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# ENVIRONMENTAL BASELINE REPORT FOR HANS HOHEISEN WILDLIFE RESEARCH STATION

Compiled by

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## EXECUTIVE SUMMARY

The Hans Hoheisen Wildlife Research Station study area is situated in the Limpopo province and located adjacent to the Orpen Gate rest camp of the Kruger National Park. The study is 25.207 ha in size with an approximate altitude of 410 m above sea level. The study area is fenced using a 2.4 m high wire construction, consisting of a 1.2 m high mesh apron at the bottom that effectively excludes any migration of larger mammal species. The facilities are used as accommodation, for research, education and support by researchers.

The proposed construction of animal quarantine enclosures necessitated an ecological evaluation of the study area to determine a baseline reference in identifying potential negative impacts.

HHWRS is located in the Mixed Lowveld Bushveld or Arid Lowveld and is described as open tree savanna with dense riverine vegetation along drainage lines and rivers. Vegetation surveys were conducted in each of the eight topographic-physiognomic units identified from satellite imagery. Fauna assessments was conducted throughout the study area using active search and confirmed occurrence data obtained from other researchers.

No Red List threatened plant species were identified in the study area; however, four protected tree species are present. *Sclerocarya birrea* subsp. *caffra* (marula) is most dominant and is found in all habitat units. Highest occurrence of protected tree species is found in Transformed habitat where modification through landscaping and gardening are the two contributing factors to high species diversity. Concomitantly, these transformed areas also have the highest prevalence of undesirable alien species (weeds).

Although a high diversity of birds are expected, emphasis was placed on threatened and protected bird species known to occur in the Limpopo province. Habitat suitability was a constraining factor in potential distribution and occurrence of any of these species would be considered incidental. Presence/absence could not be confirmed.

A number of herpetofaunal species could be confirmed by direct observation and reliable occurrence records from other researchers. Although the occurrence of Red List species in the study area could not be confirmed, the protected *Python natalensis* (Southern African python) and plated lizards (*Gerrhosaurus* sp.) are present. No threatened or protected frog species are recorded.

Invertebrate studies are invariable difficult to accomplish and much of the occurrence data is based on historical records. However, the presence of two baboon spiders (*Augacephalus breyeri* and *Augacephalus junodi*) is confirmed. These spiders are predominantly found in Habitat Units 1, 2 and 3.

Larger mammal species is excluded from the study area and cross boundary animal movement is not possible, as the boundary fence construction excludes all migration.

Small mammal species such as bats that fly over the fence and rodents that can pass through the fence are the only species present in the study area. No red Listed or protected small mammal species could be identified and no known historical records are available.

Sensitivity analysis was conducted for flora, avifauna, herpetofauna, invertebrate and mammal categories. Collation of all information culminated in a low sensitivity classification for the whole study area.

## 1 SPECIALIST INVESTIGATORS

The Natural Scientific Professions Act of 2003 aims to '*provide for the establishment of the South African Council of Natural Scientific Professions (SACNASP), and for the registration of professional, candidate and certified natural scientists; and to provide for matters connected therewith*'. Quoting the Natural Scientific Professions Act of 2003: '*Only a registered person may practice in a consulting capacity*'.

Investigator: Ben Orban (Pr.Sci.Nat.)
Capacity: Ecological Scientist
Affiliation: South African Council for Natural Scientific Professions
Registration number: 400005/03
Fields of expertise: Botanical Scientist & Ecological Scientist.

## 2 DECLARATION

All specialist investigators, project investigators and members of companies employed for the purpose of conducting this particular investigation declare that:

1. We consider ourselves bound to the rules and ethics of the South African Council for Natural Scientific Professions;
2. At the time of completing this report, we did not have any interest, hidden or otherwise, in the proposed development as outlined in this document, except for financial compensation for work done in a professional capacity;
3. We will not be affected in any manner by the outcome of the environmental process of which this report forms part of, other than being part of the general public;
4. We do not have any influence over decisions made by the governing authorities;
5. We do not necessarily object to or endorse the proposed development, but aim to present facts and recommendations based on scientific data and relevant professional experience;
6. Should we consider ourselves to be in conflict with any of the above declarations we will formally submit a Notice of Withdrawal to all relevant parties and formally register as an Interested and Affected Party.

## 3 INTRODUCTION

The maintenance and survival of South Africa's diverse endemic plant species is in severe jeopardy due to increased land transformations and modifications. The quantitative extent of these changes and the effect on the different ecosystems is difficult to determine. For many years most efforts of conservation have focused on the preservation of individual indicator species, but increasing emphasis is placed on the preservation of ecosystems and landscapes. It is considered sensible that natural areas be managed based on the most suitable land-use option that will ensure

effective utilization of the available natural resources without deterioration of the environment. An environmental baseline survey to qualify and quantify these resources is a prerequisite for maintaining biodiversity and integrity of any ecological system.

## 4 LOCALITY OF STUDY AREA

- *Name:* Hans Hoheisen Wildlife Research Station
- *District:* Phalaborwa
- *Province:* Limpopo
- *Quarter degree grid* 2431AD
- *Coordinates:* Lat (Y): S 24° 28'47.16"S
  Long (X): E 31° 23'06.59"E
- *Size:* 25.207 ha

### 4.1 Location

The Hans Hoheisen Wildlife Research Station (HHWRS) is located adjacent to Orpen Gate rest camp, Kruger National Park. The land was donated by Hans Hoheisen and the research facility completed in 1980. In 2010, after many years of neglect, the complex was refurbished with the support of various donations and is now managed by the University of Pretoria. The research station provides infrastructure and support for local and international researchers.

## 5 INFRASTRUCTURE

### 5.1 Fencing

The HHWRS is fenced using a 2.4 m high wire construction, consisting of a 1.2 m high mesh apron at the bottom that excludes any migration of larger mammal species. The fence is electrified along the perimeter, acting as a further deterrent to animal movement through or over the fence.

### 5.2 Camps

There are no internal fences present. The land is not actively stocked with game; however, sign of small antelope species is present.

### 5.3 Buildings

The HHWRS complex consists of an Auditorium, laboratories and offices. Other structures include animal holding facilities, accommodation for researchers and personnel, a swimming pool and buildings for maintenance of the property. Figure 1 illustrates the location of these structures and the proposed layout zoning for animal holding enclosures.

### 5.4 Roads

An effective road system is present on the HHWRS with access to all facilities and structures.

## 6 CLIMATE

The climate can be described as semi-arid and warm.

### 6.1 Rainfall

Precipitation is usually received in the form of thundershowers. The mean annual rainfall for the area is 513 mm with the dominant precipitation received during the months of October to March (Figure 2). The area generally receives little rainfall during the months from April to September.

### 6.2 Temperature

The highest monthly temperature of 26° C is recorded in January and the lowest monthly temperature of 0.3° C is recorded in July. Winter temperatures have never been recorded to drop below 0° C.

## 7 TOPOGRAPHY

The topography is predominantly flat with little variation. The mean altitude is 420 m above sea level.

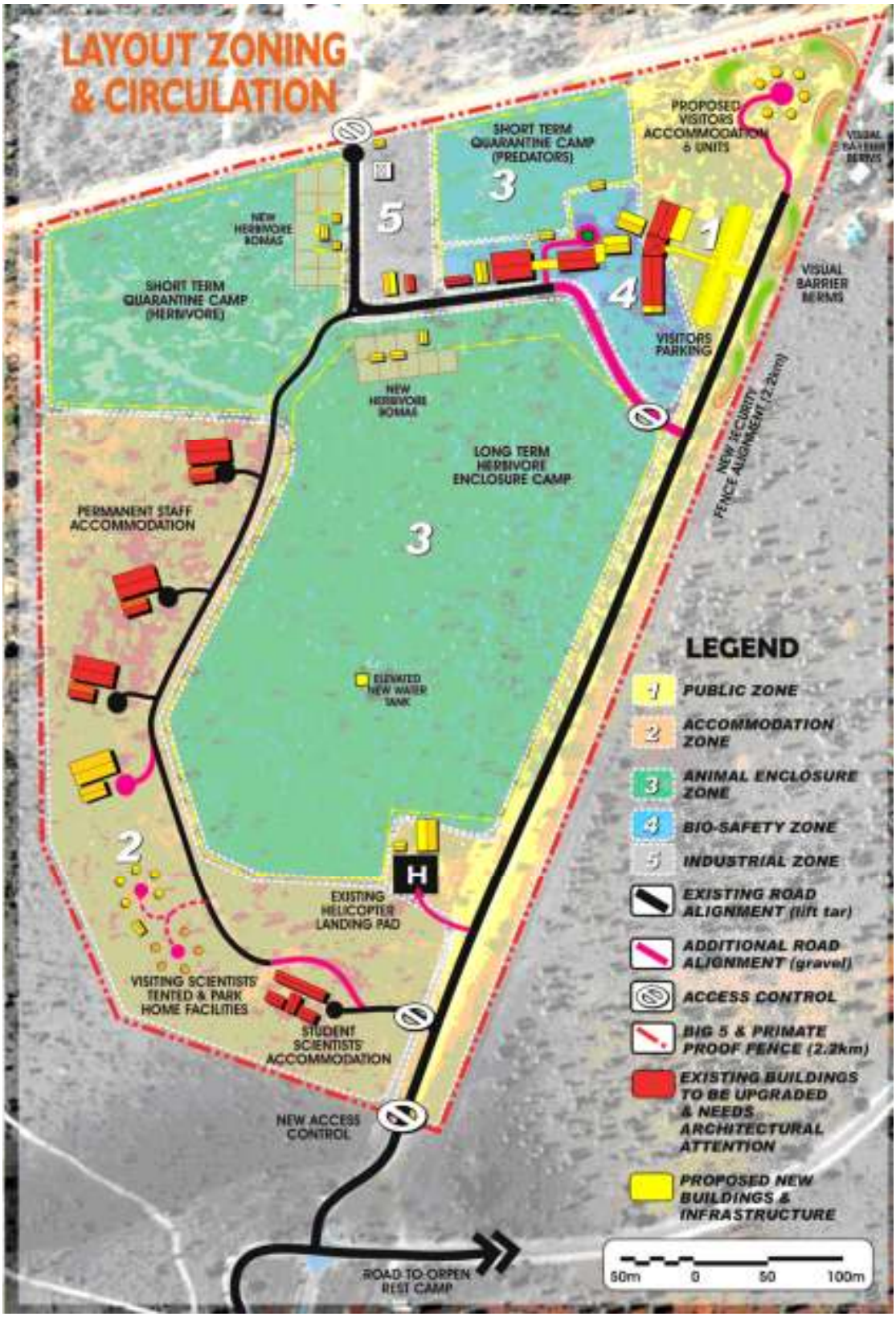
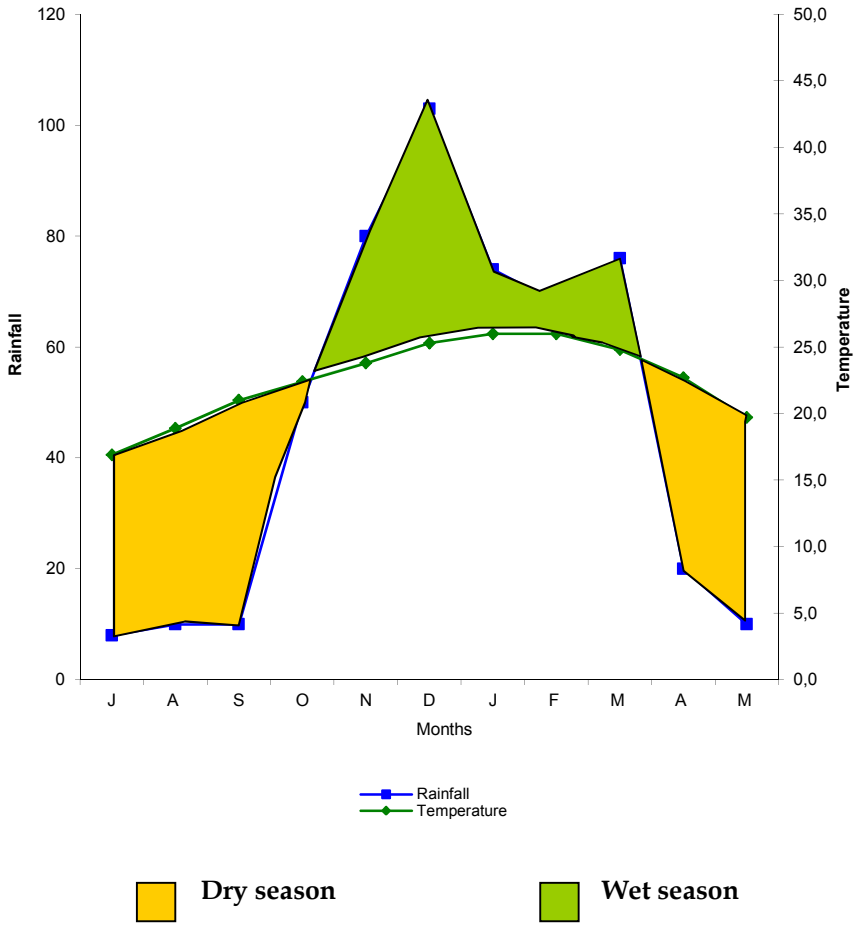



