No threatened frogs potentially occur in the study area. As such, the untransformed habitats are rated as Low importance for reptiles of conservation concern.

5.3 Selected Invertebrate Fauna

5.3.1 Scorpions

Fourteen species of scorpion are predicted as potentially occurring at the Moonlight site (Leeming 2003, Prendini 2006, Ian Engenbrecht, pers. comm.). By excluding species considered of low probability based on initial assessment of likely habitats on the site, this total was reduced to 9 (see Table 6).

Six of the potential species (shaded grey in Table 6: *Opistacanthus asper, Hadogenes troglodytes, Opistophthalmus glabrifrons, O.* sp. aff. *glabrifrons, O kalaharicus* and *O. wahlbergi*) are of conservation concern and are included on the published list of threatened and protected species (Biodiversity Act). However all are protected due to potential threats from the pet trade, rather than from habitat destruction. *Hadogenes troglodytes, Opistophthalmus glabrifrons, O. wahlbergi, O. kalaharicus* and *Opistacanthus asper* are relatively widespread in southern Africa and substantially less vulnerable to habitat destruction, while *O.* sp. aff. *glabrifrons* is far less widespread and thus more vulnerable. The most significant potential scorpion species is thus *O.* sp. aff. *glabrifrons*, due to its limited known distribution.

Table 6. Scorpion species predicted for the Moonlight project area

Species	Probability (brackets = unlikely)	Habitat
Parabuthus granulatus	X	Kalahari sands
P. kuanyamarum	(X)	Kalahari sands
P. mossambicensis	X	Sandy / loamy soils
P. transvaalicus	X	Sandy / loamy soils
Uroplectes carinatus	X	Sandy / loamy soils
U. planimanus	X	Rocky outcrops / ridges
U. vittatus	X	On trees
U. sp. aff *triangulifer*	(X)	Clay soils
Opistacanthus asper	(X)	Large trees, especially along rivers
Hadogenes troglodytes	X	Rocky areas
Opistophthalmus glabrifrons	X	Sandy / loamy soils
O. sp. aff. *glabrifrons*	(X)	Clay soils
O. kalaharicus	(X)	Clay soils
O. wahlbergii	X	Kalahari sands
Total number*	9 (14)	

Species in bold are those confirmed during fieldwork.

Six species of scorpions were found during the field surveys (see Figure 8); these included four non-protected species, *Parabuthus mossambicensis, P. transvaalicus, Uroplectes carinatus* and *C. vittatus*, and two species protected under the Biodiversity Act, *Opistophthalmus glabrifrons* and *O. wahlbergi*.

Opistophthalmus glabrifrons occurred in all terrestrial habitat types surveyed within the study area, but was far more abundant in areas with deep red soils than in the haematite or calcrete outcrops. Only one specimen of *O. wahlbergi* was located and this was in an area with deep soils.

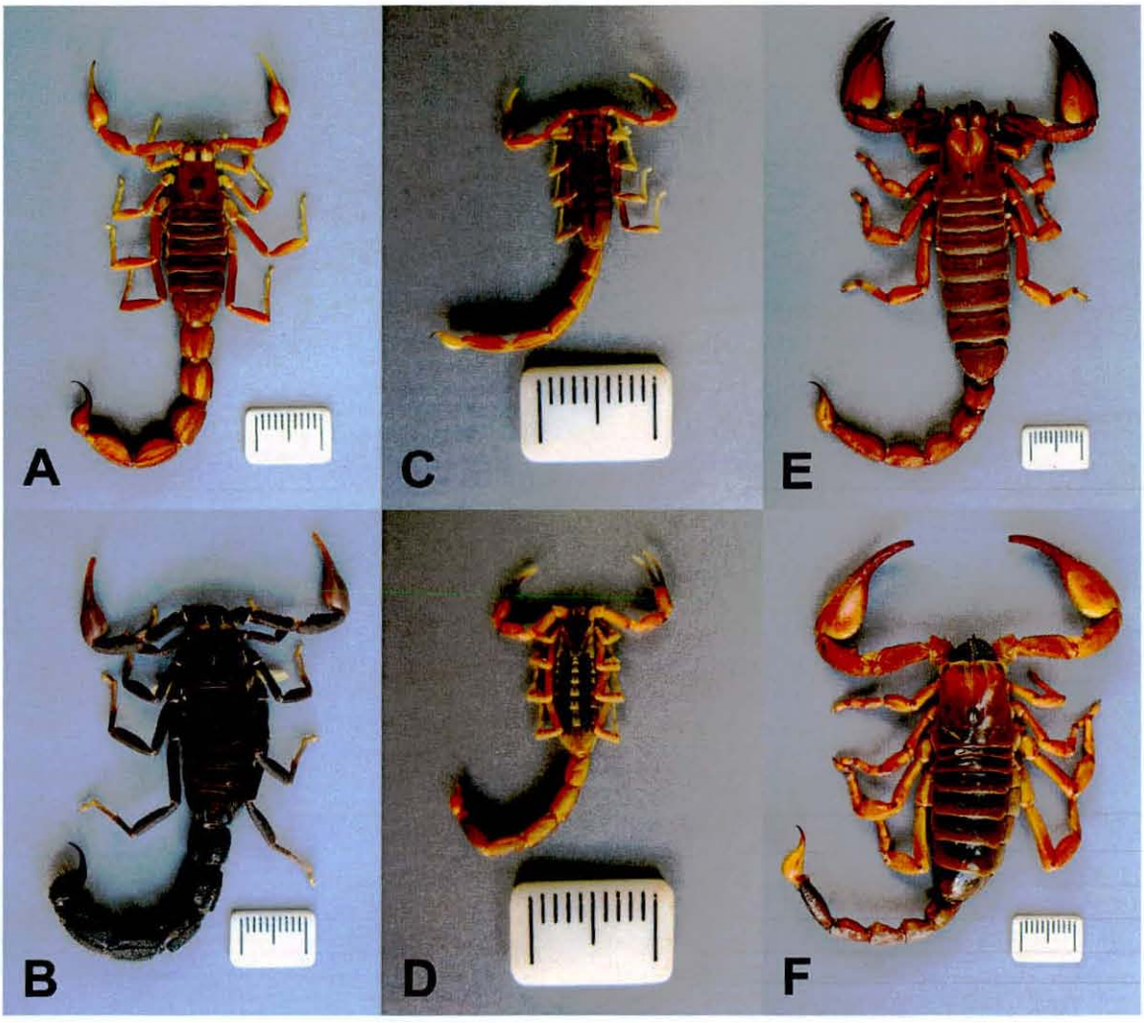

Figure 8. Scorpion species found in the Moonlight project area.

(A. *Parabuthus mossambicus*, B. *P. transvaalicus*, C. *Uroplectes carinatus*, D. *U. vittatus*, E. *Opistophthalmus glabrifrons*, F. *O. wahlbergii*. Scale bar in each photograph is 10 mm long.)

5.3.2 Trapdoor and Baboon Spiders

Only 15 species of Mygalomorph spiders are shown as confirmed from Limpopo Province in Dippenaar-Schoeman (2002); but it is likely that this low diversity is largely due to under-collecting. For the much smaller but more intensively surveyed Gauteng Province, at least 27 Mygalomorph species are listed in Dippenaar-Schoeman (2002), and others have been recorded since publication of this book. It is therefore highly probable that further surveys will add to the number of species recorded in Limpopo. On the basis of known distributions 10 of the 15 species recorded for the province could occur at the Moonlight site.

The four Theraphosid (baboon spider) species recorded for Limpopo and potentially occurring at the study site are of concern from a conservation perspective and are included on the published list of threatened and protected species compiled in terms of the Biodiversity Act. However, although *Augacephalus junodi* has a relatively limited known distribution, the two *Ceratogyrus* species and *Pterinochilus lugardi* are widespread in southern Africa.

Numerous burrows of *Augacephalus junodi* were found, all in areas with deep red soils and while one *Ceratogyrus darlingi* specimen was located (under a log at the border between a calcrete outcrop and an area deep red soils), it appears that *A. junodi* is the dominant baboon spider species at the Moonlight site.

5.3.3 Dragonflies and Damselflies (Odonata)

Two dragonfly and two damselfly species of conservation concern in South Africa may potentially occur on the Moonlight site. However, none of these species is globally significant, as all are widespread in Africa and have only marginal distributions in South Africa; only the local populations are considered vulnerable.

Odonata were abundant around the man-made dams found on the site, but diversity was low and all specimens collected belonged to the six widespread and common species listed in Table 7.

Table 7. Dragonfly and damselfly species collected in the Moonlight project area

Scientific name	Common name
Dragonflies	
Orthetrum caffrum	Two-striped skimmer
Crocothemis erythraea	Broad scarlet
Philonomon luminans	Barbet
Pantala flavescens	Pantala
Tramea basilare	Keyhole glider
Damselfies	
Lestes pallidus	Pallid Spreadwing

5.3.4 Leafhoppers (Cicadellidae)

No South African leafhopper species are currently listed as red data species, although planthoppers (including leafhoppers as well as other Auchenorhyncha) are receiving increasing conservation-related attention elsewhere in the world, especially in Canada and Europe; in the latter region a number of species are red-listed. Many leafhoppers are highly host-specific, while some are more generalist feeders; some groups feed mainly on grasses and others on shrubs or trees. The leafhopper community present can thus provide a good indication of the vegetation diversity even when identifying characters (often flowers) of the plants are not present. Monitoring of leafhopper diversity is therefore a valuable tool in evaluating rehabilitation progress.

No field survey was undertaken for leafhoppers; the thorny nature of the vegetation in many areas of the site would render sweep netting virtually impossible, and alternative sampling methods, such as D-vac suction sampling, would need to be considered if this group is selected as an indicator for rehabilitation monitoring.

5.3.5 Cicadas (Cicadidae)

No cicadas of conservation concern are predicted for project area. No field survey was undertaken for this group.

5.3.6 Ground beetles (Tenebrionidae and Carabidae)

Twenty-one described carabid species of conservation concern (see below) have been identified as potentially occurring in the study areas; most however have fairly widespread distributions and would thus not be highly vulnerable to localised habitat destruction. At present there is insufficient information to determine the probability of occurrence of each species at the two study sites, so no distinction can be made regarding relative conservation value of the sites from the perspective of these species. Fourteen species of *Graphipterus*, a carabid genus that includes one protected South African species, could also potentially occur in the area, but the protected species (*G. assimilis*) is not predicted to occur.

Thirty-two Carabid and 11 Tenebrionid species were collected during the course of the surveys (Appendix 9); given that no long-term trapping was carried out and that beetle sampling by hand was carried out at the same time as sampling of other groups, this represents a comparatively high diversity.

Two carabid specimens could not be identified beyond tribe or genus and two others were only tentatively assigned species names, but the remaining 29 species were identified with a high degree of confidence. In one case (*Cypholoba gracilis*) the presence of two distinct subspecies at the same site suggests that these are incorrectly classified as subspecies and should be considered full species. Of the identified species six (one *Manticora*, one *Megacephala* and four *Dromica* species) are protected under the Biodiversity Act; the remaining 23 species are not protected but many are flightless and may thus be good indicators of local conditions.

Seven tenebrionid species were confidently identified to species, with another being tentatively assigned a species name. Of the remaining three species one was identified to genus and the other two could only be assigned to a tribe. None of these tenebrionid species are protected but most are flightless and like the flightless Carabidae are probably good indicators of local conditions.

5.3.7 Butterflies

Although a large number of butterfly species potentially occur in the study areas, only two species of conservation concern have been confirmed in the general region of the study sites (Woodhall 2005, Gardiner & Terblanche 2010), and neither of these have been recorded within 100 km of the project area. Thus the butterfly species listed in Appendix 7 are considered only to have only a very small possibility of occurring.

No Red Data butterfly species were found on the site and all butterflies observed were common and widespread species. No habitat suitable for either *Erikssonia edgei* (hill-slope bases with vegetation dominated by *Burkea africana / Protea caffra / Clerodendrum glabrum*) or *Lachnocnema regularis regularis* (forest edges) was observed on the site and it is thus highly improbable that these species would be present.

5.3.8 Ants (Hymenoptera: Formicidae)

No detailed information on the ants of the region is available. Two IUCN Red Data ant species, both parasitic, are recorded from South Africa. However one (*Tetramorium parasiticum*) is recorded only from Kwazulu-Natal and the other (*T. microgyna*) has been recorded from sites as far apart as the Eastern Cape, KZN and Zimbabwe and its RD status is thus questionable. It is quite possible that *T. microgyna* would occur at the Moonlight site. Confirmation of this would however require extensive nest excavations and given the doubts as to the validity of this species' RD status, this would be of questionable value.

No specific sampling for *Tetramorium microgyna* was carried, but ant specimens were collected on an ad hoc basis during searches for the main focus groups of the field surveys. A preliminary analysis of the samples collected suggests very high ant diversity in view of the lack of focussed sampling on this group. While detailed processing and identification of ant samples was not budgeted for, a brief assessment of the material indicates that at least 54 ant species representing 20 genera were collected. Intensive focussed sampling of ants would be expected to at least double the number of species found, thus providing ample diversity for this group to form the basis of effective biodiversity monitoring.

5.3.9 Suitability of indicator groups for impact and rehabilitation monitoring

Ease of sampling, consistency between diversity estimates and high indices of diversity and evenness are the main criteria normally used to select the most appropriate groups for inclusion in monitoring. Since no intensive and quantified sampling of potential invertebrate indicator groups was carried out during the field surveys, it is not possible to provide an objective evaluation of the suitability of different taxa for impact assessment and rehabilitation monitoring. However, observations made in the field and assessments based on inspection of the samples collected suggest that:

- Ants (Formicidae) and ground beetles (Carabidae in particular, but also Tenebrionidae) would constitute very effective indicator groups; the more advanced state of Formicid and Carabid taxonomy would render monitoring of these groups easier to implement than for the Tenebrionids.
- The abundance and ease of location of scorpions by UV-assisted night searching indicates that these could be effectively monitored using this method, which is generally considered the most efficient and environmentally friendly technique for surveying scorpions (Leeming 2003, Lowe et al. 2003).
- Leafhoppers would be an effective group only if an alternative to the standard method (sweep-netting) used by AfriBugs was employed, since the dense and thorny nature of the vegetation in many areas would render the use of sweep-nets impossible (the most suitable alternative would be D-vac sampling, which makes use of a modified garden blower/suction device).

For all indicator groups the use of species richness estimation software such as EstimateS, (Colwell 2005) is recommended to reduce the influence of natural annual variation and weather conditions during sampling on survey results.

5.3.10 Invertebrate Assemblages in the Moonlight project area

The invertebrate communities appear very diverse, but seem to comprise assemblages mainly of widespread species. The substantially higher numbers of protected invertebrate species found in the areas with deep red soils may partly be an artefact of the relative extent of this habitat type on the site (resulting in more of the incidentally-collected specimens being located in this habitat), but is also at least partly the result of the greater suitability of the deep sandy soils for burrows of baboon spiders, scorpions and larvae of protected beetles such as *Dromica* spp.

Details of the invertebrate species on which the assessment was based are presented in Appendix 7 and a summary is given in Table 8; the assessment was based on confirmed presence/absence of predicted species, as well as inclusion of additional *Dromica* species found during the survey but which had not been predicted for the site.

Table 8. Invertebrate importance per habitat type

	Habitat		
	Combined woodlands on red soils	*Acacia-Terminalia* Thicket on calcrete	*Combretum apiculatum* Woodland
Importance score[1]	**27**	**12**	**3**
Rating[1]	High	Medium	Low

[1] Based on desktop study only

5.4 Perceived Conservation Importance

No plant species of conservation concern and only two protected tree species were located during fieldwork. As such, the assessment of the importance of the different vegetation communities for conservation-important flora resulted in communities being classified as Low-Medium, Low or Very Low (Table 9). Among mammals, one Vulnerable, three Near Threatened and one Data Deficient species were confirmed to occur. Two Vulnerable and two Near Threatened bird species were recorded during fieldwork, while no reptiles or frogs of conservation concern were found. Assessments of conservation importance of the various vegetation communities for different faunal groups were made under those sub-headings and are summarised in Table 9. The invertebrate importance assessment (Table 8) rated the woodland communities on red sands (*Sclerocarya-Boscia-Acacia* Woodland Mosaic) to have High conservation value, while the thickets on calcrete were assessed as Medium and the *Combretum* woodlands on dolerite as Low conservation importance. The integrated biodiversity / conservation importance assessment is indicated in Table 9 and presented spatially in Figure 9.

