons was suggested as being the best way to promote the recovery of the veld.

Because rain is such a strong driver of the dynamics of the vegetation of the Tankwa-Karoo to Cederberg corridor, discussion around the appropriate time to measure vegetation status converged on a period of 2 to 6 months following rain.

2. Status of the vegetation types in the corridor

The vegetation of the corridor (Figure 2) has been characterised as indicated in Table 1.

Table 1. *Five vegetation types identified in the corridor (Code refers to Mucina and Rutherfords (2006) vegetation types)*.

Name	Code	Area & (% of corridor)	Conservation status
Tanqua Wash Riviere	AZi 7	1,289ha (6%)	Least concern, 13% conserved
Swartruggens Quartzite Fynbos	FFq 2	49ha (0.2%)	Least concern, 4% conserved
Swartruggens Quartzite Karoo	SKv 2	10,270ha (45.6%)	Least concern, 5% conserved
Agter-Sederberg Shrubland	SKv 3	44ha (0.2%)	Least concern, “small patch” conserved
Tanqua Karoo	SKv 5	10,651ha (48%)	Least concern, 10% conserved

[4] Recommended by the Department of Agriculture.
[5] Buiteveld is commonly veld that is not normally used to support livestock but can serve to tide the farmer through a few months when required.

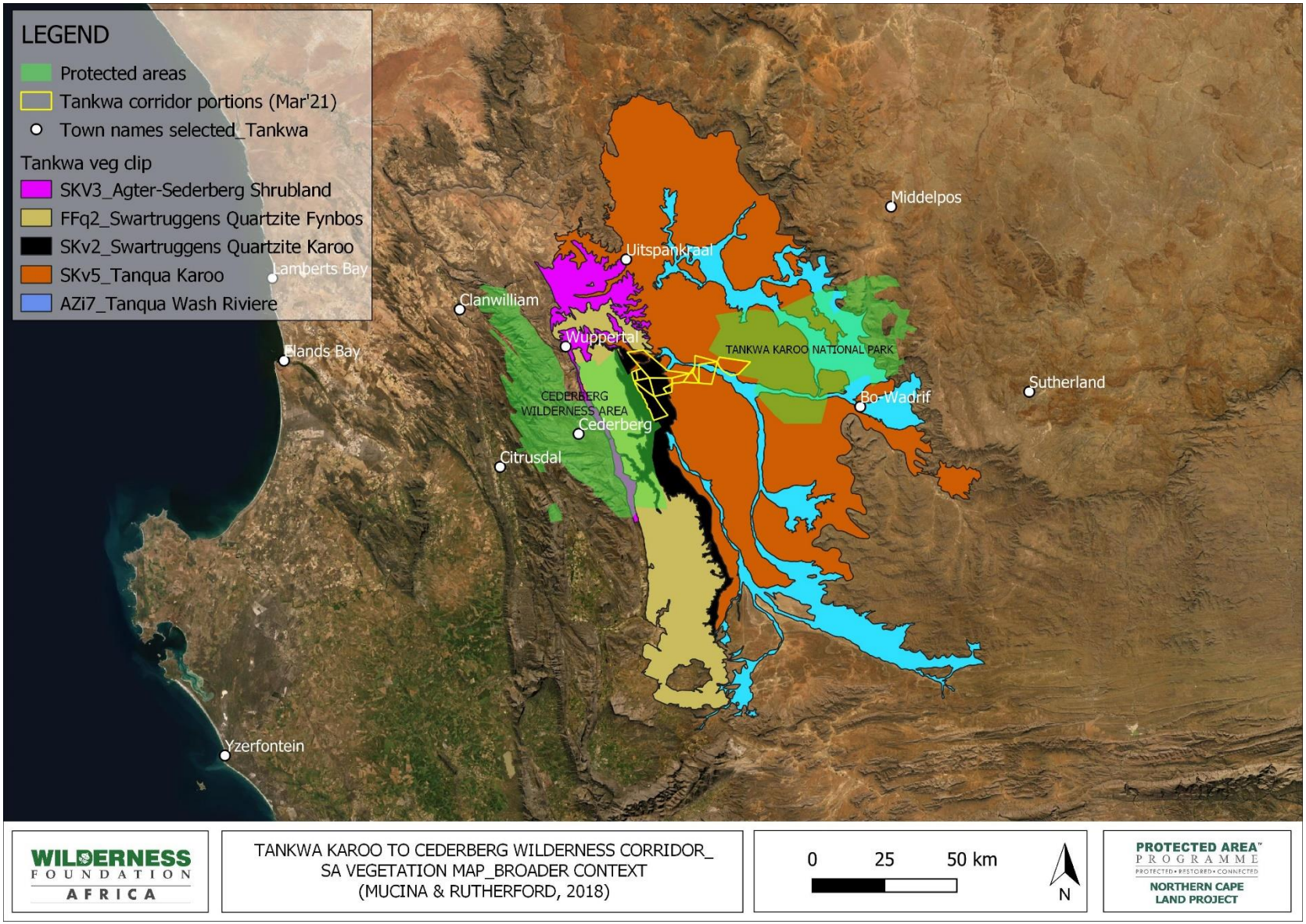

Figure 2. Vegetation map of the larger region of the Tankwa Karoo to Cederberg Wilderness Corridor.

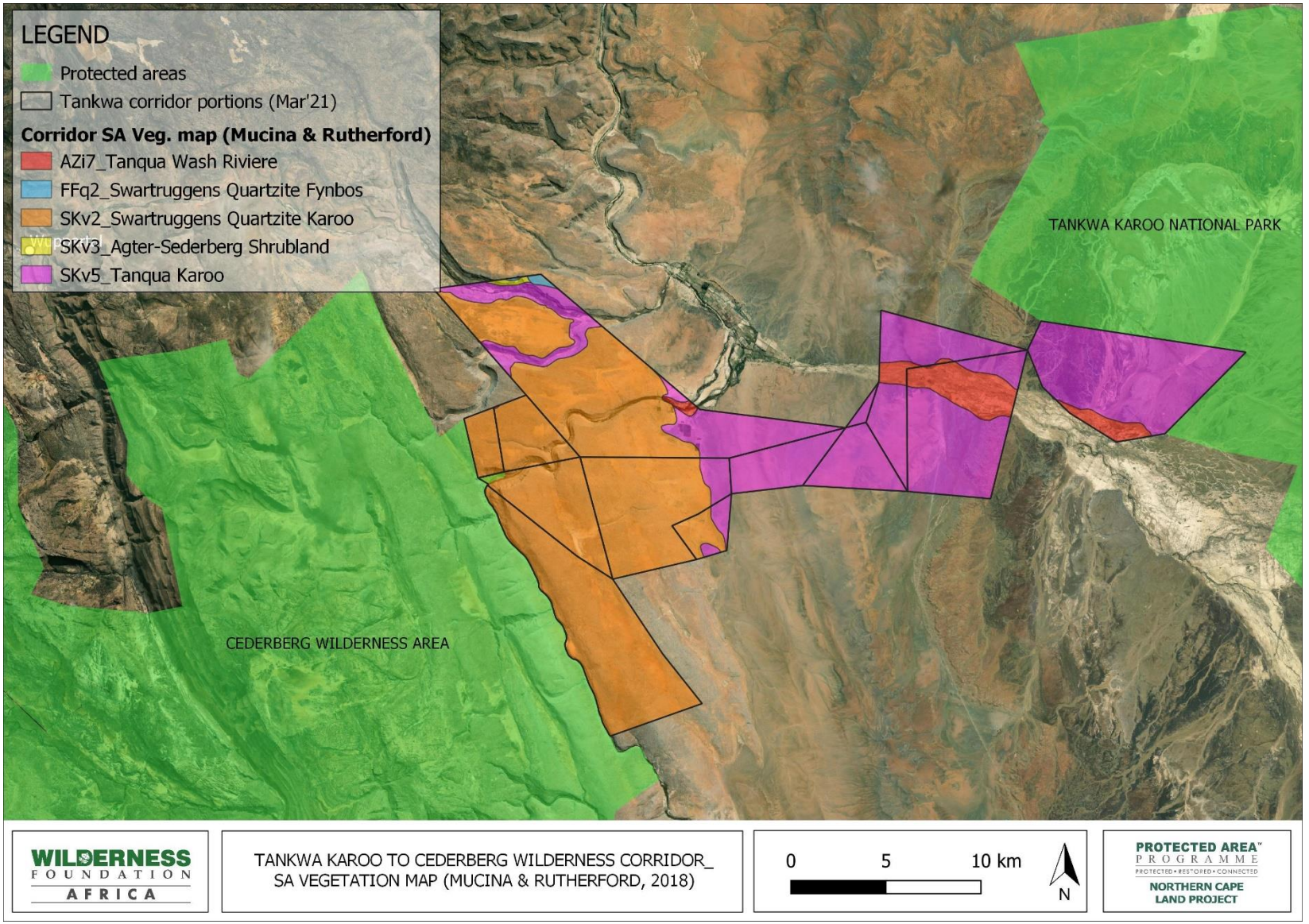

Figure 3. Detailed distribution of the five vegetation types in the Tankwa Karoo to Cederberg Wilderness Corridor.