**Figure 1: Proposed layout zoning for animal holding enclosures on Hans Hoheisen Wildlife Research Station**

| | |
|---|---|
| **A** | **513.0** |
| **B** | **265.0** |
| **C** | **0.0** |
| **D** | **22.0** |
| **E** | **41.1** |
| **F** | **0.3** |




A - Mean annual rainfall in mm
B - Highest monthly rainfall in mm
C - Lowest monthly rainfall in mm
D - Mean annual temperature in °C
E - Highest monthly temperature in °C (November)
F - Lowest monthly temperature in °C (June)

**Figure 2: A climate diagram for Hans Hoheisen Wildlife Research Station**

## 8 GEOLOGY AND SOILS

In a semi-arid region such as the proposed development area, there is usually a strong correlation between the geological formations, soil types and the associated vegetation. This implies that the soil and the parent material from which it is formed have a strong influence on the plant species composition and structure of the vegetation. The parent material influences the horizons of the profile, the inherent fertility of the soil, crust formation and compaction thereof. Therefore, the different soil types in the landscape, together with soil depth, determine the potential yield and palatability of the grazing.

A number of different types of granite and gabbro underlie the Lowveld region. These rocks include amongst others potassic granite and granodiorite with Timbavati gabbro in the HHWRS, giving rise to soil profiles that typically indicates relatively poor and shallow soil forms with poor agricultural potential.

### 8.1 Soil formations

Only one land type (Fb184) is identified in the study area. The Mispah (orthic A-horizon over hard rock) and Glenrosa soil form (orthic A-horizon over lithocutanic B-horizon) dominated the higher lying terrain of the study area. The lithocutanic B-horizon underlies a diagnostic topsoil horizon and merges into underlying weathering rock. These soils are generally shallow, rarely reaching a depth of more than 450 mm or a clay content of more than 35%.

The Hutton (orthic A-horizon over red-brown apedal B-horizon) and Clovelly (orthic A-horizon over a yellow-brown apedal B-horizon) soil types dominates the lower lying terrain of the study area. The red-brown apedal B-horizon and the yellow-brown apedal B-horizon are associated with siliceous parent materials such as granite and gneiss both of which have a lower content of weatherable minerals and thus a lower clay-forming potential. The colour is generally uniform, and structure in the soil poorly developed. Root penetration is considered high, but water retention relatively low. These apedal soils are generally considered good for crop production, often reaching a depth of between 450 and 700 mm.

## 9 SURVEYS AND DATA COLLECTION

The veld type is considered to be Mixed Lowveld Bushveld, or Arid Lowveld, and can be described variously as dense bush on the uplands, open tree savanna in the bottom lands, and dense riverine woodland on the riverbanks and drainages. The tree layer is characterised by red bushwillow *Combretum apiculatum* subsp. *apiculatum*, silver cluster leaf *Terminalia sericea*, marula *Sclerocarya birrea* subsp. *caffra* and weeping wattle *Peltophorum africanum*. Bottomland situations are dominated by knob thorn *Acacia nigrescens,* scented thorn *Acacia nilotica,* common false-thorn *Albizia harveyi* and magic guarri *Euclea divinorum*. The shrub layer is moderately developed, except in cases where overgrazing has occurred, which causes the bush to thicken dramatically, and individuals of sickle bush *Dichrostachys cinerea* and flaky thorn *Acacia exuvialis* are commonly found. The grass layer is poorly to moderately developed, and grasses such as herringbone grass *Pogonarthria squarrosa,* broad curly leaf *Eragrostis rigidior,* Natal red top *Melinis repens,* guinea grass *Panicum maximum,* finger grass *Digitaria eriantha* and spear grass *Heteropogon contortus* are the conspicuous species. Other grasses that are typical of Mixed Lowveld Bushveld are sand quick *Schmidtia pappophoroides,* tassel three-awn *Aristida congesta* subsp. *congesta* and bushveld signal grass *Urochloa mosambicensis*.

## 9.1 Field Surveys

### *9.1.1 Flora Assessment*

The vegetation surveys were done during April 2010. An assessment of the dominant plant species and habitat features were made at each 25 m x 25 m sample plot delineated, where possible. All plant species within the delineated area were identified and a percentage canopy cover value allocated, which is required for the classification and description of the plant communities. Furthermore, representative percentage estimates of the vegetation canopy cover were made of each structural layer *viz*. lower, intermediate, and upper canopy covers. Environmental attributes such as altitude, aspect, slope or gradient, terrain form and topography were recorded at each survey site to facilitate analysis of data collected. A total of seven relevés were sampled on the 25.207 ha enclosed study area.

*Data Analysis*
A classification of the vegetation data is achieved by applying ecologically accepted principles in habitat classification. Environmental parameters recorded at each relevé are then analysed to identify trends that can potentially drive vegetation development.

### *9.1.2 Alien Invasive Plant Species assessment*

An "invasive species" is any species whose establishment and spread outside of its natural distribution range (i) threatens ecosystems, habitats or other species or has a demonstrable potential to threaten ecosystems, habitats or other species; and (ii) may result in economic or environmental harm or harm to human health. Invasive alien plant species are globally considered as one of the greatest threats to biodiversity and ecosystem integrity.

Although all plant species have the inherent ability to increase their distribution under favourable conditions, most invasive plant species are alien to the country and their rapid spread can be attributed to the lack of species competition and the absence of natural control pathogens. Many alien plant species do not reveal the inherent ability to propagate themselves to such an extent that they may be considered undesirable.

The Precautionary Principle[1] is applied throughout this investigation.

### *9.1.3 Fauna Assessment*

Avifaunal observations were based on random observations of species present.

[1]The precautionary principle states that evidence of harm, rather than definitive proof of harm, should prompt policy action.

A visit to the study area and high resolution aerial imagery provided habitat specific information sufficient to characterize the site and the expected herpetofauna community. No trapping of herpetofauna was required.

Mammal observations were based on random observations of species present.
A number of research projects conducted over the years at HHWRS produced further insight into the distribution and occurrence of fauna species.

### *9.1.4 IUCN Red List Assessment*

Species are classified by the IUCN Red List into the following nine groups, based on rate of decline, population size, area of geographic distribution, and degree of population and fragmentation in distribution.

- **Extinct (EX)** – No known individuals remaining.
- **Extinct in the Wild (EW)** – Known only to survive in captivity, or as a naturalized population outside its historic range.
- **Critically Endangered (CR)** – Extremely high risk of extinction in the wild.
- **Endangered (EN)** – High risk of extinction in the wild.
- **Vulnerable (VU**) – High risk of endangerment in the wild.
- **Near Threatened (NT)** – Likely to become endangered in the near future.
- **Least Concern (LC)** – Lowest risk. Does not qualify for a more at risk category. Widespread and abundant taxa are included in this category.
- **Data Deficient (DD)** – Not enough data to make an assessment of its risk of extinction.
- **Not Evaluated (NE)** – Has not yet been evaluated against the criteria.

Threatened species are considered useful indicators of the health of an ecosystem. The term "threatened" used in context refers to a grouping of three categories: Critically Endangered, Endangered, and Vulnerable. Endangered plant species are considered to be species in danger of extinction, while vulnerable plant species are considered to move into the endangered category in the near future. Rare plant species are considered small world populations that are not presently endangered or vulnerable at present. These rare plant species are usually localized within geographical areas or thinly scattered over an extensive range.

## 9.2 Sensitivity analysis

A sensitivity analysis was performed for each habitat type where the sensitivity of the floral and faunal groups was evaluated based on the ecosystem service (*ecological function*) and the preservation of diversity (*floral and faunal importance*).
*Ecological function*

An important determinant of the sensitivity of a particular habitat type is the extent to which it is ecologically connected to the surrounding area. Habitat with a high

degree of regional landscape connectivity or with extensive drainage systems amongst one another are perceived to be more sensitive and will be those contributing to important faunal migration.

### *9.2.1 Floral importance*

Floristic sensitivity evaluations were based predominantly on subjective assessment of phytosociological attributes such as plant species diversity, Red List diversity and Endemism. In addition, the presence of especially alien invader species was also considered in the evaluation as these are considered indicative of habitat degradation.

High sensitivity values indicate areas that are considered pristine, relatively unaffected by human influences or generally managed in an ecological sustainable manner. Low sensitivity values indicate areas of poor ecological status or importance in terms of floristic attributes, including areas that have been negatively affected by human impacts or poor management.

### *9.2.2 Faunal importance*

This aspect is evaluated through species diversity, endemism and the presence of topographical features or undisturbed habitat units with the intrinsic ability to sustain a great diversity of species, among which are those of conservation importance.

*Sensitivity scale*

- ***High*** **-** Sensitive habitat with either low inherent resistance or low resilience towards disturbance factors. These habitat types represent ecosystems with high connectivity and support high fauna diversities while providing suitable habitat/records of a number of endangered, threatened or near-threatened species, CITES or naturally protected species.

- ***Moderate*** – These are partially modified habitat types which occur along gradients of disturbances of low-medium intensity with some degree of connectivity with other ecological systems or habitat types with intermediate levels of species diversity but may include potential ephemeral habitat for threatened species.

- ***Low*** – Severely modified habitat where ecological function is arrested or non-functional and a low species diversity with a dominant composition consisting of unspecialised and widespread species. The area is characterised by the absence of endangered, threatened or near-threatened species, CITES or naturally protected species.

# 10 RESULTS

## 10.1 Flora Habitat Descriptions

Vegetation has a huge influence on the rest of the ecosystem as the quality of habitats is heavily dependent on the vegetation structure and species composition, and in itself is mainly determined by physical and biological environmental factors that shape and drive plant community development.

The maintenance and survival of indigenous plant species is under threat due to increased land transformations and modifications. The quantitative extent of these changes and the effect on the different ecosystems is difficult to determine. For many years most efforts of conservation have focused on the conservation of individual indicator species, but increasing emphasis is placed on the conservation of ecosystems and landscapes. The identification and description of vegetation units across the landscape are critical first steps in building a framework for ecosystem management. A vegetation map is essential to assess the diversity of habitats, the presence of alien invasive plant species and the presence of rare and sensitive habitats and flora. The primary purpose of vegetation management, based on sound ecological principles, should be to maintain the inherent biodiversity and ecological integrity of the region to ensure that the continued capacity of the area to support life is not compromised.

Vegetation classification on the Hans Hoheisen Wildlife Research study area culminated in the identification of the following eight habitat units (Table 1, Figure 3).