Table 9. Integrated Conservation Importance for the Moonlight project area

	Acacia senegal-Terminalia prunioides Closed Woodland / Thicket	*Sclerocarya-Boscia-Acacia tortilis* Open to Closed Woodland Mosaic	*Commiphora spp. - Grewia flava* Open to Closed Woodland	*Combretum apiculatum* Closed Woodland	*Acacia-Dichrostachys* Old Lands
Flora	**Low**	**Low-Med**	**Low**	**Low**	**Very Low**
Vertebrates	Medium	Med-High	Med	Med	Low
Invertebrates	Medium	High	High	Low	Low
Integrated Importance	Med-Low	Med-High	Med	Med-Low	Low

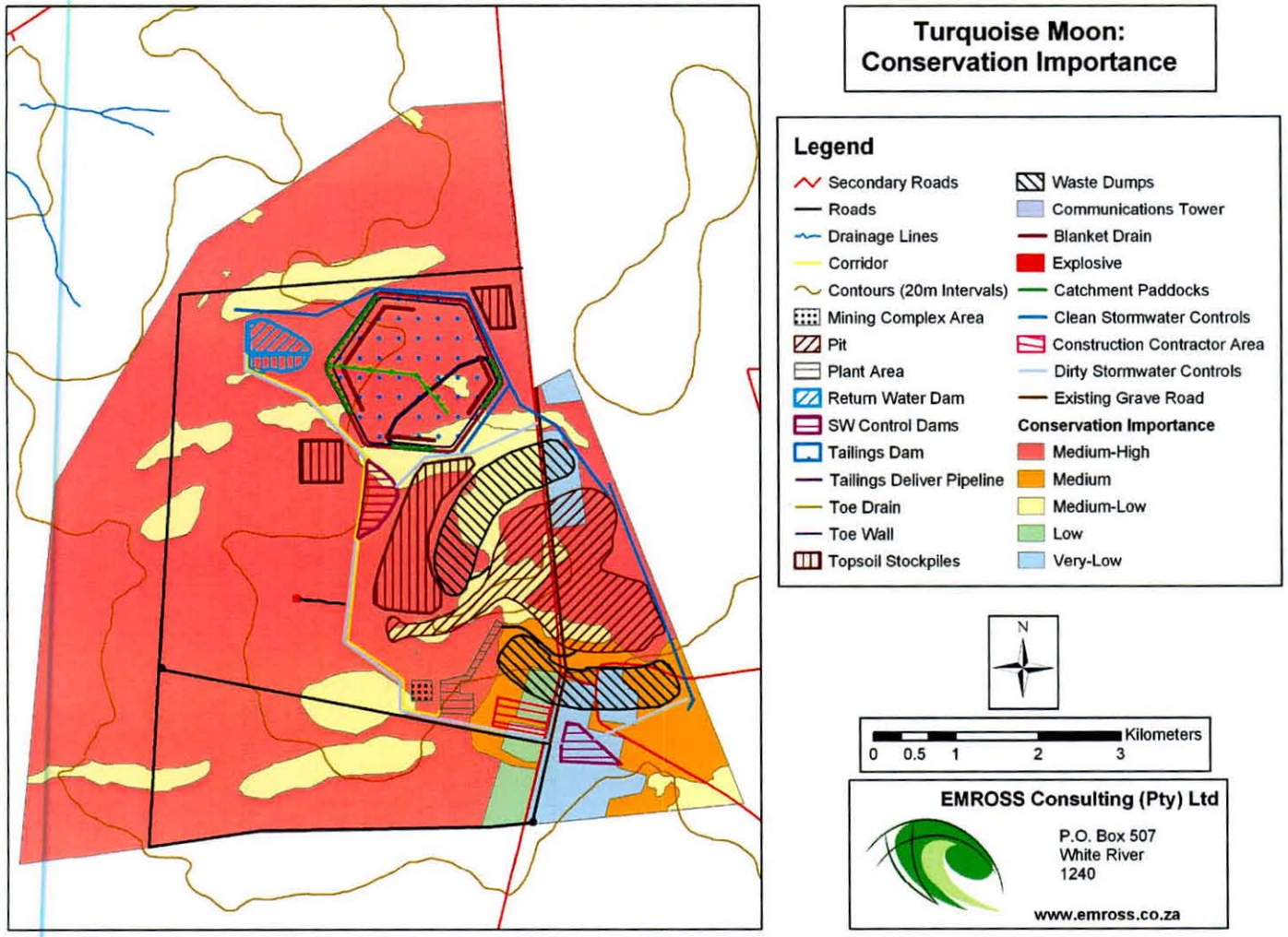

Figure 9. Conservation Importance of vegetation communities represented in the Moonlight project area

6. ASSESSMENT OF IMPACTS

The Moonlight project has a number of associated potential impacts to biodiversity. Each of these are outlined below, with a brief description of the severity, spatial scale, duration and probability of impacts. Impacts were assessed according to the following terrestrial environmental resources (receptors):

- Plant diversity and abundance
- Populations of important plants
- Animal diversity and abundance
- Populations of important animals
- Invertebrate diversity and abundance
- Populations of important invertebrates

Impacts were assessed according to the following criteria:

- Impact Status – whether impact is positive (benefit), negative (cost) or neutral
- Scale – the spatial scale of impact (site, local, regional or national)
- Duration – short-term (0-3 yrs), medium-term (3-10 yrs), long-term (>10 yrs) or permanent
- Severity – magnitude of impact (high, medium, low or negligible)
- Probability – improbable, probable, highly probable or definite

6.1 Impacts on Plant Diversity & Abundance

6.1.1 Losses through transformation of habitat

Clearing of vegetation during construction of the mine and associated infrastructure will result in loss of plant diversity and abundance. While a rehabilitation program will return functional savannah to the property post-closure, it is unlikely to have the same plant diversity and abundance as pre-construction.

Construction Phase:

Impact Status	Scale	Duration	Severity	Probability
Without Mitigation and / or Management				
Negative	Site	Permanent	Medium	Definite
With Mitigation and / or Management				
Negative	Site	Permanent	Medium	Definite

Operation Phase:

Impact Status	Scale	Duration	Severity	Probability
Without Mitigation and / or Management				
Negative	Site	Long-term	Medium	Probable
With Mitigation and / or Management				
Negative	Site	Long-term	Low	Probable

Decommissioning and Closure:

Impact Status	Scale	Duration	Severity	Probability
Without Mitigation and / or Management				
Negative	Site	Long-term	Medium	Probable
With Mitigation and / or Management				
Negative	Site	Long-term	Low	Probable

6.1.2 Losses through increased harvesting pressure on vegetation

The increase in people present on the property (contractors) could result in vegetation being harvested for fuel and medicine.

Construction Phase:

Impact Status	Scale	Duration	Severity	Probability
Without Mitigation and / or Management				
Negative	Local	Short-term	Medium	Highly probable
With Mitigation and / or Management				
Negative	Local	Short-term	Low	Highly probable

Operation Phase:

Impact Status	Scale	Duration	Severity	Probability
Without Mitigation and / or Management				
Negative	Local	Long-term	Medium	Highly Probable
With Mitigation and / or Management				
Negative	Local	Long-term	Low	Highly Probable

Decommissioning and Closure:

Impact Status	Scale	Duration	Severity	Probability
Without Mitigation and / or Management				
Negative	Site	Short-term	Medium	Probable
With Mitigation and / or Management				
Negative	Site	Short-term	Low	Probable

6.1.3 Losses through alien-plant invasion of vegetation

The clearing of vegetation during construction will result in bare soil being exposed. This could act as a significant base from which invasive exotic plants could establish themselves. Since invasive exotic species are already present within the study area (e.g. *Cereus jamacaru, Solanum elaeagnifolium*), a seed bank of these species already exists. However, it is likely to be small seed base since numbers of invasive exotic species are not high.

Construction Phase:

Impact Status	Scale	Duration	Severity	Probability
Without Mitigation and / or Management				
Negative	Local	Short-term	Medium	Highly probable
With Mitigation and / or Management				
Negative	Local	Short-term	Low	Highly probable

Operation Phase:

Impact Status	Scale	Duration	Severity	Probability
Without Mitigation and / or Management				
Negative	Local	Long-term	Medium	Highly Probable
With Mitigation and / or Management				
Negative	Local	Long-term	Low	Highly Probable

Decommissioning and Closure:

Impact Status	Scale	Duration	Severity	Probability
Without Mitigation and / or Management				
Negative	Local	Permanent	High	Highly Probable
With Mitigation and / or Management				
Negative	Local	Short-term	Medium	Probable

6.1.4 Losses through reduced groundwater

The use of groundwater for mining operations (e.g. pumping from boreholes) could result in reduced groundwater levels, depending on the intensity of water use. In an arid savannah environment such as the study area, severely reduced water levels could result in die-off of vegetation that no longer access to water resources.

Construction Phase:

Impact Status	Scale	Duration	Severity	Probability
Without Mitigation and / or Management				
Negative	Local	Long-term	Medium	Probable
With Mitigation and / or Management				
Negative	Local	Long-term	Low	Probable

Operation Phase:

Impact Status	Scale	Duration	Severity	Probability
Without Mitigation and / or Management				
Negative	Local	Long-term	Medium	Probable
With Mitigation and / or Management				
Negative	Local	Long-term	Low	Probable

Decommissioning and Closure:

Impact Status	Scale	Duration	Severity	Probability
Without Mitigation and / or Management				
Negative	Local	Short-term	Low	Probable
With Mitigation and / or Management				
Negative	Local	Short-term	Low	Probable

6.1.5 Losses through production of high levels of dust

Blasting and heavy vehicle movement can both have significant impacts on the level of dust present in the atmosphere. Vegetation along roads is likely to coated with dust, which could inhibit life-sustaining processes of the plants such as photosynthesis and transpiration. Over extended periods of time, this could result in vegetation die-off in areas of heaviest dust deposition.

Construction Phase:

Impact Status	Scale	Duration	Severity	Probability
Without Mitigation and / or Management				
Negative	Local	Long-term	Medium	Highly Probable
With Mitigation and / or Management				
Negative	Local	Long-term	Low	Highly Probable

Operation Phase:

Impact Status	Scale	Duration	Severity	Probability
Without Mitigation and / or Management				
Negative	Local	Long-term	Medium	Highly Probable
With Mitigation and / or Management				
Negative	Local	Long-term	Low	Highly Probable

Decommissioning and Closure:

Impact Status	Scale	Duration	Severity	Probability
Without Mitigation and / or Management				
Negative	Local	Short-term	Medium	Highly Probable
With Mitigation and / or Management				
Negative	Local	Short-term	Low	Highly Probable

6.2 Impacts on important plant species

6.2.1 Impoverishment of populations of important taxa

No plant species of conservation concern and only two protected tree species were located during fieldwork. Two species of conservation concern have a Moderate likelihood of occurring. The vegetation communities within the study area were thus rated as being of Low-Medium or Low importance for conservation-important flora.

Construction Phase:

Impact Status	Scale	Duration	Severity	Probability
Without Mitigation and / or Management				
Negative	Site	Permanent	Low	Definite
With Mitigation and / or Management				
Negative	Site	Permanent	Low	Definite

Operation Phase:

Impact Status	Scale	Duration	Severity	Probability
Without Mitigation and / or Management				
Negative	Site	Long-term	Low	Probable
With Mitigation and / or Management				
Negative	Site	Long-term	Low	Probable

Decommissioning and Closure:

Impact Status	Scale	Duration	Severity	Probability
Without Mitigation and / or Management				
Negative	Site	Permanent	Low	Highly Probable
With Mitigation and / or Management				
Negative	Site	Short-term	Low	Probable

6.2.2 Reduction of important vegetation communities

The Moonlight study area is situated within Roodeberg Bushveld, at the junction with Limpopo Sweet Bushveld. Both of these vegetation types have been classified as Least Threatened and are therefore not considered a conservation priority. Thus, the project is unlikely to cause the loss of vegetation types that are considered conservation priorities.

Construction Phase:

Impact Status	Scale	Duration	Severity	Probability
Without Mitigation and / or Management				
Negative	Site	Permanent	Low	Definite
With Mitigation and / or Management				
Negative	Site	Permanent	Low	Definite

Operation Phase:

Impact Status	Scale	Duration	Severity	Probability
Without Mitigation and / or Management				
Negative	Site	Long-term	Low	Probable
With Mitigation and / or Management				
Negative	Site	Long-term	Low	Probable

Decommissioning and Closure:

Impact Status	Scale	Duration	Severity	Probability
Without Mitigation and / or Management				
Negative	Site	Permanent	Low	Highly Probable
With Mitigation and / or Management				
Negative	Site	Short-term	Low	Probable

6.3 Impacts on animal diversity and abundance

6.3.1 Losses through transformation of habitat for animals

The clearing of vegetation for the mine and building of infrastructure will result in the loss of some untransformed vegetation. This vegetation provides habitat for numerous mammals, birds, reptiles and frogs, particularly since much of the study area is still untransformed.

Construction Phase:

Impact Status	Scale	Duration	Severity	Probability
Without Mitigation and / or Management				
Negative	Site	Permanent	Medium	Definite
With Mitigation and / or Management				
Negative	Site	Permanent	Medium	Definite

Operation Phase:

Impact Status	Scale	Duration	Severity	Probability
Without Mitigation and / or Management				
Negative	Site	Long-term	Medium	Probable
With Mitigation and / or Management				
Negative	Site	Long-term	Low	Probable

Decommissioning and Closure:

Impact Status	Scale	Duration	Severity	Probability
Without Mitigation and / or Management				
Negative	Site	Short-term	Medium	Probable
With Mitigation and / or Management				
Negative	Site	Short-term	Low	Probable

6.3.2 Losses through increased poaching of animals

The influx of people during the construction and operational phases combined with a lack of education regarding the importance of protecting biodiversity is likely to increase the risk of illegal poaching. The presence of several antelope species will pose a significant temptation to poach if no education of contractor staff is undertaken and no control measures are in place.

Construction Phase:

Impact Status	Scale	Duration	Severity	Probability
Without Mitigation and / or Management				
Negative	Site	Short-term	Medium	Highly Probable
With Mitigation and / or Management				
Negative	Site	Short-term	Low	Highly Probable

Operation Phase:

Impact Status	Scale	Duration	Severity	Probability
Without Mitigation and / or Management				
Negative	Site	Long-term	Medium	Highly Probable
With Mitigation and / or Management				
Negative	Site	Long-term	Low	Highly Probable

Decommissioning and Closure:

Impact Status	Scale	Duration	Severity	Probability
Without Mitigation and / or Management				
Negative	Site	Short-term	Medium	Highly Probable
With Mitigation and / or Management				
Negative	Site	Short-term	Low	Highly Probable

6.3.3 Disruption of animal movement

The study area is enclosed with a high electric fence which severely restricts large animal movement. The footprint, therefore, is unlikely to be an important migration corridor for large herbivores within the region. Predators such as Brown Hyaena, Leopard and Caracal would be able to move between properties and may thus have their movements disrupted by the development of a mine. Within the study area, the mine construction and operation is likely to severely disrupt movements and grazing patterns of large herbivores.

Construction Phase:

Impact Status	Scale	Duration	Severity	Probability
Without Mitigation and / or Management				
Negative	Site	Long-term	Medium	Highly Probable
With Mitigation and / or Management				
Negative	Site	Long-term	Medium	Highly Probable

Operation Phase:

Impact Status	Scale	Duration	Severity	Probability
Without Mitigation and / or Management				
Negative	Site	Long-term	Medium	Highly Probable
With Mitigation and / or Management				
Negative	Site	Long-term	Medium	Highly Probable

Decommissioning and Closure:

Impact Status	Scale	Duration	Severity	Probability
Without Mitigation and / or Management				
Negative	Site	Short-term	Low	Highly Probable
With Mitigation and / or Management				
Negative	Site	Short-term	Low	Highly Probable

6.3.4 Losses through reduced groundwater

The use of groundwater for mining operations (e.g. pumping from boreholes) could result in reduced groundwater levels, depending on the intensity of water use. In an arid savannah environment such as the study area, severely reduced water levels could result in drying up of boreholes that are currently used to fill water reservoirs that supply drinking water to game and cattle.

Construction Phase:

Impact Status	Scale	Duration	Severity	Probability
Without Mitigation and / or Management				
Negative	Local	Long-term	Medium	Probable
With Mitigation and / or Management				
Negative	Local	Long-term	Low	Probable

Operation Phase:

Impact Status	Scale	Duration	Severity	Probability
Without Mitigation and / or Management				
Negative	Local	Long-term	Medium	Probable
With Mitigation and / or Management				
Negative	Local	Long-term	Low	Probable

Decommissioning and Closure:

Impact Status	Scale	Duration	Severity	Probability
Without Mitigation and / or Management				
Negative	Local	Short-term	Low	Probable
With Mitigation and / or Management				
Negative	Local	Short-term	Low	Probable

6.3.5 Disruption of breeding cycles through increased noise production

Elevated noise levels associated with blasting and heavy vehicle movement is likely to have a disruptive and detrimental effect on breeding cycles of fauna, particularly birds since most rely on audio signals to initiate breeding and maintain breeding territories. It is possible that breeding territories closest to the noise point of origin will have lower nesting success rates than those further away.

Construction Phase:

Impact Status	Scale	Duration	Severity	Probability
Without Mitigation and / or Management				
Negative	Site	Long-term	Medium	Highly Probable
With Mitigation and / or Management				
Negative	Site	Long-term	Medium	Highly Probable

Operation Phase:

Impact Status	Scale	Duration	Severity	Probability
Without Mitigation and / or Management				
Negative	Site	Long-term	Medium	Highly Probable
With Mitigation and / or Management				
Negative	Site	Long-term	Medium	Highly Probable

Decommissioning and Closure:

Impact Status	Scale	Duration	Severity	Probability
Without Mitigation and / or Management				
Negative	Site	Short-term	Medium	Highly Probable
With Mitigation and / or Management				
Negative	Site	Short-term	Medium	Highly Probable

6.4 Impacts on important animal species

6.4.1 Impoverishment of populations of important taxa through habitat removal

Three Vulnerable, five Near Threatened and one Data Deficient species were confirmed to occur during fieldwork. While some of these are likely to only move through the site in search of food, others may be resident. The removal of habitat for these species to feed and breed in could result in impoverishment of populations of these species within the study area. This would be particularly relevant during the breeding seasons of any species of conservation concern, since a disrupted breeding season could cause these species to breed elsewhere on other adjacent properties where disturbance levels are lower.