The vegetation on the individual properties that collectively form the Tankwa-Karoo to Cederberg corridor has not been described or mapped in detail which means that this document relies on general summarised descriptions for the status of the vegetation types as a whole and use has been made of Mucina and Rutherford (2006) which should be referred to for additional detail.

Tanqua Wash Riviere (AZi 7)

The Tanqua Wash Riviere is an alluvial vegetation type (Mucina & Rutherford 2006) which implies that it is associated with the flow of water and changes over time as erosion and deposition of more nutrient rich sediments takes place. Alluvia tend to support habitat complexes resulting from the interplay of rates of hydration, flow rates, sediment loads, water chemistry, nutrient content, soil texture. It has been demonstrated that the vegetation which occurs in Alluvia is primarily structured by environmental gradients found in the river channel (van Coller 2000). The diversity of alluvial habitats can be considerable.

The Tanqua Wash Riviere is found along the channel and banks of the Tanqua River, as well as some of its tributaries, and a portion of the Doring River. It is found over altitudes ranging from 300m to 1,000m although within the Tankwa-Karoo to Cederberg corridor the altitude range is substantially restricted.

The broad sheet-wash plains support sparse vegetation of various *Salsola* species and *Vachellia Karroo* which often build little phytogenic hillocks which add texture to the otherwise monotonous barren face of the landscape (Mucina & Rutherford 2006).

Important taxa are *Vachellia karroo, Galenia africana, Lyceum cinereum, Malephora luteola, Salsola arborea* and *Sarcocornia mossiana*. For additional species consult Mucina & Rutherford (2006).

Swartruggens Quartzite Fynbos (FFq 2)

Found west of the Cedarberg, on the high plateau south of the Tra-Traberge, Swartruggens Quartzite Fynbos is generally found above 1,000m. It consists of a medium dense and moderately tall restiod and ericoid shrubland with open tall proteoid shrubs. Found on quartzite derived sands this diverse Fynbos is largely devoid of grass. As the rainfall declines (from approx 600mm to approx. 250mm) down slope, the Fynbos is replaced by karoo shrublands and succulent shrublands become dominant (see Swartruggens Quartzite Karoo below). It is a species rich vegetation, with many important taxa (Mucina & Rutherford 2006).

Swartruggens Quartzite Karoo (SKv 2)

Generally found between 300m and 1,000m, this vegetation type is found in the eastern portions of the Swartruggens bordering on the Tanqua Basin. It is a hilly landscape dissected by valleys with steep slopes with a winter rainfall regime. Total annual rainfall averages in the range of 200mm. The soils are largely quartzitic sandstones which support Fynbos and

renosterveld elements as well as succulent shrubs. Occasional frosts are experienced. It is a vegetation with a medium density of important taxa (Mucina & Rutherford 2006).

Agter-Sederberg Shrubland (SKv 3)

Found on the Tra-Traberge to the east of Wupperthal, the steep slopes and incised valleys support a mix of succulent and non-succulent shrubs on dark siltstones and shales. The predominantly winter rainfall is low (approx. 250mm per annum) and the temperatures are relatively cool with a mean annual temperature of around 17˚C. Frost days are rare. It is a species rich vegetation, with many important taxa (Mucina & Rutherford 2006).

Tanqua Karoo (SKv 5)

Encompassing the valleys of the Tanqua and Doring Rivers between the Cedarberg (Swartruggens) in the west, the Roggeveld mountains in the east and the higher elevation plains of the Hantam Karoo to the north, the Tanqua Karoo is mostly found at an altitude of between 300m and 450m above mean sea level. The valley floor, composed mainly of mudrock and sandstone based soils, undulates with occasional dolerite outcrops and elevated ridges, is very sparsely vegetated and following a dry spell can appear completely barren. Quartz patches can be found but are rare.

The rainfall of the Tanqua Karoo is largely concentrated in the winter (May to August) with very little rain in December and January. Mean annual precipitation ranges from 70mm to 110mm, with the rain shadow reducing precipitation to 40mm in some years. Summer days can be hot (mean maximum of 35˚C) and frosts are not uncommon during winter nights.

The Tanqua Karoo is one of the driest forms of Succulent Karoo with low succulent shrubs of taxa such as *Ruschia, Drosanthemum, Aridaria* and *Zygophyllum* being most common, while on the slopes of the outcrops and ridges medium tall *Euphorbia hamata* and *Pteronia incana* are found. Following rains annual plants such as *Gazania lichtensteinii*, *Euryops annuus* and *Ursinia nana* can be conspicuous. There is a long list of important and endemic plant species (Mucina & Rutherford 2006).