**Table 1: Habitat units and their relative contribution to HHWRS**

| *Habitat Unit* | *Area (Ha)* | *Ecological State* |
|---|---|---|
| 1 – Short Open Shrubland | 4.782 | Natural |
| 2 – Short Open Shrubland | 3.220 | Natural |
| 3 – Tall Open Woodland | 2.514 | Natural |
| 4 – Short Open Shrubland | 1.795 | Natural |
| 5 – Short Open Woodland | 3.759 | Natural |
| 6 – Short Open Woodland | 3.215 | Natural |
| 7 – Short Open Woodland | 2.225 | Natural |
| 8 – Transformed | 3.697 | Modified |
| **Total** | | |

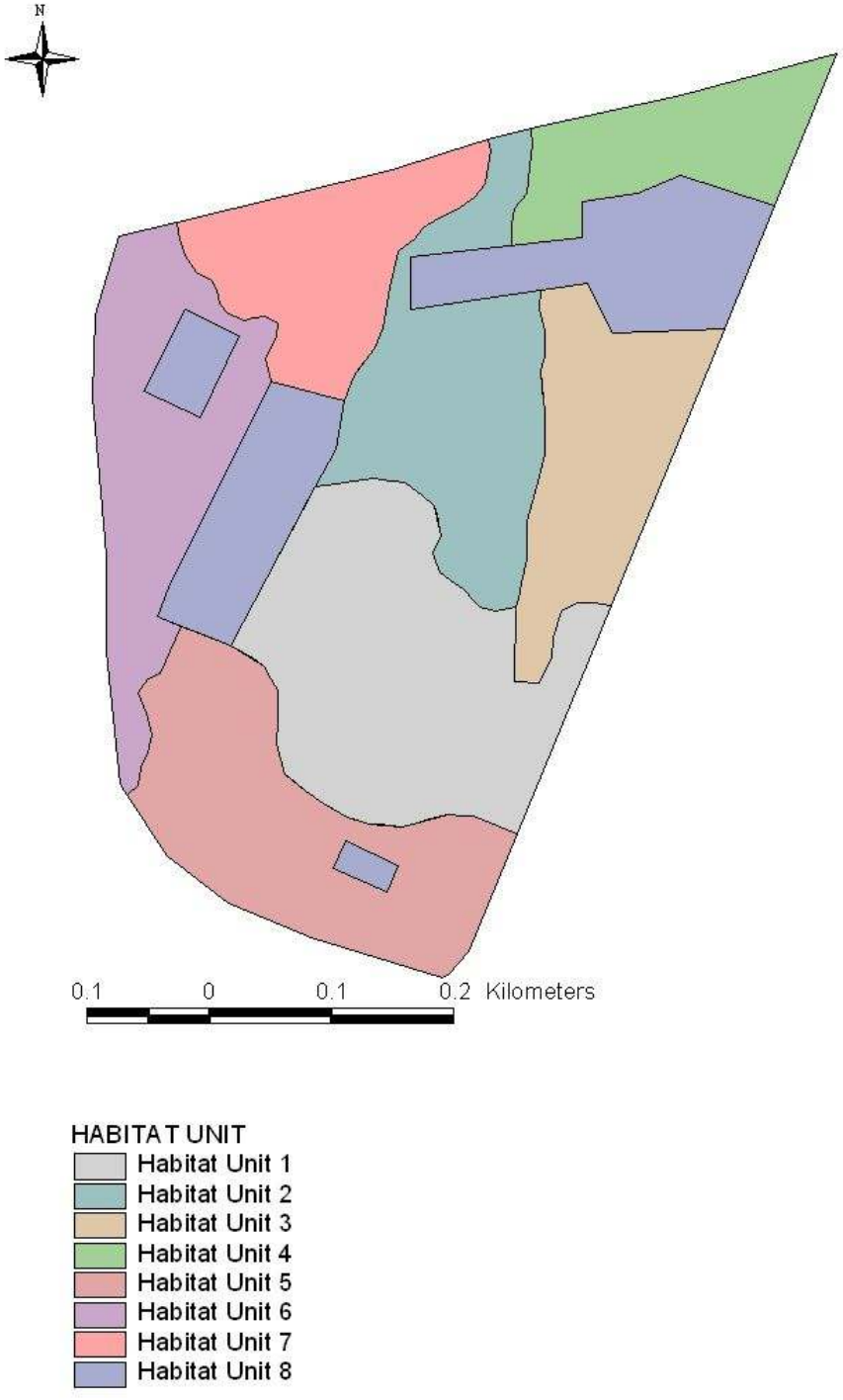



**Figure 3: Habitat units identified in the HHWRS study area**

**Habitat Unit 1: *Dalbergia melanoxylon* – Short Open Shrubland**

- Size 4.782 ha
- Slope Gradual
- Gradient Footslope
- Geomorphology Flat
- Rock cover 5 %
- Soil form Clovelly

This habitat unit is characterized by the dominance of trees and shrubs of short stature, forming an open structure with a few scattered tall trees (Figure 4). The dominant tree is *Dalbergia melanoxylon* with mixture of *Combretum* species (Table 2). The presence of *Burkea africana* is a good indicator of the relatively deep apedal soils identified. The herbaceous layer is dominated by relatively sour grassland species such as *Enneapogon scoparius* and *Heteropogon contortus* forming a good ground cover in protecting the soil surface.

**Figure 4: Short Open Woodland habitat of Unit 1**

**Table 2: Plant species identified in the *Dalbergia melanoxylon* – Short Open Shrubland**

| Growth Form | Species |
|---|---|
| ***Trees and Shrubs*** | *Dalbergia melanoxylon (d); Acacia exuvialis; Acacia nigrescens; Burkea africana; Combretum apiculatum* subsp. *apiculatum; Combretum hereroense; Commiphora mollis; Gardenia volkensii* subsp. *volkensii; Grewia bicolor; Grewia monticola; Gymnosporia buxifolia; Lannea schweinfurthii* var. *stuhlmannii; Sclerocarya birrea* subsp. *caffra (P); Terminalia sericea; Ziziphus mucronata.* |
| ***Climbers*** | *Rhoicissus tridentata.* |
| ***Forbs*** | *Abutilon austro-africanum; Boerhavia erecta; Bulbostylis burchellii;* |

| Growth Form | Species |
|---|---|
| ***Grasses*** | *Heliotropium ciliatum; Hibiscus trionum; Indigofera filipes; Indigofera zeyheri; Justicia flava; Lantana rugosa; Leucas glabrata* var. *glabrata; Ocimum canum; Plexipus hederaceus* var. *hederaceus; Protasparagus setaceus; Protosparagus suaveolens; Sida alba; Tricliceras mossambicense. Enneapogon scoparius (d); Heteropogon contortus (d); Aristida adscensionis; Aristida congesta* subsp. *barbicollis; Aristida congesta* subsp. *congesta; Cymbopogon plurinodes; Eragrostis superba; Fingerhuthia africana; Hyperthelia dissoluta; Panicum maximum; Themeda triandra.* |
| *(P) – Protected species; (d) - Dominant species* | |

*Species Composition and Ecological State*

Although no Red Listed plant species is present, the protected *Sclerocarya birrea* subsp. *caffra* is found scattered throughout this habitat unit. Although signs of degradation are present due to historic land-use options applied, species composition is relatively healthy with few undesirable alien plant species being present. This habitat unit is classified as natural habitat based on IFC PS6 habitat classification criteria.

**Habitat Unit 2: *Grewia bicolor* – Short Open Shrubland**

- Size 3.220 ha
- Slope Flat
- Gradient Footslope
- Geomorphology Flat
- Rock cover 2 %
- Soil form Clovelly

This habitat unit is characterized by the dominance of relatively short shrubland species such as *Grewia bicolor* and *Grewia flava* (Figure 5); however, some scattered individuals of taller tree species such as *Commiphora mollis, Dalbergia melanoxylon* and *Gardenia volkensii* subsp. *volkensii* are also found. The herbaceous layer is dominated by the grass *Heteropogon contortus* and further characterized by the presence of a number of undesirable alien plant species (Table 3).

**Figure 5: Short Open Shrubland habitat of Unit 2**

**Table 3: Plant species identified in the *Grewia bicolor* – Short Open Shrubland**

| Growth Form | Species |
|---|---|
| ***Trees and Shrubs*** | *Grewia bicolor (d); Acacia exuvialis; Acacia nigrescens; Combretum hereroense; Commiphora mollis; Dalbergia melanoxylon; Dichrostachys cinerea; Ehretia rigida; Flueggea virosa; Gardenia volkensii* subsp. *volkensii; Grewia flava; Gymnosporia buxifolia; Ziziphus mucronata.* |
| ***Climbers*** | *Cucumis hirsutus; Ipomoea cairica (a).* |
| ***Forbs*** | *Bidens pilosa (a); Heliotropium ciliatum; Hibiscus trionum; Indigofera filipes; Lantana rugosa; Achyranthes aspera (a); Commelina africana* var. *africana; Conyza bonariensis (a); Felicia muricata; Helichrysum rugulosum; Hermannia tomentosa; Pupalia lappacea; Rhynchosia totta* var. *totta; Sida cordifolia; Solanum panduriforme; Tagetes minuta (a).* |
| ***Grasses*** | *Heteropogon contortus (d); Enneapogon scoparius; Fingerhuthia africana; Hyperthelia dissoluta; Panicum maximum; Themeda triandra; Cenchrus ciliaris; Chloris virgata; Eragrostis lehmanniana* var. *lehmanniana; Eragrostis plana; Eragrostis racemosa; Hyparrhenia hirta; Schmidtia pappophoroides; Setaria sphacelata* var. *sphacelata; Sorghum bicolor; Sporobolus ioclados; Urochloa mosambicensis.* |
| ***Ferns & Mosses*** | |
| *(a) – Alien species; (d) - Dominant species* | |

*Species Composition and Ecological State*

No Red Listed or protected plant species are found in this habitat unit. Habitat degradation is present as indicated by the presence of *Achyranthes aspera* under trees and *Bidens pilosa, Conyza bonariensis* and *Tagetes minuta* found in exposed, open areas. This habitat unit is classified as natural habitat based on IFC PS6 habitat classification criteria.

**Habitat Unit 3: *Acacia nigrescens / Panicum Maximum* - Tall Open Woodland**

- Size 2.514 ha
- Slope Flat
- Gradient Footslope
- Geomorphology Flat
- Rock cover 1 %
- Soil form Hutton

This habitat unit is characterized by the presence of tall *Acacia nigrescens* forming a virtual windbreak adjacent to the *Dalbergia melanoxylon* – Short Open Shrubland (Figure 6). The grass layer is dominated by *Panicum maximum* and *Themeda triandra*, with few undesirable plant species; however, the climbers *Ipomoea cairica* and *Ipomoea purpurea* are prevalent (Table 4).

**Figure 6: Tall Open Woodland habitat of Unit 3**

**Table 4: Plant species identified in the *Acacia nigrescens / Panicum Maximum* - Tall Open Woodland**

| Growth Form | Species |
|---|---|
| ***Trees and Shrubs*** | *Acacia nigrescens (d); Acacia exuvialis; Acacia tortilis* subsp. *heteracantha; Dalbergia melanoxylon; ; Dichrostachys cinerea; Flueggea virosa; Grewia bicolor; Grewia flavescens* var. *flavescens; Grewia occidentalis; Gymnosporia buxifolia; Ozoroa paniculosa* var. *salicina; Seersia pyroides; Ziziphus mucronata.* |
| ***Climbers*** | *Cucumis hirsutus; Ipomoea cairica (a); Ipomoea pupurea (a).* |
| ***Forbs*** | *Abutilon austro-africanum; Acalypha indica; Achyranthes aspera (a); Albuca glauca; Bulbostylis burchellii; Ceratotheca triloba; Commelina africana* var. *africana; Convolvulus sagittatus* var. *aschersonii; Crabbea angustifolia; Cyphostemma lanigerum; Cyphostemma schlecteri; Heliotropium ciliatum; Hermannia tomentosa; Indigofera daleoides; Indigofera filipes; Kalanchoe paniculata; Lantana rugosa; Lippia javanica;* |

| Growth Form | Species |
|---|---|
| ***Grasses*** | *Merremia tridentata* subsp. *angustifolia; Protasparagus setaceus; Pupalia lappacea; Sesamum triphyllum; Sida alba; Verbena bonariensis (a). Panicum maximum (d); Themeda triandra (d); Aristida congesta* subsp. *Congesta; Brachiaria deflexa; Cenchrus ciliaris; Dactylotenium australe; Enneapogon scoparius; Eragrostis racemosa; Eragrostis rigidior; Heteropogon contortus; Perotis patens; Sporobolus africana; Urochloa mosambicensis.* |
| ***Ferns & Mosses*** | *Pellaea calomelanos.* |
| *(a) – Alien species; (d) - Dominant species* | |

*Species Composition and Ecological State*

No Red Listed or protected plant species are found in this habitat unit. Habitat functionality and veld condition is high as indicated by the high prevalence of desirable grass species i.e. *Panicum maximum* and *Themeda triandra*. Furthermore, the low presence of undesirable alien plant species can be attributed to the high grass canopy cover. This habitat unit is classified as natural habitat based on IFC PS6 habitat classification criteria.