Construction Phase:

Impact Status	Scale	Duration	Severity	Probability
Without Mitigation and / or Management				
Negative	Site	Long-term	Medium	Highly Probable
With Mitigation and / or Management				
Negative	Site	Long-term	Medium	Highly Probable

Operation Phase:

Impact Status	Scale	Duration	Severity	Probability
Without Mitigation and / or Management				
Negative	Site	Long-term	Medium	Highly Probable
With Mitigation and / or Management				
Negative	Site	Long-term	Medium	Highly Probable

Decommissioning and Closure:

Impact Status	Scale	Duration	Severity	Probability
Without Mitigation and / or Management				
Negative	Site	Short-term	Low	Highly Probable
With Mitigation and / or Management				
Negative	Site	Short-term	Low	Highly Probable

6.4.2 Impoverishment of populations of important taxa through collisions with overhead transmission lines

The proposed construction of low voltage (11-33kV) overhead transmission lines to distribute power from a substation to the mine could result in a significant impact to large flying birds through collisions with these transmission lines. A number of these species have Red Data status, particularly large birds of prey such as Martial Eagle, Tawny Eagle, various vulture species and Bateleur.

Construction Phase:

Impact Status	Scale	Duration	Severity	Probability
Without Mitigation and / or Management				
Negative	Local	Long-term	High	Probable
With Mitigation and / or Management				
Negative	Local	Long-term	Medium	Probable

Operation Phase:

Impact Status	Scale	Duration	Severity	Probability
Without Mitigation and / or Management				
Negative	Local	Long-term	High	Probable
With Mitigation and / or Management				
Negative	Local	Long-term	Medium	Probable

Decommissioning and Closure:

Impact Status	Scale	Duration	Severity	Probability
Without Mitigation and / or Management				
Negative	Local	Permanent	High	Probable
With Mitigation and / or Management				
Negative	Local	Permanent	Medium	Probable

6.5 Impacts on invertebrate diversity and abundance

6.5.1 Losses through transformation of habitat for invertebrates

The clearing of vegetation for the mine and building of infrastructure will result in the loss of some untransformed vegetation. This vegetation provides habitat for numerous invertebrates, particularly since much of the study area is still untransformed. The vegetation communities that will be most sensitive to this impact are the two plains communities (*Sclerocarya-Boscia-Acacia tortilis* Open to Closed Woodland Mosaic, *Commiphora* spp. – *Grewia flava* Open to Closed Woodland).

Construction Phase:

Impact Status	Scale	Duration	Severity	Probability
Without Mitigation and / or Management				
Negative	Site	Long-term	High	Definite
With Mitigation and / or Management				
Negative	Site	Long-term	Medium	Definite

Operation Phase:

Impact Status	Scale	Duration	Severity	Probability
Without Mitigation and / or Management				
Negative	Site	Long-term	Medium	Highly Probable
With Mitigation and / or Management				
Negative	Site	Long-term	Medium	Highly Probable

Decommissioning and Closure:

Impact Status	Scale	Duration	Severity	Probability
Without Mitigation and / or Management				
Negative	Site	Short-term	Low	Highly Probable
With Mitigation and / or Management				
Negative	Site	Short-term	Low	Highly Probable

6.6 Impacts on important invertebrate species and assemblages

6.6.1 Impoverishment of populations of conservation-important species

Six species of scorpions, two baboon spiders and six ground beetles confirmed to occur in the study area in this study are considered to be of conservation importance. Since these species occur within the impact footprint, there will be some impoverishment of populations that are not able to escape during construction.

Construction Phase:

Impact Status	Scale	Duration	Severity	Probability
Without Mitigation and / or Management				
Negative	Site	Long-term	High	Highly Probable
With Mitigation and / or Management				
Negative	Site	Long-term	Medium	Highly Probable

Operation Phase:

Impact Status	Scale	Duration	Severity	Probability
Without Mitigation and / or Management				
Negative	Site	Long-term	Medium	Highly Probable
With Mitigation and / or Management				
Negative	Site	Long-term	Medium	Highly Probable

Decommissioning and Closure:

Impact Status	Scale	Duration	Severity	Probability
Without Mitigation and / or Management				
Negative	Site	Short-term	Low	Highly Probable
With Mitigation and / or Management				
Negative	Site	Short-term	Low	Highly Probable

7. RECOMMENDED MITIGATION MEASURES

The approach taken in dealing with impacts on biodiversity was to first consider whether any critical habitat was present. Habitat was assessed according to the guidelines for Biodiversity Conservation and Sustainable Natural Resource Management (Guidance Note 6, International Finance Corporation, 2006). Once it was determined that no critical habitat was present, biodiversity off-set options were not considered any further. Mitigatory measures were then recommended in order to minimise or manage the magnitude of the impact. This included rehabilitation of transformed habitat and the establishment of a Biodiversity Action Plan. All proposed mitigation measures are included in Table 10.

Table 10. Recommended measures for mitigation impacts on biodiversity

Impact	Mitigation Measure	Management objective
Habitat transformation	The layout design should be focussed on transformed habitat wherever possible (minimise impact footprint).	Reduce severity of habitat transformation
	A rehabilitation plan should be developed for the reconstruction of the areas that will be transformed; this plan should include Site Preparation, Rehabilitation Implementation and Maintenance, and Ongoing Monitoring and Research	Ensure that the rehabilitated vegetation cover has at least 75% similarity to original plant species composition
	Topsoil should be stockpiled adjacent the disturbed areas and kept free of weed infestation. As areas are of the pit are back-filled, the topsoil should be returned and a seedmix of indigenous grasses occurring in the area should be planted and regularly watered (as per the Rehabilitation Plan).	Ensure that the rehabilitated vegetation cover has at least 75% similarity to original plant species composition
	A nursery should be established in which plant species of conservation concern are cultivated and maintained for the rehabilitation of back-filled areas. This nursery will also produce the seedmix of indigenous grasses for planting on back-filled areas.	Ensure that the rehabilitated vegetation cover has at least 75% similarity to original plant species composition
	A Biodiversity Action Plan should be drawn up by suitably experienced ecologists. This plan should outline the approach to implementing the mitigation measures recommended in this report and should include a time-line and staff allocation for each action needed.	Comply with Mining Best Practice Guidelines
	An Environmental Compliance Officer (ECO) should be employed and this person's duties should include checking compliance of all the mitigation measures recommended in this report.	Ensure enforcement of mitigation measures

Increased harvesting pressure on vegetation	Plant resources that are being destroyed through vegetation clearing during construction, such as fuelwood and medicinal plants, should be made available to local communities. This does not negate the need to comply with legislation regarding the destruction of protected species and provincial and national legislation will have to be adhered to.	Local communities benefit from project
	Prior to construction, the borders of the development zone should be securely fenced in order to prohibit access by the construction team outside of the impact footprint.	Reduce chance of illegal harvesting of plant resources
	The ECO should investigate adjacent habitat during construction to ensure that illegal harvesting is not taking place	Ensure enforcement of mitigation measures
Invasion by alien plants	In order to comply with the Conservation of Agricultural Resources Act, all listed invasive exotic plants as indicated in the text above should be targeted and controlled.	Comply with legislation regarding alien plants
	Topsoil should be stockpiled adjacent the disturbed areas and kept free of weed infestation.	Ensure optimal seed bank is returned to disturbed areas during rehabilitation
	Once topsoil is returned after construction, weed control measures should be implemented for several seasons, allowing indigenous pioneer species a chance to colonise the bare soil.	Reduce levels of alien plant infestation
Reduced groundwater	Without knowing the precise details of water use in the impact footprint it will be impossible to recommend mitigation measures	
Increased dust levels	Water bowsers should regularly wet the road surfaces that are being used by heavy vehicles during construction and operation phases. Such actions are particularly important during the dry season (April-Oct). This water needs to be brought in from an outside source since groundwater use during operations is already potentially going to reduce water levels	Reduce levels of air-borne dust

Loss of conservation-important plants	The footprints of the ore-body to be mined, the tailings and return-water dam footprints and the waste-rock dump footprint should be surveyed by a botanist prior to clearing. The nursery team should walk with the botanist and mark the species that need to be removed and relocated for propagation in the nursery.	Reduce impact on conservation-important plants
	Apply for permits to destroy the *Sclerocarya birrea* and *Boscia albitrunca* trees within the impact footprint	Comply with legislation regarding protected trees
	Plants of all protected species to be destroyed should be propagated in the nursery for replanting of back-filled areas during operations and for general site rehabilitation post-closure	Reduce impact on conservation-important plants
Reduction of important plant communities	There are no conservation-important vegetation communities within the study area	
Increase in poaching	Prior to construction, the borders of the development zone should be demarcated with danger tape in order to prohibit access by the construction team outside of the impact footprint.	Reduce chance of poaching
	The ECO should investigate adjacent habitat during construction to ensure that poaching is not taking place	Ensure enforcement of mitigation measures
Disruption of animal movements	There are no significant measures to mitigate the loss of habitat of conservation-important fauna; however, much habitat should remain intact within the study area during the duration of the project and rehabilitation measures should restore the structural integrity of fauna habitat	
	The mine and associated infrastructure should be securely fenced off so that large mammals do not wander into the impact footprint	Reduce risk of injury or death to large mammals within the impact footprint

Disruption of breeding cycles of threatened species through noise of blasting	Since timing blasting activity outside of the breeding periods of potentially occurring and confirmed occurring conservation-important bird is unlikely to be logistically feasible, a walk-through survey of the impact footprint and 2 km buffer area should be undertaken by an ornithologist and any nests of threatened birds of prey located and the risk of disturbance assessed per nest site; mitigation measures can then be recommended according to the location of these sites'if no such sites are found, then the impact can be considered negligible	Reduce chance of disruption of breeding cycles of species of conservation concern
Loss of conservation-important animals through habitat transformation	A rehabilitation plan should be developed for the reconstruction of the areas that will be transformed; this plan should include Site Preparation, Rehabilitation Implementation and Maintenance, and Ongoing Monitoring and Research	Ensure that the rehabilitated vegetation cover has at least 75% similarity to original plant species composition
	The mine and associated infrastructure should be fenced off so that large mammals do not wander into the impact footprint	Reduce risk of injury or death to large mammals within the impact footprint
Loss of conservation-important birds through collisions with transmission lines	All transmission lines should be fitted with "bird flappers" as prescribed by Eskom guidelines for reducing collisions by large birds	Reduce risk of injury or death to large birds within the study area
Loss of conservation-important invertebrates	Since habitat of conservation-important species is likely to be destroyed, successful vegetation rehabiliatation will be a key mitigation; a Rehabilitation Plan should be prepared, which will cover the different phases of rehabilitation, such as Site Preparation, Rehabilitation Implementation and Maintenance, and Ongoing Monitoring and Research	Restore habitat to as close to original state as possible
	Rocks and boulders, especially those with deep cracks or large exfoliating flakes, are vital for the survival of certain species; careful attention should be paid to ensuring that the reconstructed landscape includes such rock formations; it may be necessary to stockpile suitable rocks separately from the main subsoil stockpiles.	

	A rescue operation should target key scorpions, baboon spiders, ants and ground beetles; these should be relocated to similar habitat adjacent the impact footprint	Reduce losses of conservation-important species
	Detailed baseline studies of selected indicator groups should take place in the vegetation communities that will suffer direct impacts: for each vegetation type an area within the direct impact zone and a control area outside of this zone (preferably outside of the 500m buffer zone) should be selected and surveyed.	Return biodiversity levels of indicator species (total species number estimates) to at least 90% of baseline average, with diversity/evenness indices at least 90% of mean baseline values and at least 70% similarity of community species composition to baseline measure. Rank abundance plot slopes, which are expected to become significantly steeper in the early stages of rehabilitation, should have regained a similar pattern to that obtained from the baseline studies if rehabilitation is to be considered complete.
	Regular monitoring of selected indicator species.	

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9. APPENDICES

Appendix 1. Checklist of plants recorded during fieldwork

Species	Family	Growth Form	Red Data	Endemic	Protected	*Acacia senegal-Terminalia prunioides* Closed Woodland / Thicket	*Sclerocarya-Boscia-Acacia tortilis* Open to Closed Woodland Mosaic	*Commiphora spp. - Grewia flava* Open to Closed Woodland	*Combretum apiculatum* Closed Woodland	*Acacia tortilis - Dichrostachys cinerea* Old Lands
Abutilon rehmannii	Malvaceae	Herb					+		1	
Acacia grandicornuta	Fabaceae	Tree				1		1		+
Acacia karroo	Fabaceae	Tree					1			
Acacia mellifera	Fabaceae	Tree				2				+
Acacia nigrescens	Fabaceae	Tree					2	2	+	
Acacia senegal var. leiorachis	Fabaceae	Tree				3	1	1	+	
Acacia senegal var. rostrata	Fabaceae	Shrub				1	2	1	+	
Acacia tortilis	Fabaceae	Tree				3	2	2		4
Albizia anthelminthica	Fabaceae	Tree				1		1		
Albizia harveyi	Fabaceae	Tree					1			
Ammocharis coranica	Amaryllidaceae	Geophyte					+			
Aptosimum lineare	Scrophulariaceae	Herb							+	
Argyrolobium sp. (no flowers)	Fabaceae	Creeper							1	
Aristida adscencionis	Poaceae	Grass				+	1	+		
Aristida bipartita	Poaceae	Grass				+				
Aristida congesta subsp. barbicollis	Poaceae	Grass				1	1	1		
Aristida congesta subsp. congesta	Poaceae	Grass					2	1	1	2
Aristida cf. sciurus	Poaceae	Grass					1		1	
Aristida vestita	Poaceae	Grass				1		1	2	
Asparagus cf. laricinus	Asparagaceae	Herb				1		1	+	
Asparagus cooperi	Asparagaceae	Herb				1				

Asparagus nelsii	Asparagaceae	Herb						1		
Asparagus suaveolens	Asparagaceae	Shrub					+			
Barleria cf. prionitis	Acanthaceae	Herb				1				
Barleria transvaalensis	Acanthaceae	Dwarf Shrub					+			
Bauhinia petersiana	Fabaceae	Shrub						1		
Blepharis cf. subvolubilis	Acanthaceae	Dwarf Shrub				1	2			
Boscia albitrunca	Capparaceae	Tree			NFA		2	1	+	
Boscia foetida	Capparaceae	Tree				1	1	2		
Brachiaria deflexa	Poaceae	Grass				1	1	+		
Brachiaria sp.	Poaceae	Grass				2	2			1
Cadaba aphylla	Capparaceae	Shrub				1				
Cardiospermum corindum	Sapindaceae	Climber				+				
Cenchrus ciliaris	Poaceae	Grass				1				
Cereus jamacaru *	Cactaceae	Succulent					1	1		
Chascanum pinnatifidum	Scrophulariaceae	Herb				1		1		
Chloris virgata	Poaceae	Grass				1		+		
Chlorophytum cf. fasciculatum	Anthericaceae	Geophyte							1	
Citrullus lanatus	Cucurbitaceae	Creeper						1		
Clematis brachiata	Ranunculaceae	Creeper				1				
Cleome sp. (no flowers)	Capparaceae	Herb				1				
Coccinia rehmannii	Cucurbitaceae	Creeper				1	1	1		
Combretum apiculatum	Combretaceae	Tree						1	3	
Commelina africana	Commelinaceae	Herb				1	1		1	
Commelina benghalensis	Commelinaceae	Herb							+	
Commelina cf. erecta	Commelinaceae	Herb							1	
Commicarpus pentandrus	Nyctaginaceae	Herb				1			1	
Commiphora africana	Burseraceae	Shrub				+	1	1		
Commiphora glandulosa	Burseraceae	Tree				1	1	2		
Commiphora mollis	Burseraceae	Tree					1	3	2	
Commiphora pyracanthoides	Burseraceae	Shrub				2	2	3	1	1
Commiphora schimperi	Burseraceae	Shrub							+	
Corchorus asplenifolius	Malvaceae	Herb					1		1	
Cordia ovalis	Boraginaceae	Shrub				1				
Cucumis hirsutus	Cucurbitaceae	Creeper					1			
Cyperus sphaerocephalus	Cyperaceae	Sedge							+	
Dichrostachys cinerea subsp. *africana*	Fabaceae	Shrub				2	2	2	1	4
Digitaria eriantha	Poaceae	Grass					1			
Digitaria velutina	Poaceae	Grass				1	1			