3. Guidelines for conservation management

Due to limited site-specific information, these guidelines are by necessity very general in nature. Although the ecology of the different vegetation types varies the details may not be formally known, *i.e.,* they have not been recorded in the scientific literature. They may however be known by local farmers whose experience on the land may offer valuable insights. For this reason, it is important that a manager of land in the corridor is adaptive and open to exploring new ideas. This adaptive management should however be conducted in a manner that it is clearly documented and can thus be subjected to some form of scrutiny and scientific testing.

In addition, it should be noted that although there are clear differences between the five vegetation types found in the Tankwa-Karoo to Cederberg corridor, there are also strong similarities due to the climatic drivers of the system. There is also a limited range of interventions possible for a manager to choose from, most of which revolve around the intensity (density, individual biomass), feeding preference (browser vs grazer) and timing (duration, seasonality and frequency) of exposure of the vegetation to large mammal herbivory. There is thus a high degree of overlap in the management approach to the different vegetation types. These are expanded on below.

General principles

Rest the land

Although the extent of degradation of the veld in the five vegetation types in the Tankwa-Karoo to Cederberg corridor cannot be easily quantified, it was agreed by those present that they are all to some extent degraded. It was also agreed that, with the average farm size, it is no longer commercially viable to manage the land for livestock. For this reason, it was agreed that the land needs to be managed for a number of years in a manner that aims to substantially reduce the intensity of herbivory on the vegetation. This is known as "resting the land". This can be achieved in many different ways depending on the circumstances of the property and owner.

The period of rest will depend on a number of factors. Firstly, it will depend on the pattern and quantity of future rains. As the system is episodic and to a certain extent stochastic[6], how the rains will fall are not predictable and may vary considerably, and so it is not possible to put a timeline on any period of rest. Secondly, and this particularly applies to the Tanqua Karoo and the Tanqua Wash Riviere, the period of rest will depend on the results of veld condition monitoring once the current eight-year below average rainfall period has broken. As long as there is an annual increase in perennial and palatable species and their cover, the veld should continue to be rested. This could take upwards of 20 years, but will require continual reassessment, recognising that a level of herbivory and large mammal activity is inherent in the evolutionary history of the vegetation and that permanent rest is unlikely to be favourable. In those portions of the corridor, e.g., in parts of Stonehenge, it may take considerably longer for the vegetation to recover due to limited seed banks in the soil. There is however little known about this aspect of the veld in the corridor.

Use of large mammalian herbivores

Although a PE is a category of protected area and primarily focusses on biodiversity conservation, it also accommodates sustainable use of natural resources (i.e., livestock

[6] Episodic in this context refers to the rainfall taking place over a short period of time after which it is dry. Much of the ecologically important activity (growth, setting seed, germination and establishment) in plants takes place within a few months of that rainfall. Following that, other than grazing, little changes until the next rainfall, or, if the dry period is longer than average, some of the vegetation dies.

grazing for commercial purposes). It is therefore necessary to include guidelines for sustainable grazing while simultaneously rehabilitating the veld.

Where the decision has been made to manage large herbivores on the land there are a number of guidelines that should be followed.

- Avoid stocking indigenous wildlife[7] in fenced areas (at least while restoration of the vegetation is a primary objective) as they are very difficult to manage and thus make achieving your objective more difficult. If indigenous game move through the area, that is unlikely to present a problem to the vegetation. Non-indigenous wildlife or species such as donkeys should be discouraged or kept at very low densities.
- Use the condition of the vegetation and the levels of herbivory to guide livestock stocking decisions rather than the condition of the animals. A good general guide is to, as far as is possible, avoid exposing as much veld as possible to herbivory for the first eight weeks following rains and to remove livestock once 50% of the new growth has been removed i.e., avoid herbivory of the early post rain growth and well as the complete defoliation of individual plants.
- In all vegetation types the recommended maximum livestock densities are 50 to 70% of the recommended agricultural grazing carrying capacities (Figure. 4). In the initial stages of rehabilitation, it is better to be closer to 50% and this can increase to 70% as the rehabilitation process improves the veld condition (see Table 2 below).
- Even if livestock are used in low density, they should not simply be left to roam. Rather they should be managed in a camp system designed to optimize biodiversity (vegetation restoration) goals.

Where there are no large mammals (livestock or wildlife) to manage on a property, fencing should be removed as part of efforts to increase the level of naturalness of the landscape.

Table 2. Recommended stocking rates for the three main vegetation types in the corridor.