**Habitat Unit 4: *Acacia excuvialis / Panicum maximum* – Short Open Shrubland**

- Size 1.795 ha
- Slope Flat
- Gradient Footslope
- Geomorphology Flat
- Rock cover 1 %
- Soil form Clovelly

This habitat unit is relatively small and remains as a remnant of the natural vegetation adjacent to the HHWRS complex (Figure 7). The vegetation is dominated by *Acacia excuvialis,* with *Combretum apiculatum* subsp. *apiculatum* and *Grewia flava* being sub-dominant. The grass layer is well developed and dominated by *Panicum maximum* and *Themeda triandra*. The presence of undesirable alien plant species are relatively low and represented by climbers and *Bidens pilosa* (Table 5).

**Figure 7: Short Open Shrubland habitat of Unit 4**

**Table 5: Plant species identified in the *Acacia excuvialis / Panicum maximum* – Short Open Shrubland**

| Growth Form | Species |
|---|---|
| ***Trees and Shrubs*** | *Acacia exuvialis (d); Combretum apiculatum* subsp. *apiculatum (d); Grewia flava (d); Acacia nigrescens; Grewia bicolor; Grewia flavescens* var. *flavescens; Grewia occidentalis; Gymnosporia buxifolia; Seersia pyroides; Acacia robusta; Burkea africana; Combretum hereroense; Combretum molle; Combretum zeyheri; Commiphora mollis; Diospyros lycioides; Euclea divinorum; Grewia monticola; Lannea schweinfurthii* var. *stuhlmannii; Mundulea sericea; Mystroxylon aethiopicum; Pterocarpus rotundifolius; Schotia brachypetala; Sclerocarya birrea* subsp. *caffra (P); Terminalia sericea.* |
| ***Climbers*** | *Cucumis hirsutus; Ipomoea cairica (a); Ipomoea pupurea (a); Kedrostis africana.* |
| ***Forbs*** | *Abutilon austro-africanum; Achyranthes aspera (a); Acrotome hispida; Aptosimum lineare; Bidens pilosa (a); Boophane disticha; Cleome maculata; Dicoma tomentosa; Gossypium herbaceum* subsp. *africanum; Heliotropium ciliatum; Hypertelis salsoloides* var. *salsoloides; Ipomoea obscura; Leonotis ocymifolia; Ocimum canum; Plexipus hederaceus* var. *hederaceus; Protosparagus suaveolens; Pupalia lappacea; Rhynchosia totta* var. *totta; Sida alba; Solanum incanum; Solanum panduriforme; Tagetes minuta (a); Vernonia poskeana.* |
| ***Grasses*** | *Panicum maximum (d); Themeda triandra (d); Cenchrus ciliaris; Enneapogon scoparius; Aristida stipitata* subsp. *stipitata; Bothriochloa insculpta; Dactyloctenium aegytium; Eragrostis trichophora; Panicum natalense; Setaria sphacelata* var. *sphacelata.* |
| *(P) – Protected species; (a) – Alien species; (d) - Dominant species* | |

*Species Composition and Ecological State*

No Red Listed plant species are found in this habitat unit, however, the protected *Sclerocarya birrea* subsp. *caffra* is present. The habitat degradation present is attributed to injudicious dumping of building rubble, now overgrown but still characterized by

the prevalence of *Bidens pilosa* and *Tagetes minuta*. Habitat functionality and veld condition recovery are attributed to natural successional processes. This habitat unit is classified as natural habitat based on IFC PS6 habitat classification criteria.

**Habitat Unit 5: *Acacia nigrescens / Grewia bicolor* – Short Open Woodland**

- Size 3.759 ha
- Slope Gradual
- Gradient Footslope
- Geomorphology Convex
- Rock cover 20 %
- Soil form Clovelly

This habitat unit exhibits ecotonal characteristics with scattered individuals of *Acacia nigrescens* and a *Grewia bicolor* dominated shrub layer (Figure 8). The grass layer is dominated by *Enneapogon scoparius* and *Heteropogon contortus* indicating a moderate veld condition. The presence of *Tragus berteronianus* is an indicator of habitat degradation. Relatively high human traffic is responsible for the prevalence of weeds such as *Acanthospermum australe* and *Alternanthera pungens* (Table 6).

**Figure 8: Short Open Woodland habitat of Unit 5**

**Table 6: Plant species identified in the *Acacia nigrescens / Grewia bicolor* – Short Open Woodland**

| Growth Form | Species |
|---|---|
| ***Trees and Shrubs*** | *Acacia nigrescens (d); Grewia bicolor (d); Acacia nilotica* subsp. *kraussiana; Combretum apiculatum* subsp. *apiculatum; Combretum* |

| Growth Form | Species |
|---|---|
| | *hereroense; Combretum zeyheri; Commiphora mollis; Dalbergia melanoxylon; Dichrostachys cinerea; Flueggea virosa; Gardenia volkensii* subsp. *volkensii; Grewia flavescens* var. *flavescens; Gymnosporia buxifolia; Lannea schweinfurthii var. stuhlmannii; Mundulea sericea; Sclerocarya birrea* subsp. *caffra (P); Spirostachys africana; Ziziphus mucronata.* |
| ***Climbers*** | *Cissus quadrangularis* |
| ***Forbs*** | *Abutilon austro-africanum; Acanthospermum australe (a); Alternanthera pungens (a); Bidens pilosa (a); Boerhavia erecta; Cyperus rupestris* var. *rupestris; Dyschoriste fischeri; Evolvulus alsinoides; Heliotropium ciliatum; Indigofera daleoides; Kyphocarpa angustifolia; Lantana rugosa; Ocimum canum; Plexipus hederaceus* var. *hederaceus; Protasparagus setaceus; Protosparagus suaveolens; Pupalia lappacea; Rhoicissus tridentata; Rhynchosia caribaea; Rhynchosia totta* var. *totta; Sida alba; Sida cordifolia; Sida rhombifolia.* |
| ***Grasses*** | *Enneapogon scoparius (d); Heteropogon contortus (d); Aristida congesta* subsp. *barbicollis; Aristida congesta* subsp. *congesta; Cymbopogon plurinodes; Digitaria diagonalis; Eragrostis lehmanniana* var. *lehmanniana; Eragrostis micrantha; Eragrostis rigidior; Eragrostis superba; Fingerhuthia Africana; Hyparrhenia hirta; Panicum deustum; Panicum maximum; Perotis patens; Pogonarthria squarrosa; Schmidtia pappophoroides; Themeda triandra; Tragus berteronianus; Urochloa mosambicensis.* |
| *(P) – Protected species; (a) – Alien species; (d) - Dominant species* | |

*Species Composition and Ecological State*

No Red Listed plant species are found in this habitat unit, however, the protected *Sclerocarya birrea* subsp. *caffra* is present. Habitat degradation is moderate and is attributed to high human activity and vehicular traffic though this unit. This habitat unit is classified as natural habitat based on IFC PS6 habitat classification criteria.

**Habitat Unit 6: *Combretum apiculatum / Combretum hereroense* - Short Open Woodland**

- Size 3.215 ha
- Slope Gradual
- Gradient Footslope
- Geomorphology Convex
- Rock cover 20 %
- Soil form Glenrosa

This habitat unit is located behind the personnel accommodation and characterized by moderately deep soils and exposed rocky promontories (Figure 9). The unit is dominated by *Combretum apiculatum* subsp. *apiculatum*, associated with shallow Glenrosa soils, *Combretum hereroense* and *Acacia* species such as the protected *Acacia imberbe*, generally associated with more nutrient rich soils. The grass composition, while sour in nature has a good canopy cover with a dominance of *Panicum maximum* under trees (Table 7).

**Figure 9: Short Open Woodland habitat of Unit 6**

**Table 7: Plant species identified in the *Combretum apiculatum / Combretum hereroense* - Short Open Woodland**

| Growth Form | Species |
|---|---|
| ***Trees and Shrubs*** | *Combretum apiculatum* subsp. *apiculatum (d);Combretum hereroense (d); Acacia exuvialis; Acacia nigrescens; Combretum imberbe (P); Combretum zeyheri; Dichrostachys cinerea; Dombeya rotundifolia; Euclea divinorum; Flueggea virosa; Gardenia volkensii* subsp. *volkensii; Grewia bicolor; Grewia flavescens* var. *flavescens; Lannea schweinfurthii* var. *stuhlmannii; Peltophorum africanum; Pterocarpus rotundifolius; Ximenia americana* var. *microphylla; Ziziphus mucronata.* |
| ***Climbers*** | *Cucumis hirsutus; Ipomoea cairica (a); Ipomoea pupurea (a).* |
| ***Forbs*** | *Abutilon austro-africanum; Achyranthes aspera (a); Bidens pilosa (a); Bulbostylis burchellii; Commelina erecta; Conyza bonariensis (a); Crabbea hirsute; Cyphostemma lanigerum; Evolvulus alsinoides; Gomphocarpus burchellii; Indigofera filipes; Kyphocarpa angustifolia; Lantana rugosa; Leonotis ocymifolia; Leucas glabrata* var. *glabrata; Merremia tridentata subsp. angustifolia; Phyllanthus parvulus var. parvulus; Schkuhria pinnata (a); Sida alba; Sida cordifolia; Sida rhombifolia; Solanum panduriforme; Waltheria indica.* |
| ***Grasses*** | *Panicum maximum (d); Aristida congesta* subsp. *barbicollis; Aristida congesta* subsp. *congesta; Bothriochloa radicans; Chloris virgata; Digitaria diagonalis; Enneapogon scoparius; Eragrostis lehmanniana* var. *lehmanniana; Eragrostis plana; Heteropogon contortus; Panicum natalense; Pogonarthria squarrosa; Setaria verticilata; Sporobolus africana.* |
| *(P) – Protected species; (a) – Alien species; (d) - Dominant species* | |

*Species Composition and Ecological State*

No Red Listed plant species are found in this habitat unit, however, the protected *Combretum imberbe* is present as young growth. The species composition is well represented and an indication of ecosystem health. Although historic degradation is

noticed, veld recovery through natural ecological processes is evident. This habitat unit is classified as natural habitat based on IFC PS6 habitat classification criteria.

**Habitat Unit 7: *Combretum apiculatum / Grewia bicolor* - Short Open Woodland**

- Size 2.225 ha
- Slope Gradual
- Gradient Footslope
- Geomorphology Flat
- Rock cover 70 %
- Soil form Glenrosa

This habitat unit is characterized by relatively shallow soils, high rock cover and a dominance of *Combretum apiculatum* subsp. *apiculatum*, *Combretum molle* and *Grewia bicolor* (Figure 10). *Aloe marlothii* is also a feature of this habitat unit. The herbaceous layer is poorly developed due to the growth medium present, and typically dominated by *Aristida congesta* subsp. *barbicollis* and *Urochloa mosambicensis*. The forb component is well represented and dominated by *Abutilon austro-africanum*, *Achyranthes aspera* and *Bidens pilosa* in degraded areas (Table 8).