Dipcadi glaucum	Hyacinthaceae	Geophyte					+			
Ehretia obtusifolia	Boraginaceae	Shrub							1	
Ehretia rigida	Boraginaceae	Shrub				1	1	1		
Ehrharta erecta	Poaceae	Grass				+	+			
Elephantorrhiza obliqua var. glabra	Fabaceae	Dwarf Shrub					+		+	
Endostemon tenuiflorus	Lamiaceae	Herb				+	+			
Endostemon tereticaulis	Lamiaceae	Herb						+		
Enneapogon cenchroides	Poaceae	Grass				2	1	1		
Enneapogon desveauxii	Poaceae	Grass				2				
Enneapogon scoparius	Poaceae	Grass					2	1		
Eragrostis chloromelas	Poaceae	Grass				2	1	2	2	1
Eragrostis curvula	Poaceae	Grass					1			2
Eragrostis lehmanniana	Poaceae	Grass				1	2		1	
Eragrostis micrantha	Poaceae	Grass					+			
Eragrostis pallens	Poaceae	Grass				+				
Eragrostis rigidior	Poaceae	Grass				+	2	2	1	2
Eragrostis viscosa	Poaceae	Grass					+			
Erianthemum ngamicum	Loranthaceae	Epiphyte				+				
Eriospermum cf. porphyrovalve	Eriospermaceae	Geophyte					+			
Eriospermum sp. (leaves, no flowers)	Eriospermaceae	Geophyte							+	
Euclea undulata var. *myrtina*	Ebenaceae	Shrub				1	+			
Evolvulus alsinoides	Convolvulaceae	Creeper					+	+	+	+
Felicia clavipilosa subsp. *transvaalensis*	Asteraceae	Herb					1			
Felicia mossamedensis	Asteraceae	Herb					1			1
Flueggea virosa	Phyllanthaceae	Shrub				2			1	
Gomphocarpus tomentosus	Apocynaceae	Shrub							+	
Grewia bicolor	Malvaceae	Shrub					1	1	2	
Grewia flava	Malvaceae	Shrub				2	3	3	2	2
Grewia flavescens	Malvaceae	Shrub					1	1	1	
Grewia monticola	Malvaceae	Shrub				1			1	
Grewia villosa	Malvaceae	Shrub				1				
Gymnosporia glaucophylla	Celastraceae	Tree				1	1			
Harpagophytum procumbens	Pedaliaceae	Creeper					1		+	+
Heliotropium nelsonii	Boraginaceae	Herb				2	1	1	1	1
Heteropogon contortus	Poaceae	Grass						1		
Hibiscus cf. calyphyllus (no flowers)	Malvaceae	Herb						1		
Hibiscus lunarifolius	Malvaceae	Herb							2	
Hibiscus micranthus	Malvaceae	Herb				1	1	1	1	
Hibiscus platycalyx	Malvaceae	Herb					+			

Hirpicium bechuanense	Asteraceae	Herb					+			
Indigastrum costatum	Fabaceae	Herb				1				+
Indigofera cf. ingrata	Fabaceae	Dwarf Shrub							+	
Indigofera heterotricha	Fabaceae	Dwarf Shrub				1			+	
Indigofera trita subsp. subulata	Fabaceae	Dwarf Shrub							+	
Ipomoea albivenia	Convolvulaceae	Creeper						+		
Ipomoea bolusiana	Convolvulaceae	Creeper					1			
Ipomoea magnusiana	Convolvulaceae	Creeper					+			
Ipomoea obscura	Convolvulaceae	Creeper					1	1		+
Justicia odora	Acanthaceae	Herb				1	+	1		
Justicia cf. protracta	Acanthaceae	Herb							1	
Kalanchoe cf. brachyloba	Crassulaceae	Succulent				+			1	
Kalanchoe rotundifolia	Crassulaceae	Succulent							+	
Kleinia longiflora	Asteraceae	Succulent							+	
Kyllinga alba	Cyperaceae	Sedge				+	+		+	
Kyphocarpha angustifolia	Amaranthaceae	Herb					1	1		1
Lannea schweinfurthii var. *stuhlmannii*	Anacardiaceae	Tree				+	1	1	2	
Lantana rugosa	Verbenaceae	Shrub				1	1	1		+
Ledebouria marginata	Hyacinthaceae	Geophyte					1	+	1	1
Limeum sulcatum	Limeaceae	Herb					+			
Lycium schizocalyx	Solanaceae	Shrub				2				
Maerua angolensis	Capparaceae	Tree					1	+		
Maerua parvifolia	Capparaceae	Shrub				2	2			
Megalochlamys sp. (no flowers)	Acanthaceae	Dwarf Shrub				+				
Melhania acuminata	Malvaceae	Dwarf Shrub				1	1	1		
Melhania burchellii	Malvaceae	Dwarf Shrub							+	
Melhania rehmannii	Malvaceae	Dwarf Shrub					1			
Melinis repens	Poaceae	Grass				1	1	1	1	
Momordica balsamina	Cucurbitaceae	Creeper					+	1		
Momordica boivinii	Cucurbitaceae	Creeper						+		
Monsonia glauca	Malvaceae	Herb				+	+			
Neorautanenia amboensis	Fabaceae	Herb					+			
Ocimum cf. gratissimum	Lamiaceae	Herb					1	1	1	1
Ocimum filamentosum	Lamiaceae	Herb				+				
Ocimum obovatum subsp. obovatum	Lamiaceae	Herb				1	1			

Ornithogalum seineri	Hyacinthaceae	Geophyte				+	1			
Otoptera burchellii	Fabaceae	Creeper					+			
Ozoroa paniculosa	Anacardiaceae	Tree					1	1		
Panicum coloratum	Poaceae	Grass					+		1	
Panicum maximum	Poaceae	Grass				1	+	1	2	2
Pavonia burchellii	Malvaceae	Herb						+	+	
Pellaea calomelanos	Sinopteridaceae	Fern							+	
Peltophorum africanum	Fabaceae	Tree							1	
Perotis patens	Poaceae	Grass				1	1			
Phyllanthus cf. maderaspatensis	Phyllanthaceae	Herb				+	+			1
Pogonarthria squarrosa	Poaceae	Grass						2	2	1
Polygala hottentota	Polygalaceae	Herb					1			
Polygala sphenoptera	Polygalaceae	Herb							+	
Portulaca collina	Portulacaceae	Succulent				+				
Portulaca kermesina	Portulacaceae	Succulent					+			+
Ptycholobium contortum	Fabaceae	Herb				1	+			
Rhynchosia cf. totta	Fabaceae	Creeper							1	
Ruellia cordata	Acanthaceae	Herb							2	
Ruellia patula	Acanthaceae	Herb				1			1	
Sansevieria aethiopica	Dracaenaceae	Geophyte				+				
Sarcostemma viminale	Apocynaceae	Succulent					1		1	
Schmidtia pappophoroides	Poaceae	Grass					2	2	1	
Sclerocarya birrea subsp. *cafra*	Anacardiaceae	Tree			NFA		3	1	1	
Searsia leptodictya	Anacardiaceae	Tree				+			1	
Secamone parvifolia	Apocynaceae	Climber							1	
Seddera capensis	Convolvulaceae	Herb				1			1	
Senna italica	Fabaceae	Herb					1	1		
Setaria pumila	Poaceae	Grass					+	2		
Setaria sphacelata	Poaceae	Grass				2			2	1
Setaria sp.	Poaceae	Grass				1				
Setaria verticillata	Poaceae	Grass				+				
Sida alba	Malvaceae	Herb					+			
Sida cf. ovata	Malvaceae	Herb					+	+		
Solanum catombelense	Solanaceae	Shrub					+			
Solanum elaeagnifolium *	Solanaceae	Shrub				1	1	1	1	2
Solanum incanum	Solanaceae	Dwarf Shrub				1	1			1
Solanum tettense var. *renchii*	Solanaceae	Shrub				1				
Sporobolus sp.	Poaceae	Grass						+		
Sterculia rogersii	Malvaceae	Tree							2	

Stipagrostis uniplumis	Poaceae	Grass					1	+	1	
Strychnos madagascariensis	Strychnaceae	Tree							2	
Tephrosia rhodesica	Fabaceae	Shrub							1	
Terminalia prunioides	Combretaceae	Tree				3		2	1	
Terminalia sericea	Combretaceae	Tree					2	1	1	
Tragus berteronianus	Poaceae	Grass				1	1			
Tribulus sp.	Zygophyllaceae	Herb					+			
Tribulus terrestris	Zygophyllaceae	Herb					1			
Tribulus zeyheri	Zygophyllaceae	Herb				1	1			
Tricholaena monacne	Poaceae	Grass					+		+	
Tylosema fassoglense	Fabaceae	Creeper						+		
Urochloa mossambicensis	Poaceae	Grass				1	1		1	
Viscum rotundifolium	Viscaceae	Epiphyte					1			
Ximenia americana	Olacaceae	Tree							+	
Ximenia caffra	Olacaceae	Tree							2	
Ziziphus mucronata	Rhamnaceae	Tree							1	
		188	0	0	2	86	107	69	82	28

NFA = National Forest Act

Appendix 2. Detailed Data – Flora Quadrats

	Quadrat 1	Quadrat 2	Quadrat 3	Quadrat 4	Quadrat 5	Quadrat 6	Quadrat 7	Quadrat 8	Quadrat 9
Vegetation Structure	Closed Woodland	Closed Woodland / Shrubland	Closed Woodland	Closed Shrubland	Closed Woodland	Open Woodland	Open Woodland	Closed Woodland	Closed Woodland
Dominant soils	Coega	Hutton	Hutton	Coega	Coega	Hutton	Hutton	Mispah	Mispah
Species									
Abutilon cf. rehmannii					+				
Acacia grandicornuta				1					
Acacia mellifera	4		2		1				
Acacia nigrescens									+
Acacia senegal var. leiorachis	2	1	1			+	+		
Acacia senegal var. rostrata					3				+
Acacia tortilis		1	1	1	1		2		
Albizia anthelminthica				+					
Albizia harveyi									
Aristida congesta subsp. congesta			2				2		
Aristida cf. sciurus		2	2					1	1
Asparagus cf. laricinus			1	+	+	+			
Asparagus cooperi	+								
Asparagus nelsii			+						+
Asparagus suaveolens									
Barleria cf. prionitis	2				+	1			
Barleria transvaalensis			+						
Bauhinia petersiana									
Blepharis cf. subvolubilis	1						2		1
Boscia albitrunca						2	2		
Boscia foetida									
Brachiaria sp.	+	1			1				

Cadaba aphylla									
Cereus jamacaru *			+						
Chascanum pinnatifidum	1			1					
Clematis brachiata					+				
Cleome sp. (no flowers)				1					
Coccinia rehmannii		1		+					
Combretum apiculatum		+	+					3	2
Commelina africana							+	+	+
Commelina cf. erecta									+
Commicarpus pentandrus					1				
Commiphora africana			1				1		
Commiphora glandulosa		2	2				1		
Commiphora mollis		2	2			1		2	2
Commiphora pyracanthoides	+			+	+	+			+
Commiphora schimperi								+	
Corchorus asplenifolius		+		1			1		
Cordia ovalis				1					
Dichrostachys cinerea subsp. *africana*	1	1		1				1	1
Ehretia rigida	+	+			+		+		
Elephantorrhiza obliqua var. glabra							+		
Endostemon tenuiflorus	1	+			1				
Endostemon tereticaulis									
Eragrostis chloromelas					2			2	1
Eragrostis curvula									
Eragrostis micrantha			+						
Eragrostis rigidior (curly-leaf)		2	1			3	2		
Erianthemum ngamicum									
Eriospermum cf. porphyrovalve		+					1		
Euclea undulata var. *myrtina*	1								
Evolvulus alsinoides						1		1	
Felicia clavipilosa subsp. *transvaalensis*									
Felicia mossamedensis									
Grewia bicolor						1			
Grewia flava	1	3	2	3	2	3	3		1
Grewia flavescens			2		+	+	1		
Grewia monticola								2	2
Gymnosporia glaucophylla									

Harpagophytum procumbens							+		
Heliotropium nelsonii				1	+				
Hibiscus cf. calyphyllus (no flowers)		1							
Hibiscus micranthus	+						+	1	1
Hibiscus platycalyx			1						
Hirpicium bechuanense									
Indigastrum costatum				2					
Indigofera heterotricha				1	1	1			
Indigofera trita subsp. subulata								+	
Ipomoea albivenia									
Ipomoea magnusiana							+		
Ipomoea obscura									
Justicia odora				2					
Justicia striata subsp. striata								+	
Kalanchoe cf. brachyloba									
Kyllinga alba		1							
Kyllinga sp.			1						
Kyphocarpha angustifolia			+					+	
Lannea schweinfurthii var. *stuhlmannii*				+					
Lantana rugosa	1	+		+		1	1	+	
Ledebouria marginata		+					+		
Limeum sulcatum						+		+	
Lycium schizocalyx					+		2		
Maerua angolensis									
Maerua parvifolia	+				+				
Megalochlamys sp. (no flowers)	+								
Melhania acuminata	+			1	1	1		+	1
Melhania burchellii								1	1
Momordica balsamina							+		
Momordica boivinii									
Monsonia glauca									
Neorautanenia amboensis							1		
Ocimum cf. gratissimum		+							
Ocimum filamentosum				+					
Ocimum obovatum subsp. obovatum					+				
Ornithogalum seineri		+	+						
Otoptera burchellii							1		

Panicum coloratum								1	
Panicum maximum	2	2	2					2	2
Pavonia burchellii				+	+	1		+	
Phyllanthus cf. maderaspatensis	+	+							
Polygala hottentota					1				
Polygala sphenoptera								+	
Ptycholobium contortum	1	+	1			1			+
Rhynchosia cf. totta								+	
Ruellia cordata									2
Ruellia patula									
Sansevieria aethiopica	+								
Sarcostemma viminale									
Sclerocarya birrea subsp. *cafra*			1						
Searsia leptodictya	+								
Seddera capensis	+								
Senna italica		1					1		
Setaria sphacelata									
Setaria sp.					1				
Sida alba									
Sida cf. ovata									
Solanum catombelense							+		
Solanum elaeagnifolium *	+					1			
Solanum incanum		+				+	+		
Solanum tettense var. *renchii*				1		+			
Sterculia rogersii									3
Stipagrostis uniplumis							2	1	
Tephrosia rhodesica									1
Terminalia prunioides					3				
Terminalia sericea									
Tribulus zeyheri				2		2			
Viscum rotundifolium									
Number of Species	25	26	24	23	25	21	28	23	22

Cover Abundance Scale:
4 = 51-75%
3 = 26-50%
2 = 6-25%

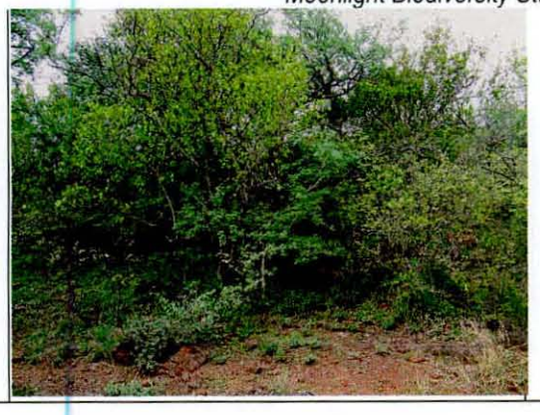
1 = 1-5%
+ < 1%

Appendix 3. Photos of Flora Quadrats

Quadrat No.	Photograph	Veg Community
1		*Acacia senegal-Terminalia prunioides* Closed Woodland / Thicket
2		*Commiphora spp. - Grewia flava* Open to Closed Woodland

3		*Commiphora* spp. - *Grewia flava* Open to Closed Woodland
4		*Acacia senegal-Terminalia prunioides* Closed Woodland / Thicket
5		*Acacia senegal-Terminalia prunioides* Closed Woodland / Thicket

6		*Sclerocarya-Boscia-Acacia tortilis* Open to Closed Woodland Mosaic
7		*Sclerocarya-Boscia-Acacia tortilis* Open to Closed Woodland Mosaic
8		*Combretum apiculatum* Closed Woodland

9		*Combretum apiculatum* Closed Woodland

Appendix 4. Checklist of vertebrate fauna recorded during fieldwork

Common Name	Scientific Name	Red Data	Endemic	Protected	*Acacia senegal-Terminalia prunioides* Closed Woodland / Thicket	*Sclerocarya-Boscia-Acacia tortilis* Open to Closed Woodland Mosaic	*Commiphora spp. - Grewia flava* Open to Closed Woodland	*Combretum apiculatum* Closed Woodland
Mammals								
Aardvark	*Orycteropus afer*			LEMA 2		x		
Impala	*Aepyceros melampus*				x	x	x	x
Common Molerat	*Cryptomys hottentotus*				x	x	x	
Spotted Hyaena	*Crocuta crocuta*	NT		NEMBA	x	x	x	x
Brown Hyaena	*Hyaena brunnea*	NT		NEMBA	x	x	x	x
Leopard	*Panthera pardus*	VU*		NEMBA	x	x	x	x
Caracal	*Lynx caracal*				x	x	x	x
Serval	*Felis serval*	NT		NEMBA		x	x	x
Aardwolf	*Proteles cristatus*			LEMA 3		x	x	
Eland	*Taurotragus oryx*					x	x	x
Red Hartebeest	*Alcelaphus caama*					x	x	
Kudu	*Tragelaphus strepsiceros*				x	x	x	x
Blesbok	*Damaliscus dorcus*					x		
Gemsbok	*Oryx gazella*					x	x	x
Steenbok	*Raphicerus campestris*			LEMA 3	x	x	x	x
Warthog	*Phacochoerus africanus*				x	x	x	x
Cape Porcupine	*Hystrix africaeaustralis*				x	x	x	x
Springhare	*Pedetes capensis*					x		
Namaqua Rock Mouse	*Aethomys namaquensis*				x	x	x	x
Banded Mongoose	*Mungos mungo*				x	x	x	x
Dwarf Mongoose	*Helogale parvula*				x	x	x	x
Tree Squirrel	*Paraxerus cepapi*				x	x	x	x
Bushveld Elephant Shrew	*Elephantulus intufi*	DD			x	x	x	x
Subtotal	23	5	0	7	15	23	20	17
Birds								