Vegetation	Agricultural Carrying Capacity	Recommended Carrying Capacity for PE	Recommended ha/LSU for corridor PEs	Recommended ha/SSU for corridor PEs
Tanqua Wash Riviere	60	50%	120	29.3
Swartruggens Quartzite	72		144	35.1
Tanqua Karoo	110		220	53.7

[7] Indigenous wildlife are those species which would have existed in the area without human introduction. It may be useful to compile a list of indigenous large mammals for the corridor e.g., see Skead (2011).

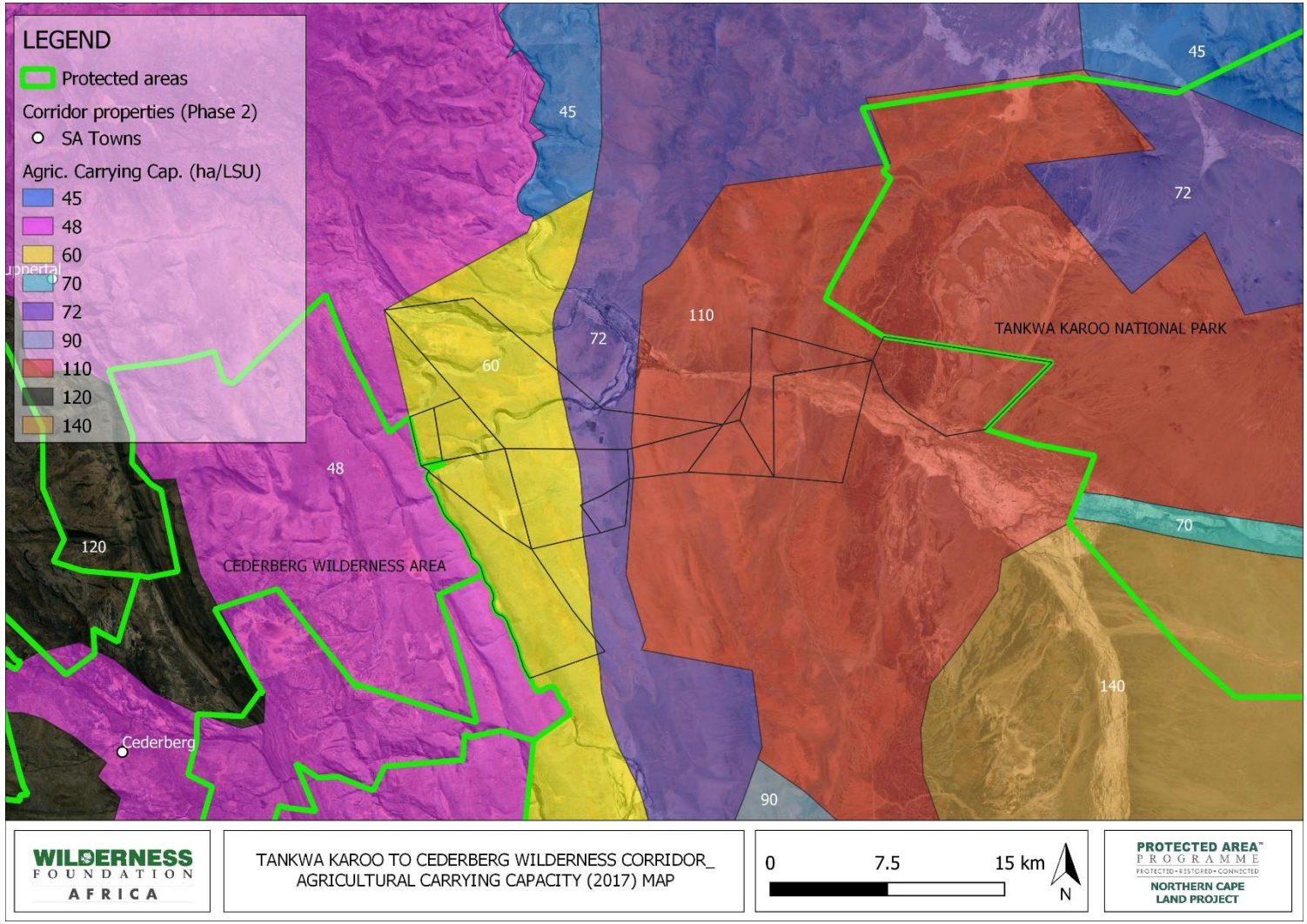

Figure 4. Agricultural carrying capacity (2017) in hectare per large stock unit for the region.

Vegetation indicators

In the early stages of restoration, focus on promoting the establishment of individual plants as they get roots into the ground and provide cover. To do this both annual and perennial plants should be the focus of animal management. After a reasonable cover has been established the focus can shift to favouring the perennial plant and allowing them to grow and root more strongly. The logic behind this is that annual plants are likely to recover more rapidly in the landscape than perennial plants.

Soil capping

The field trip indicated areas, particularly in the Tanqua Karoo vegetation where the soil has been capped. Efforts to break this capping, without damaging the lower levels of the soil (e.g., avoid ploughing) which may still contain geophytes, should be explored.

Aquatic environments

The section of the Olifants-Doring River System (ODRS) which flows through the western reaches of the corridor requires urgent conservation attention (Impson 2020). The ODRS is a high priority area (Skelton *et al.* 1995) due to the number of endemic fish species (eight) and it is thought that at least three of these are still found in the Tankwa Karoo to Cederberg Wilderness corridor. Unfortunately, no detailed surveys of the Doring, Tankwa and Tra Tra rivers were undertaken prior to the introduction of ecologically harmful non-native fishes from the early 1900s onwards including three bass species and the bluegill sunfish in the 20th century had a particularly severe impact on native fishes in the ODRS (van der Walt et al. 2016).

Detailed rehabilitation actions are presented in Impson (2020) and are not repeated here but include, restocking of water bodies with indigenous species of fish, encouraging anglers to keep and consume non-native species but to return native species and increasing awareness of the state of aquatic conservation in the area.

Infrastructure

- Although there are clear ecological benefits to removing some fencing, there is an ongoing risk of feral livestock entering the corridor from Elandsvlei and Wupperthal. Adequate measures should be taken to control this. Also, if a low number of livestock are to be kept on the land, fences are necessary to implement a camp system.
- Limit the construction of new roads as far as is possible. Old roads should be maintained to prevent erosion, or they should be decommissioned and restored to their original condition as part of the larger landscape. This should be done in a manner that encourages the re-establishment of vegetation and minimises erosion.
- Driving off road can damage the vegetation and the soil, and this serves to counter any restoration efforts. For this reason, off-road driving should be avoided if possible but at the very least kept to a minimum.

Other factors

- It is important that effort be made to control alien species. This may manifest through the need to remove and to control invasive alien plants such as the various species of *Prosopis* which is invading many arid landscapes, especially in the alluvial reaches of non-perennial waterways. Other examples of what should be included are domestic cats which, if not neutered, can hybridize with indigenous African wild cats or, if neutered, serve as an exotic and dominant predator on local fauna.
- Where walls and channels have been built to enable water from the TKNP dam to be used for irrigation purposes, these should be removed, and the landscape should be returned as far as is possible to its natural state.
- Guidelines for Karoo management need to be used with due consideration for the goals of the landowner. The conventional guidelines are designed for a productive landscape through livestock management – this will not be the objective in the corridor and thus management is likely to be different in some important ways.
- As it is not possible to farm commercially on the land in the corridor, it should not be attempted. Instead, alternative land-uses should be considered such as "farming with people" and their experiences – walking, solitude, education etc.
- For many of these land uses, the view is important and view sheds are an important consideration.

4. Monitoring

Effective land management requires that both the veld and the large mammals be monitored. A carefully designed monitoring programme should be initiated as soon as possible and should have the goal of maximizing information flow to the land manager.

Mapping

- To effectively monitor the vegetation, it is necessary to know what vegetation there is on the property and it is thus important to develop a map of the vegetation delineating the various vegetation types.
- The vegetation map needs to be overlain by relevant management infrastructure such as camp fencing, water points and roads. It is also useful to include contours and drainage lines.

Select monitoring sites

- For vegetation monitoring to be effective it must be conducted in a regular manner. If the initial design of the monitoring programme is over ambitious, field information will not be collected the programme will be of no use. Thus, it is important to make the monitoring manageable.
- Vegetation monitoring should take place at marked sites which are revisited annually at roughly the same time of year so that site specific change can be detected. The

vegetation at these sites should be largely representative of the vegetation type that it is in e.g., the sites should not all be close to water points where the levels of utilisation and trampling will be high.

- Aim for a minimum of one monitoring site per vegetation type and for the more extensive vegetation types aim for two or three sites.
- Where there is more than one site in a vegetation type, they should attempt to cover different aspects of the landscape e.g., they should be on different parts of the catena[8].
- Land which has a specific management goal (e.g., it is being rehabilitated using a specific intervention) should also be monitored by establishing a monitoring site.
- At each site two types of data should be collected. Plot data and photographic data. The plot data, details of which will be captured into the monitoring table at the end of this document, should be marked with an immovable and identifiable marker (e.g., a metal stake or large rock) which can easily be relocated each year. These plots should be 50 by 2 meters in dimension and should follow the contour rather than run up or down slope.

Make monitoring observations

- Monitoring data should be collected annually and should be collected between four and eight weeks after the fall of the first substantial summer rains.
- Using the site marker as a base, standard plots (50 by 2 m) should be marked out in a manner that allows them to be revisited annually. These plots should run along the contour as opposed to up and down the slope.
- At each monitoring site, complete the attached Veld Assessment form, including the scoring, in line with the instructions and include information from your livestock monitoring records if appropriate. In order to be able to track changes over time it is important to record all monitoring observations in a standardized format.
- It is also very useful to take photographs of each site to gain a visual record of the site[9]. A standard approach of taking four pictures, one facing each of north, south east and west from the same point and height using a standard lens and magnification (focal length) is most useful as it allows for interannual comparison. If it is possible to take the pictures at midday and in conditions of low contrast, this is helpful, but not essential. See Hall (2001a) and Hall (2001b) for further insights.
- Ensure that all pictures are collated, dated and managed for future reference;

Collaboration with the Department of Agriculture or a university might be helpful when setting up a monitoring programme.

[8] A catena is the sequence of change in soils as they change from a hilltop to valley floor. This catena is established as soils erode from the top of the slope (resulting in shallower soils) and accumulate near the base of the slope and in valley bottoms where there are generally deeper soils.

[9] See https://efotg.sc.egov.usda.gov/references/public/NM/bio61a6_PhotoDocumentation_Protocol.pdf).

Interpreting the score

- Because the scoring system for this monitoring programme is set out for a "typical karoo" farm and the circumstances in the corridor may not be typical, caution should be used in interpreting the score against the book standard. The key objective of management should be to increase the score over the "normal" or above average rainfall years. Note: if a dry period is experienced, the score in the dry years may remain static or regress, purely as a function of the absence of rain.

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KAROO VELD ASSESSMENT FORM

[*Modified from: Esler, Milton and Dean (2010)*]

SITE DESCRIPTION

Farm name _____ Assessment date _____

Area name _____ Vegetation type _____

Distance to water _____ Rainfall in past 3 mths _____mm

Can you see damage by? a) Hail _____ b) Ruspes _____ c) Locusts _____

Can you see? a) Dongas _____ b) trampled areas/paths _____ c) Bare heuweltjies _____

GRAZING RECORD

Area of camp _____ Animal breed _____ Herd size _____ Grazing period _____

VELD ASSESSMENT

(Data collected from the plot)

MONITORING CRITERION	**1**	**2**	**3**	**4**	**5**	**SCORE**
Vegetation cover (not opslag) (% of soil covered by living plant material)	0-10	11-20	21-30	31-50	>50	
Forage value (estimated % of vegetation that is palatable)	0-20	21-40	41-60	61-80	>80	
Grazing impact (% new shoot removal from palatable plants)	100	75	50	25	<5	
Indicators of disturbance (% of cover that is opslag or weeds)	100	75	50	25	<20	
Seedling palatability ratio (Ratio of palatable to unpalatable seedlings)	5:95	20:80	40:60	60:40	80:20	
Soil health (Proportion of negative to positive indicators)	All -ve	Mostly -ve	Balanced	Mostly +ve	All +ve	
> 25 = Excellent; 21-25 = Good; 16-20 = Fair; 11-15 = Poor; <11 = degraded				**Total Score**		

Species numbers and types in 50x2m transect	Trees	Bossies	Grasses	Opslag	**Total**

6. Annexures

Annexure I Field Trip, Workshop & Online Contributors

(In no particular order)

Jean-Pierre De Villiers	Landowner
Helga van der Merwe	SAEON
Nelmarie Saayman	Elsenburg, Department of Agriculture
Malebo Manyala	Northern Cape Department of Agriculture, Environmental Affairs, Rural Development and Land Reform
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Hugo Bezuidenhout	SANParks
Hennie Delport	SANParks
Giel de Kock	SANParks
Marna Herbst	SANParks
Timm Hoffman	University of Cape Town
Jan Coetzee	WWF South Africa
Katherine Forsythe	WWF South Africa
Garth Mortimer	CapeNature
Annelise le Roux	Botanist
Matthew Norval	Wilderness Foundation Africa
Kerry Purnell	Wilderness Foundation Africa
D'Reull de Beer	Wilderness Foundation Africa
Ben-Jon Dreyer	Wilderness Foundation Africa
Dave Balfour	Independent consultant

Annexure II Notes from Field Trip and Workshop

Cover and composition (diversity (linked to relative abundance) and growth form) are measures of the state of the vegetation. Not objectively sure what “ideal” would look like – i.e. a fully functioning landscape: subjectivity may be only tool. But it is clear that the full suite of plant species is not present. Clearly fully functioning depends on rainfall and soil, so that also needs to be taken into consideration. There are widely ranging soil depths in the corridor as well as rainfall gradients.

National Guidelines for the Stonehenge area suggest 10 to 12% cover based on rainfall. Estimate of current cover is <1%. (This after there has been very limited rain since 2012 – approx. 20mm / year). The workshop did not have a clear consensus of what recovery would look like, or when it should be measured, although it was suggested that 4 weeks after rain might be appropriate?

There have been no livestock animals (grazers or browsers) other than transient game on Stonehenge for 18 years.

Composition was not measured, but it looked very limited in diversity and driven by ephemerals and annuals.

This suggests a need for recovery, but an important question is “when should the measurement be taken?”

Soil depth is a local modifier of cover.

Summer rains tend to be patchy and downpours while winter rains are more of a frontal rain which is softer.

Altitude is an important correlate of rainfall, but there is also a rain shadow effect. Dramatic gradient over short distances – but no monitoring or stations to provide data.

Historically, transhumance (Roggeveld) was very important for livestock farmers, and even so the landscape has been allowed to degrade. Used to place animals in Tankwa in July / August then leave. Permanent presence farming started first along the river. Over time the movement stopped although a camp system prevailed.

Farmers have historically taken their management cues from the livestock not the vegetation, although this has shifted over time. Still not strongly cued by veg.

No real sense that the Dam in the NP has had an influence although their might have been. The Tankwa River is not perennial but planning along its banks and relying on the dam for water has had some impact where the ground has been ploughed.

The Riverine Wash veg. is impacted partially by the canalisation and partly by increased grazing. Trial rehabilitation plots could be a good idea. There is a possibility of Riverine Habitat being present in Loxton (EWT).

Much talk of the value of removing the dam wall and this would be supported by farmers – it was built for an outdated agricultural "village" idea.

Prosopis is a problem – bio control should be introduced.

On the Quartzitic vegetation (Swartruggens Quartzite Karroo) there are low numbers of palatable species, and very little of it is used for significant income generation (Buiteveld). Very nutrient poor, higher rainfall. Carrying capacity is 50 to 60% of agric. recommended.

Need guideline for its management – is it important to regulate uncontrolled grazing from Wupperthal and Elandsvlei?

Most farmers work on 70% of Dept. Agric. carrying capacity.

Camp system started in 1950s/60s.

One of 6 camps must rest for 12 months. All acknowledge that rest is important. "Veld probably needs a lifetime of rest".

Try to limit grazing to 50% of annual growth – this is a very useful heuristic (GUIDELINE).

More camps is better but depends on area. Drought has had big impact, now the area is not commercially viable anymore. But with 20,000ha might be. 110ha/LSU (6 ewes). 2-3 months in each camp.

Sense that there are more predators in the drought as fewer other resources for them. Need to sterilize domestic cats – which are pest predators – to avoid hybridisation.

Need supplementary income – farming with livestock not possible on a commercial basis.

Need new forms of land use – "Farm with people"

If stocking with game only then go for 50% of Agric. recommendations. Can't do game in camps. Cattle and sheep not the same – sheep more selective, cattle need more grass. Game less selective.

Summer rain tends to favour grass, winter rain favours shrubs.

In an episodic climate driven system can anticipate two "events" a decade and these are NB for management. i.e., few opportunities to intervene. System is "brittle". Timing of interventions is important. If there has been no rain, there is little point in intervening.

There is value in experiments – especially in the washes. Again, this is where the water is.

What are the processes we want to restore.? Measure pattern within 6 months of rain.

Fencing – need compatible land use, best to remove old fences that are redundant.

Do not drive off road – but this can be hard to manage, especially where the public road approaches the park. Use signboards and printed documentation. Cameras are a possibility but reactive rather than proactive.

Look to removing the “keerwalle” for the old river farming structures but do so in a manner that does not make matters worse.

Be aware of the sense of place – view sheds – it is a strong feature of the landscape. Be useful to do a sensitivity analysis at a site – this could include a structure or a plant or a patch.

Alternative livelihoods

Other options to grazing as a land use.

Activities that are actively beneficial to rehabilitation.

Form a local directory of expertise and potentially a forum of learning.

Need weather stations so that we know more about the actual conditions on the ground.