**Figure 10: Short Open Woodland habitat of Unit 7**

**Table 8: Plant species identified in the *Combretum apiculatum / Grewia bicolor* - Short Open Woodland**

| Growth Form | Species |
|---|---|
| ***Trees and Shrubs*** | *Combretum apiculatum* subsp. *apiculatum (d); Combretum molle (d); Grewia bicolor (d); Acacia exuvialis; Burkea africana; Combretum* |

| Growth Form | Species |
|---|---|
| | *hereroense; Commiphora mollis; Dalbergia melanoxylon; Dichrostachys cinerea; Dombeya rotundifolia; Euclea divinorum; Flueggea virosa; Grewia flavescens* var. *flavescens; Gymnosporia buxifolia; Ormocarpum trichocarpum; Pappea capensis; Peltophorum africanum; Sclerocarya birrea* subsp. *caffra (P); Seersia guenzii; Ziziphus mucronata.* |
| ***Climbers*** | *Cucumis hirsutus.* |
| ***Forbs*** | *Abutilon austro-africanum; Achyranthes aspera (a); Aloe marlothii; Bidens pilosa (a); Bulbostylis burchellii; Commelina africana var. africana; Commelina erecta; Convolvulus sagittatus* var. *aschersonii; Conyza bonariensis (a); Criptolepis oblongifolia; Cyperus obtusiflorus; Dicoma tomentosa; Evolvulus alsinoides; Helichrysum rugulosum; Hibiscus trionum; Indigofera daleoides; Kyphocarpa angustifolia; Lantana rugosa; Leonotis ocymifolia; Ocimum canum; Plexipus hederaceus* var. *hederaceus; Pupalia lappacea; Sesamum triphyllum; Sida alba; Sida cordifolia; Vernonia poskeana; Waltheria indica.* |
| ***Grasses*** | *Aristida congesta* subsp. *barbicollis (d); Urochloa mosambicensis (d); Aristida congesta* subsp. *congesta; Digitaria eriantha; Eragrostis curvula; Eragrostis superba; Heteropogon contortus; Melinis repens; Panicum maximum; Panicum natalense; Pogonarthria squarrosa; Schmidtia pappophoroides; Themeda triandra.* |
| *(P) – Protected species; (a) – Alien species; (d) - Dominant species* | |

*Species Composition and Ecological State*

No Red Listed plant species are found in this habitat; however, the protected *Sclerocarya birrea* subsp. *caffra* is present as scattered individuals. Species composition is moderately good with relatively few undesirable alien plant species present. Habitat functionality is moderately good and classified as natural habitat based on IFC PS6 habitat classification criteria.

**Habitat unit 8: Transformed**

- Size 3.697 ha
- Slope Flat
- Gradient Footslope
- Geomorphology Flat
- Rock cover 1 %
- Soil form Variable

This habitat is considered highly transformed through habitat manipulation and landscaping (Figure 11). However, species composition and habitat functionality is much higher than in the surrounding habitat units. The herbaceous layer is however, very poor due to monoculture lawns and impermeable surfaces. Weeds such as *Chaemasyce hirta*, *Chaemasyce inaequlatera*, *Euphorbia hirta*, *Guilleminea densa* and *Richardia brasiliensis* are considered dominant (Table 9).

**Figure 11: Transformed habitat**

**Table 9: Plant species identified in the transformed habitat unit**

| Growth Form | Species |
|---|---|
| ***Trees and Shrubs*** | *Acacia karroo; Acacia nigrescens; Acacia robusta; Acacia xanthophloea; Adenium multiflorum; Balanites maughamii (P); Bauhinia galpinii; Burkea africana; Combretum apiculatum* subsp. *apiculatum; Combretum hereroense; Combretum imberbe (P); Combretum paniculatum; Combretum zeyheri; Dovyalis caffra; Grewia flavescens* var. *flavescens; Kiggelaria Africana; Lantana camara (a); Ormocarpum trichocarpum; Pappea capensis; Peltophorum africanum; Philenoptera violacea (P); Portulacaria afra; Pterocarpus rotundifolius; Sclerocarya birrea* subsp. *caffra (P); Spirostachys africana; Tecoma capensis; Trichilia emetic; Ziziphus mucronata.* |
| ***Forbs*** | *Alternanthera pungens (a); Carissa bispinosa; Carpobrotus edulis; Chaemacrista mimosoides; Chaemasyce hirta (a); Chaemasyce inaequlatera (a); Cyperus esculentus (a); Euphorbia hirta (a); Galinsoga parviflora; Gomphrena celosioides; Guilleminea densa (a); Monadenium lugardiae; Oxalis corniculata; Portulaca qudrifida (a); Richardia brasiliensis (a); Sanseviera aethiopica; Sanseviera pearsonii; Stapelia gigantea; Tribulus terrestris.* |
| ***Grasses*** | *Cynodon dactylon; Dactylotenium australe (d); Eragrostis curvula; Melinis repens; Panicum maximum; Setaria verticilata; Tragus berteronianus.* |
| *(P) – Protected species; (a) – Alien species; (d) - Dominant species* | |

Although no Red Listed plant species are found in this habitat, four protected plant species i.e. *Balanites maughamii*, *Combretum imberbe*, *Philenoptera violacea* and *Sclerocarya birrea* subsp. *caffra* are present. Despite the high prevalence of alien plant species, generally considered weeds, habitat functionality is high. However, based on the IFC SP6 habitat classification criteria this habitat unit is considered modified.

### 10.2 Avifauna

Of the 568 potential bird species present in Limpopo[2], emphasis was placed on Red List and protected bird species in the HHWRS study area and on historical observation records of personnel living in the study area[3]. The bird species of concern are mostly dependant on open water, with a preference for marshlands for their feeding, breeding, nesting and resting requirements. However, only bird species of national concern are discussed with reference to potentially suitable habitat in the study area.

- The painted snipe *Rostratula benghalensis*, despite having a relative large distribution in South Africa, is nowhere common. This snipe lives along reeds in marshes and on the edges of lakes and dams. Daily sustenance is derived from flying insects, worms, small molluscs and crustaceans. Suitable habitat for this species is not present in the HHWRS study area.
- The half-collared kingfisher *Alcedo semitorquata* is considered relatively rare, with large streams and associated vegetation as the preferred habitat. Daily sustenance is derived from fish, water animals and insects. Although no suitable habitat is present in the study area they may be present due to the close proximity of the river.
- The open-billed stork *Anastomus lamelligerus* is considered a migrant species to South Africa. This bird is colonial in trees or reed beds, in association with still open-water such as marshes. Food consumed, consists of fresh-water molluscs, fish and frogs. Nests are built in trees or reed-beds, consisting of a platform constructed from sticks and reeds. The habitat is considered unsuitable, with no record of open-billed stork occurrence could be established.
- The yellow-billed stork *Mycteria ibis* is a migrant to South Africa, and associated with open-water. This stork can often be found along rivers, streams, dams and estuaries. Their diet consists of aquatic insects, crustaceans, fish, frogs and small mammals. Nest building usually occur on large trees or cliffs. The habitat is not considered suitable, and no record of yellow-billed stork occurrence could be established.
- The black stork *Ciconia nigra* is well distributed throughout South Africa and considered resident where it breeds. However, these migrant birds are rare and seldom found in large numbers. Habitat association is marshes, dams, rivers and estuaries. Their diet consists of insects, crustaceans, fish and frogs. Nest building usually occurs on a ledge, and nests are constructed as a platform of sticks. The habitat is not considered suitable, and no record of black stork occurrence could be established.
- The marabou stork *Leptoptilos crumeniferus* is considered rare in South Africa although with few nesting sites recorded. This stork has adapted the habits of vultures and is frequently associated with this carrion feeding species. Diet consists of carrion, termites, locust fish, frogs, lizards, snakes and rats. Nesting usually occurs in large trees or on ledges of cliffs. No suitable habitat is present and no record of marabou stork occurrence could be established.

[2] (http://www.birdlife.org.za)
[3] Dr L van Schalkwyk, louis.vanschalkwyk@up.ac.za

- The greater *Phoenicopterus ruber* and lesser *Phoeniconaias minor* flamingos are considered migrants, associated with large, shallow open-water. The greater flamingo's diet consists of insect larvae, shrimps and small molluscs. The lesser flamingo's diet is limited to vegetable matter. Both species nests on mud mounds build in the shallow water. No suitable habitat was identified, and no record of historic occurrence or presence of flamingos could be established.
- The wattled crane *Grus carunculatus* is uncommon in South Africa, and associated with the fringes of swamps and the adjoining grasslands. Their diets consist of small reptiles, frogs and insects. Nests are built on vegetated islands in swamps. Habitat in the study area is considered marginal and no record of wattle crane occurrence could be established.
- The sacred ibis *Threskiornis aethiopicus* is associated with inland water systems, where they feed and breed. However, this ibis is often seen on farmland pastures where they feed on small molluscs, crickets, grasshoppers, frogs and small reptiles. Nesting usually occurs in trees, bushes or in reed beds. Habitat in the study area is considered marginally suitable, but no record of occurrence could be established.
- The distribution of the African finfoot *Podica senegalensis* is limited to densely vegetated rivers and overgrown banks. Diet consists of insects, crustaceans, snails, frogs and fish. The nest is constructed from sticks and lines with reeds and coarse grass, and located in trees along the embankment. The habitat is considered not suitable.
- The secretary bird *Sagittarius serpentarius* is widely dispersed over open grasslands and savannah in South Africa. Nests are large platform like structures found in tall trees. Diet consists of insects, snakes, lizards, tortoises, young birds and small mammals. The tree structure and herbaceous cover on the property are considered suitable for secretary birds. Feeding and resting requirements for Secretary birds are present in the study area.
- The Peregrine falcon *Falco perigrinus* and Lanner falcon *Falco biamicus* is fairly common in South Africa, but usually found in drier mountainous or open country. These falcons can, however, come into small towns to hunt. Diet consists of birds, with a preference for rock pigeons and queleas. Nests are usually built on a ledge of a cliff face. The habitat in the study area is not considered unsuitable and any occurrence will be incidental.
- The lesser kestrel *Falco naumanni* is a migrant from Europe and Asia that does not breed in South Africa. This falcon frequents urban areas and can be found in all habitats. Diet consists mainly of locusts. The habitat in the study area is considered suitable, however, no kestrels were observed.
- The African marsh harrier *Circus ranivorus* is considered a resident species that frequents marshland areas. Diet consists of rodents, frogs, lizards and young birds. Nests are constructed from sticks and reeds and located in dense reeds or marshy growths. Habitat in the study area is not considered suitable, and no record of occurrence could be established.
- The tawny eagle *Aquila rapax* and martial eagle *Polemaetus bellicosus* are associated with mountainous and open savannah areas, with tall trees for nesting. Diet consists of dassies, hares, rodents and birds. Furthermore, the tawny eagle will also eat carrion, and the martial eagle will catch small

antelope. The habitat in the study area is considered suitable for these birds of prey.

- The Cape vulture *Gyps coprotheres* is relatively common in South Africa with a wide distribution. Diet consists of carrion and nests are built on a precipice of a cliff. There are no suitable nesting areas in the study area.
- The African white-backed vulture *Gyps africanus* and lappet-faced vulture *Torgos tracheliotus* has a wide distribution throughout South Africa. Diet consists of carrion, and nests are built in tall trees. The habitat is suitable and their presence on the study area should not be discounted.
- The white-winged flufftail *Sarothrura ayresi* is associated marshlands and flooded areas. Diet consists of water insects. No suitable habitat was identified, and the presence of flufftail in the study area can be discounted.
- The black-bellied korhaan *Eupodotis malanogaster* is associated with marshland areas and surrounding vegetation. Diet consists of grasshoppers, caterpillars, crickets and other insects. Nests are usually a scrape under a tree or among grass. Marginally suitable habitat was identified in the study area, and the presence of the black-bellied korhaan cannot be discounted.
- The redbilled oxpecker *Buphagus erythrorhynchus* is associated with savanna and grassland habitats. However, these birds, due to their dependency on ticks for their diet is limited to agricultural areas. The habitat is considered suitable and the presence of oxpeckers was confirmed.
- The corncrake *Crex crex* is a migrant species associated with grasslands and weeds fringing streams. However, these birds are often found in old cultivated areas. Diet consists of insects and aquatic vegetation. The habitat is considered marginally suitable, however, no corncrakes were observed in the study area.
- The grass owl *Tyto capensis* frequents grassland habitats along streams and marshland areas. Diet consists of rodents. Nests are constructed on the ground in long grass. No grass owls were observed in the study area and the habitat available is not considered suitable.