Acacia Pied Barbet	*Tricholaema leucomelas*				x	x	x	
African Cuckoo	*Cuculus gularis*					x		x
African Hoopoe	*Upupa africana*				x			x
Amur Falcon	*Falco amurensis*					x		
Ashy Tit	*Parus cinerascens*				x	x	x	
Barn Swallow	*Hirundo rustica*				x	x	x	x
Barred Wren-Warbler	*Calamonastes fasciolatus*		K-H		x	x		
Bateleur	*Terathopius ecaudatus*	VU		NEMBA		over		
Bearded Woodpecker	*Dendropicos namaquus*					x		
Black Cuckoo	*Cuculus clamosus*				x			x
Black-chested Prinia	*Prinia flavicans*				x	x	x	
Black-headed Oriole	*Oriolus larvatus*						x	x
Blue Waxbill	*Uraeginthus angolensis*				x	x	x	x
Brown-crowned Tchagra	*Tchagra australis*				x	x	x	
Brubru	*Nilaus afer*				x			x
Burchell's Sandgrouse	*Pterocles burchelli*		K-H		x	x		
Burnt-necked Eremomela	*Eremomela usticollis*				x			
Cape Turtle Dove	*Streptopelia capicola*				x	x	x	x
Cardinal Woodpecker	*Dendropicos fuscescens*				x	x	x	x
Chestnut-vented Titbabbler	*Parisoma subcaeruleum*				x	x	x	
Chinspot Batis	*Batis molitor*				x	x	x	x
Cinnamon-breasted Bunting	*Emberiza tahapisi*				x		x	x
Common Scimitarbill	*Rhinopomastus cyanomelas*				x			x
Common White-throat	*Sylvia communis*				x	x		
Crested Barbet	*Trachyphonus vaillantii*				x	x	x	x
Crested Francolin	*Dendroperdix sephaena*				x	x	x	x
Crimson-breasted Shrike	*Laniarius atrococcineus*				x	x		
Crowned Lapwing	*Vanellus coronatus*				x	x		
Desert Cisticola	*Cisticola aridulus*					x		
Diederik Cuckoo	*Chrysococcyx caprius*				x	x	x	x
Emerald-spotted Wood Dove	*Turtur chalcospilos*				x	x	x	x
European Bee-eater	*Merops apiaster*				x	x	x	x
European Roller	*Coracias garrulus*	NT				x		
Fork-tailed Drongo	*Dicrurus adsimilis*				x	x	x	x
Gabar Goshawk	*Melierax gabar*				x	x	x	x
Glossy Starling	*Lamprotornis nitens*				x	x	x	x
Golden-breasted Bunting	*Emberiza flaviventris*					x	x	x
Golden-tailed Woodpecker	*Campethera abingoni*				x	x	x	x
Great Sparrow	*Passer motitensis*					x		

Green-winged Pytilia	*Pytilia melba*				x			x
Grey Go-away Bird	*Corythaixoides concolor*				x	x	x	x
Grey-backed Camaroptera	*Camaroptera brevicaudata*				x		x	x
Helmeted Guineafowl	*Numida meleagris*				x	x	x	x
Jacobin Cuckoo	*Clamator jacobinus*				x	x	x	x
Kalahari Scrub-Robin	*Cercotrichas paena*		K-H		x	x		
Klaas's Cuckoo	*Chrysococcyx klaas*				x	x	x	x
Kurrichane Buttonquail	*Turnix sylvaticus*					x		
Larklike Bunting	*Emberiza impetuani*					x		
Laughing Dove	*Streptopelia senegalensis*				x	x	x	x
Lesser Grey Shrike	*Lanius minor*				x	x		
Lilac-breasted Roller	*Coracias caudatus*					x		
Little Bee-eater	*Merops pusillus*				x	x	x	
Long-billed Crombec	*Sylvietta rufescens*				x	x	x	x
Magpie Shrike	*Corvinella melanoleuca*				x			
Marico Flycatcher	*Bradornis mariquensis*				x	x		
Marico Sunbird	*Cinnyris mariquensis*				x	x	x	x
Monotonous Lark	*Mirafra passerina*				x	x		
Namaqua Dove	*Oena capensis*				x	x		
Olivetree Warbler	*Hippolais olivetorum*				x			
Pied Babbler	*Turdoides bicolour*				x	x		
Purple Roller	*Coracias naevius*				x	x	x	
Rattling Cisticola	*Cisticola chiniana*				x	x	x	x
Red-backed Shrike	*Lanius collurio*				x	x	x	x
Red-billed Hornbill	*Tockus erythrorhynchus*				x	x	x	x
Red-billed Oxpecker	*Buphagus erythrorhynchus*	NT			x	x	x	x
Red-billed Quelea	*Quelea quelea*				x	x	x	
Red-breasted Swallow	*Hirundo semirufa*					x	x	
Red-crested Korhaan	*Lophotis ruficrista*				x	x	x	x
Red-faced Mousebird	*Urocolius indicus*				x	x	x	x
Red-headed Finch	*Amadina erythrocephala*					x		
Rufous-cheeked Nightjar	*Caprimulgus rufigena*				x	x	x	x
Rufous-naped Lark	*Mirafra africana*					x		
Sabota Lark	*Calendulauda sabota*				x	x		
Scaly-feathered Finch	*Sporopipes squamifrons*				x	x		
Shaft-tailed Whydah	*Vidua regia*				x	x		
Southern Ant-eating Chat	*Myrmecocichla formicivora*				x	x		
Southern Black Tit	*Parus niger*				x	x	x	x
Southern Grey-headed Sparrow	*Passer diffusus*				x	x	x	x

Southern Masked Weaver	*Ploceus velatus*				x	x	x	x
Southern Pale Chanting Goshawk	*Melierax canorus*					x		
Southern White-crowned Shrike	*Eurocephalus anguitimens*				x	x		
Southern Yellow-billed Hornbill	*Tockus leucomelas*				x	x	x	x
Spotted Flycatcher	*Muscicapa striata*				x	x	x	x
Spotted Thick-knee	*Burhinus capensis*					x		
Swainson's Francolin	*Pternistis swainsonii*				x	x	x	x
Swallow-tailed Bee-eater	*Merops hirundineus*				x	x		
Violet-eared Waxbill	*Granatina granatina*				x	x		
Wattled Starling	*Creatophora cinerea*				x	x	x	x
White-backed Vulture	*Gyps africanus*	VU		NEMBA	x	x	x	x
White-bellied Sunbird	*Cinnyris talatala*		Zm		x	x	x	x
White-browed Scrub-Robin	*Cercotrichas leucophrys*				x	x	x	x
White-browed Sparrowweaver	*Plocepasser mahali*				x	x		
White-throated Robin-Chat	*Cossypha humeralis*		Zm		x		x	
Willow Warbler	*Phylloscopus trochilus*				x	x		x
Subtotal	94	4	5	2	77	82	52	49
Reptiles								
Leopard Tortoise	*Stigmochelys pardalis*					x		
Flapneck Chamaeleon	*Chamaeleo dilepis*							x
Common Dwarf Gecko	*Lygodactylus capensis*					x	x	
Kalahari Round-headed Worm Lizard	*Zygaspis quadrifrons*					x		
Spotted Sandveld Lizard	*Nucras intertexta*					x	x	
Tropical Girdled Lizard	*Cordylus tropidosternum*				x		x	
Variegated Skink	*Trachylepis variegata*				x			
Peters' Thread Snake	*Leptotyphlops scutifrons*				x			
Sundevall's Writhing Skink	*Lygosoma sundevallii*				x			
Yellow-throated Plated Lizard	*Gerrhosaurus flavigularis*				x	x	x	
Subtotal	10	0	0	0	5	5	4	1
Frogs								
Bubbling Kassina	*Kassina senegalensis*							x
Foam-nest Frog	*Chiromantis xerampelina*							x
Bushveld Rain Frog	*Brevisceps adspersus*							x
Common River Frog	*Afrana angolensis*							x
Ornate Frog	*Hildebrandtia ornata*							x
African Bullfrog	*Pyxicephalus edulis*			LEMA 3				x
Subtotal	6	0	0	1	0	0	0	6

Red Data categories:
VU = Vulnerable
NT = Near Threatened
DD = Data Deficient
Biome-restricted assemblages:
K-H = Kalahari-Highveld Transition
Zm = Zambezian
Protective legislation:
NEMBA = National Environmental Management: Biodiversity Act
LEMA 2 = Schedule 2 of Limpopo Environmental management Act
LEMA 3 = Schedule 3 of Limpopo Environmental management Act

Appendix 5. Potentially occurring fauna of conservation concern

Common Name	Scientific Name	Red Data Status	Conservation Importance Value	*Acacia senegal-Terminalia prunioides* Closed Woodland / Thicket	*Sclerocarya-Boscia-Acacia tortilis* Open to Closed Woodland Mosaic	*Commiphora spp. - Grewia flava* Open to Closed Woodland	*Combretum apiculatum* Closed Woodland
Mammals							
Botswana Long-eared Bat	*Laephotis botswanae*	VU	Med	(x)	(x)	(x)	(x)
Leopard	*Panthera pardus*	VU*	High	xx	xx	xx	xx
Pangolin	*Manis temminckii*	VU	High	x	x	x	x
Peak-saddle Horseshoe Bat	*Rhinolophus blasii*	VU	Med	(x)	(x)	(x)	(x)
Brown Hyaena	*Hyaena brunnea*	NT	Med	xxx	xxx	xxx	xxx
Darling's Horseshoe Bat	*Rhinolophus darlingi*	NT	Low	(x)	(x)	(x)	(x)
Geoffroy's Horseshoe Bat	*Rhinolophus clivosus*	NT	Low	xx	xx	xx	xx
Hildebrandt's Horseshoe Bat	*Rhinolophus hildebrandtii*	NT	Low	(x)	(x)	(x)	(x)
Honey Badger	*Mellivora capensis*	NT	Med	xx	xx	xx	xx
Natal Long-fingered Bat	*Miniopterus natalensis*	NT	Low	xx	xx	xx	xx
Rusty Bat	*Pipistrellus rusticus*	NT	Low	(x)	(x)	(x)	(x)
Serval	*Leptailurus serval*	NT	Med		xxx	xxx	xxx
South African Hedgehog	*Atelerix frontalis*	NT	Med		x	x	
Spotted Hyaena	*Crocuta crocuta*	NT	Med	xxx	xxx	xxx	xxx
Temminck's Hairy Bat	*Myotis tricolor*	NT	Low	x	x	x	x
Welwitsch's Hairy Bat	*Myotis welwitschii*	NT	Low	(x)	(x)	(x)	(x)
African Weasel	*Poecilogale albinucha*	DD	Med	x	x	x	x
Bushveld Elephant Shrew	*Elephantulus intufi*	DD	Med	xxx	xxx	xxx	xxx
Bushveld Gerbil	*Tatera leucogaster*	DD	Med	xx	xx	xx	xx
Gambian Epauletted Fruit Bat	*Epomophorus crypturus*	DD	Low	(x)	(x)	(x)	(x)
Lesser Red Musk Shrew	*Crocidura hirta*	DD	Med	xx	xx	xx	xx
Reddish-grey Musk Shrew	*Crocidura cyanea*	DD	Med	xx	xx	xx	xx

Rock Dormouse	*Graphiurus platyops*	DD	Med	x			x
Short-snouted Elephant Shrew	*Elephantulus brachyrhynchus*	DD	Med	x	x	x	x
Single-striped Mouse	*Lemniscomys rosalia*	DD	Med		x	x	
Woodland Mouse	*Grammomys dolichurus*	DD	Med	x	x	x	x
		26	26	23	25	25	24
	Birds						
Lappet-faced Vulture	*Aegypius tracheliotus*	VU	Med	xx	xx	xx	xx
Tawny Eagle	*Aquila rapax*	VU	High	xx	xx	xx	xx
Kori Bustard	*Ardeotis kori*	VU	High		xx		
White-backed Vulture	*Gyps africanus*	VU	High	xxx	xxx	xxx	xxx
Cape Vulture	*Gyps coprotheres*	VU	Med		x	x	
Hooded Vulture	*Necrosyrtes monachus*	VU	Med	xx	xx	xx	xx
Martial Eagle	*Polemaetus bellicosus*	VU	High	xxx	xxx	xxx	xxx
Bateleur	*Terathopius ecaudatus*	VU	High	xxx	xxx	xxx	xxx
Red-billed Oxpecker	*Buphagus erythrorhynchus*	NT	Med	xxx	xxx	xxx	xxx
European Roller	*Coracias garrulus*	NT	Med	xxx	xxx	xxx	xxx
Lanner Falcon	*Falco biarmicus*	NT	Med		xxx	xxx	
Secretarybird	*Sagittarius serpentarius*	NT	Med		xx		
		12	12	8	12	10	8
	Reptiles & Frogs						
Southern African Python	*Python natalensis*	VU	High	xx	xx	xx	xx

VU = Vulnerable	(x) = very low [-0.1]
NT = Near Threatened	x = low [-0.25]
DD = Data Deficient	xx = medium [-0/.5]
* = NEMBA threat status	xxx = high [-1]

NEMBA = National Environment Management: Biodiversity Act
LEMA2 = Schedule 2 of Limpopo Environment Management Act
LEMA3 = Schedule 3 of Limpopo Environment Management Act

Appendix 6. Photos of Reptiles and Frogs captured during fieldwork

Chamaeleo dilepis
(foraging at night in *Combretum apiculatum* woodland, 03.12.2010)

Cordylus tropidosternum
(found hiding under bark of tree in woodland on calcrete, 03.12.2010)

Trachylepis variegata
(foraging on a log in *Acacia-Terminalia* woodland, 03.12.2010)

Zygaspis quadrifrons
(unearthed while digging for scorpions in *Acacia-Terminalia* woodland, 03.12.2010)

Geochelone pardalis (juvenile found crossing road in *Acacia-Terminalia* woodland on calcrete, 03.12.2010)

Hildebrandtia ornata (captured at small dam in *Combretum apiculatum* woodland, 03.12.2010)

Leptotyphlops cf. scutifrons (several individuals found under rotting logs and termitaria, 03.12.2010)

Pyxicephalus edulis (caught at a roadside pool in *Combretum apiculatum* woodland, 04.12.2010)

Lygosoma sundevallii (several individuals found in soil under rotting logs, *Acacia-Terminalia* woodland on calcrete, 03.12.2010)

Appendix 7. Conservation importance values, probability of occurrence and confirmed conservation-important invertebrate species in natural habitats on the Moonlight site

COMMON NAME	SPECIES	IUCN Red List status[1]	SA Red Data Status[2]	Endemic status[3]	Protection status[4]	Importance value	Predicted	confirmed – red soils	confirmed – calcrete outcrops	confirmed – haematite outcrops	confirmed - wetlands
Scorpions											
Flat Rock Scorpion	*Hadogenes newlandsii*	-	-	Local	NEMBA	Medium	(x)	-	-	-	-
Flat Rock Scorpion	*H.* sp. aff. *newlandsii*	-	-	Local	NEMBA	High	(x)	-	-	-	-
Flat Rock Scorpion	*H. troglodytes*	-	-	Regional	NEMBA	Medium	X	-	-	-	-
Creeping scorpion	*Opistacanthus asper*	-	-	Regional	NEMBA	Medium	(x)	-	-	-	-
Burrowing Scorpion	*Opistophthalmus glabrifrons*	-	-	Regional	NEMBA	Medium	XX	X	X	X	-
Burrowing Scorpion	*O.* sp. aff. *glabrifrons*	-	-	Local	NEMBA	High	(x)	-	-	-	-
Burrowing Scorpion	*O. kalaharicus*	-	-	Local	NEMBA	Medium	(x)	-	-	-	-
Burrowing Scorpion	*O. wahlbergii*	-	-	Regional	NEMBA	Medium	XX	X	-	-	-
Trapdoor and baboon spiders											
Horned Baboon Spider	*Ceratogyrus darlingi (= bechuanicus)*	-	-	Continent	MNCA/NEMBA	Medium	XXX	-	X	-	-
Horned Baboon Spider	*C. brachycephalus*	-	-	Continent	MNCA/NEMBA	Medium	XX	-	-	-	-
Golden Baboon Spider	*Augacephalus (Pterinochilus) junodi*	-	-	Regional	MNCA/NEMBA	Medium	XX	X	-	-	-
Golden Baboon Spider	*Pterinochilus lugardi (= P. pluridentatus)*	-	-	Continent	MNCA/NEMBA	Medium	XX	-	-	-	-
Dragonflies and damselflies											
Fairytail	*Lestinogomphus angustus*	LC	(NT)	Continent	-	Low	(x)	-	-	-	-
Slender Bottle-tail	*(Olpogastra lugubris)*	LC	(VU)	Continent	-	Low	(x)	-	-	-	-
Assegaai Sprite	*Pseudagrion assegai*	LC	(VU)	Continent	-	Low	(x)	-	-	-	-
Makabusi Sprite	*(P. makabusiense)*	LC	(VU)	Continent	-	Low	(x)	-	-	-	-
Ground beetles											
Tiger Beetle	*Megacephala regalis*	-	-	Continent	NEMBA	Medium	XX	X	-	-	-
Monster Tiger Beetle	*Mantichora latipennis*	-	-	Continent	NEMBA	Medium	XX	X	-	-	-
Monster Tiger Beetle	*Mantichora mygaloides*	-	-	Continent	NEMBA	Medium	XX	-	-	-	-
Monster Tiger Beetle	*Mantichora tibialis*	-	-	Continent	NEMBA	Medium	XX	-	-	-	-
Monster Tiger Beetle	*Mantichora tuberculata*	-	-	Continent	NEMBA	Medium	XX	-	-	-	-
Tiger Beetle	*Dromica tuberculata transvaalensis*	-	-	Regional	NEMBA	Medium	XX	-	-	-	-
Tiger Beetle	*Dromica clathrata clathrata*	-	-	Continent	NEMBA	Medium	XX	-	-	-	-
Tiger Beetle	*Dromica pseudoclathrata*	-	-	Continent	NEMBA	Medium	XX	-	-	-	-

Tiger Beetle	*Dromica polyhirmoides*	-	-	Continent	NEMBA	Medium	XX	-	-	-	-
Tiger Beetle	*Dromica quadricostata*	-	-	Regional	NEMBA	Medium	XX	-	-	-	-
Tiger Beetle	*Dromica limpopoiana limpopoiana*	-	-	Continent	NEMBA	Medium	XX	-	-	-	-
Tiger Beetle	*Dromica limpopoiana speciosa*	-	-	Continent	NEMBA	Medium	XX	-	-	-	-
Tiger Beetle	*Dromica consimilis*	-	-	Continent	NEMBA	Medium	XX	-	-	-	-
Tiger Beetle	*Dromica alboclavata*	-	-	Continent	NEMBA	Medium	XX	-	-	-	-
Tiger Beetle	*Dromica tenella*	-	-	Continent	NEMBA	Medium	XX	-	-	-	-
Tiger Beetle	*Dromica gloriosa*	-	-	Continent	NEMBA	Medium	XX	-	-	-	-
Tiger Beetle	*Dromica concinna*	-	-	Continent	NEMBA	Medium	XX	X	-	-	-
Tiger Beetle	*Dromica dolosa*	-	-	Continent	NEMBA	Medium	XX	-	-	-	-
Tiger Beetle	*Dromica convexicollis*	-	-	Regional	NEMBA	Medium	XX	-	-	-	-
Tiger Beetle	*Dromica sexmaculata*	-	-	Continent	NEMBA	Medium	XX	-	-	-	-
Tiger Beetle	*Dromica kolbei*	-	-	Continent	NEMBA	Medium	XX	-	-	-	-
Tiger Beetle	*Dromica lepidula*	-	-	Continent	NEMBA	Medium	-	X	-	-	-
Tiger Beetle	*Dromica costata*	-	-	Continent	NEMBA	Medium	-	X	X	-	-
Tiger Beetle	*Dromica lateralis*	-	-	Continent	NEMBA	Medium	-	X	X	-	-
	Butterflies										
Edge's Copper	*(Erikssonia edgei)**	VU D2	CR	Local	-	Very High	(x)	-	-	-	-
Regular Woolly Legs	*(Lachnocnema regularis regularis)*	-	DD	Local	-	Medium	(x)	-	-	-	-
	Ants										
Parasitic ant	*Tetramorium microgyna*	VU D2	-	Regional	-	High	X	(-)**	(-)**	(-)**	(-)**
SUBTOTAL	**24**	**6 (7)**	**7**	**18**	**11**			**9**	**4**	**1**	**0**

* originally considered an isolated southern population of E. acraeina and as such listed as Vulnerable by Henning & Henning (1989), this population has recently been described as a distinct species (Gardiner & Terblanche 2010) and according to the latter authors should be considered as critically endangered; the population has been listed as Critically Endangered under the name E. acraeina (but with a note to the effect that it is probably a distinct species) in Henning, Terblanche & Ball 1009. The IUCN status applies to the earlier classification including the northern populations (E. acraeina) and thus downplays the threat to the southern population (E. edgei).

** not surveyed for, so absence not confirmed

Notes to Appendix 7:

1. IUCN categories (brackets indicate meets criteria, but formal evaluation still in progress):	**2**. SA Red data categories:	**3**. Degree of endemism: note that some of the beetle species may be locally rather than regionally endemic, but insufficient data is available at present to substantiate this; their importance values may thus be slightly underestimated here.	**4**. Protection status:	Probability of occurrence:
EN = Endangered VU = Vulnerable DD = Data Deficient LC = Least Concern	RE = Regionally Extinct CR = Critically Endangered NT = Near-threatened		**NEMBA** = Included on current list of threatened and protected species in terms of National Environmental Management: Biodiversity Act. Restricted activities involving species on this list will be regulated from 1 June 2007. **MNCA** = Protected in terms of the Mpumalanga Nature Conservation Act, 1998.	- = none (0.00) (x) = v low (0.10) X = low (0.25) XX = medium (0.50) XXX = high (1.00)

Appendix 8. Framework of criteria used to assess conservation importance of habitats for invertebrate fauna

Red Data Status	Breeding / Foraging								Foraging Only							
	Local Endemic		Regional Endemic		National Endemic		Global		Local Endemic		Regional Endemic		National Endemic		Global	
	Prot	NonProt	Prot	NonProt	Prot	NonProt	Prot	NonProt	Prot	NonProt	Prot	NonProt	Prot	NonProt	Prot	NonProt
CR, EN	Very High	Very High	Very High	Very High	Very High	Very High	Very High	Very High	High	High	High	High	High	High	High	High
VU, NT	Very High	High	Very High	High	High	High	High	High	High	Medium	High	Medium	Medium	Medium	Medium	Medium
DD	High	Medium	High	Medium	Medium	Medium	Medium	Medium	Medium	Low	Medium	Low	Low	Low	Low	Low
LC, None	High	Medium	Medium	Low	Medium	Low	Medium	Low	Medium	Low	Low	Very Low	Low	Very Low	Low	None

Values for assessment calculations: None = 0, Very Low = 1, Low = 2, Medium = 3, High = 4, Very High = 5.

Appendix 9. Carabid and Tenebrionid species collected at the Moonlight site

Species	Habitat		
	Red soils	Haematite outcrops	Calcrete outcrops
Carabidae			
Anthia burchelli	x		
Anthia cephalotes	x	x	x
Anthia cinctipennis	x		
Anthia circumscripta		x	
Anthia homoplatum	x	x	
Anthia massilicata	x		
Anthia thoracica			x
Atractonotusmulsanti	x		
Cypholoba alveolata	x		
Cypholoba chaudoiri		x	
Cypholoba gracilis subspecies *seineri/gracilis*	x	x	
Cypholoba gracilis subspecies *scrobiculata*	x		
Calosoma			x
Dromica concinna	x		
Dromica costata	x	x	
Dromica lateralis	x	x	
Dromica lepidula	x		
Megacephela regalis	x		
Manticora latipennis	x		
Graphipterus ?circumdatus	x	x	
Graphipterus ?velutinus	x		
Graphipterus albolineatus		x	
Graphipterus anchora	x	x	
Graphipterus atrimedius	x		
Graphipterus bilineatus	x		
Piezia algoensis	x	x	
Chlaenius fasciger	x		
Chlaenius pulchellus	x		
Brachyodes conspicuus	x	x	
Scarites sp.	x		
Tribe Oodini, genus and species not determined.	x		
TOTAL	**25**	**12**	**3**
Tenebrionidae			
Adesmia maculicollis	x	x	
Anomalipus ?proximus	x	x	x
Anomalipus elephas		x	
Eupezus longipennis	x		x
Eurychora ciliata	x		
Gonopus hirtipes	x	x	
Gonopus tibialis	x		x
Moluris discoideus	x		
Phanerotomea sp	x		x
Tribe Adesmiini genus and species unknown #1		x	
Tribe Platynotini genus and species unknown #1		x	
TOTAL	**8**	**6**	**4**

APPENDIX I: VELD ASSESSMENT AND GRAZING MANAGEMENT STUDY

Specialist report prepared by X, May 2011

TURQUOISE MOON

Veld Condition Assessment
Grazing Management Report

MAY 2011

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Veld Condition Assessment

Turquoise Moon Development area

May 2011

1. INTRODUCTION

1.1 Executive Summary

Enviropulse CC, represented by Francois de Wet was asked by Ecorex CC to evaluate the current veld condition and provide guidelines in the numbers of game (grazers) that should be accommodated.

A veld condition assessment evaluation at 18 areas within the study area revealed that veld condition is overgrazed at all areas assessed.

Veld condition assessments on regular intervals should reveal the impact of grazers on the veld, but on the positive side it may also show improvement depending on the rainfall received and the grazir pressure and management applied during the period. The trend of veld condition should therefore be closely followed in future in order to provide information on how to manage the numbers of game or livestock (i.e. cattle).

The following grazing capacities are applicable on the respective vegetation communities identified by Ecorex CC.:

- *Acacia Senegal – Terminalia prunioides* Closed Woodland – 13 ha/LAU;
- *Sclerocarya birrea –Boscia – Aciacia tortilis* Open/Closed Woodland – 16 ha/LAU;
- *Commifera spp – Grewia flava* Open/Closed Woodland – 17 ha/LAU; and
- *Combretum apiculatum* Closed Woodland – 18 ha/LAU.

1.2 Veld condition assessment, monitoring and interpretation of past land-use practices

Grassland dynamics within the semi-arid savanna is largely influenced by rainfall. Numbers of grazers and the proportion between bulk and selective grazers also influence the condition of the veld. The typ of management applied to influence both the pattern and intensity of grazing is important.

Veld condition should form the basis of decision-making with regulating the numbers of grazers as well as when and how to apply fire (if that is an appropriate management tool for the wildlife management in the study area). Veld condition trends (which is influenced by both rainfall and grazing management) is therefore important to keep track of.

Veld condition assessments should therefore reveal whether the grassland area has been well managed (i.e. burnt frequently enough) or mismanaged (either over-rested, or too frequently burnt). Trends in veld condition (towards under-utilization or overgrazing) should be determined or monitored over time by regular veld condition assessments.

2. METHODS

2.1. SITE SELECTION – STRATIFICATION AND MARKING OF SITES

For veld condition assessment the most representative veld had to be identified first before the evaluation of veld condition could commence. Stratification was done on the basis of ecological variation (soil and vegetation differences) observed from aerial photos.

A total of 18 grassland monitoring sites were selected. See a copy of the position of the survey sites on a Google Image below, Figure 1.

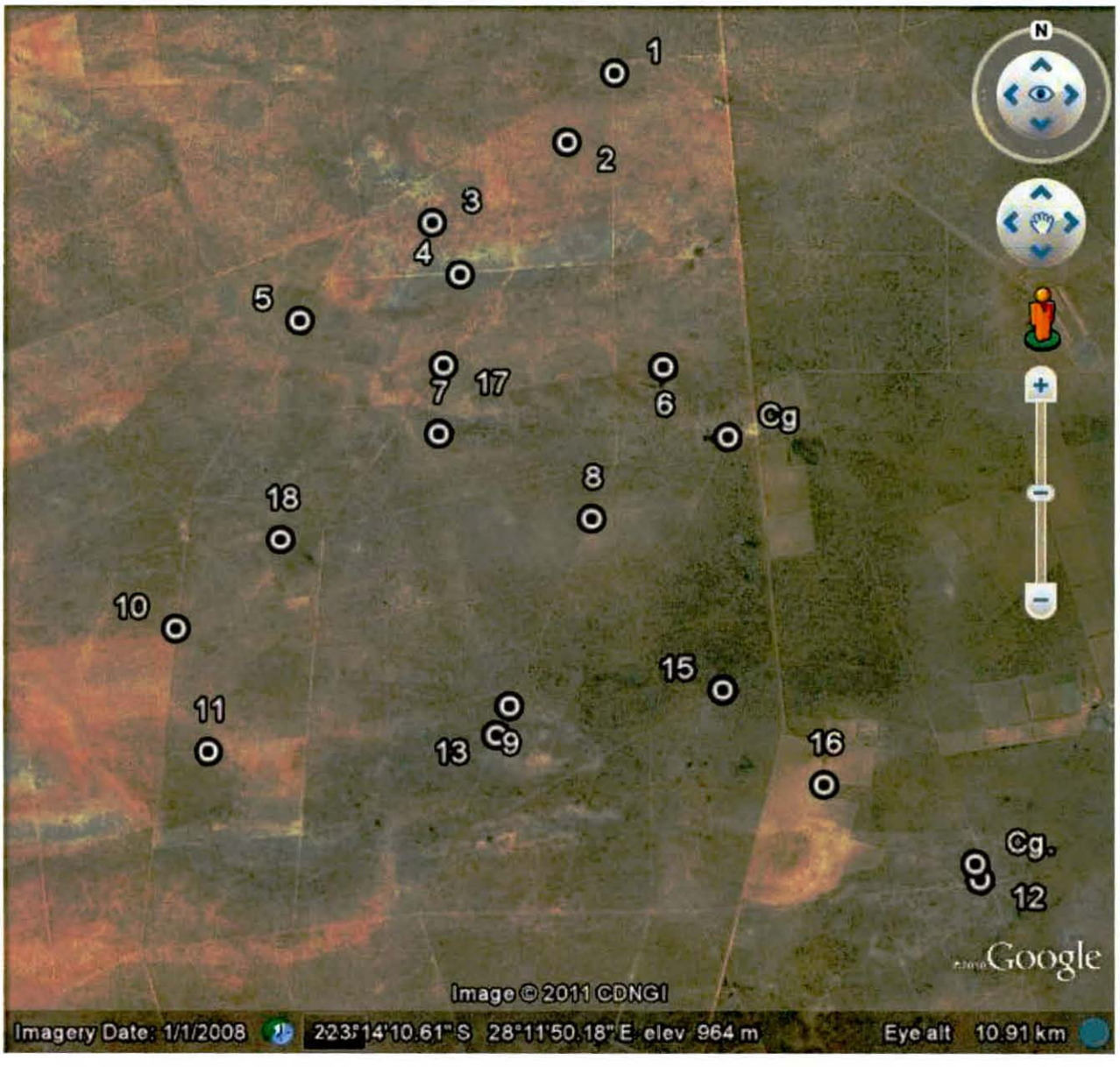

Figure 1: Distribution of Veld Condition Assessment Sites within the study area (2011).

2.2. VELD CONDITION ASSESSMENT

The veld condition assessment consisted of two parts: The estimation of grazing volume and the assessment of the grass composition.

2.2.1 Grazing volume was assessed with a disc meter. See illustration below.

Figure 2: The disc meter, developed by Bransby & Tainton (1977) to determine the standing grass phytomass. Grazing volume is expressed in kg/ha or tons/ha.

A total of 100 readings of compressed grass height were obtained by dropping the disc on the grass layer within 2 m intervals. Settling height of the disc on the compressed grass layer is read on the cm-calibrated rod which fits in the shaft (pipe). The average height is calculated and used in the calibration formula provided by Trollope and Potgieter (1986) to translate compressed height into tons/ha (or kg/ha).

2.2.2 Grass composition:

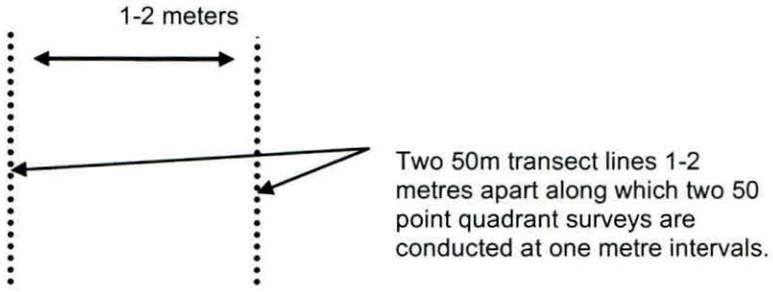

Figure 3: Diagram of a Point Quadrant Technique used to determine the grass composition of the grass layer.

A total of 100 grass species observations (at the same area where disc height readings were taken) were recorded per veld condition site and the grass tuft distance between the monitoring rod and the rooted part of the grass was recorded at each observation. The nearest perennial and annual grass species (which ever was the closest) to the monitoring rod was recorded at each of the 100 grass species observations along the two transect lines illustrated above. If herbaceous forb species occurred closer to the monitoring rod than grasses it was recorded as well, but the nearest grass species was still recorded as a second recording per monitoring point. This would enable the comparison as reflected in the veld condition tables, to have a grass composition including the forbs (and sedges*) or excluding the forbs (and sedges*). * Sedges were distinguished from dicotyledonous herbaceous forbs and recorded, whichever occurred closer to the monitoring rod, the forb or the sedge. The total number of grasses was expressed out of 100 sampling observations as percentage abundance.

Grass composition is summarized in tables where the grasses are listed within ecological categories (as defined by Tainton, 1988), Decreasers and Increasers (Increasers 1 and 2). The contribution of each grass species within the survey is expressed as frequency abundance. Decreasers are climax grasses within the semi-arid savanna and the most desired grasses for these grasses are productive and palatable. Increaser 1 species are abundant in temperate Highveld grasslands and not expected to be abundant within this veld type but these grasses indicate climax conditions and are more woody and therefore less palatable and desired for grazers. Increaser 2 species are pioneer grasses and not desirable as these grasses are also often lower in production and as a rough guideline have lower basal cover and veld dominated by these grasses would therefore be prone to higher soil loss due to erosion. The report also contains graphs illustrating the condition of the veld on a degradation axis showing climax grassland on the one extreme of the axis and severely overgrazed veld on the other extreme of the axis. These ISPD graphs will be updated with follow-up monitoring which can then show the direction of trend, reflecting on rainfall and grazing conditions (ISPD = Integrated System for Plant Dynamics – Bosch & Booysen, 1992).

Grazing capacity is estimated using both rainfall and current veld condition (Danckwerts, 1989).

4. VELD CONDITION RESULTS

The veld condition assessment at the study area can be summarized as follows:

4.1. Grazing Volumes:

The following legend applies to the volumes illustrated in the graphs below, as is also explained in the veld condition assessment tables:

- Very high – > 4 000 kg/ha
- High is between 3 000 – 4000 kg/ha
- Medium is between 2 000 to 3 000 kg/ha
- Low - < 2000 kg/ha.

Plant Community 1:

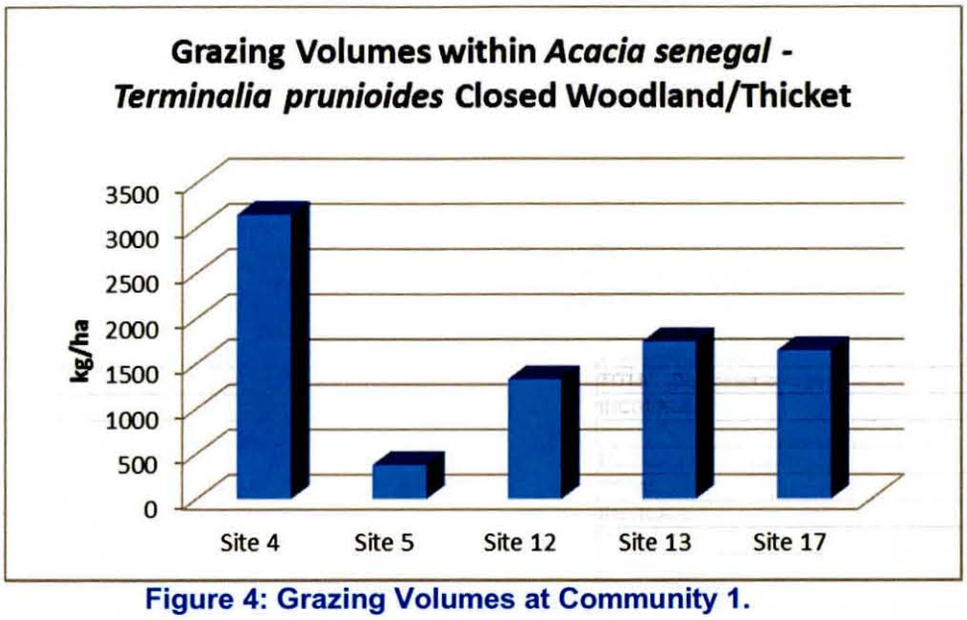

Figure 4: Grazing Volumes at Community 1.

Grazing volume varied but was highest at Site 4 and lowest at Site 5.

Plant Community 2:

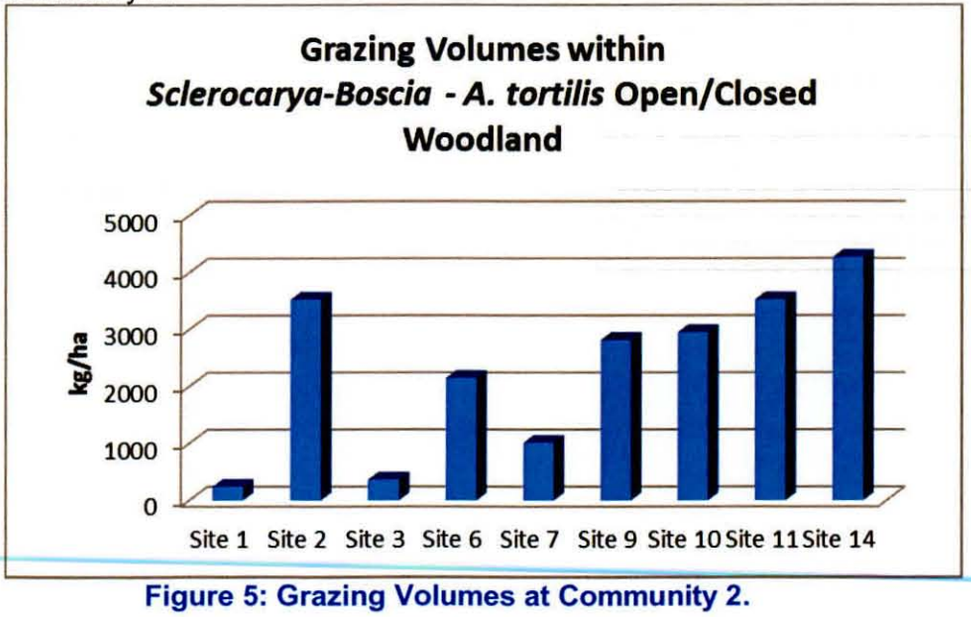

Figure 5: Grazing Volumes at Community 2.

Grazing volume varied with low grazing volumes at Sites 1, 3 and 7 but was higher at the other sites assessed.

Plant Community 3:

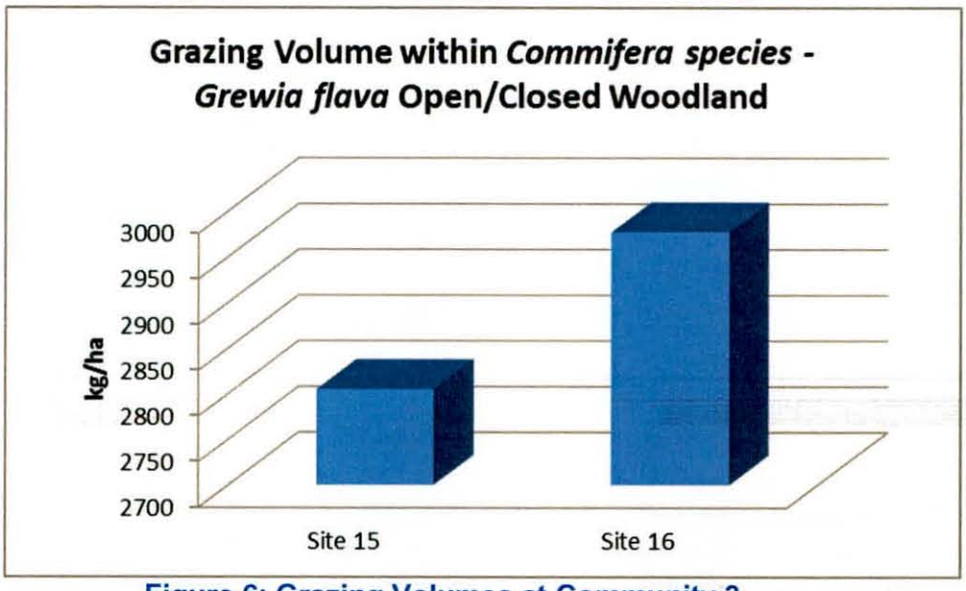

Figure 6: Grazing Volumes at Community 3.

Grazing volume varied between medium and high.

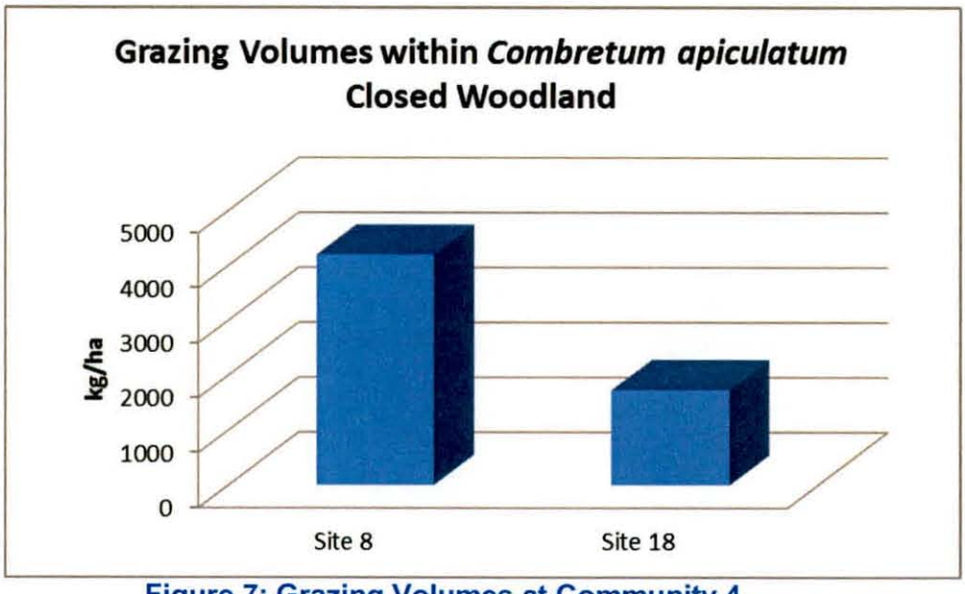

Figure 7: Grazing Volumes at Community 4.

Grazing volume varied between medium and high.

Plant Community 4:

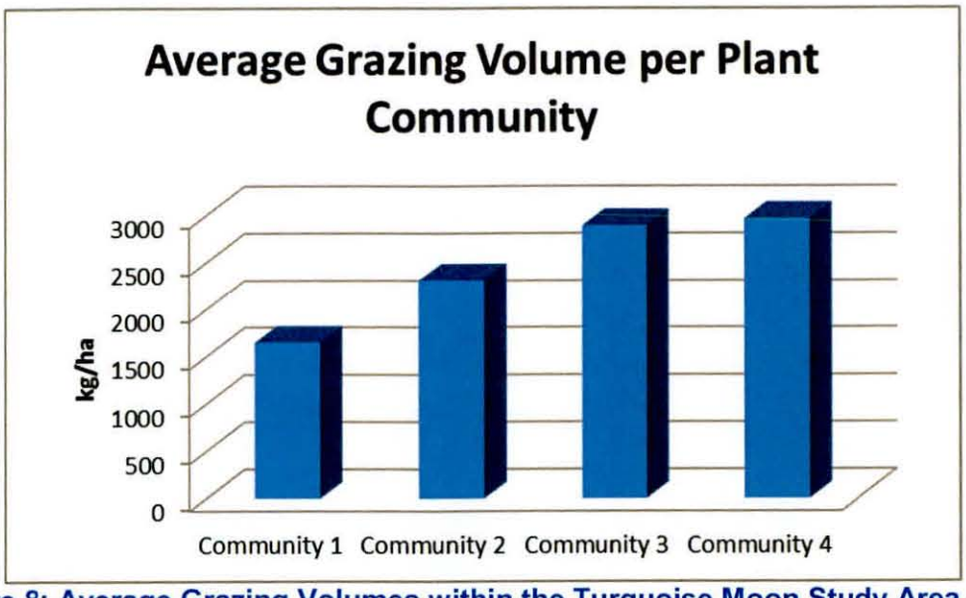

Figure 8: Average Grazing Volumes within the Turquoise Moon Study Area.

Average Grazing volume in the study area varied between medium and high.

4.2. Grass Composition:

Veld condition from the grass composition shows overgrazing and the grazing volume is often low and of poor grazing value.

The condition of the veld condition assessments are projected on an x-axis within the following ecological units or plant communities, as identified by Ecorex (2011):

4.2.1. *Acacia Senegal – Terminalia prunioides* Closed Woodland – Plant Community 1:

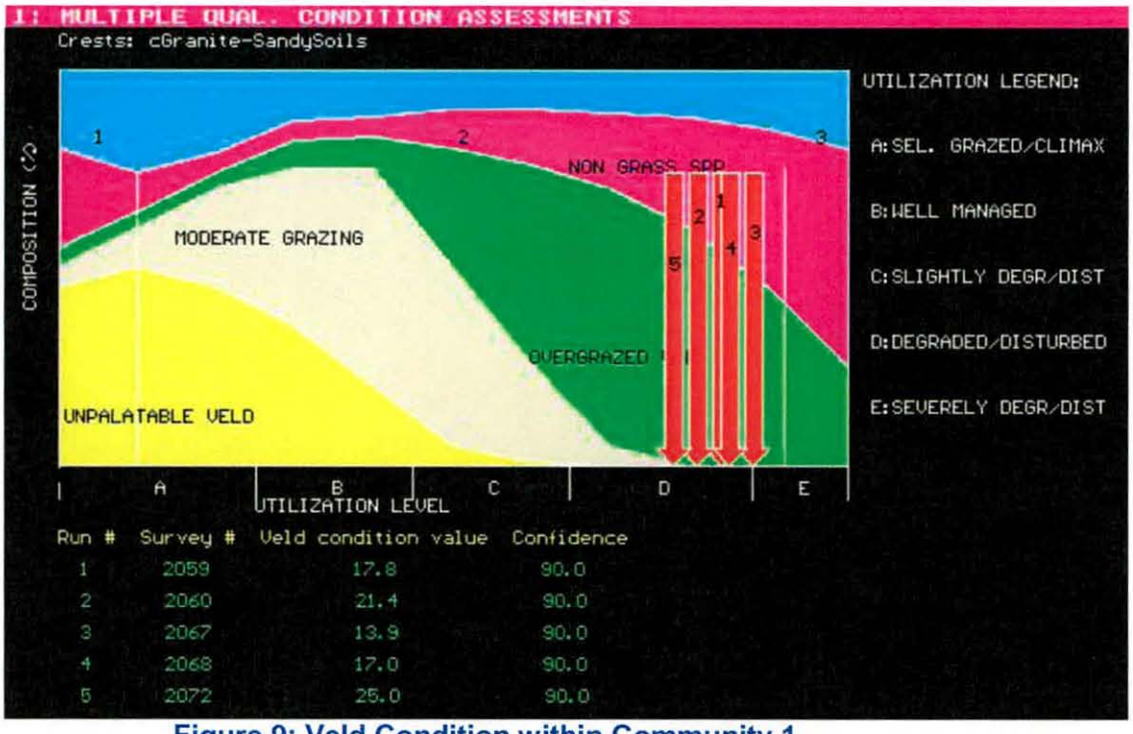

Figure 9: Veld Condition within Community 1.

The veld condition of all these surveys is within the D-category, which reflects overgrazing. On the graph Runs 1 to 5 represent Veld Condition Sites 4, 5, 12, 13 and 17 respectively.
Site 4 - *Enneapogon desvauxii* (Eight Day Grass) and *Enneapogon cenchroides* (Nine-awned Grass) are both Increaser 2 species that are dominant at this site.
Site 5 - *Eragrostis lehmanniana* (Lehmann's Love Grass) is an Increaser 2 species that is abundant at this site.
Site 12 - *Enneapogon desvauxii* dominant.
Site 13 – The Increaser 2, *Setaria pumila* Garden Bristle Grass, is dominant.
Site 17 - *Eragrostis lehmanniana* dominant.

4.2.2. *Sclerocarya birrea/Boscia/Acacia tortilis* Open/Closed Woodland – Plant Community 2:

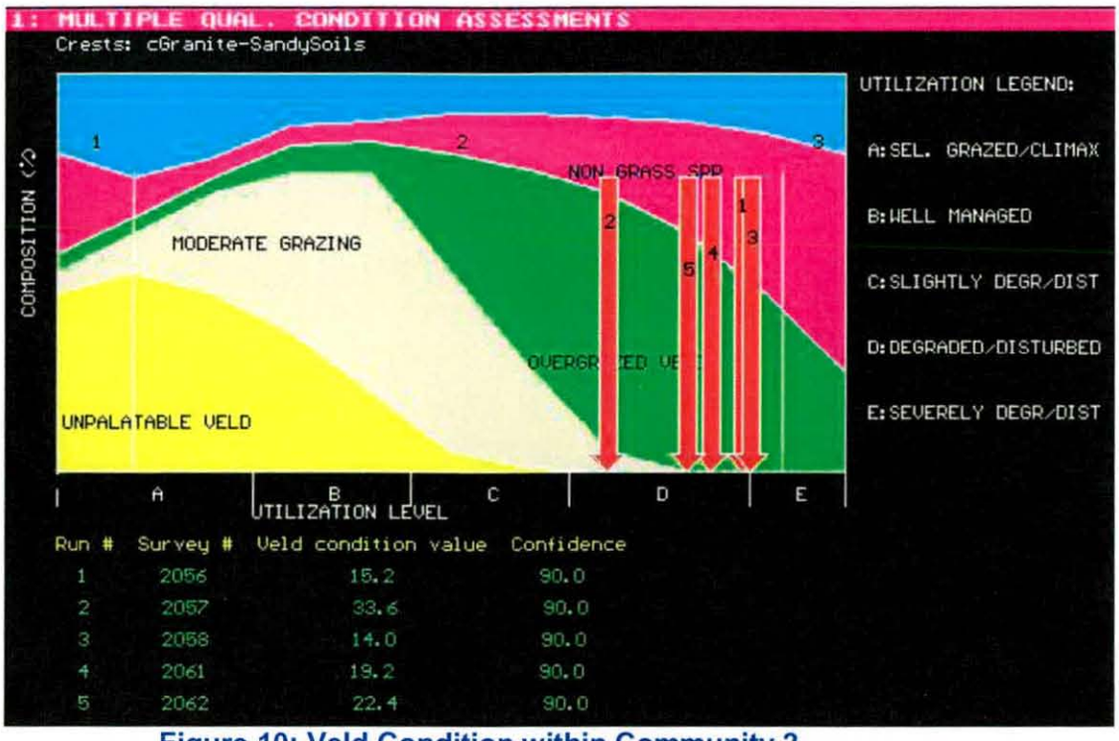

Figure 10: Veld Condition within Community 2.

The veld condition of all these surveys (5 of 9 assessments within this community) is within the D-category, which reflects overgrazing (A maximum of 5 multiple condition assessments can be illustrated per ISPD graph). On the graph Runs 1 to 5 represent Veld Condition Sites 1, 2, 3, 6 and 7 respectively.

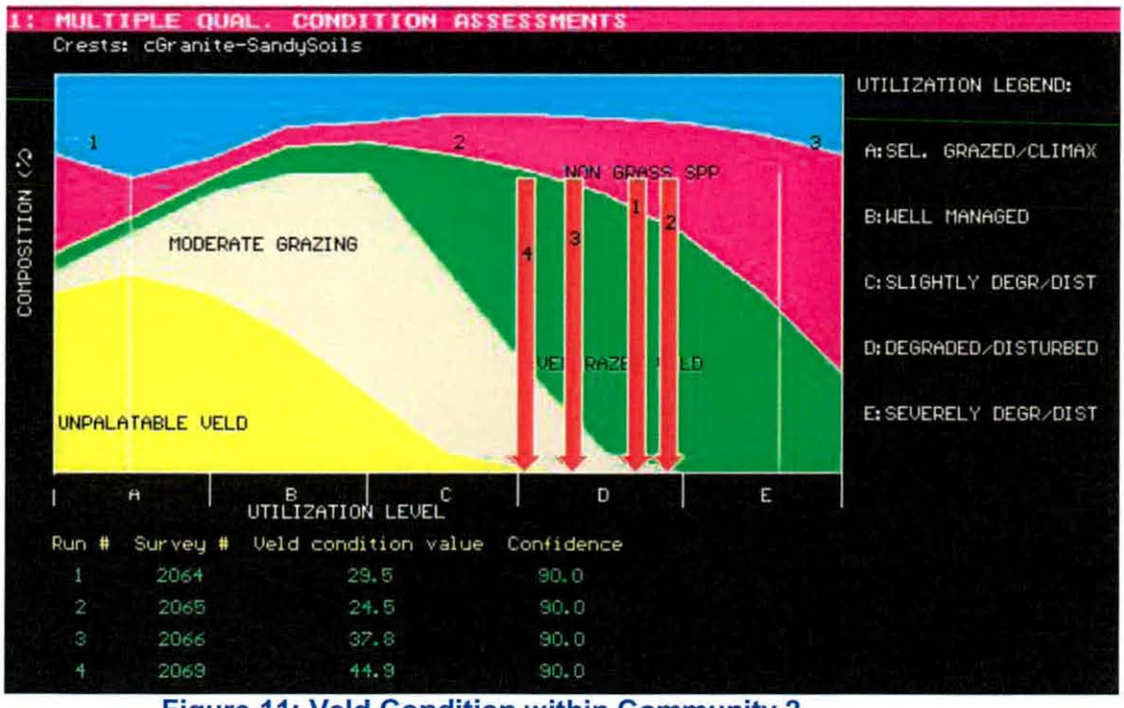

Figure 11: Veld Condition within Community 2.

The veld condition of all these surveys (4 of the 9 assessments within this community) is within the D-category, which reflects overgrazing. (A maximum of 5 multiple condition assessments can be

illustrated per ISPD graph). On the graph Runs 1 to 5 represent Veld Condition Sites 9, 10, 11 and 14 respectively.
Site 9 –*Urochloa mosambicensis* together with other Increaser 2 grasses, *Eragrostis rigidior* and *E. lehmanniana* abundant.
Site 10 –*Aristida vestita* abundant, together with other Increaser 2 grasses, *E. rigidior* and *Schmidtia pappophoroides*.
Site 11 - *Eragrostis rigidior* (Curly Leaf / Krulblaar) abundant.
Site 14 - *Eragrostis rigidior*, *Tricholaena monachne* (Blue-seed Grass) and *Schmidtia pappophoroides* (Sand Quick) abundant.

4.2.3. *Commifera spp* – *Grewia flava* Open/Closed Woodland – Plant Community 3:

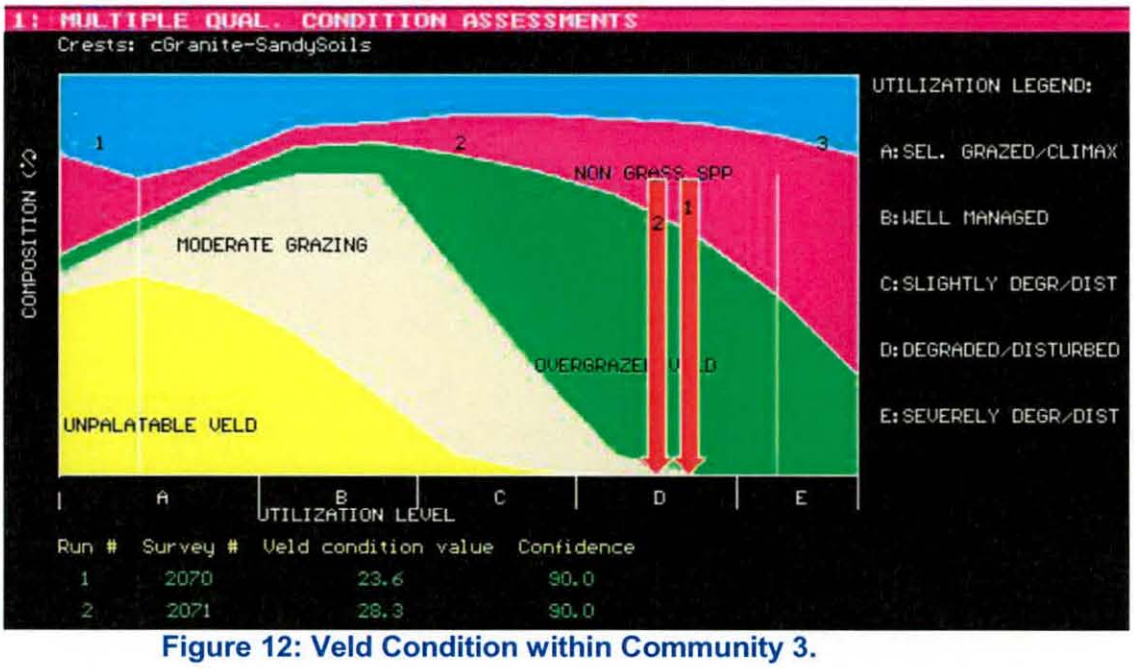

Figure 12: Veld Condition within Community 3.

The veld condition of the two surveys is within the D-category, which reflects overgrazing. On the graph Runs 1 and 2 represent Veld Condition Sites 15 and 16 respectively.
Site 15 - *Setaria pumila* (Garden Bristle Grass) dominant with another Increaser 2 species, *Eragrostis rigidior*.
Site 16 – Two Increaser 2 species, *Eragrostis rigidior* and *Urochloa mosambicensis* dominant.

2.4.4. *Combretum apiculatum* Closed Woodland – Community 4:

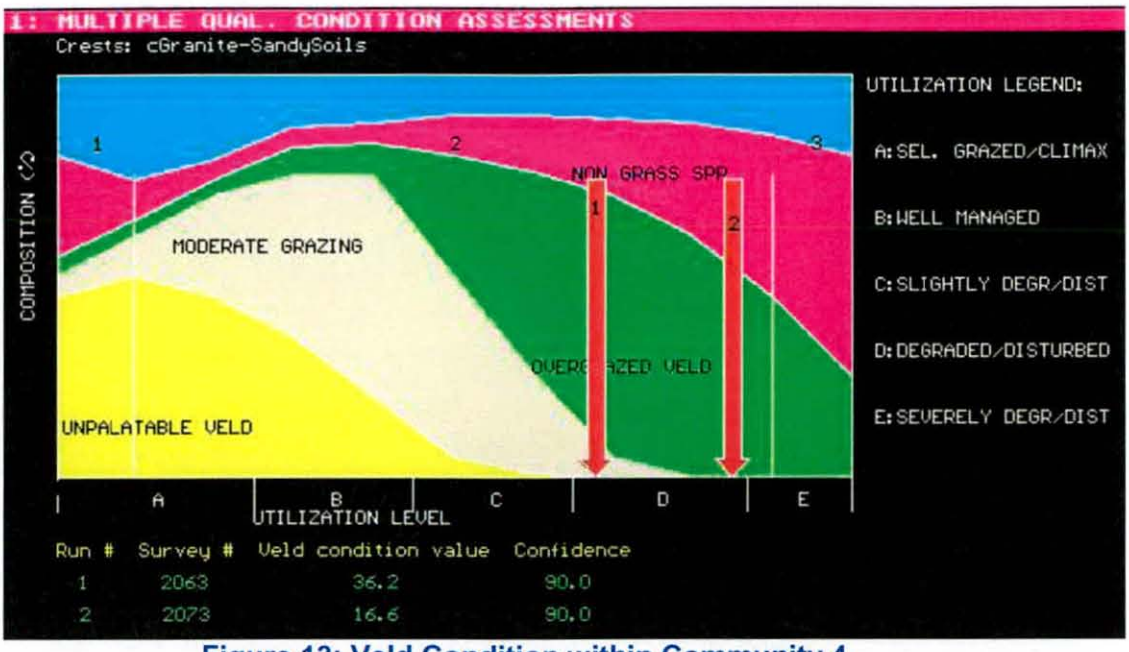

Figure 13: Veld Condition within Community 4.

The veld condition of all the two surveys is within the D-category, which reflects overgrazing. On the graph Runs 1 and 2 represent Veld Condition Sites 8 and 18 respectively.
Site 8 – Two Increaser 2 species, *Aristida vestita* and *Schmidtia pappophoroides* dominant.
Site 18 – A number of Increaser 2 species together contribute to a high Increaser 2 total.

5. GRAZING CAPACITY AND RECOMMENDED STOCKING RATES 2011

From the 2011 veld condition the relative low grazing volumes and overgrazing observed from the grass composition influences the outcome of the calculation of the grazing capacity. (Grazing volumes reflect the difference between rainfall received and the amount of grass after being grazed but the composition of the grass layer is an indication of the production potential, measure by the proportion of palatable productive species (Decreasers). The method by Tainton (1988) was used to determine the grazing capacity at each site, as reflected by grass composition, basal cover, topography and soil erodability.

The average grazing capacity varies between 13 and 18 ha/LAU. Stocking rates for the four plant communities are therefore 0.077, 0.063, 0.059 and 0.056 LAU/ha respectively.

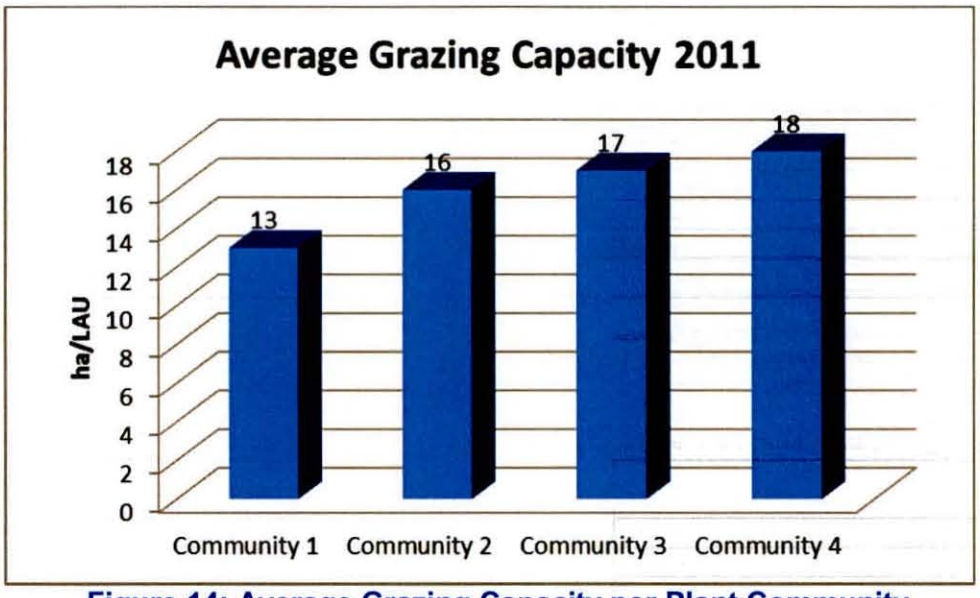

Figure 14: Average Grazing Capacity per Plant Community.

6. CONCLUSION

The veld condition assessment in 2011 reveals overgrazed conditions and grazing volumes that varied between low to high. The current condition of the veld can support a relatively low grazing capacity which varies between 13 and 18 ha/LAU.

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APPENDIX A: EXPLANATION OF GRASSLAND DYNAMICS

The following paragraphs illustrate the way in which grassland dynamics can be interpreted:

Veld condition can be interpreted by grouping the grass species into ecological categories or classes. Grass species are classified into three groups, as follows:

1) Decreaser species (indicators of well managed veld) – i.e. those which dominate in veld which is in good condition and which decline in abundance when overgrazing or degradation takes place;
2) Increaser I species (indicators of under-utilization) – i.e. those which are not abundant in veld which is in good condition, but which increase when veld is under-utilized (over-rested) or burnt on a overly low frequency;
3) Increaser II species (indicators of degradation) – i.e. those which are not abundant in veld which is in good condition, but which increase when veld is over-utilized or degraded by too much burning.

Tainton (1988) states the following: "If the decline in veld condition over a period of time is the result of a increase in the proportion of Increaser I species, then it is clear that the area is being under-utilized and so stocking rate or burning frequency should be increased;

If a decline in veld condition is associated with a replacement of Decreaser species by Increaser II species, then the area has been over-utilized and the stocking rate or the burning frequency should be reduced and if possible longer resting periods should be applied;

Therefore, in order to monitor the veld condition trends, one needs to repeat the monitoring over a period of time.

APPENDIX B

TABLES

Table 1.1: Veld condition assessment table: Grass species cover and composition at Turquoise Moon (2011).

TURQUOISE MOON *Acacia* Closed Woodland	Soil Form: Plooysburg	
	Site 1	
	Incl. Sedges & Forbs	Excl. Sedges & Forbs
	2011	
TUFT DISTANCES (in cm) : <5cm = Good, 5-6cm = Moderate, >6cm = Poor	11	
PHYTOMASS / FUEL LOAD (in kg/ha)	240	
CO-ORDINATES: South	23° 11' 36.3"	
East	28° 12' 10.8"	
HEIGHT ABOVE SEA LEVEL (m)	952m	
DIRECTION OF TRANSECT	145°	
GRASS SPECIES IN CATEGORIES		
DECREASERS		
No Decreaser species recorded	0	0
TOTAL (Decreaser category):	**0**	**0**
INCREASER I		
Brachiaria deflexa False Signal Grass	3	6
Monocot Forbs, including sedges (Cyperaceae)	0	
TOTAL (Increaser I cat.):	**3**	**6**
INCREASER II		
Aristida adscensionis Annual Three-awn	7	9
Digitaria velutina Long-plumed Finger Grass	1	1
Ehrharta erecta Shade Ehrharta	**	**
Enneapogon cenchroides Nine-awned Grass	6	9
Enneapogon scoparius Bottlebrush Grass	24	36
Eragrostis lehmanniana Lehmann's Love Grass	18	23
Eragrostis rigidior Curly Leaf / Krulblaar	1	1
Eragrostis viscosa Sticky Love Grass	1	1
Melinis repens Natal Red Top	**	1
Tragus berteronianus Carrot-seed Grass	9	13
Dicot Herbaceous Perennial Forbs	30	
Bare Ground	0	0
TOTAL (Increaser II cat.):	**97**	**94**
Unidentified	0	0
TOTAL (All categories):	**100**	**100**

** Less than 1% of species present at site