Due to the relatively small size of the study area and the absence of any open water or marshlands most of these birds will only be recorded as incidentals. The presence of none of these bird species could be confirmed; however, due to the close proximity of other water resources in the area some future transients could be recorded. The presence or absence of most of these species can only be confirmed on extended visits and surveys conducted over a period of time.

## 10.3 Herpetofauna

### *10.3.1 Snakes and Lizards*

Observations and identifications of potential herpetofaunal species, including snakes lizards and tortoises are based on active search, historical observations by personnel[2]

and researchers[4] in the HHWRS study area. The following list has been confirmed by direct or historical observation (Table 10).

**Table 10: Confirmed sightings of Herpetofaunal species in the HHWRS study area[3]**

| Family | Scientific name | Common name |
|---|---|---|
| **SNAKES** | | |
| Atractaspididae | *Amblyodipsas polylepis* | Common purple-glossed snake |
| Atractaspididae | *Aparallactus capensis* | Black-headed centipede-eater |
| Colubridae | *Crotaphopeltis hotamboeia* | Herald snake |
| Colubridae | *Dipsadoboa aulica* | Marbled tree snake |
| Colubridae | *Dispholidus typus* | Boomslang |
| Colubridae | *Hemirhagerrhis nototeania* | Eastern bark snake |
| Colubridae | *Lamprophis capensis* | Brown House Snake |
| Colubridae | *Mehelya capensis* | Southern File Snake |
| Colubridae | *Philothamnus semivariegatus* | Spotted bush snake |
| Colubridae | *Psammophis mossambicus* | Olive grass snake |
| Colubridae | *Psammophis subtaeniatus* | Western stripe-bellied sand snake |
| Colubridae | *Psammophylax tritaeniatus* | Striped skaapsteker |
| Colubridae | *Telescopus semiannulatus* | Common tiger snake |
| Colubridae | *Thelotornis capensis* | Southern vine snake |
| Elapidae | *Aspidelaps scutatus* | Shield cobra |
| Elapidae | *Dendroaspis polylepis* | Black mamba |
| Elapidae | *Naja annulifera* | Snouted cobra |
| Elapidae | *Naja mossambica* | Mozambique spitting cobra |
| Pythonidae | *Python natalensis* | Southern African python |
| Viperidae | *Bittis arietans* | Puff adder |
| Viperidae | *Causus defilippii* | Snouted night adder |
| **LIZARDS** | | |
| Argamidae | *Acanthocercus atricollis* | Southern tree agama |
| Chamaeleonidae | *Chamaeleo dilepis* | Flap-neck chameleon |
| Gekkonidae | *Chondrodactylus turneri* | Turners tubercled gecko |
| Gekkonidae | *Hemidactylus mabouia* | Moreau's tropical house gecko |
| Gekkonidae | *Homopholis walbergii* | Wahlberg's velvet gecko |
| Gekkonidae | *Lygodactylus capensis* | Cape dwarf gecko |
| Gerrhosauridae | *Gerrhosaurus flavigularis* | Yellow-throated plated lizard |
| Gerrhosauridae | *Gerrhosaurus major* | Tawny plated lizard |
| Gerrhosauridae | *Gerrhosaurus validus* | Giant plated lizard |
| Lacertidae | *Heliobolus lugubris* | Bushveld lizard |
| Scincidae | *Lygosoma sundevallii* | Sundeval's writhing skink |
| Scincidae | *Scelotes bidigittatus* | Lowveld dwarf burrowing skink |

[4] Ian Sharp, galago23@gmail.com

| | | |
|---|---|---|
| Scincidae | *Trachylepis striata* | Eastern striped skink |
| Scincidae | *Trachylepis varia* | Variable skink |
| Varanidae | *Varanus albigularis* | Rock monitor |
| **TESTUDINES** | | |
| Pelomedusidae | *Pelomedusa subrufa* | Marsh terrapin |
| Testudinidae | *Kinixys Spekii* | Speke's hinged tortoise |
| Testudinidae | *Stigmochelys pardalis* | Leopard tortoise |

Both African rock python and plated lizards are considered threatened and thus classified as protected species based on the National Environmental Management: Biodiversity Act (No. 10 of 2004), (NEMBA).

### *10.3.2 Amphibians*

An interactive workshop was conducted in Cape Town during July 2000 to compile a Conservation Assessment and Management Plan (CAMP) for southern African frogs. Of the 109 species currently listed for the region, 22 were listed under the various categories of threat. Of the 22 species, all but two are endemic to the region. Suitable habitat does not exist on the property. However, the following frog species were confirmed by direct observation during the study period (Table 11). None of the frog species identified is considered threatened or protected.

**Table 11: Confirmed sightings of amphibians in the HHWRS study area**

| Family | Scientific name | Common name |
|---|---|---|
| Bufonidae | *Amietophrynus gutturalis* | Guttural toad |
| Bufonidae | *Schismaderma carens* | Red toad |
| Hyperoliidae | *Kassina senegalensis* | Bubbling kassina |
| Rhacophoridae | *Chiromantis xerampelina* | Southern foam nest frog |

## 10.4 Invertebrates

### *10.4.1 Scorpions*

Scorpions have successfully adapted to virtually the full range of potentially compatible terrestrial habitats. No species is unselective in its choice of habitat, but scorpions can be found wandering from one habitat to another when searching for prey. The burrow entrances of scorpions are oval in cross-section and can be distinguished from other arthropods, which in most cases are round in cross-section.

In addition, a fan-shaped mound, consisting of soil that has been excavated, radiate away from the entrance. Suitable habitat does exist in the study area with seven expected species[4]; however, only the presence of *Parabuthus transvaalicus* (Transvaal thick-tailed scorpion) is confirmed.

### *10.4.2 Spiders*

Trapdoor spiders are usually sedentary and ground living, building intricate burrows that although generally well camouflaged is noticeable once familiar with the different construction methods employed. These spiders are generally burrow-bound during the day, some sitting at the mouth of the burrow, door ajar, waiting for prey to pass by. Once disturbed or in possession of prey, the spider retreats to the burrow, closing the door tightly behind it. The presence of trapdoor spiders could not be confirmed, but the habitat is considered potentially suitable for these arachnids.

The presence of baboon spiders can be confirmed and numerous distinctive burrows were identified at various locations on the study area. Baboon spiders inhabit warm arid areas and are commonly found under stones or in clumps of grass. There are more than162 African species and they are mostly large, hairy with colours varying from light brown to almost black, and they look similar to the rain and lizard spiders. The entrances of the tunnels are often silked over during the day when they remain in there burrows. Three species of baboon spider[4] occur in the study area of which only two could be confirmed (Table 12)[5].

**Table 12: Confirmed sightings of baboon spiders in the HHWRS study area**

| Family | Scientific name | Common name |
|---|---|---|
| Theraphosidae | *Augacephalus breyeri* | Golden brown baboon spider |
| Theraphosidae | *Augacephalus junodi* | Golden baboon spider |

### *10.4.3 Butterflies*

Of the 143 potential butterfly species recorded for the study area[6], the presence of 47 species[3] can be confirmed (Table 13). None of the species is threatened or protected.

[5] Patrick Gildenhuys, p_gildenhuys@mweb.co.za
[6] http://sabca.adu.org.za/

## Table 13: Confirmed sightings of butterflies in the HHWRS study area

| Family | Scientific name | Common name |
|---|---|---|
| Hesperiidae | *Abantis paradisea* | Paradise skipper |
| Hesperiidae | *Abantis tettensis* | Spotted velvet skipper |
| Hesperiidae | *Caprona pillaana* | Ragged skipper |
| Hesperiidae | *Coeliades lorenza* | Coastal Red-tab policeman |
| Hesperiidae | *Parosmodes morantii* | Morant's orange |
| Hesperiidae | *Spilia dromus* | Forest sandman |
| Hesperiidae | *Spilia spio* | Mountain sandman |
| Hesperiidae | *Zophopetes dysmephila* | Palm-tree night-fighter |
| Lycaenidae | *Cigaritis ella* | Ella's bar |
| Lycaenidae | *Deudorix dinochares* | Apricot playboy |
| Lycaenidae | *Euchrysops osiris* | Osiris smoky blue |
| Lycaenidae | *Iolaus pallene* | Saffron sapphire |
| Lycaenidae | *Iolaus silaris* | Straight-line sapphire |
| Lycaenidae | *Iolaus trimeni* | Trimen's sapphire |
| Lycaenidae | *Lachnocnema durbani* | D'Urban's woolly legs |
| Lycaenidae | *Lachnocnema laches* | Southern pied woolly legs |
| Lycaenidae | *Lepidochrysops plebeia* | Twin-spot blue |
| Lycaenidae | *Leptomyrina henningi* | Henning's black-eye |
| Lycaenidae | *Leptotes babaulti* | Babault's zebra blue |
| Lycaenidae | *Stugeta bowkeri* | Bowker's marbled sapphire |
| Nymphalidae | *Acraea acara* | Acara acraea |
| Nymphalidae | *Acraea aganice* | Wanderer |
| Nymphalidae | *Amauris albimaculata* | Layman friar |
| Nymphalidae | *Amauris niavius* | Common friar |
| Nymphalidae | *Amauris ocjlea* | Novice friar |
| Nymphalidae | *Charaxes achaemenes* | Bushveld charaxes |
| Nymphalidae | *Charaxes brutus* | White-barred charaxes |
| Nymphalidae | *Charaxes candiope* | Green-veined charaxes |
| Nymphalidae | *Charaxes castor* | Giant charaxes |
| Nymphalidae | *Charaxes jahlusa* | Pearl-spotted charaxes |
| Nymphalidae | *Charaxes jasius* | Foxy charaxes |
| Nymphalidae | *Charaxes phaeus* | Demon charaxes |
| Nymphalidae | *Charaxes vansoni* | Van Son's charaxes |
| Nymphalidae | *Charaxes varanes* | Pearl charaxes |
| Nymphalidae | *Coenyra hebe* | Zulu shadefly |
| Nymphalidae | *Coenyropsis natalii* | Natal brown |
| Nymphalidae | *Neptis saclava* | Spotted sailor |
| Nymphalidae | *Pardopsis punctatissima* | Polka dot |
| Nymphalidae | *Pseudacraea lucretia* | False chief |
| Nymphalidae | *Sevenia natalensis* | Natal tree-nymph |
| Papilionidae | *Graphium antheus* | Large striped swordtail |
| Papilionidae | *Graphium leonidas* | Veined swordtail |
| Papilionidae | *Graphium porthaon* | Cream striped swordtail |

| | | |
|---|---|---|
| Papilionidae | *Papilio dardanus* | Mocker swallowtail |
| Pieridae | *Colotis eris* | Banded gold tip |
| Pieridae | *Colotis regina* | Queen purple tip |
| Pieridae | *Eronia leda* | Auttumn leaf vagrant |

### 10.5 Mammals

Virtually no mammal species occur in the study area and with the exception of small mammals that can move through or fly over the fence, none were recorded. Habitat suitability was evaluated for 44 threatened[7] or protected mammal species (Table 14). All larger mammal species are effectively excluded from the study area; however bats, shrew, rats and mice are present. Bats are present in the study are, but no threatened or protected species were identified or their presence confirmed from reliable sightings. The presence of other threatened species such as *Crocidura flavescens*, *Myosorex varius* and *Rhabdomys pumilio* could not be established, and the habitat is considered not suitable to *Dasymys incomtus* or *Thallomys paedulcus*.

**Table 14: Threatened and protected mammal species of the region**

| Order | Scientific name | Common name |
|---|---|---|
| Artiodactyla | *Oreotragus oreotragus* | Klipspringer |
| Artiodactyla | *Pelea capreolus* | Grey rhebok |
| Artiodactyla | *Raphicerus sharpei* | Sharp's grysbok |
| Artiodactyla | *Redunca arundinum* | Reedbuck |
| Artiodactyla | *Redunca fulvorufula* | Mountain reedbuck |
| Artiodactyla | *Tragelaphus angasii* | Nyala |
| Carnivora | *Aonyx capensis* | Cape clawless otter |
| Carnivora | *Canis adustis* | Side-striped jackal |
| Carnivora | *Civettictis civetta* | African civet |
| Carnivora | *Crocuta crocuta* | Spotted hyaena |
| Carnivora | *Felis sylvestris* | African wild cat |
| Carnivora | *Leptailurus serval* | Serval cat |
| Carnivora | *Lutra maculicollis* | Spotted-necked otter |
| Carnivora | *Lycaon pictus* | African wild dog |
| Carnivora | *Mellivora capensis* | Honey badger |
| Carnivora | *Panthera pardus* | Leopard |
| Carnivora | *Parahyaena brunnea* | Brown hyaena |
| Carnivora | *Poecilogale albinucha* | African weasel |
| Carnivora | *Proteles cristatus* | Aardwolf |
| Chiroptera | *Cloeotis percivalli* | Short-eared trident bat |

[7] (http://www.speciesstatus.sanbi.org)

| | | |
|---|---|---|
| Chiroptera | *Kerivoula lanosa* | Lesser woolly bat |
| Chiroptera | *Miniopterus fraterculus* | Lesser long-fingered bat |
| Chiroptera | *Miniopterus schreibersii* | Schreiber's long-fingered bat |
| Chiroptera | *Myotis tricolor* | Temminck's hairy bat |
| Chiroptera | *Myotis welwitschii* | Welwitsch's hairy bat |
| Chiroptera | *Neoromicia zuluensis* | Aloe serotine bat |
| Chiroptera | *Pipistrellis rusticus* | Rusty bat |
| Chiroptera | *Rhinolophus clivosus* | Darling's horseshoe bat |
| Chiroptera | *Rhinolophus darlingi* | Darling's horseshoe bat |
| Chiroptera | *Rhinolophus fumigatus* | Rüppell's horseshoe bat |
| Chiroptera | *Rhinolophus hildebrandtii* | Hildebrandt's horseshoe bat |
| Chiroptera | *Rhinolophus landeri* | Lander;s horseshoe bat |
| Chiroptera | *Rhinolophus simulator* | Bushveld horseshoe bat |
| Insectivora | *Amblysomus hottentotus* | Hottentot golden mole |
| Insectivora | *Crocidura flavescens* | Greater musk shrew |
| Insectivora | *Myosorex varius* | Forest Shrew |
| Pholidota | *Manis temminckii* | Pangolin |
| Primates | *Cercopithecus mitis* | Samango monkey |
| Primates | *Galago moholi* | SA lesser bushbaby |
| Rodentia | *Dasymys incomtus* | Water rat |
| Rodentia | *Pedetes capensis* | Springhare |
| Rodentia | *Rhabdomys pumilio* | Striped mouse |
| Rodentia | *Thallomys paedulcus* | Tree rat |
| Tubulidentata | *Orycteropus afer* | Aardvark |

## 10.6 Species of Conservation Concern

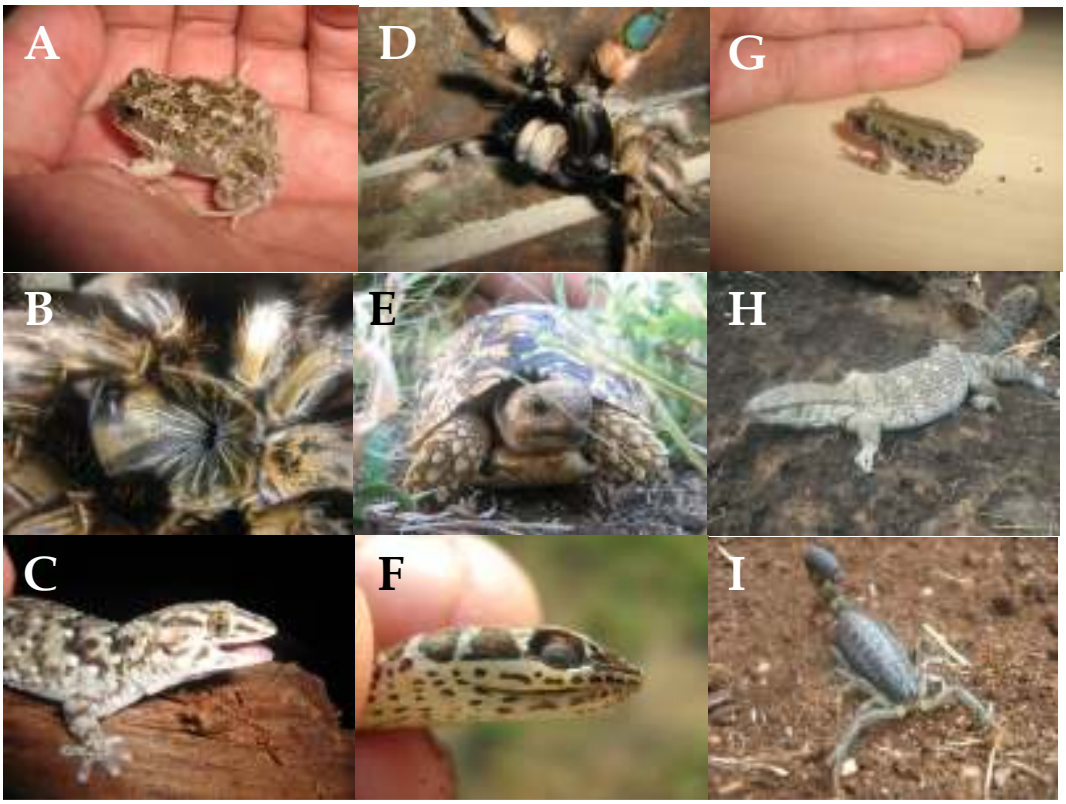
A selection of species photographed (Table 15) within the HHWRS study area is shown in Figure 12. Many of these species identified are not under threat of extinction or restricted in distribution, but considered important indicators of ecosystem health.

**Table 15: Selected species photographs from Figure 10**

| Photograph | Description | Photograph | Description |
|---|---|---|---|
| A | Guttural toad *Amietophrynus gutturalis* | F | Western stripe-bellied sand snake *Psammophis subtaeniatus* |
| B | Golden baboon spider *Augacephalus junodi* | G | Bubbling kassina *Kassina senegalensis* |
| C | Turner's tubercled gecko *Chondrodactylus turneri* | H | Rock monitor *Varanus albigularis* |
| D | Golden brown baboon spider *Augacephalus breyeri* | I | Transvaal thick tail scorpion *Parabuthus transvaalicus* |

| Photograph | Description | Photograph | Description |
|---|---|---|---|
| E | Leopard tortoise<br>*Stigmochelys pardalis* | | |

**Figure 12: Indicator species of ecosystem health**




### *10.6.1 Flora*

No Red List threatened species are present in the HHWRS study are; however, four protected species (*Balanites maughamii*, *Combretum imberbe*, *Philenoptera violacea* and *Sclerocarya birrea* subsp. *caffra*) are present. Although *Combretum imberbe* and *Sclerocarya birrea* subsp. *caffra* are found scattered throughout the study area, all these species are only found in the transformed habitat units. This phenomenon can be attributed to habitat modification and landscape gardening.

### *10.6.2 Avifauna*

Despite potential for a high diversity of bird species present in the study area, habitat size and suitability in requirements for feeding, breeding, nesting and resting is severely limited. Most threatened and protected bird species are either water

dependant or habitat specific. Although the presence of none of these species can be confirmed, future incidental occurrence cannot be excluded.

### *10.6.3 Herpetofauna*

A number of herpetofauna was identified in the study area, but no threatened species recorded. The protected plated lizard *Gerrhosaurus* sp. was, however, recorded in the study area. Furthermore, historical records do confirm the presence of both plated lizards and the protected *Python natalensis* (Southern African python).

### *10.6.4 Invertebrates*

No threatened or protected amphibian species were present in the study area; and although seven scorpion species is expected in the study area, only *Parabuthus transvaalicus* (Transvaal thick-tailed scorpion) could be confirmed. Although this scorpion is not threatened or protected, it is of medical concern due to its venomous properties. The presence of baboon spiders (*Augacephalus breyeri* and *Augacephalus junodi*) is especially prevalent in Habitat Unit 1, 2 and 3. These spiders are of conservation concern, and due care and consideration will need to be applied in any future development. Despite a high prevalence of butterfly species present in the study area, none of these are threatened or protected.

### *10.6.5 Mammals*

Although the habitat in the study is considered suitable to a number of mammal species, occurrence is severely limited by the habitat size and available. Furthermore, the fence construction is such that only very small mammal species that can crawl through the fence will be present. No large mammal species are present, with only bats, shrews, rats and mice being confirmed. The presence of other threatened species such as *Crocidura flavescens*, *Myosorex varius* and *Rhabdomys pumilio* could not be established. The habitat is not considered suitable to *Dasymys incomtus* or *Thallomys paedulcus* and these species can also be excluded. The presence/absence of threatened or protected bat species could not be confirmed, but incidental occurrence is a possibility.

## 11 SENSITIVITY ANALYSIS

A combined output of the sensitivity ratings for each habitat type is desired to illustrate the overall ecological sensitivity of the HHWRS study area. This was achieved but applying a numerical value to each of the sensitivity classes where Low sensitivity = 1, Moderate sensitivity = 2 and High sensitivity = 3. Summation of the

sensitivity scores across the floral and faunal categories could therefore produce habitat scores between 5 and 15, representing a spread of different possible outcomes. Scores of sensitivity were divided equally between the spread as follows:

Low sensitivity = 5-7
Moderate sensitivity = 8-11
High sensitivity = 12-15

This summative approach assigns equal weight to each of the individual sensitivity evaluations and the equal spread of sensitivity classes removes bias from the interpretation. The results of this combined sensitivity analysis are shown in (Table 16). It is clear that the whole of the HHWRS study area is rated as being of low sensitivity from an ecological perspective.

**Table 16: Combined Sensitivity Analysis based on all flora and fauna in the HHWRS study area**

| Habitat | Flora | Avifauna | Herpetofauna | Invertebrate | Mammals | Sensitivity |
|---|---|---|---|---|---|---|
| 1 – Short Open Shrubland | 2 | 1 | 1 | 2 | 1 | Low |
| 2 – Short Open Shrubland | 2 | 1 | 1 | 2 | 1 | Low |
| 3 – Tall Open Woodland | 2 | 1 | 1 | 2 | 1 | Low |
| 4 – Short Open Shrubland | 2 | 1 | 1 | 2 | 1 | Low |
| 5 – Short Open Woodland | 2 | 1 | 1 | 1 | 1 | Low |
| 6 – Short Open Woodland | 2 | 1 | 2 | 1 | 1 | Low |
| 7 – Short Open Woodland | 2 | 1 | 2 | 1 | 1 | Low |
| 8 – Transformed | 3 | 1 | 2 | 1 | 1 | Low |

## APPENDIX 1: List of tree species identified at HHWRS

| Scientific name | Common name |
|---|---|
| *Acacia exuvialis* | Flaky thorn |
| *Acacia grandicornuta* | Horned thorn |
| *Acacia karroo* | Sweet thorn |
| *Acacia nigrescens* | Knob thorn |
| *Acacia nilotica* subsp. *kraussiana* | Scented thorn |
| *Acacia robusta* | Brack thorn |
| *Acacia tortilis* subsp. *heteracantha* | Umbrella thorn |
| *Acacia xanthophloea* | Fever tree |
| *Adenium multiflorum* | Impala lily |
| *Balanites maughamii* | Green thorn |
| *Bauhinia galpinii* | Pride-of-de Kaap |
| *Berchemia zeyheri* | Red ivory |
| *Burkea africana* | Wild syringa |
| *Combretum apiculatum* subsp. *apiculatum* | Red bushwillow |
| *Combretum hereroense* | Russet bushwillow |
| *Combretum imberbe* | Leadwood |
| *Combretum paniculatum* | Flame creeper |
| *Combretum molle* | Velvet bushwillow |
| *Combretum zeyheri* | Large-fruited bushwillow |
| *Commiphora mollis* | Velvet corkwood |
| *Dalbergia melanoxylon* | Zebrawood |
| *Dichrostachys cinerea* | Sickle bush |
| *Diospyros lycioides* | Bluebush |
| *Dombeya rotundifolia* | Common wild pear |
| *Dovyalis caffra* | Kei-apple |
| *Ehretia rigida* | Puzzle bush |
| *Euclea divinorum* | Magic guarri |
| *Euphorbia tirucalli* | Rubber euphorbia |
| *Flueggea virosa* | White-berry bush |
| *Gardenia volkensii* subsp. *volkensii* | Savanna gardenia |
| *Grewia bicolor* | White raisin |
| *Grewia flava* | Velvet raisin |
| *Grewia flavescens* var. *flavescens* | Sandpaper raisin |
| *Grewia monticola* | Silver raisin |
| *Grewia occidentalis* | Cross-berry |
| *Gymnosporia buxifolia* | Common spike-thorn |
| *Kiggelaria africana* | Wild peach |
| *Lannea schweinfurthii var. stuhlmannii* | False marula |
| *Lantana camara* | Bird's brandy |
| *Mundulea sericea* | Corky bark |
| *Mystroxylon aethiopicum* | Kooboo berry |
| *Ormocarpum trichocarpum* | Caterpillar bush |
| *Ozoroa paniculosa var. salicina* | Common resin tree |
| *Pappea capensis* | Jacket plum |
| *Peltophorum africanum* | Weeping wattle |
| *Philenoptera violacea* | Apple leaf |
| *Portulacaria afra* | Porkbush |
| *Pterocarpus rotundifolius* | Round-leaved teak |

| | |
|---|---|
| *Rhus guenzii* | Thorny karree |
| *Rhus pyroides* | Common wild currant |
| *Schotia brachypetala* | Weeping boer-bean |
| *Sclerocarya birrea subsp. caffra* | Marula |
| *Spirostachys africana* | Tamboti |
| *Tecoma capensis* | Cape honeysuckle |
| *Terminalia sericea* | Silver cluster leaf |
| *Trichilia emetica* | Forest mahogany |
| *Ximenia americana var. microphylla* | Blue sourplum |
| *Ziziphus mucronata* | Buffalo-thorn |

Alien species
No known common name
Declared weed and invader species — Category 1
Declared weed and invader species — Category 2
Declared weed and invader species — Category 3

## APPENDIX 2: List of grass species identified at HHWRS

| Scientific name | Common name |
|---|---|
| *Andropogon chinensis* | Hairy blue grass |
| *Aristida adscensionis* | Annual three-awn |
| *Aristida congesta* subsp. *barbicollis* | Spreading three-awn |
| *Aristida congesta* subsp. *congesta* | Tassel three-awn |
| *Aristida stipitata subsp. stipitata* | Long-awned three-awn |
| *Bothriochloa insculpta* | Pinhole grass |
| *Bothriochloa radicans* | Stinking grass |
| *Brachiaria deflexa* | False signal grass |
| *Cenchrus ciliaris* | Blue baffalo grass |
| *Chloris virgata* | Feathered chloris |
| *Cymbopogon plurinodes* | Narrow-leaved turpentine grass |
| *Cynodon dactylon* | Couch grass |
| *Dactyloctenium aegytium* | Common crowsfoot |
| *Dactylotenium australe* | L.M. grass |
| *Digitaria diagonalis* | Brown-seed finger grass |
| *Digitaria eriantha* | Finger grass |
| *Enneapogon scoparius* | Bottlebrush grass |
| *Eragrostis curvula* | Weeping love grass |
| *Eragrostis lehmanniana* var. *lehmanniana* | Lehmann's love grass |
| *Eragrostis micrantha* | Finesse grass |
| *Eragrostis plana* | Tough love grass |
| *Eragrostis racemosa* | Narrow heart love grass |
| *Eragrostis rigidior* | Broadleaved curly leaf |
| *Eragrostis superba* | Sawtooth love grass |
| *Eragrostis trichophora* | Hairy love grass |
| *Fingerhuthia africana* | Thimble grass |
| *Heteropogon contortus* | Spear grass |
| *Hyparrhenia hirta* | Common thatching grass |

| | |
|---|---|
| *Hyperthelia dissoluta* | Yellow thatching grass |
| *Melinis repens* | Natal red-top |
| *Panicum deustum* | Broad-leaved panicum |
| *Panicum maximum* | Guinea grass |
| *Panicum natalense* | Natal panicum |
| *Perotis patens* | Cat's tail |
| *Pogonarthria squarrosa* | Herringbone grass |
| *Schmidtia pappophoroides* | Sand quick |
| *Setaria sphacelata* var. *sphacelata* | Common bristle grass |
| *Setaria verticilata* | Sticky bristle grass |
| *Sorghum bicolor* | Common wild sorghum |
| *Sporobolus africana* | Rat's tail dropseed |
| *Sporobolus ioclados* | Pan dropseed |
| *Themeda triandra* | Red grass |
| *Tragus berteronianus* | Common carrot-seed grass |
| *Urochloa mosambicensis* | Bushveld signal grass |

Alien species
No known common name
Declared weed and invader species — Category 1
Declared weed and invader species — Category 2
Declared weed and invader species — Category 3

## APPENDIX 3: List of Forb species identified at HHWRS

| Scientific name | Common name |
|---|---|
| *Abutilon austro-africanum* | |
| *Acalypha indica* | |
| *Acanthospermum australe* | Prostrate starbur |
| *Achyranthes aspera* | Chaff flower |
| *Acrotome hispida* | White cat's paws |
| *Ageratum conyzoides* | |
| *Albuca glauca* | |
| *Aloe marlothii* | Mountain aloe |
| *Alternanthera pungens* | Paperthorn |
| *Aptosimum lineare* | |
| *Bidens pilosa* | Blackjack |
| *Boerhavia erecta* | Spiderling |
| *Boophane disticha* | Poison bulb |
| *Bulbostylis burchellii* | |
| *Carissa bispinosa* | Forrest num-num |
| *Carpobrotus edulis* | Ice plant |
| *Ceratotheca triloba* | Wild foxglove |
| *Chaemacrista mimosoides* | Fishbone cassia |
| *Chaemasyce hirta* | Red milkweed |
| *Chaemasyce inaequlatera* | Smooth creeping milkweed |
| *Cissus quadrangularis* | Cactus vine |
| *Cleome maculata* | |
| *Commelina africana* var. *africana* | |
| *Commelina erecta* | |

| | |
|---|---|
| *Convolvulus sagittatus var. aschersonii* | |
| *Conyza bonariensis* | Flax-leaf fleabane |
| *Cotyledon orbiculata* | Plakkie |
| *Crabbea angustifolia* | |
| *Crabbea hirsuta* | |
| *Criptolepis oblongifolia* | Ram's horn |
| *Cucumis hirsutus* | Wild cucumber |
| *Cyperus esculentus* | Yellow nutsedge |
| *Cyperus obtusiflorus* | Geelbiesie |
| *Cyperus rupestris var, rupestris* | |
| *Cyphostemma lanigerum* | Wild grape |
| *Cyphostemma schlecteri* | |
| *Dicoma tomentosa* | |
| *Dyschoriste fischeri* | |
| *Euphorbia hirta* | |
| *Evolvulus alsinoides* | |
| *Felicia muricata* | |
| *Galinsoga parviflora* | Gallant soldier |
| *Gomphocarpus burchellii* | |
| *Gomphrena celosioides* | Bachelor's button |
| *Gossypium herbaceum subsp. africanum* | Wild cotton |
| *Guilleminea densa* | Carrot weed |
| *Helichrysum rugulosum* | |
| *Heliotropium ciliatum* | |
| *Hermannia tomentosa* | |
| *Hibiscus trionum* | Bladderweed |
| *Hypertelis salsoloides var. salsoloides* | |
| *Indigoferadaleoides* | |
| *Indigofera filipes* | |
| *Indigofera zeyheri* | |
| *Ipomoea cairica* | Common ipomoea |
| *Ipomoea obscura* | Wild petunia |
| *Ipomoea pupurea* | Common morning glory |
| *Justicia flava* | |
| *Kalanchoe paniculata* | Krimpsiektebossie |
| *Kedrostis africana* | |
| *Kyphocarpa angustifolia* | |
| *Lantana rugosa* | Bird's brandy |
| *Leonotis ocymifolia* | Wild dagga |
| *Leucas glabrata var. glabrata* | |
| *Lippia javanica* | Laventelbossie |
| *Merremia tridentata subsp. angustifolia* | |
| *Monadenium lugardiae* | |
| *Ocimum canum* | |
| *Oxalis corniculata* | Creeping sorrel |
| *Pellaea calomelanos* | |
| *Phyllanthus parvulus var. parvulus* | Dye bush |
| *Plexipus hederaceus var. hederaceus* | |
| *Portulaca qudrifida* | Wild purslane |
| *Protasparagus setaceus* | Asparagus fern |
| *Protosparagus suaveolens* | Wild asparagus |

| | |
|---|---|
| *Pupalia lappacea* | |
| *Rhoicissus tridentata* | Bushman's grape |
| *Rhynchosia caribaea* | |
| *Rhynchosia totta var. totta* | |
| *Richardia brasiliensis* | Tropical richardia |
| *Sanseviera aethiopica* | Bowstring hemp |
| *Sanseviera pearsonii* | |
| *Schkuhria pinnata* | Dwarf marigold |
| *Sesamum triphyllum* | Wild sesame |
| *Sida alba* | Spiny sida |
| *Sida cordifolia* | Flannel weed |
| *Sida rhombifolia* | Arrow-leaf sida |
| *Solanum incanum* | Bitter apple |
| *Solanum panduriforme* | Poison apple |
| *Stapelia gigantea* | Giant carrion flower |
| *Tagetes minuta* | Khaki weed |
| *Tribulus terrestris* | Dubbeltjie |
| *Tricliceras mossambicense* | Lion's eye |
| *Verbena bonariensis* | Wild verbena |
| *Vernonia poskeana* | |
| *Waltheria indica* | Meidebossie |

| | |
|---|---|
| Alien species | |
| No known common name | |
| Declared weed and invader species | Category 1 |
| Declared weed and invader species | Category 2 |
| Declared weed and invader species | Category 3 |

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environmental affairs
Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

**DETAILS OF SPECIALIST AND DECLARATION OF INTEREST**

| | (For official use only) |
|---|---|
| File Reference Number: | *14/12/16/3/3/3/48* |
| NEAS Reference Number: | *DEA/EIA/0001347/2012* |
| Date Received: | |

Application for authorisation in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998), as amended and the Environmental Impact Assessment Regulations, 2010

**PROJECT TITLE**

**PROPOSED UPGRADE OF THE HANS HOHEISEN WILDLIFE RESEARCH STATION, MPUMALANGA**

| | | | |
|---|---|---|---|
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| | | | |
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SPECIALIST DECLARATION OF INTEREST

4.2 The specialist appointed in terms of the Regulations_

I, **Ben Orban** declare that --

General declaration:

- I act as the independent specialist in this application
- I will perform the work relating to the application in an objective manner, even if this results in views and findings that are not favourable to the applicant
- I declare that there are no circumstances that may compromise my objectivity in performing such work;
- I have expertise in conducting the specialist report relevant to this application, including knowledge of the Act, regulations and any guidelines that have relevance to the proposed activity;
- I will comply with the Act, regulations and all other applicable legislation;
- I have no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the competent authority all material information in my possession that reasonably has or may have the potential of influencing - any decision to be taken with respect to the application by the competent authority; and - the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of Regulation 71 and is punishable in terms of section 24F of the Act.

Signature of the specialist:

NABRO Ecological Analysts CC

Name of company (if applicable):

15/07/2013

Date: