UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

MOOLMAN, M

ASPECTS OF BIODIVERSITY IN THE SOUTHERN AFRICAN GRASSLAND BIOME

MSc UP 1998

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Aspects of biodiversity in the southern African Grassland Biome

by

Marisa Moolman

Submitted in partial fulfilment of the requirements for the degree

MAGISTER SCIENTIAE

in the Faculty of Biological and Agricultural Sciences (Department of Botany)

University of Pretoria
Pretoria

Supervisor: Prof. Dr. A.E. van Wyk
Co-supervisor: Prof. Dr. G.J. Bredenkamp

December 1998

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

"Praise the Lord from the earth, you sea monsters and all deeps! You lightning, hail, fog *and* frost, you stormy wind fulfilling His orders! Mountains and hills, fruitful trees and all cedars! Beasts and all cattle, creeping things and flying birds! Kings of the earth and all peoples, princes and all rulers *and* judges of the earth! Both young men and maidens, old men and children! Let them praise *and* exalt the name of the Lord, for His name alone is exalted *and* supreme! His glory *and* majesty are above earth and heaven!" PSALM 148:7–13.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

ABSTRACT

Aspects of the biodiversity in the southern African Grassland Biome

by

Marisa Moolman

Supervisor: Prof. Dr. A.E. van Wyk

Co-supervisor: Prof. Dr. G.J. Bredenkamp

Submitted in partial fulfilment of the requirements

for the degree

MAGISTER SCIENTIAE

The South African grassland is considered the economic and industrial heartland of the country and is associated with numerous negative environmental impacts. Nowhere is the alteration of the southern African Grassland Biome more pronounced than in the Highveld Region, particularly the Drakensberg Escarpment, where areas are still being irreversibly fragmented and transformed by agricultural (notably afforestation), mining, and industrial practices. Little is yet known of the biodiversity, including the endemic, rare and threatened species of both faunal and floristic components of the Grassland Biome. Inventories collated by various criteria show that the Grassland Biome has an extremely high floristic and faunal diversity, (number of southern African/sub-Region endemics in brackets): 554 bird (126), 243 (121) reptile and amphibian, 195 butterfly (± 63) and 172 (23) mammal species. Of these, 12 bird, 29 herpetofauna, 49 butterfly and eight mammal species are largely restricted to grassland. The presence of many, often endangered, endemic and rare specialist species in the Grassland Biome suggests that this region is in urgent need of much higher conservation status than is currently the case.

Keywords: amphibian, bird, biodiversity, Biome, butterfly, conservation, endemism, Escarpment, grassland, herpetofauna, Highveld, mammal, reptile

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

TABLE OF CONTENTS

PART ONE: Text

CHAPTER 1. INTRODUCTION....9

1.1 Grassland Biome....9
1.2 Motivation for study....10
1.3 Key questions....10
1.4 Objectives....10

CHAPTER 2. STUDY AREA AND PHYSICAL ENVIRONMENT....13

2.1 Study area....13
2.2 Physical environment....15
2.2.1 Topography and landscape....15
2.2.2 Geology....18
2.2.3 Soils....20
2.2.4 Climate....22
2.3 Flora....24
2.4 Community types....25
2.5 Grassland Biome dynamics....25
2.5.1 Historical impact on grasslands....26
2.5.2 Grazing....28
2.5.3 Fire....27
2.6 Conservation....28

CHAPTER 3. METHODS....30

3.1 Methods: Birds of the Grassland Biome....32
3.1.1 Criteria employed....32
3.1.2 Data sources employed....34

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

3.2 Methods: Herpetofauna of the Grassland Biome....34
3.2.1 Criteria employed....35
3.2.2 Data sources employed....36
3.2.3 Collecters bias....36
3.3 Methods: Butterflies of the Grassland Biome....37
3.3.1 Criteria employed....37
3.3.2 Data sources employed....39
3.4 Methods: Mammals of the Grassland Biome....39
3.4.1 Criteria employed....40
3.4.2 Data sources employed....41

CHAPTER 4. BIRDS OF THE GRASSLAND BIOME....42

4.1 Results....42
4.2 Discussion and additional information....45
4.2.1 The Grassland Biome afivauna....45
4.2.2 Habitat selection....47
4.2.3 Habitat structure....48
4.2.4 Climate....53
4.2.5 Geography and Topography....54
4.2.6 Edge effect....54
4.2.7 Area size....55
4.2.8 Habitat selection and competition....56
4.2.9 Habitat selection and foraging as structural factor....57
4.2.10 Habitat selection and predation....59
4.2.11 Migration, Breeding status and nesting sites....60
4.2.12 Human impact....61
4.2.13 Threatened status....71
4.2.14 Conclusions....72
4.2.15 Recommendations....73

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

CHAPTER 5. HERPETOFAUNA OF THE GRASSLAND BIOME.....75

5.1 Results.....76
5.2 Discussion and additional information.....79
5.2.1 Grassland Biome Herpetofauna.....79
5.2.2 Diversity.....81
5.2.3 Endemics.....85
5.2.4 Habitat selection.....89
5.2.5 Factors in habitat selection.....90
5.2.6 Climate and soil.....95
5.2.7 Topography and Geographical Distribution.....96
5.2.8 Area size and territoriality.....97
5.2.9 Habitat selection and foraging.....98
5.2.10 Human impact.....98
5.2.11 Fire.....105
5.2.12 Threatened status of the Grassland Biome Herpetofauna.....107
5.2.13 Conservation.....109
5.2.14 Conclusions.....110
5.2.15 Recommendations.....111

CHAPTER 6. BUTTERFLIES OF THE GRASSLAND BIOME.....112

6.1 Results.....112
6.2 Historical relict elements.....119
6.3 Butterflies as indicator group.....123
6.4 Factors determining butterfly distribution.....124
6.5 1 Vegetation.....125
6.5.2 Climate.....135
6.5.3 Microclimate.....138
6.5.4 Topography.....140
6.5.5 Larval and adult food plants.....144
6.5.6 Breeding sites.....148

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

6.5.7 Predators....149
6.5.8 Mutualistic interactions....150
6.6 Human impact....151
6.6.1 Agricultural acitivities....151
6.6.2 Habitat fragmentation....153
6.6.3 Grazing....154
6.6.4 Afforestation....157
6.6.5 Pesticides....157
6.6.6 Urbanisation & introduction of alien plants/fauna....158
6.7 Succession....160
6.7.1 Abandoned grassland....161
6.8 Fire....162
6.9 Threatened species....163
6.10 Conservation....164
6.11 Conclusions....166
6.12 Recommendations....167

CHAPTER 7. MAMMALS OF THE GRASSLAND BIOME....168

7.1 Results....168
7.2 Species richness....173
7.3 Species distribution....173
7.4 Endemics....174
7.5 Hotspots....175
7.6 Conservation & Recommendations....176

CHAPTER 8. GENERAL DISCUSSION....177

8.1 Motivation....177
8.2 Species distribution....178
8.3 Endemics....180
8.4 Habitat selection....182

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

8.5 Vegetation....183
8.6 Succession....182
8.7 Climate....185
8.8 Topography....186
8.9 Area size....188
8.10 Habitat fragmentation....189
8.11 Habitat selection and foraging....189
8.12 Breeding sites....191
8.13 Human impact....192
8.14 Fire....196
8.15 Threatened status....197
8.16 Conservation....198

CHAPTER 9. GENERAL CONCLUSIONS AND RECOMMENDATIONS....199

9.1 General conclusions....199
9.2 General recommendations....202

SUMMARY....204
OPSOMMING....207
ACKNOWLEDEMENTS....210
REFERENCES....211
CURRICULUM VITAE....228

PART TWO

Tables and Figures

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

The complete datatbase is available from the HGWJ Schweikerdt Herbarium, Department of Botany, University of Pretoria. The database is done in Microsoft Access for Windows, version 2.0.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

CHAPTER 1

INTRODUCTION

1.1 Grassland Biome

The Grassland Biome of southern Africa occupies a central geographic position and covers an area of approximately 343 000 km^2 (Rutherford & Westfall 1994), or 333 942 km^2 according to Low & Rebelo (1996). The South African Highveld grassland represents climatic climax vegetation over most of the area (Acocks 1953; Tainton & Mentis 1984) and is characterised by the strong dominance of hemicryptophytes of the Poaceae (Rutherford & Westfall 1994). Highveld grassland types are bounded by the Nama-Karoo Biome (dwarf shrubland) to the south-west, and by mixed savanna types elsewhere. Phytogeographically the Grassland Biome (Figure 1) falls mainly within the Kalahari-Highveld Region and the Afromontane Archipelago, as defined by White (1978).

The hypothesis that these humid grasslands, and especially those of Afromontane affinity, are anthropogenically derived (Acocks 1953; White 1978) is now generally discounted. Evidence in support of their primary status is provided by the diversity and biogeography of animals and plants. The overall extent of the Grassland Biome would seem to be limited by climate (including fire), but, in addition, edaphic factors which depend *inter alia* on climate, climatic variables, topography and grazing, strongly determine the extent of the Grassland Biome (Bredenkamp & Van Vuuren 1987; Coetzee *et al.* 1995).

The South African grassland region is considered the economic driving force in the country. The gold and coal mining industries are centred in the Highveld grassland, resulting in cities with the highest population densities in the country. Climatic conditions in the grassland region are conducive to agriculture and well over 50 % of the region has been ploughed at one time or another. In terms of the classification suggested by Ray (1982), the biome in general can be classified as vulnerable and declining. According to Siegfried (1989), only 2 % of the biome is being conserved.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

Little is known of the biodiversity, including the endemic, rare and threatened species of both faunal & floristic components of the Grassland Biome. As a thorough understanding of a region's biodiversity forms the basis for understanding and managing its resources and environment (Matthews, Van Wyk & Bredenkamp 1993), the principal aim of this study is to assess the faunal/floristic diversity of the Grassland Biome. Brief comments are also presented on the current distribution of the Grassland Biome (as defined by Rutherford & Westfall 1994), as well its relation to surrounding biomes.

1.2 Motivation for study

It has been suggested by concerned conservationists that the Grassland Biome be awarded primary conservation status. The South African grassland region is under considerable pressure from agriculture, mining and urbanisation. The Biome as a whole has an extremely poor conservation status in South Africa (Huntley 1978; Scheepers 1983; Greyling & Huntley 1984; Clinning 1986; Tarboton 1991; Rutherford & Westfall 1994). Estimates for the area of the Grassland Biome conserved range from 1,38 (Low & Rebelo 1996) to 2 % (Siegfried 1989). Nowhere is the alteration of the South African Grassland Biome more obvious than in the Highveld region, where vast areas have been or are increasingly becoming irreversibly fragmented and transformed by expanding agricultural, mining and other industrial practices, resulting in cities with the highest population densities in the country and industries causing major pollution.

The grasslands of the South African Highveld and, in particular, the Drakensberg Escarpment, are still being severely fragmented by commercial afforestation and other agricultural activities. If a habitat island has a smaller total area than the original habitat, then fragmentation has taken place (Wilcove *et al.* 1986). If the fragment is too small to accommodate the home range of an animal, then local extinction is likely to occur. Fragments usually lack the physical and biological heterogeneity found in the original area and have a negative effect on the survival of habitat-specialist or rare species.

The conservation and sustainable utilisation of biodiversity can be justified in both economic and ethical terms. Biodiversity is not distributed evenly, and one popular criterion

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

that is used to describe these patterns, is species richness. An alternative approach to conservation is to conserve areas richest in unique kinds or organisms (Ehrlich 1988).

By compiling faunal/floristic inventories of the Grassland Biome, conservation priorities and aspects in need of further study can be identified. Improved knowledge of the biodiversity of the region may shed more light on the origin, processes and dynamics of this biome. At the same time, endemics and species that might be threatened, can be identified. By establishing data, the present study may contribute towards the conservation of the fast disappearing Highveld and montane grassland, as well as serving as a basis for further studies.

1.3 Key questions

The following key questions may be asked:

- Are there any endemic/near–endemic animals (selected groups) in the Grassland Biome, and if so, where do they occur ?

- What is the conservation status of the above mentioned species?

- To what extent do species run the risk of becoming extinct due to habitat destruction?

- Can any broad biogeographical faunal/floristic affinities be identified?

- What is the conservation status of the Grassland Biome?

1.4 Objectives

The ever increasing threat to the Grassland Biome, and in particular, its animal and plant species, poses enormous conservation problems. The collation of information on rare, threatened and endemic species is an essential first step towards the conservation, utilisation and management of the Grassland Biome.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

The principal objectives of this study are to:

- compile inventory lists of the Grassland Biome birds, mammals, reptiles, amphibians and butterflies;

- establish faunal/vegetation associations;

- identify endemic/near endemic species;

- collate literature on different grassland faunal groups, and make a synthesis of the present state of knowledge;

- identify biogeographical patterns that may reflect on the history and delimitation of the Grassland Biome;

- determine the conservation status of certain faunal groups/floristic vegetation types as lineated by Low & Rebelo (1996), and to suggest conservation priorities;

- identify aspects in need of further research.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

CHAPTER 2

Study area

Various terms have been used to describe biotic areas. It is generally agreed that a biome is a broad ecological unit (Smith 1974) that is characterised by life forms with similar physiognomic types (Hanson 1962). Both plant and animal forms are included in the biotic component.

Biome delimitation is essential for extensive comparisons, environmental planning, scientific research and economic planning, since resource deterioration is fully recognisable at biome scale (Rutherford & Westfall 1994). Various subdivisions of southern Africa have been previously suggested, and, to avoid confusion, the climatic and growth form classification scheme of Rutherford & Westfall (1994) and the Biome delimitation of Low & Rebelo (1996) were followed to describe the extent of the Grassland Biome. The Grassland Biome is the only biome that corresponds to a single unit in Köppen's classification of climate, namely Cwb (Schulze & McGee 1978).

2.1 Study area

For the purposes of this study "southern Africa" refers to that part of Africa south of the Kunene and Zambezi rivers; this encompasses the countries of Botswana, Lesotho, Mozambique (south of the Zambezi River), Namibia, South Africa, Swaziland and Zimbabwe. "South Africa" includes the Republic of South Africa, as well as the Kingdoms of Swaziland and Lesotho. In this study, the former province delimitation of South Africa is mostly used, since most of the distribution records of species have been compiled using the boundaries of the former provinces. Where possible, the new province delimitations are followed.

The Grassland Biome (Figure 2) is centrally located on the inland plateau of southern Africa, the mountainous areas of Eastern Cape, and the inland- and seaboard areas of Natal. According to Rutherford & Westfall (1994) the Grassland Biome covers approximately 343 000 km^2 (333 942 km^2 according to Low & Rebelo (1996), 349 174 km^2 according to

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

O'Connor & Bredenkamp 1997), or 16,5 % of South Africa. Its extent is limited by climatic conditions, with the "boundaries" being determined by: the vegetation changes in the transitional zones between biomes, the occurrence of satellite grasslands within other biomes, variables that distinguish one biome type from another, and factors that preclude woody invasion from the Grassland Biome. The Grassland Biome "boundaries" interface with the:

- nama-karoo;
- savanna;
- fynbos;
- forest patches.

Satellite grasslands also occur within the Nama-Karoo and Savanna Biomes, and exhibit distinctive environmental profiles relative to the surrounding plant communities (O'Connor & Bredenkamp 1997). Grassland patches within the Savanna Biome are restricted to higher elevation hills with poorly drained, sandy soils overlying sandstone or quartzitic rocks in high rainfall areas. Several hypothesis are put forward for the absence of woody components in grassland (O'Connor & Bredenkamp 1997). The hypothesis that grasslands were anthropogenically derived and maintained by fire, is now discounted. McKenzie (1989) argues that in the former Transkei, the density of the Iron Age human population would have been too low for their activities to have resulted in the increase of the extent of grasslands. Hypotheses to explain the presence of grassland include:

- "False" grassland maintained by fire (i.e. a secondary vegetation type): Story (1951), Acocks (1953), White (1978), Tainton (1981) and Smit (1992).

- Grassland limited by soil development: Feely (1987).

- Soil-moisture balance: Tinley (1982).

- Frost: Acocks (1953).

- Topography, soil and fire-proneness of site: Ellery (1992), Wells (1965, 1970) and Axelrod (1985).

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

- Illuviation & waterlogging desiccation effect of pans: Feely (1987) and Tinley (1982).

- Mainly climatic (associated with topography/altitude): Bredenkamp & Van Vuuren (1987).

Although the extent of the Grassland Biome is predominately the result of climatic variables, the interplay of climate, topography, fire and grazing exert a strong influence over the "boundaries" of the southern African grasslands. Fire is recognised as a secondary determinant that mediates its effect through the climate (O'Connor & Bredenkamp 1997).

2.2 Physical environment

2.2.1 Topography & Landscape

An understanding of the landscape history is important for understanding the evolution and distribution of southern African plant communities (Partridge 1997). The chronicle of changing climates is readily apparent in the landscapes of the present southern Africa. Although most of the present landscape of southern Africa post-dates the break-up of Gondwanaland, several elements predate this event.

A sequence of events caused by the break-up of Gondwanaland in the late Jurassic and early Cretaceous Periods, are to some extent responsible for the present-day configuration of the southern African landscape. Elevation of the interior plateau occurred during this period, with these elevations ranging from 1800 m in the interior to approximately 2350 m in the zones of upwarping adjacent to the rift margins. By the mid-Cretaceous, the Great Escarpment had been driven back by erosion between 50 and 200 km. Large volumes of material have been removed from parts of the interior plateau by erosion, a cycle that was largely completed by the end of the Cretaceous. Much of the African surface is overlain by deposits of Cretaceous age. After planation of the African surface was complete, landscape development in southern Africa was primarily characterised by the fragmentation of habitats. Today, most of the remnants of the African surface are covered by grassland (Partridge 1997).

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

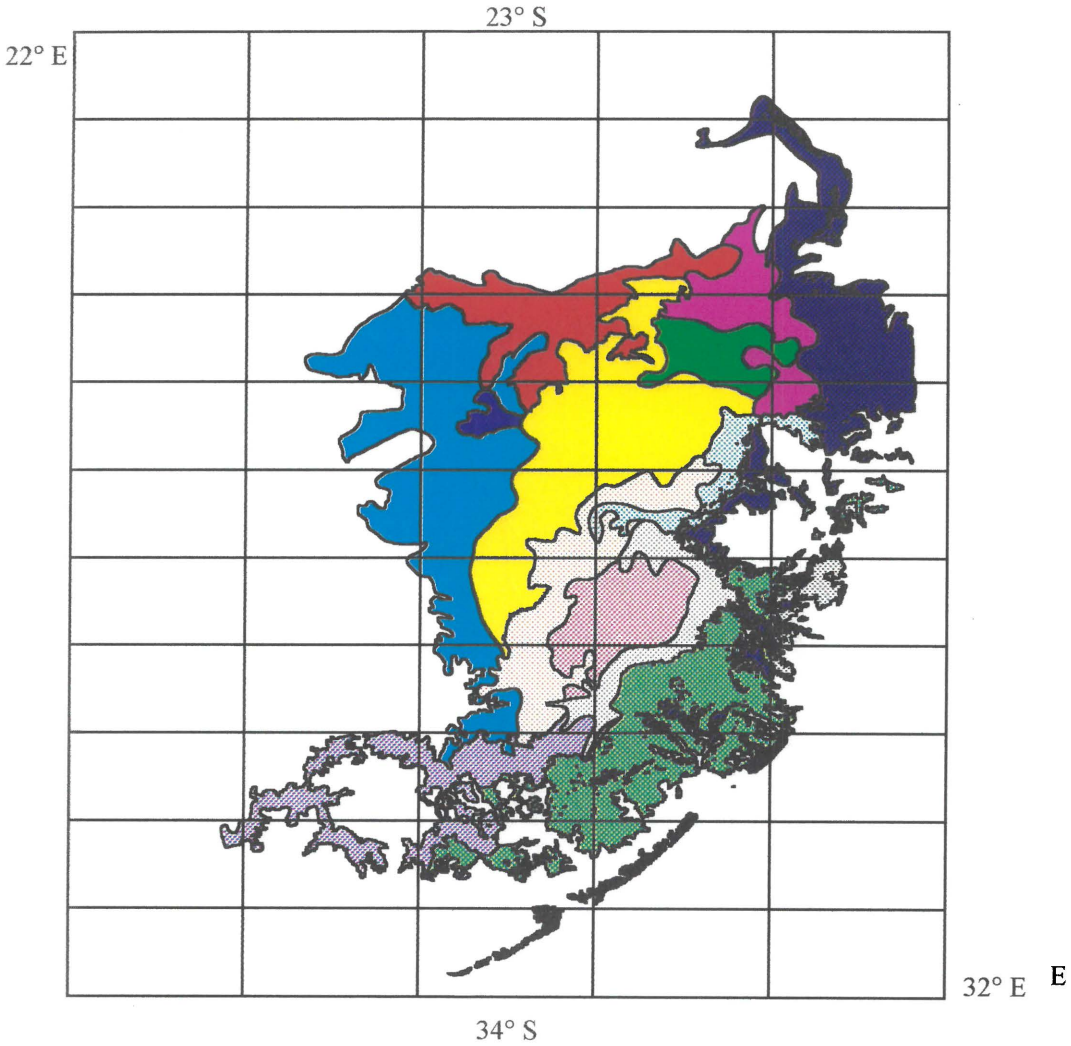


Figure 1. Grassland vegetation types of the Grassland Biome (Low & Rebelo 1996).

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

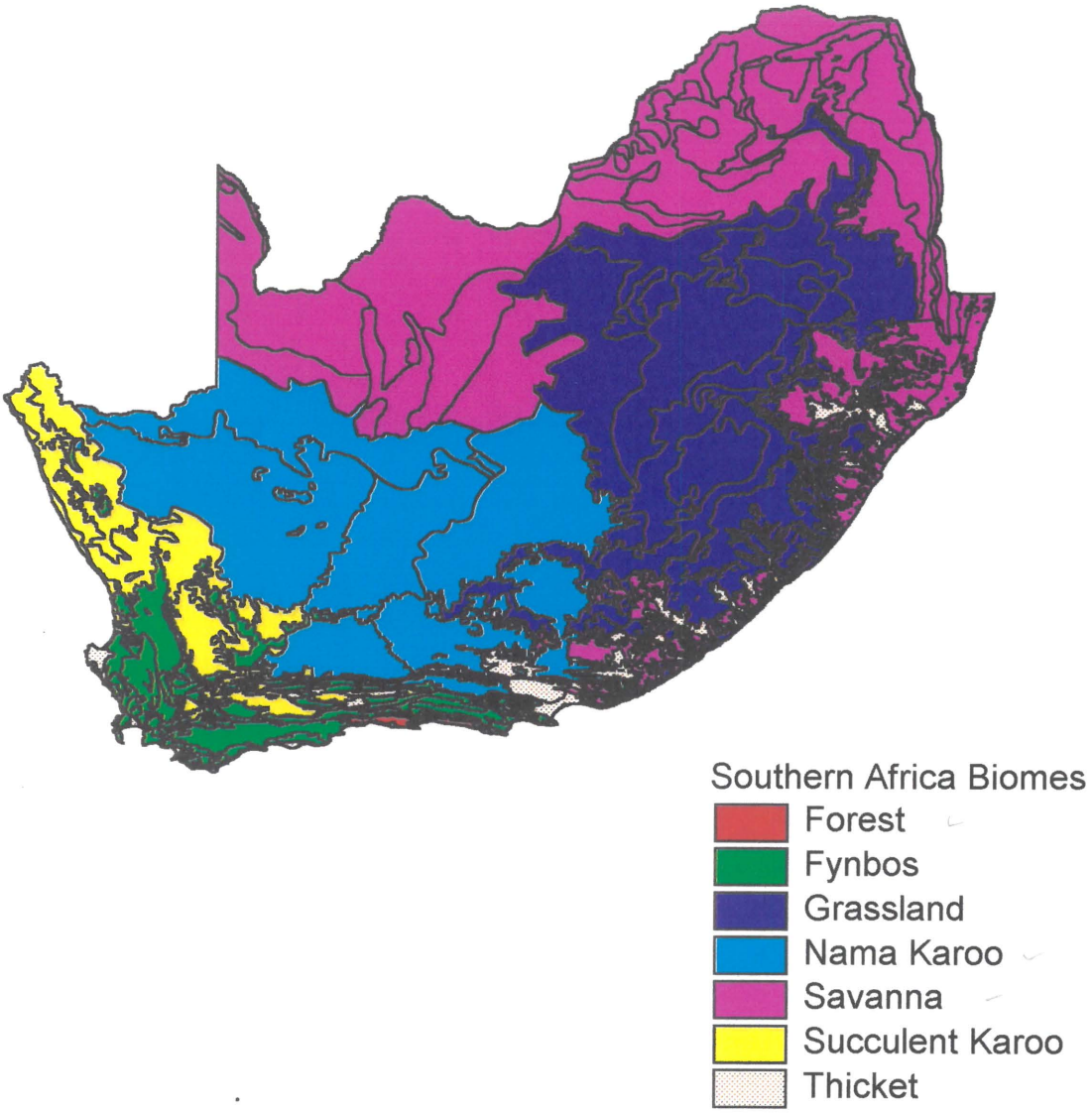


Figure 2. Geographical setting of the Grassland Biome (Low & Rebelo 1996).

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

The African cycle was completed during the early Miocene. It was brought to an end by the uplift of the subcontinent, with the amplitude being greatest in the eastern part of the country. The Post-African landscape is widely represented in southern Africa, with most of the interior being characterised by the undulating topography. The Post-African I cycle was brought to an end during the Pliocene by an uplift largely concentrated in the south-eastern hinterland. The probable mechanism was the migration of the hot mantle material from the Mozambique channel to its present position beneath the Lesotho Highlands. This resulted in an increase in the westward gradient of the subcontinent. The east-west climatic gradient, which was established during the late Miocene, persisted through much of the Pliocene.

The topography of the Grassland Biome varies from flat and/or rolling grasslands (Figure 3) to mountainous grasslands incised by forest vegetation. Some mountain slopes are characterised by tussock grass species such *as Trachypogon spicatus, Tristachya leucothrix, Panicum natalense* and many more, while karroid shrubs and forbs may be common at overgrazed sites, and wetland areas may be dominated by sedges (O'Connor & Bredenkamp 1997).

2.2.2 Geology

The main geological units underlying the Grassland Biome are the Beaufort and Ecca Groups, Molteno, Elliot and Clarens formations (Karoo Sequence), and the Ventersdorp Supergroup. Geological units such as the Witwatersrand Supergroup and Dominion Group are limited to the Grassland Biome, while other units include: the Drakensberg Group and Dwyka Formation (Karoo Sequence); the Table Mountain Group of the Cape Supergroup; Quaternary and Tertiary deposits; the Pretoria, Chuniespoort and Wolkberg groups (Transvaal Supergroup); the Swaziland Supergroup; the Rustenburg Layered Suite (Bushveld Complex and other Basement Complexes) (Rutherford & Westfall 1994).

The distribution of grassland types (Figure 1) can be summarised as follows (Low & Rebelo 1996):

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

- Dry Highveld Grassland

-Rocky Highveld Grassland is mainly found at altitudes between 1 500 – 1 600 m. Topographically the region is mountainous with ridges and plains of quartzite, conglomerate, shale, dolomite and andesitic lava in areas.
- Dry Clay Highveld Grassland, known as panveld, is situated at altitudes between 1 500 to 1 600 m, with dry, duplex soils derived from the Ecca Group sandstone with mudstone and shale underlying it. Dolerate sills occur in some areas.
- Dry Sandy Highveld Grassland in found on the flat to gently undulating altitudes between 1 370 to 1 460 m on apedal, aeolian sand, often covering limestone.

- Moist Highveld Grassland

- Moist Clay Highveld Grassland occurs between 1 500 to 1 700 m above sea level, and soils are comprised of vertic or near vertic, mostly montmorillonitic clays.
- Moist Sand Highveld grasslands are found between 1 600 to 1 800 m, with shales and sandstones of the Ecca Group predominant amongst the underlying rocks.
- Red (Hutton) and yellow (Clovelly) soils on Karoo Sequence sediments and shale (Witwatersrand Supergroup), and andestic lava of the Ventersdorp Supergroup underlie the Moist Cool Highveld Grassland found between 1 400 to 1 600 m.
- The Moist Cold Highveld Grassland is situated at 1 350 to 2 000 m above sea level, and occurs on deep, yellow and grey sand-loam derived from sandstones and shales of the Beaufort and Ecca Group.
- The Moist Upland Grassland commonly found between 600 to 1 400 m, is found on shallow, rocky soils derived from the Karoo Sequence sediments and dolerite.
- The soils of the South-eastern Mountain Grassland (Eastern Cape) are of volcanic origin.

- Wet Grassland

- The soils of the Wet Cold Highveld Grasslands are shallow lithosols of the Glenrosa and Mispah soil forms. The Elliot and Molteno Formations and the Beaufort Group are the main underlying rock types of these grasslands, which are associated with altitudes greater than 1

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

750 m.

- The soils of the North-eastern Mountain Grassland of the Mpumalanga escarpment mountains are shallow lithosols derived from a variety of rocks. These soils are predominately shallow, doleritic, peaty soils, with some sandstone.
- Apedal subsoils, and organic topsoils, characterise the geology of the Short Mistbelt of the KwaZulu-Natal Mistbelt.
- The soils of the Coastal Grassland are mainly marine of origin.

- Wet Afro- and Alti- Mountain Grassland

- The geology of the Alti Mountain Grassland (2 500 to 3 480 m) is the Drakensberg basalts of the Stormberg Group, with acidic lithosols.
- The cool Afro Mountain Grassland (1 700 to 2 500 m) is situated on shallow, rocky and leached soils, with the sandstone being capped with basalt.

2.2.3 Soils

The most common soil group, which accounts for 50 % of the Grassland Biome, is the red-yellow-grey latosol plinthic catena, followed by black and red clays, solonetzic soils, latosols and black clay soils, with the last two mainly occurring in the Grassland Biome only (Rutherford & Westfall 1994). Lithosols, undifferentiated rock, alluvial plains, and lime-poor, weakly developed soils on rock also feature among the soils occurring in the Grassland Biome. Erosion is especially severe in high rainfall areas on solonetzic, duplex soils (Rutherford & Westfall 1994).

On the Lesotho Highlands, soils are sporadically developed (Partridge 1997), and litholic of nature. These soils differ in conformity, with the rocks being predominantly mollisols and basalt. These rocks are immature in comparison to the older, more weathered soil of the African surface. Most of the Eastern Transvaal Highveld (now Mpumalanga) was formed by small-scale lowering of the landsurface through the removal of saprolite, and conforms to the concept of the etchplain.

The Central inland plateau is dominated by *Themeda triandra-Eragrostis curvula*

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

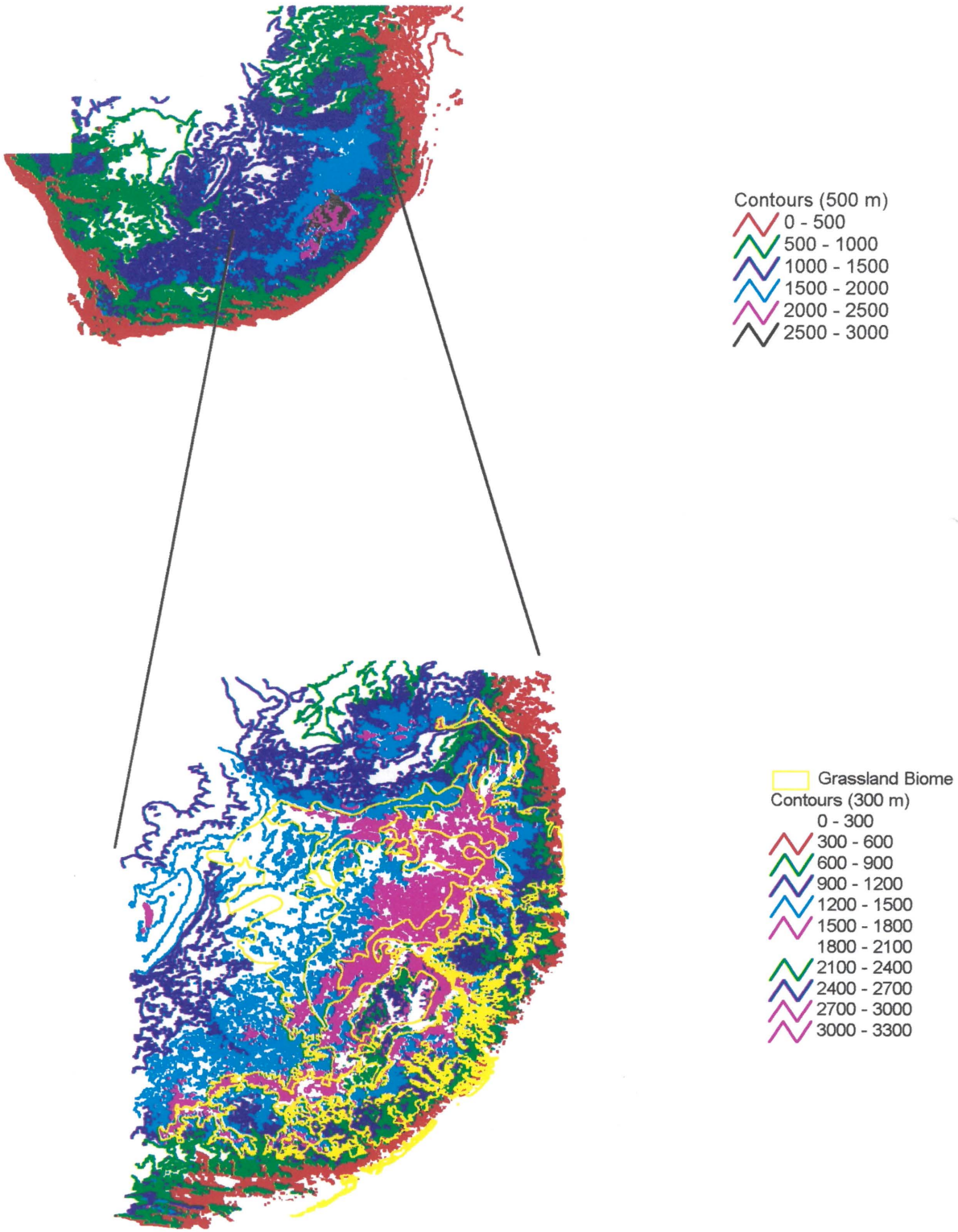


Figure 3. Contour delimitation of the Grassland Biome (Low & Rebelo 1996).

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

grassland, which occurs on eutrophic soils. Deep aeolian soils underlie the Dry western grasslands, which is dominated by *Eragrostis obtusa-Eragrostis lehmanniana* grassland. The area is physiographically complex, and some areas are dominated by karoo vegetation. The northern areas include the shallow, rocky slopes of Magaliesberg, Daspoort ridges, the Witwatersrand ridges, Suikerbosrand and the mountains of the Vredefort Dome (O'Connor & Bredenkamp 1997). The grass species have a Drakensberg affinity, but the broken landscape results in a diversity of plant communities. *Aristida junciformis-Eragrostis plana* grassland occurs on the sandy loam soils of the eastern inland plateau (eastern Free State), a region poor in plant species. The cool, high-altitude slopes of the eastern mountains and escarpment are the habitat *of Rhus dentata-Leucosida sericea* shrubland, commonly found on the lower, rocky slopes, while the *Monocymbium ceressiforme-Tristachya leucothrix* grassland occurs on leached, shallow mountain slopes. The *Loudetia simplex-Diheteropogon filifolius* grassland contains many endemic or near endemic plant species, and is found in a narrow zone on the Black Reef quartzites, with some more endemics occurring on the Chuniespoort Formation dolomites. The Eastern lowlands are comprised of *Hyparrhenia hirta* grassland, with underlying shallow, rocky dolorite-derived soils.

2.2.4 Climate

Climate is perceived as the principal dynamic independant variable shaping vegetation and soil on micro and sub-continental scales (Akin 1991). The interaction of climatic factors, especially light, temperature and moisture, which varies on a macro-, meso- and micro-scale, is the key determinant of vegetation distribution.

Climate affects the vegetation of southern Africa directly and indirectly: directly through solar radiation, temperature and moisture, and indirectly through the influence of climate on the vegetation, soil conditions and fire regime. Furthermore, the reciprocal influence of vegetation on the micro-climate may in turn influence the distribution of certain species (Schulze 1997). In southern Africa, both temperature and precipitation serve as most important inputs of climate in relation to vegetation. In the Grassland Biome, tree cover is related to the number of growing days and slope, with woodland patches appearing to be restricted to areas of topographic complexity (Bredenkamp & Theron 1980). Climate

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

contributes indirectly to the maintenance of grassland by supporting a fire regime that prevents the growth of woody species not tolerant of fire.

The amount of rain, and its spatial and seasonal distribution are important in the subdivision of vegetation formations in southern Africa. It is not the average amount of rain that is a constraint to the distribution of vegetation, but rather the seasonality and intensity of precipitation (Schulze 1997). The Grassland Biome has a relatively high rainfall, which results in a high productivity and hence a high fuel load. This, together with the high incidence of lightning strikes, precludes the establishment of woody growth. The Grassland Biome is limited to summer rainfall areas, with the mean annual rainfall varying between 400 and 2000 mm. A moisture gradient across the Grassland Biome causes variation in the functional attributes of grass species. Primary production in the grasslands is related to the mean annual rainfall, with production being limited by the availability of phosphorus and nitrogen (O'Connor & Bredenkamp 1997). High-rainfall grasslands are characterised by sour, unpalatable species that flower early or throughout the season. Arid grasslands exhibit the converse characteristics, and flower later in the growing seasons.

Temperature is used as an index of the energy status of the environment, and is often the factor by which the distribution of vegetation is limited. Temperature irregularities are induced by topographic variation on the subcontinent, and are especially pronounced over most of Lesotho. The broken interior of the Grassland Biome is characterised by low cold night-time temperatures averaging 0 °C or less. Low temperatures and frost, which are common in the Grassland Biome, are often critical in determining plant survival and their distribution. The high altitudes of the Drakensberg and Maluti mountains are characterised by 225 or more days during which frost can occur, decreasing to 150 days towards the north-westerly direction. Frost is exacerbated by increasing altitude aridity, and cryoturbation at higher altitudes results in bare patches, such as the terracettes of the Drakensberg (Rutherford & Westfall 1994).

Snow is mainly limited to the higher mountain ranges of the Great Escarpment and the ranges of the Western Cape. The Drakensberg Escarpment and Lesotho experience an average of 8,3 snowfalls per annum, with an annual frequency of 5,2 between May and August, snowfalls being common in every month of the year (Schulze 1997).

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Lightning is an important ignition source of fires in natural ecosystems in southern Africa, especially in the Grassland Biome. The ground-flash densities can be up to 12 to 14 flashes km^2 per year in the Drakensberg Escarpment region. The number of days with thunder averages 70 for the Grassland Biome (Schulze 1965).

2.3 Flora

Southern Africa is extremely rich in plant species at 21 137 indigenous species, with the majority being endemic to the region (Cowling & Hilton-Taylor 1997). On a regional scale, the Grassland Biome is phytogeographically classified as part of the Kalahari-Highveld Region and the Afromontane Region. The Kalahari-Highveld Region occupies an area of low relief between 850 and 1 800 m on the interior plateau, with vegetation being predominantly grassland with few Zambezian floristic elements. The Afromontane Region consist of an archipelago-like regional centre of endemism, and includes the eastern boundary of the Kalahari-Highveld Region. Centres of major generic endemism are the Cape Region, Karoo-Namib Region and the Afromontane Region. In southern Africa, the Afromontane region is centred in the Lesotho and KwaZulu-Natal Drakensberg with extensions to the north and south along the Great Escarpment. The predominant vegetation is grasslands (C_3 and C_4 grass species) (Vogel *et al.* 1978), while forest and ericaceous shrublands also features in this region. Local endemism is very high among grassland forbs throughout the Afromontane Region.

Centres of exceptional species endemism are located in an arc across the subcontinent, including sectors of the Great Escarpment. Within the Grassland Biome, the Drakensberg Alpine Region of the KwaZulu-Natal and associated uplands (Afromontane Region) have been identified under the auspices of the WWF/IUCN Plant Conservation Programme as one such centre. In the Drakensberg Alpine Region and Wolkberg Centre almost all endemics are associated with grassland habitats (Killick 1978; Matthews, Bredenkamp & Van Wyk 1993).

The vegetation of the Grassland Biome is predominantly characterised by hemicryptophytes of the Poaceae, with canopy cover decreasing with lower annual rainfall. Trees within the Grassland Biome are mainly associated with the higher altitude areas of the eastern Escarpment (Rutherford & Westfall 1994).

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

The vegetation of the Grassland Biome is moisture dependant, with the sour grasses (e.g. *Aristida junciformis*) being more abundant in areas with a mean annual rainfall above 625 mm, and sweet grasses, (e.g. *Panicum coloratum*), being more common, though not dominant, in areas below 625 mm/annum. Sour grasses are better represented in the Grassland Biome, whereas sweet grasses are better represented in the Savanna Biome. C_4 grasses predominate in the Grassland Biome, with C_3 grasses occurring in the high altitude mountains of the Drakensberg (Vogel *et al.* 1978). Rare plants in the Grassland Biome are mainly restricted to the higher altitude and higher rainfall areas.

2.4 Community types

A synopsis of the community types of the Grassland Biome (Figure 1), and the vegetation types, as expounded in Low & Rebelo (1996), is summarised below:

Grassland type	% Conserved	% Transformed	Area (km²)
Rocky Highveld Grassland	1,38	65	240 633
Moist Sandy Highveld Grassland	0,67	55	155 468
Moist Cool Highveld Grassland	0,29	72	489 601
Moist Cold Highveld Grassland	0,63	70	226 037
Wet Cold Highveld Grassland	6,72	60	95 016
Moist Upland Grassland	2,52	60	440 125
North-eastern Mountain Grassland	7,42	45	419 054
South-eastern Mountain Grassland	0,33	32	226 757
Afro Mountain Grassland	0,00	32	158 945
Alti Mountain Grassland	12,53	32	119 188
Short Mistbelt Grassland*	2,37	89	48 150
Coastal Grassland*	1,13	area unknown	27 097

*Not included in study

2.5 Grassland Biome dynamics

The interplay of various factors determines community change in grasslands. The sour

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

grasslands of high-rainfall areas are less susceptible to changes in community structure in response to continuous grazing, in contrast to arid grasslands that undergo marked changes in floristic composition in response to severe grazing (O'Connor & Bredenkamp 1997). The absence of fire and grazing can result in a transformation of grassland communities. This does not necessarily imply that encroachment by woody species takes place. The response of a grassland community to rainfall, grazing and fire will depend on the seasonal variability of the rainfall, and the interaction of grazing, fire and rainfall.

2.5.1 Historical human impact on grasslands

Towards the end of the Iron Age there was a dramatical increase in cultural, agricultural and economic developments, with changes to the disturbance regime of savanna and grasslands at both landscape and regional scales (Hoffman 1997). Sites in the Grassland Biome that were occupied first, mostly include the transitional zones between the Grassland Biome and Savanna Biome, while the more unpalatable, sour grasslands of the Drakensberg region were avoided.

Europeans entered the Grassland Biome from 1830 onwards, with the replacement of indigenous herbivores by domestic animals being the most profound impact the colonists had on the Grassland Biome. Many of the original megaherbivores, such as wildebeest, zebra, rhinoceros and other large mammals were slaughtered. Overgrazing by domestic animals is recognised as the primary cause for the landscape and vegetation degradation in the Savanna- and Grassland Biome, while crop cultivation probably has the greatest impact on the terrestrial biota of a region (Hoffman 1997). This is often accompanied by soil destruction, changes in water relations, and an increasing effect of wind erosion on the environment (Hoffman 1997).

The replacement of grasslands by agricultural monocultures, mainly maize, has transformed large areas of the Grassland Biome, while the replacement of natural vegetation by alien timber species has several catastrophic impacts on the environment. Not only do native plant species rarely survive beneath pine and eucalyptus plantations, but the natural runoff of ecosystems is also reduced, the soils are easily eroded, and there is a drop in biotic diversity, with centres of high diversity and endemism being exploited most severely.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

2.5.2 Grazing

The type of grazing regime exerts a strong influence on the composition of the grassland. Grasses of high rainfall, sour grasslands are well adapted to defoliation by grazing, and grazing management is not suspected to change the grassland types. Sweet grasslands of the more arid areas are more susceptible to change in species composition following heavy grazing, fire or mowing in the incorrect season (Fuls 1991; O'Connor & Bredenkamp 1997).

Selective grazing by livestock may result in the degradation of the basal cover and species composition of grassland communities, and large inputs of water are required to reverse this situation. Although termites are mainly responsible for patch effects, the area around the termite mounds receives a high water run-off, and the growth response is much higher than in the surrounding grassland. Termitaria not only provide shelter for many reptile, small mammal and invertebrate species, but also increase the productivity of the immediate environment.

2.5.3 Fire

The interplay of fire, climate and herds of ungulates have long been considered as the sculptors of southern African landscapes during historical times. Within the Grassland Biome, fire is most frequent in the sour grasslands where sufficient fuel material accumulates, while it rarely occurs in arid grasslands where, historically, herbivores have utilised the palatable (even when dry) grasses (Bond 1997). Fire is a regular phenomenon in most of the central and eastern parts of the Grassland Biome, and the natural fire regime is determined by the fuel characteristics, climate and ignition events. Grasses make excellent fuel material, and flammability is enhanced by the high surface-area ratio and low moisture content. Currently, most fires in the grassland and savanna biomes are ignited by humans. These fires have a different seasonal distribution to fires induced by lightning (Bond 1997). These fires caused by humans, occur throughout the year.

In general, fires in the dormant season or early in the growing season are considered beneficial in maintaining grass productivity and species composition, while fires in the growing season have detrimental effects on grass cover and composition (Bond 1997).

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

Fuel accumulation is lower in the arid grasslands, and fires in these sweetveld areas occur at longer intervals than in the sour grasslands or high rainfall regions. Thus, in grasslands, fire frequency depends on the availability of fuel, which in turn depends on the season, rainfall and grazing intensity. Fire towards the end of the rainy season in "sour" grassland favours wood plant expansion, while in arid grassland, no woody invasion occurs (Trollope 1984). Fire in the Grassland Biome is predominately of surface nature. Geophytes' flowering is stimulated by fire, with the absence of fire resulting in the demise of geophytes (Tainton & Mentis 1984).

2.6 Conservation

An assessment of the adequacy of the existing nature reserve system protecting the biodiversity of a region calls for at least 5 % of each vegetation type to be conserved, but despite this initiative, only 2 % of the Grassland Biome is protected (Siegfried 1989). Historically, little attention was paid to the conservation of entire ecosystems, with the preservation of large mammals species being the main objective. Later on, the focus shifted to rare species and Red Data Book species, while the present-day trend is to optimise preservation of the biodiversity of a region within the reserve network. It is now realised that sustainable utilisation and the management of areas outside the reserve network is necessary to conserve and manage ecosystems and species adequately. Of the broad vegetation types with no conservation status in South Africa, six occur in the Grassland Biome, seven in the Nama-Karoo, two in succulent karoo and two in savanna (Rebelo 1997).

The Grassland Biome is considered to be rich in plant species diversity, and is a centre of diversity for many large genera. Little is known of the faunal diversity of the Grassland Biome, however, neither of congruent patterns that may exist within and between faunal taxons, nor how these patterns are related to the environment.

Several factors determine what levels are adequate to conserve the heterogeneity and viability of an ecosystem. According to Rebelo (1997), they can be addressed under: "Ecosystem approaches" and "Species approaches".

The Grassland Biome is the cornerstone of agricultural activities, with agronomical activities being very important in the maize triangle, while pastures that occur in the higher

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

rainfall areas include cocksfoot, stargrass, lucerne and clover. With a wealth of mineral reserves (e.g. gold, coal, uranium) situated in this Biome, the urban population density of the Grassland Biome is higher than in any other southern African biome. Afforestation of the eastern Drakensberg Escarpment transforms areas that are considered high in plant biodiversity and endemic species (Matthews *et al.* 1993). Furthermore, urban tree planting has resulted in the invasion of grasslands by some of the introduced/alien species.
Existing conserved areas are primarily limited to the margins of the Grassland Biome.

It should be stressed that the extent of areas required for maintaining functioning ecosystems varies from region to region. Iterative selection procedures, which requires that every species should feature at least once in a configuration of 25 x 25 km grid cells, mirror that top conservation priorities are the succulent karoo, the grasslands and the fynbos lowlands (Rebelo 1997). Species turnover and endemicity are two factors which influence the spatial configuration of a reserve network that conforms to the requirements of iterative procedures. In terms of conservation priorities, the Grassland Biome is in urgent need of better conservation of the particular vegetation types that are most at risk of being destroyed.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

CHAPTER 3

General Methods

The figures published in Low & Rebelo (1996) (Figure 1 & 2) were used as directive to determine the extent of the Grassland Biome's range. The distribution of the species of the five major animal groups studied are explained by maps of varying detail, however, most of them of very weak resolution. This complicates matters, and therefore data on the distribution of species, in co-operation with the their distribution maps and the map of Low & Rebelo (1996) were used to determine to which degree they can be classified as species occurring in the Grassland Biome. A system was employed where priority weights, based on various criteria, were allotted to each species.

In this study the lowest taxonomic unit used is the subspecies, but many taxonomists refer to such taxa as merely representing intraspecific variation. Subspecies are populations of a species that are geographically restricted, and which differ genetically from other individuals of the same species. However, subspecific status serves to identify local differences in morphology, behaviour and ecology which are consistent and recognisable (Jacobsen 1989). These infraspecific taxa exhibit intergrades or hybrids, and are not reproductively isolated. Mayr (1969) states that it is preferable to treat allopatric populations of doubtful rank as subspecies, while Poynton & Broadley (1985) have justified the retention of the subspecies concept by recognising phylogenetic and biogeographical affinities of relict populations of species. It becomes evident that no taxonomic system can hope to avoid conflicting opinions amongst taxonomists, and therefore this study employs the example set by Jacobsen (1989), but acknowledges that all approaches are interlinked: placing emphasis on the processes, biological attributes and objects. Infraspecific variation need to be formally labelled to ensure that unique genetic material can be conserved. In this study, the term "subspecies" is included in the term species, unless otherwise indicated. When referring to endemic species, the term includes species endemic to the Grassland Biome, to South Africa, and the sub-Region (southern Africa, sub-Saharan Africa and the Afrotropical sub-region), except when otherwise indicated.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

The inventories of species covered in this project were compiled from range summaries and maps in standard literature references, from various articles, from species lists obtained from Research Institutions (e.g. Transvaal Museum), and through consultation with regional experts. Species marked with an asterisk represent species that have been recorded in the Grassland Biome, but that are actually marginal to the biome's "boundaries". These species were included in the inventories to give a true reflection of the Grassland Biome's dynamics.

Computerised databases on the various groups have been developed. Information on the various faunal groups was extracted from regional references and other sources and stored in the database.

The following aspects are addressed in this study:

1. Compilation of faunal/floristic inventory lists by collating available literature and by consulting authorities on the taxonomy of the respective taxons.
2. Taxon inventories indicate (where possible):
    - identity and taxonomic status of species found in grassland;
    - habitat/food preference;
    - distribution/locality of endemic and near–endemic species in the Grassland Biome;
    - an indication of conservation status (where possible);
    - subjective mark allocation to species based on different criteria to evaluate ("quantify") their conservation status, thus establishing priorities;
    - various queries based on different criteria.
3. Collated evidence from the literature in an attempt to identify and explain current patterns of biodiversity in the Grassland Biome.
4. Comparison between South African climatic grassland and grasslands elsewhere in the world, notably the American prairies, where possible.

It should be emphasised that several factors that determine the occurrence and distribution of species within each faunal group, are addressed. It may thus appear that some aspects within each faunal chapter are being repeated, but this apparent repetition emphasises the critical importance, of the complex interaction of factors determining the distribution and habitat requirements of faunal species. Several criteria should therefore be considered in the

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

conservation and management of areas within the Grassland Biome.

3.1 Methods: Birds of the Grassland Biome

In this study, all the birds that have been recorded within the Grassland Biome "boundaries", were included in the inventories (Table 1). A description of each species' occupancy/distribution status (migrants, grassland residents, species that are widely distributed over several vegetation types, etc.) is given. Vagrants and some ecotonal species that utilise (foraging/nesting) the grasslands, were included in the inventories and data analysed to give a true reflection of the region's ecological status and processes.

Species were categorised according to various criteria – their habitat preference (i.e the habitat in which the species is most likely to occur, although it may be found in other habitat types), endemicity status (endemic to the Grassland Biome, southern Africa, sub-Saharan Africa, sub-Afrotropical), abundance, threatened and breeding status. Each category was subdivided into various classes that were subjectively awarded scores (5 = top score, 1 = lowest score), similar to that employed by Jacobsen (1989) and Lambiris (1988), but modified according to the information available. This system does not indicate the degree to which a taxon is threatened, but focuses attention on these species and provides a basis from which a priority list can be compiled for future monitoring and evaluation. In addition, it indicates fields in need of further research.

3.1.1 Criteria employed

3.1.1.1 Habitat preference

Score	Habitat type	Habitat preference	Rank
5	1	grassland	1st
4	2	grassland & vlei/cultivated areas	2nd
3	3	grassland & shrub/savanna/desert/other habitat	3rd

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

		types/ecotonal elements	
2	4	habitats other than grassland	4th
1	5	human settlements	5th

3.1.1.2 Endemicity

Score	Scale of endemicity	Rank
5	Grassland Biome	1st
4	South Africa	2nd
3	sub-Saharan Africa/southern Africa/ sub-Afrotropical	3rd
2	non-endemics	4th
1	vagrants/stragglers	5th

3.1.1.3 Breeding status

Score	Breeder	Rank
5	South African	1st
3	Breeding migrant	2nd
1	Nonbreeding migrant	3rd

3.1.1.4 Abundance

Score	Abundance	Rank
5	rare (low density/vagrant)	1st
4	scarce/uncommon	2nd
3	locally common/relatively uncommon	3rd

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

2	fairly common	4th
1	common/abundant	5th

3.1.1.5 Threatened status (According to Scientific Programmes Report 97, Brooke 1984; Harrison *et al.* 1997)

Score	Threatened status	Rank
5	endangered	1st
4	vulnerable	2nd
3	rare/indeterminate/vagrant	3rd
2	uncommon/locally common/uncertain	4th
1	common	5th

3.1.2 Data Sources employed

The primary sources of distributional data consulted for the compilation of the inventory on birds were:
Brooke (1984); Tarboton & Allen (1984); Clancey (1986); Tarboton, Kemp & Kemp (1987); Farkas (1988); Crowe (1990); Siegfried (1992); Maclean (1985, 1993); McAllister (1994); Newman (1996); Allan *et al.* (1997); Harrison *et al.* (1997); and distributional data extracts acquired from the Transvaal Museum (1997, 1998).

3.2 Methods: Reptiles and amphibians of the Grassland Biome

Reptiles and amphibians are treated under the combined heading of "herpetofauna". The Grassland Biome herpetofauna (Table 2) were categorised according to their endemic status and habitat preference. The two categories were subdivided into several classes with codes allotted to each class to simplify data syntheses. Grassland Biome species, as well as a few ecotonal species which utilise grasslands to some extent, were taken into account in the data

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

processing. Although information on the Grassland Biome herpetofauna are collated into one inventory, results on the reptiles and amphibians are listed separately.

3.2.1 Criteria employed

3.2.1.1 Habitat preference

Species/subspecies were subdivided into the following classes according to their habitat preference:

Score	Habitat type	Habitat preference	Rank
5	1	grassland	1 st
3	2	grassland & savanna/woodland/desert/karoo/shrub	2 nd
4	3	grassland/savanna uncertainty (precise preference unknown)	3 rd
4	4	rocky areas/termitaria/streams within grassland	4 th
2	5	rocky areas within several habitat types	5 th
1	6	habitats excluding grassland	6 th

3.2.1.2 Endemicity

Species/subspecies were assessed according to their endemicity status (endemic to Biome, near-endemic, endemic to South Africa). All of the abovementioned endemic classes are henceforth classified as being endemic, except when indicated otherwise. Further subdivision of the classes was not made due to insufficient information about their distribution range. Data syntheses about the endemicity status of the herpetofauna were therefore limited to the following classes:

Score	Endemicity	Rank
5	endemic	1 st
3	unknown	2 nd
1	non-endemic	3 rd

Describtion of the endemicity status of the herpetofauna are given in the main inventory (Table

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

2). These are detailed as possible.

3.2.1.3 Red Data Book status (National Scientific Programmes Report 151, Branch 1988)

Score	Threatened status	Rank
1 =	vulnerable	1st
2 =	rare	2nd
3 =	indeterminate	3rd
4 =	unknown	4th

The herpetofauna of the Grassland Biome were assessed according to their Red Data Book status:

3.2.2 Data sources employed

The following data sources were primarily consulted in the compilation of the inventories: FitzSimons (1943); Rose (1962); Carruthers (1976); Bourquin & Channing (1980); De Waal (1980a); De Waal (1980b); Broadley (1983); Boycott & Borquin (1988); Branch (1988 a,b); Branch *et al.* (1988); Lambiris (1988 a,b); Lambiris (1989); Jacobsen, N.H.G. (1989); Bates (1991); Bates (1992); Jacobsen (1992); Jacobsen (1994); Bates (1995 a,b); Branch *et al.* (1995); Douglas (1995); Drinkrow & Cherry (1995); Passmore & Carruthers (1995); Van Dijk (1996).

3.2.3. Collectors, bias

Sampling amphibians and reptiles in open grassland habitat presents some particular problems, as they are extremely vigilant and often able to hide. Niches for concealment, such as small vertebrate and invertebrate burrows, are often located within, or at the base of grass tussocks, and are not obvious to the collectors (Douglas 1995). This may lead to incomplete distribution records.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

3.3 Methods: Butterflies of the Grassland Biome

The resolution of distribution maps of southern African butterfly species is not well delimited, and descriptions on their distribution within the various vegetation types are often discrepant with the extent of "biome" boundaries and vegetation types, as delimited in Low & Rebelo (1996). For the purpose of this study, some ecotonal species that show an affinity with the Grassland Biome (ecotonal/edge species) were included, as well as species that probably fall within the range of the Grassland Biome, but whose ranges is (incorrectly ?) represented on the distribution maps. This approach attempts to give a true reflection of butterfly species that occur in the Grassland Biome (Table 3), as well as other species that may contribute one way or another to the dynamics/processes of the grassland of southern Africa.

Butterflies were categorised according to their "Habitat preference", their "Boundary status", Red Data Book status and according to their larval Grass-feeding status. Categories were further subdivided, and different codes were awarded to these classes to simplify data processing.

3.3.1 Criteria employed

3.3.1.1 Habitat preference

Species were subdivided into four classes according to their habitat preference within the Grassland Biome and the transitional zones, with scores being awarded to each subsequent class:

Score	Habitat preference	Rank
5	grassland	1 st
4	grassland & other vegetation types	2 nd
3	habitats other than grassland	3 rd
2	habitat unknown	4 th

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

3.3.1.2 "Boundary status"

The extent of the distribution range of the butterflies within the various biomes (Low & Rebelo 1996) is not always clearly delimited, and it was decided to group the species in this category into three, further classes. Species whose distribution ranges (as deduced from their distribution maps) definitely fall within the Grassland Biome, are called "Non-edge species". Species whose distribution maps differ slightly from Low & Rebelo's (1996) biome delimitation, but whose distribution nonetheless falls within grassland, are called Marginal species. Species that occupy the transitional zones between the Grassland Biome and other biome types, are also included under the heading "Marginal species" and "Edge/ecotonal species" if they utilise grassland at some stage, or if they have been recorded in the Grassland Biome previously.

Score	Boundary status	Rank
5	Non-edge species	1 st
3	Marginal species	2 nd
1	Edge/Ecotonal species	3 rd

3.3.1.3 Red Data Book status (National Scientific Programmes Report 158, Henning & Henning1989)

Butterflies of the Grassland Biome were assessed according to their Red Data Book Status with respect to their "Habitat preference", "Boundary Status", "Family grouping", and "Grass-feeding status". Factors that contribute to the threatened status of these species, are also listed.

3.3.1.4 Grass-feeding species

Species that feed on grass swards in the larval stage, were assessed according to their "Habitat preference", "Boundary status", Family grouping" and "Red Data Book status". Larval grass feeders were awarded top score = 5, while non-grass feeders were awarder a score = 0.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

3.3.2 Data sources employed

The following were the most important sources consulted to collate the inventories: Dickson & Kroon (1978); Migdoll 1987; Henning *et al.* (1994); Armstrong & Van Hensbergen (1997), Henning & Henning (1989), Henning *et al.* (1997).

3.4 Methods: Mammals of the Grassland Biome

Information on small and large mammals of the Grassland Biome (Table 4) was entered into one data base. Numerous investigations have been conducted on the life-history patterns, diversity, distribution patterns, biology and ecology of the southern African mammals. Information on the present day distribution, and factors that may regulate (and have historically done so) the distribution patterns of native mammals, is readily available. However, new questions always arise, which create endless opportunities for further investigation.

For the purpose of this study, only a synopsis of the mammals present in the Grassland Biome, is given. Several publications, regional experts, the Transvaal Museum, species lists, and, especially, recent research articles, were consulted to compile the inventory. The factors which may govern the distribution of Grassland Biome mammals are not discussed here because of the extensiveness of such a study. Instead, references to some relevant sources are listed. Although much of the true grassland ungulates have contracted their ranges due to habitat destruction, they, together with several other endemic grassland species (mostly rodents), justify the protection of these species and their habitats.

The Grassland Biome mammals were classified into five categories, with each of these being further divided into five classes. Codes were allotted to each class to simplify data syntheses. Ten former Grassland Biome species, (which have either become extinct or contracted their ranges), were included in the inventory, but were not employed in further data analysis.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

3.4.1 Criteria employed

3.4.1.1 Habitat preference

Species/subspecies were clarified into seven classes according to their main habitat preference:

Score & Rank	Habitat type	Habitat preference
5	1	grassland
4	2	grassland & vlei
3	3	grassland & other habitat types
2	4	habitats other than grassland
1	5	human settlements
0	0	extinct species
8	8	historical occurence

3.4.1.2 Endemics

Species were assessed according to their endemicity status (endemic to South Africa, near-endemic to South Africa):

Score	Endemicity
5	Endemic
4	restricted
0	Non-endemic

3.4.1.3 Food preference

Food preference	Code
Insectivore	1
Carnivore	2
Herbivore/Fructivore	3
Insects/Vertebrates	4

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

Omnivore	5
Granivore	6
Unknown	7
Extinct species	0
Historical distribution	8

3.4.1.4 Red Data Book status (National Scientific Programmes Report 125, 1986)

The Grassland Biome mammals were also assessed according to their RDB status (ranking from first to third: vulnerable score = 5, rare score = 4, indeterminate score = 3). This is related to their habitat preference, food preference, and endemicity status in the results.

3.4.2 Data sources employed

The following sources were consulted:
Du Plessis (1969); Meester (1976); De Graaff (1981); Rautenbach (1982); Lynch (1983); Smithers (1983); Lynch (1985); Smithers (1986); Lynch & Watson (1990); Skinner & Smithers (1990); Siegfried & Brown (1992); Lynch (1994); Gelderblom & Bronner (1995); Freitag (1996); Van Djik (1996); species lists obtained from the Transvaal Museum (1997).

Additional literature sources that can be consulted, include: Van Hoepen (1932), Hooijer (1958); Webbs (1962, 1965, 1969); Cooke (1974); Klein (1980); and Jarvis (1984).

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

CHAPTER 4

Birds of the Grassland Biome*

The southern African subcontinent has a diversity of habitats that are represented in seven major biomes (Low & Rebelo 1996), each of them being subdivided into various vegetation types and more specific plant communities (Rutherford & Westfall 1994). Perhaps because of this habitat diversity, the region hosts close to 800 bird species or *ca.* 9 % of the world's total avifauna (Harrison *et al.* 1997). The terrestrial avifauna of South Africa, which forms part of the Ethiopian Zoogeographical Region, contains 6 % of species which are Cosmopolitan (genera of the Old and New Worlds), 33 % which range widely over the whole Ethiopian Region, and 34 % which occur in East as well as southern Africa.

Species distribution is associated with one or more geographical variables, of which vegetation type (vegetation structure rather than plant species composition), is the critical habitat parameter for most birds (MacArthur & MacArthur 1961; Pianka & Huey 1971; Gentilli 1992; Herremans 1993). Hall & Moreau (1970) state "It is the distribution of vegetation which governs the geographical lines along which speciation has taken place". Patterns are repeated across orders and families, although every species' distribution has its peculiarities. Winterbottom (1959) suggests that passerines are more useful in indicating the faunal affinities of South African birds, since non-passerines have a wider distribution all over the Ethiopian Region or beyond. The Highveld avifauna of the Free State and Transvaal shows an affinity with the western parts of southern Africa (a region rich in endemic bird species).

4.1 Results

4.1.1 Introduction

A survey of the literature revealed that 554 species have been recorded in, or show some affinity with the Grassland Biome (Table 1). Vagrants and some ecotonal species that utilise the grasslands (foraging/nesting), were included in the inventories and data processing to give

* Subspecies endemic to the Grassland Biome are not considered in this Chapter, neither have they been considered for statistical purposes. They have, however, subsequently been added to the data base.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

a true reflection of the region's ecological status and dynamics. Results are presented under various headings below (4.1.2 – 4.1.4).

4.1.2 Habitat preference

The habitat preference of the species can be summarised as follow:

Habitat preference	Table	Habitat type	Number of species
Grassland	5	Habitat type 1	12
Grassland & vlei	*	Habitat type 2	70
Grassland & other vegetation types	*	Habitat type 3	97
Habitat types other than grassland	*	Habitat type 4	372
Human settlements	*	Habitat type 5	3

4.1.3 Endemicity

A total of six species are endemic to the Grassland Biome (Table 6), 15 species are endemic to South Africa (Table 7), and 105 (Table 8) species are endemic to the sub-Region (southern Africa, sub-Saharan Africa, Afrotropical Africa) (Figure 4).

Habitat preference	Table	Endemic: Grassland Biome	Endemic: South Africa	Endemic: sub-Region
Habitat type 1	9	1	0	5
Habitat type 2	10	2	0	9
Habitat type 3	11	3	7	25
Habitat type 4	12	0	8	66
Habitat type 5	*	0	0	0
Total	*	6	15	105

4.1.3 Breeding status

A total of 421 species are southern African breeders, 39 species are migrant breeders and 94 species are non-breeding migrants (Table 14) (Figure 5 & 6). This is summarised in the table

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

below:

Habitat preference	South African breeder	Migrant breeder	Non-breeding migrant
Habitat type 1	9	2	1
Habitat type 2	48	5	17
Habitat type 3	80	6	11
Habitat type 4	281	26	65
Habitat type 5	3	0	0
Total	421	39	94

4.1.4 Threatened status (according to South African National Scientific Programme Report 97, Brooke 1984; Harrison *et al.* 1997)

The fifty-three Grassland Biome Red Data Book species include: one species that is probably extinct, four endangered species, ten vulnerable species, 22 rare species, and 16 species of which the status is indeterminate (while another 12 species are vagrants in the Grassland Biome) (Table 13) (Figure 7). Of the endangered species, the Blue Swallow (*Hirundo atrocaerulea*) has a preference for grassland habitat. The latter, however, is at the southern limit of its range in Africa. The Blackrumped Buttonquail *Turnix hottentotta* and The Wattled Crane *Grus carunculata* are two endangered species that prefer grassland, floodplains and fallow lands (Habitat type 2). The following species are classified as endangered:

Species name	Common name	Habitat
Neophron pernopterus	Egyptian Vulture	cliffs, open country, semidesert but not woodland
Turnix hottentotta	Blackrumped Buttonquail	open grassland, fallow lands, montane grassland
Grus carunculata	Wattled Crane	open grassland, floodplains, swamps, vleis
Rynchops flavirostris	African Skimmer	lakes, pans
Hirundo atrocaerulea	Blue Swallow	moist montane grassland

Of the species listed above, the first three are southern African breeders, while the last two species are breeding migrants. None of them are endemic to the Grassland Biome, South

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

Africa or the sub-Region. All are insectivorous or carnivorous.

Of the vulnerable species (Table 13), Rudd's lark *Heteromirafra ruddi* is a grassland specialist and endemic to the Grassland Biome, while the Grass Owl *Tyto capensis* utilises marshy grassland near water. Three of the vulnerable species utilise Habitat type 3, while four species utilise habitats other than grassland (Habitat type 4). Two of the vulnerable species are endemic to the Grassland Biome (Rudd's lark and the Yellow-breasted Pipit *Hemimacronyx chloris*). In terms of food preference, one species feed on carrion, six species feed on insects/invertebrates/small vertebrates/carrion, while two species are omnivorous. The feeding preferences of one species is unrecorded.

4.2 Discussion and additional information

4.2.1 The Grassland Biome avifauna

Terrestrial birds exhibit an east-west biogeographical pattern in southern Africa, similar to that of frogs and large mammals (Crowe 1990). The primary cause of this east-west pattern is the amount and reliability of rainfall, mediated through its effects on biotic diversity. Waterbirds, on the other hand, show simplistic distribution patterns attributable to their dependence on reliable aquatic biotopes and their propensity for long-distance movement (Oatley & Prys-Jones 1986), the result being the virtual absence of local endemic waterbirds.

The southern and eastern regions with their higher rainfall regimes support fewer endemic bird species, but a higher species diversity (Crowe 1990). This has been attributed to the fact that the south-western biotic regions have enjoyed relatively stable climatic conditions over great periods of time, allowing more rapid speciation, whereas the more mesic eastern parts have experienced more climatic oscillations, giving rise to the alteration of biomes in recent times (Clancey 1986).

The Grassland Biome hosts 554 bird species, i.e. 69 % of southern Africa's total avifauna, as outlined below:

Number of species in Grassland habitat	Number of species in the Grassland Biome	Number of species in southern Africa	Grassland Biome species as percentage of southern Africa's total
13	554	± 800	69,25 %

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

Although dominated by a single layer of grass plants (Rutherford & Westfall 1994), the Grassland Biome is floristically heterogeneous, with variation in plant communities and vegetation structure. Sour-, sweet-, and scrubby grassland, Karoo and Fynbos elements, forest elements in grassland ravines, riverine vegetation, grassland wetlands and pans have, since historical times, featured in the Grassland Biome, creating habitats for a wide spectrum of species restricted to particular veld types within southern Africa's grasslands. The region is a summer refuge to numerous wetland/panveld species, while the Transvaal Drakensberg Escarpment functions as migration zone for breeding and non-breeding migrants (Harrison *et al.* 1997).

The International Council for Bird Preservation (ICBP 1992) identified four endemic bird areas in South Africa, one of which occurs partly in the Mpumalanga Province, with the centre of this endemic area being centred in the north-eastern Free State and northern Lesotho Highlands. The area was defined by the presence of three globally threatened grassland species: Rudd's Lark *Heteromirafra ruddi*, Botha's Lark *Spizocorys fringillaris* and the Yellow-breasted Pipit *Anthus chloris*. All four endemic bird areas identified by the ICBP (1992) overlap with the seven South African hot-spots of botanical endemism and diversity (Cowling & Hilton-Taylor 1994), one of which is centred on the grasslands of the Drakensberg escarpment in Mpumalanga (Allan *et al.* 1997) and the Free State-Qwa-Qwa region.

Twelve species are restricted to grassland vegetation types within the biome, and another seventy species to grassland/vlei/cultivated-associated habitats. One hundred-and-twenty-six endemics (Tables 6-8) (Endemic to Grassland Biome, -South Africa, -sub-Region: southern Africa, sub-Saharan Africa, Afromontane Region) occur within the Grassland Biome :

Habitat	Habitat type 1	Habitat type 2	Habitat type 3	Habitat type 4	Habitat type 5	Total: Endemics
Endemic: Biome	1	2	3	0	0	6
Endemic: South Africa	0	0	7	8	0	15
Endemic: sub Region	5	9	25	66	0	105
Total: Habitat types	6	11	35	74	0	126

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

Six species (rare/uncommon & threatened, as listed below) are endemic to the Grassland Biome (Table 6), another 15 are endemic to South Africa (Table 7), although none of these are exclusively restricted to grasslands or Habitat type 2. One Hundred and five species are endemic to the sub-Region (Table 8) (Figure 4).

Common name	Species name	Habitat score
Rudd's Lark	*Heteromirafra ruddi*	5
Botha's Lark	*Spizocorys fringillaris*	4
yellowbreasted pipit	*Anthus chloris*	3
blue korhaan	*Eupodotis caerulescens*	3
bald ibis	*Geronticus calvus*	4
buffstreaked chat	*Oenanthe bifasciata*	4

The Grassland Biome avifauna seems to follow the avian distribution pattern suggested by Crowe (1990), in that a high diversity of birds species occurs towards the eastern sector (Transvaal Escarpment) of the Biome, while the number of endemics increases to the west of the subcontinent. It should be emphasised that, although data suggest that most species occur within Habitat type 4, in which no grassland vegetation types feature, most of the bird species show some affinity with grasslands (foraging, migration, trophic web), making them an essential part of the region's normal ecological dynamics.

It should also be stressed that all the biome-endemics are restricted to grassland or grassland-associated habitats, according them, and consequently the vegetation types they inhabit, higher conservation priority.

4.2.2 Habitat selection

Victorian naturalists and travellers have already observed that different birds inhabited different habitats, and studies of habitat selection were closely tied to questions about the taxonomy of species, while a more ecological approach was followed by David Lack (1933). The evolution of habitat preference is determined by, and determines, the bird's morphological structure and behavioural functions, as well as its ability to obtain food and shelter successfully in the

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

particular habitat type. It is widely accepted that vegetation structure (rather than floristic composition) is the proximate stimulus of habitat choice (Elton & Miller 1954; MacArthur & MacArthur 1961; MacArthur *et al.* 1962; Pianka & Huey 1971; Gentilli 1992; Herremans 1993), while other factors such as nesting opportunities, presence of other species, protection from predators and foraging might predominate, or operate synergistically at certain times (Cody 1985). The ranges and densities of grassland species fluctuate considerably in response to the abovementioned factors (Stepney & Power 1973).

Grasslands are usually inhabited by birds characteristic of this vegetation type, with passerine bird families such as pipits (Moralcillidae), buntings (Emberizidae), larks (Alaudidae), starlings (Sturnidae) and weaverfinches (Ploceidae and Estrildidae) being dominant (Cody 1985). Several species of the families Charadriidae and Scolopacidae utilise grassland wetland, further contributing to the avian diversity. Grassland birds may be widespread throughout one grassland type, but localised and habitat-restricted in another, as in the case of the Horned Lark *Eremophila alpestris* in Colorado and Wyoming, America (Cody 1985). The ranges and densities of grassland birds show fluctuations in response to climatic fluctuations (short- and long-term), as well as factors such as fire regimes, food abundance, and huma impact on the environment (Cody 1985).

4.2.3. Habitat structure

4.2.3.1. Vegetation structure

Moreau (1966) and Cody (1985) maintain that vegetative structure (vertical and horizontal directions) is the principle determinant in the distribution and abundance of birds. Fitzgerald & Tanner (1992) maintain that a reduction in complexity of vertical habitat structure due to prairie restoration activities (Florida) should cause a shift in species composition in the avian community and overall lowering of species diversity on these areas, suggesting that vegetative structure is important in structuring avian communities. Various other authors have related the distribution patterns of southern African avifauna to vegetation types (Winterbottom 1959, 1973, 1974, 1978; Pianka & Huey 1971; Herremans 1993), while Recher (1969), MacArthur & MacArthur (1961) and Cody (1970) have demonstrated that bird species diversity is

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

strongly related to foliage height diversity.

Birds are recognised as good indicators of habitat conditions (Bock & Webb 1984), and changes in the vegetative community composition and physiognomic structure most probably will result in an altered avian community (Anderson 1980; Johnston & Odum 1956).

Vegetation patterns reflect and integrate numerous environmental factors, e.g. topography, rainfall, temperature, fire, latitude, height above sea-level, atmospheric circulation and the influence of ocean currents, most of which have a direct or indirect effect on climate (Gentilli 1992; Tyson 1986). Rainfall (total, seasonality and variability) mainly determines vegetation structure and thus influences the distribution and abundance of birds. Studies conducted by Cody (1985) illustrated that migrant species are less strongly related to habitat structure than residuals.

The Grassland Biome is composed of a heterogeneity of habitat types, and one of the criteria used in the avifaunal assessment, was the bird species habitat preference, i.e. Grassland Biome and their dependence on certain vegetation types within the study area. These habitat types, as defined under Study Area & Methods (Chapter 3), are now discussed.

- Grassland elements

Bird species of taller grassland seem to be more precise in habitat selection, by being more responsive to vegetation height and density than short-grassland species (Cody 1968). In the Grassland Biome, avian species show a clear preference for different vegetation types, e.g. the Bearded Vulture *Gypaetus barbatus* and the Sentinel Rock Thrush *Monticola explorator* show high reporting rates in Alpine Grasslands, while the Cattle Egret *Bubulcus ibis*, Black Shouldered Kite *Elanus caeruleus* and Fiscal Shrike *Lanius collaris* prefer lower altitudes/tall grasslands. The following birds frequent Sour grassland:

Bald Ibis *Geronticus calvus*	Redwinged Francolin *Francolinus levaillantii*
Yellow-breasted Pipit *Hemimacronyx chloris*	Botha's Lark *Spizocorys fringillaris*
Buffstreaked Chat *Oenanthe bifasciata*	Palecrowned Cisticola *Cisticola brunnescens*

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

Blue Swallow *Hirundo atrocaerulea*	Rudd's Lark *Heteromirafra ruddi*

Rudd's Lark *Heteromirafra ruddi* prefers sites with moderately or heavily grazed grassland without forb invasions. This species occurs within a geographically and altitudinally restricted range which conforms closely to the boundaries of the high-altitude grasslands of eastern South Africa (Hockey *et al.* 1988). Rudd's Lark is absent from tall stands of grass, and occurs most regularly at sites with a low ground cover.

The Melodius Lark *Mirafra cheniana*, South African Swallow *Hirundo spilodera* and Mountain Pipit *Anthus hoeschi* prefer Mixed and Sweet Grassland – this distribution of the birds may be attributed to altitudinal variation – which, in turn, affects the habitat structure (height and rankness of grass, presence of rocky outcrops).

- Karoo elements

Several bird species typical of the Karoo are found in the grasslands of Lesotho, often being represented by partially isolated populations (Harrison *et al.* 1997) and by distinct subspecies:

Common name	Species name	Habitat preference
Sicklewinged Chat	*Cercomela sinuata*	karoo, montane grassland, cultivated land, grazed pastures
Karoo Korhaan	*Eupodotis vigorsii*	karoo, semi-desert desert, grass stubble
Southern Grey Tit	*Parus afer*	karoid scrub
Karoo Chat	*Cercomela schlegelii*	karoo, stony hillsides
Thickbilled Lark	*Galerida magnirostris*	montane grassland, semi-arid Karoo, fynbos, cultivated land
Blackheaded Canary	*Serinus alario*	shrubby hillsides, subalpine rocky slopes

The scrubby karroid nature of some of the alpine grasslands in Lesotho could possibly account for the species' distribution. Karoo species found in the drier western grasslands include the Karoo Lark *Mirafra albescens*, the Black Korhaan *Eupodotis vigorsii* and the Tractac Chat *Cercomela tractac*.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

- Fynbos elements

  The presence of the greater Doublecollared Sunbird *Nectarinia afra* and Gurney's Sugarbird *Proerops gurneyi* may be ascribed to the presence of Proteaceae (especially *Protea caffra*) and Aloeaceae in the grasslands, expanding these birds' distributional ranges.

- Panveld and Wetland (vlei) elements

The panveld of southern Africa is chiefly situated in the Grassland Biome (Geldenhuys 1982; Allan *et al.* 1997). Regular high rainfall in the eastern grasslands of the Transvaal results in semi-permanent freshwater pans that support a wide diversity of aquatic vegetation and associated waterbirds. During dry periods, the panveld in the catchment area of the Transvaal Drakensberg Escarpment forms an essential refuge for high concentrations of waterbirds.

Inland pans are utilised by various Palearctic migrant waders (ringed plover, greenshank, little stint, ruff, curlew-, marsh-, wood and common sandpipers), ducks, geese, all of which are birds that breed at pans only. Waterbirds that are found typically at brackish pan systems include:

South African Shelduck *Tadorna cana*	Avocet *Recurvirostra avosetta*
Cape Teal *Anas capensis*	Blacknecked Grebe *Podiceps nigricollis*
White Pelican *Pelecanus anocrotalus*	Lesser Flamingo *Phoeniconaias minor*
Pinbacked Pelican *Pelican rufescens*	Greater Flamingo *Phoenicopterus truber*

The following species find refuge in the Central Plateau panveld during dry periods:

Crested Grebe	*Podiceps cristatus*
Southern Pochard	*Netta erythrophthalma*
Cape Shoveller	*Anas Smithii*
Maccoa Duck	*Oxyura maccoa*

Fitzgerald & Tanner (1992) suggest that a reduction in the vertical structure of prairie grassland of America as a result of restoration activities, should cause a lowering in the avian diversity, but that the presence of wetlands should provide a diversity of vegetative structure to support a mixture of grassland and forest birds. Wetlands, such as Nylsvley, are covered by hygrophilous vegetation, providing a habitat for wetland specialists and other waders.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

The Crowned Crane *Balearica regulorum*, Wattled Crane *Burgeranus carunculatus* (RDB species) and the Whitewinged Flufftail *Sarathura elegans* are restricted to vleis in the eastern Highveld grasslands (Taylor 1994), while the following species prefer moist grasslands in the vicinity of vleis:

Common name	Species name	Habitat preference
Blackheaded Heron	*Ardea melanocephala*	open grassland, inland waters
Swainson's Francolin	*Francolinus swainsonii*	grassland with trees, cultivated land, bushveld, vleis
African Crake	*Crex egregia*	flooded grassland, marshes, vleis
Orangethroated Longclaw	*Macronyx capensis*	moist short grassland, vleis

The higher rainfall of the Transvaal Drakensberg Escarpment results in numerous river courses and catchments-providing habitats to birds restricted to riverine areas (e.g. African Finfoot *Podia senegalensis*).

4.2.3.2 Habitat structure changes and vegetation succession

As mesquite (*Prosopis* spp.) develops on grazed sites, the structural complexity of grasslands of the Rio Grande Plains, Texas, increases, attracting avifauna that frequent wooded habitats. This hypothesis is supported by similar observations in New Jersey, the Chilean matorral and in Mexican rain forest.

The invasion of southern African grasslands by woody elements (both native and alien), and the destruction of grasslands by afforestation, urban tree planting and cropping activities, has lead to a change in the community structure of birds, favouring woodland species. Grassland species or species that require grassy patches (Secretary Bird *Sagittarius serpentarius*, Kori Bustard *Ardeotis kori*, whitewinged korhaan *Eupodotis afraoides* And Black Korhaan *Eupodotis afra*) are put at risk, while thicket-loving species (listed below) are favoured by these changes in vegetation structure:

Common name	Species name	Habitat preference
Southern Boubou	*Laniarius ferrugineus*	dense bush, gardens, thickets
Cape White-Eye	*Zosterops pallidus*	forest, woodland, savanna, garden, exotic plantations
Swee Waxbill	*Estrilda melanotis*	evergreen forest, exotic plantations, gardens, farm yards

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Vegetation variation within the Grassland Biome gives rise to a high diversity of bird species, many of whose distribution is primarily determined by the vegetation structure. Various species depend on the presence of grasslands (nesting, foraging, song display) – and it should be stressed that it is essential to distinguish between the various grassland types because of their structural difference, and thus the bird species that inhabit them – and vegetation types found within or adjacent (ecotones) to grasslands. A change in vegetation structure, often artificially induced, results in a change in the avifaunal community structure, often to the detriment of grassland specialists.

4.2.4 Climate

Weather, especially rainfall patterns, can significantly influence grassland bird abundance and nesting success within prairie areas (Cody 1985; George *et al.* 1992; Zimmerman 1992). Grassland bird breeding densities are generally lowered by drought, although this reduction may be short-term. All grassland species are not affected equally by drought, but burning in dry years may influence bird communities more strongly than burning in average or wet years (Zimmerman 1992). Species in summer-rainfall regions, such as the major part of the Grassland Biome, display longer breeding seasons than winter-rainfall breeders. Emergences of termite alates, grasshoppers and rodents after good rainfall determine to a large extent the occurrence and abundance of non-breeding migrants. Temperature affects bird activity and habitat occupation, and cold winter temperatures cause altitudinal migration of various species (e.g. Ayre's Cisticola *Cisticola ayresii*, the Yellow-Breasted Pipit *Hemimacronyx chloris*, and the Sentinel Rock Thrush *Monticola explorator*) (Harrison *et al.* 1997) along the Drakensberg Escarpment. Isolated populations of some species at high altitudes breed later than their conspecifics of lower altitudes, due to the late springs, sometimes resulting in subspeciation (e.g. Fairy Flycatcher *Stenostira scita*, Southern Grey Tit *Parus afer*) (Harrison *et al.* 1997).

Seasonality and uncertain rainfall patterns affect the biogeographical range of waterbirds, and also determine breeding seasonality models.

Rainfall patterns exert a great influence on the abundance and distribution of species. The

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

effect of rainfall patterns are often mediated through variation in vegetation structure. This can be illustrated by the high diversity of species that occurs towards the higher rainfall areas of the Transvaal Drakensberg Escarpment, while temperature fluctuations (whose effects are more pronounced in certain areas, such as the high altitudes of the Escarpment) contribute to the seasonal/annual variation of bird density and presence in the Grassland Biome.

4.2.5 Geographical setting & Topography

The southern African range of the Longtailed Widow *Euplectus progne* delineates the boundaries of the Grassland Biome, as well as that of the ecotonal Grassy Karoo. On the Central Plateau the distribution of species either follow (e.g. Longtailed Wagtail *Motacilla clara*) or avoid (e.g. the Glossy Starling *Lamprotornis nitens*) the Transvaal Drakensberg Escarpment (Harrison *et al.* 1997). Inland mountains and the broken interior Central Plateau provide habitats for various species, further contributing to the avifaunal biodiversity of the biome.

The following species, either South African or sub-Region endemics, prefer mountainous habitats:

Common name	Species name	Habitat preference
Bearded Vulture	*Gypaetus barbatus*	Drakensberg massif and foothills
Short-Toed Rock Thrush	*Monticola brevipes*	rocky outcrops, koppies, towns, river valley
Redwinged Starling	*Onycchognathus nabouroup*	mountains, cliffs, rocky hills, buildings
Cape Rock Thrush	*Monticola rupestris*	gorges, cliffs, hillsides
Ground Woodpecker	*Geocolaptes olivaceus*	mountains, dongas, rocky hillsides

4.2.6 Edge effect

Diversity studies have indicated that bird species diversity and habitat structure are closely correlated, and that species diversity increases with habitat complexity. In avian communities, Lovejoy *et al.* (1986) identified edge effects as the most important cause of ecological changes that result from habitat fragmentation (*cf.* Gilbert 1980), with the variety and density of

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

organisms greater at the interface between two habitats than in the interior of a habitat (edge-effect principle).

Edges can be described as the junction of two habitat elements forming an ecotone where plant and animal communities grade into one another (Yahner 1988), thus leading to the tenet of conservation biology that edges (periphery) are zones of high biodiversity. However, edges in fragmented landscapes owe their origin to short-term human-induced practices such as grazing, afforestation and industrial activities, resulting in artificial edges (Lovejoy *et al.* 1986) with no transition zone. "Artificial" edge species often contribute to the biodiversity of patches in the short-term only, but do not increase the overall numbert of grassland-dependant species. Edges are thus not always beneficial (Harris 1988), and fragmentation can possibly result in:

- increased predation risk by generalists;
- competition by ecotonal species with grassland interior specialists;
- the reduction of the required home range of birds;
- extinction of species due to isolated, non-viable populations.

Small scale mosaics (heterogeneity of fragmented areas) may increase species diversity, whereas large scale patches may lead to declining diversity (Rotenberry 1978). Edge effects are more pronounced when habitat fragments are small or of irregular shape, since these fragments have a disproportionately large ratio of edge relative to area (Forman & Godron 1986). Various authors (Temple & Cary 1988; Saunders *et al.* 1991) state that interior species are less likely to persist in small remnants because of the edge effect and processes.

4.2.7 Area size

Species sensitivity to habitat area varies, but in general, larger bird species need a larger critical area of habitat to avoid extinction (Cody 1985), and they occur only sporadically below the required habitat area. Avifauna may increase their territory size as food supplies decrease, up to a certain point, with the result of low productivity overriding suitable habitat structure, as illustrated by Kushlan (1976) for American White Ibisis *Eudocimus albus* that shift their nesting colonies in response to lower food availability. Prairie in Iowa thas has been

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

fragmented supports fewer species (Robbins 1979; Dinsmore 1981; Freemark and Merriam 1986). It was found that the development of natural habitats into residential property favours habitat generalists over more specialised grassland and forest species (Bernstein *et al.* 1990). Bird communities from small prairie fragments differ in species composition from those on large prairie fragments because they lack several prairie bird species that are restricted to large prairie fragments (Herkert 1991a). It follows therefore that management strategies for small and large fragments need not be the same.

The Wattled Crane *Bugeranus carunculatus*, Bearded Vulture *Gypaetus barbatus*, and various other Grassland species, especially grassland habitat specialists, are very sensitive to area size, and a reduction thereof may precipitate extinction of the species. The emergence of large numbers of insects and termite alates after good rains, especially in the Transvaal Escarpment area, provides a food reservoir to various Palearctic migrants and native bird species, giving cause to high concentrations of birds with reduced foraging areas, while the reverse prevails during droughts.

Patchy or heterogeneous habitats in the Grassland Biome may enhance or impair bird diversity. Artificial edges and small fragmented areas may not include the heterogeneous habitat required by bird species, or may exclude grasslands required by grassland specialists, ground breeders, and larger species with large foraging prerequisites, whereas perspicacious agricultural activities can increase habitat and avifaunal diversity.

4.2.8 Habitat selection and Competition

Various studies indicate that some species expand their habitat range due to intraspecific population competition, forcing some individuals into less favourable habitats (Stepney & Power 1973; Hurley & Franks 1976; Macdonald 1985, 1990). Bush encroachment results in a shift of the avian community structure, resulting in thicket-loving generalist birds to competing with grassland specialists for the same resources, often to the detriment of grassland specialists. Cropping, afforestation, and man-made structures have facilitated the range expansion of the alien Indian Mynah *Acridotheres tristis* to expand its range, displacing native species, while the Redbilled Quelea *Quelea quelea* competes with threatened species such as

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

Botha's Lark *Spizocorys fringillaris* for grain in agricultural areas.

4.2.9 Habitat selection and foraging as structural factors

Food availability and abundance, together with vegetation structure, provide various foraging opportunities for birds due to niche differentiation, and may determine what bird species coexist in any habitat (Cody 1983; Robinson & Holmes 1984; Holmes & Recher 1986). Birds native to the North American prairie are predominantly insectivorous, and their relative densities fluctuate in response to differences in above-ground production (Archibold 1995). The application of farm chemicals, and the subsequent decreases in insects and soil invertebrates, have led to a decline in the grassland bird community in Dickinson County, Iowa (Bernstein *et al.* 1990). Agricultural activities likewise contributed to the mortality of various species in southern Africa. In southern Africa, most grassland species appear to be omnivores (Table 15), with a higher intake of insects during the breeding season. The food preference of selected Grassland Biome species is listed below:

Food Preference	Common name	Species name	Prey/food
Terrestrial omnivore	blue crane	*Anthropoides paradiseas*	frogs, termites, grain, grass seeds
Terrestrial omnivore	grassveld pipit	*Anthus cinnamomeus*	insects, seeds
Terrestrial omnivore	orangethroated longclaw	*Macronyx capensis*	insects, grass seeds
Terrestrial insectivore	cloud cisticola	*Cisticola textrix*	small insects
Aquatic omnivore	Baillon's Crake	*Porzana pusilla*	aquatic insects, molluscs, seeds
Aquatic omnivore	knobbilled duck	*Sarkidiornis melanotos*	grass seeds, insects, grain crops
Aquatic insectivore	African Rail	*Rallus caerulescens*	crabs, insects, small frogs, worms

Data syntheses indicate that 33 % (four species) of the Grassland specialists (Habitat type 1 utilisers) are insectivorous, 50 % (six species) are omnivorous (with insects being the primary food source), while the food preference of Rudd's Lark *Heteromirafra ruddi* and the Mountain Pipit *Anthus hoeschi* is unrecorded. None of the grassland specialists are granivores. Thirty eight (54,23 %) species categorised as Habitat type 2 utilisers, are insectivorous or carnivorous (16 of these species primarily feed on carrion, small vertebrates and occasionally insects), 31 (44,23 %) of these species are omnivorous, while only one species (1,43 %) feeds on grain. A summary of these data is given in the following table, with the percentages (%) indicated in brackets:

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

Food preference	Number of species: Habitat type 1	Number of species: Habitat type 2	Total Species
Insectivore	4 (33,3)	38 (54,23)	42 (51,22)
Omnivore	6 (50)	31 (44,23)	37 (45,12)
Granivore	0 (0)	1 (1,43)	1 (1,22)
Unknown	2 (16,67)	0 (0)	2 (2,44)
Total Species	12	70	82

When data on the species of these two habitat types is combined, more than half the species (51,22 %) are insectivores, while 45,12 % are omnivores. Only 1,22 % of these species are granivores.

The Grassland Biome provides superfluous food in the form of insect larvae, grasshoppers, other insects and tadpoles after good rains. Large concentrations of birds, many of them Palearctic migrants, flock together during the summer months in grassland areas, especially in the Nylsvley wetland which provides a refuge for various waders (Tarboton 1997).

Many of the grassland types have been converted to maize-, sorghum-, wheat and sunflower crops, providing grain to species during the drier months, and especially favouring species such as the Redbilled Quelea *Quelea quelea* – considered to be an agricultural pest, Botha's Lark *Spizocorys fringillaris* and the Blue Crane *Anthropoides paradiseas.* These selfsame activities pose a threat to e.g. the Yellow-breasted Pipit *Hemimacronyx chloris* (RDB species). Discriminant analyses suggests that Prairie Falcons *Falco mexicanus* (Gillette, Wyoming), preferentially use grassland habitats that lack sagebrush when given the choice (Squires *et al.* 1993). These prey species were probably more vulnerable to predation in open grasslands compared to more structured habitat types. Similar observations may be made in South Africa, underlining the importance of conserving adequate habitat types to ensure the preservation of viable fauna populations.

The variety of food resources provided by the various vegetation types contributes to the Grassland Biome's bird diversity, although a variation in the food availability (climatically

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

induced) may cause a shift in the density and distribution of bird species. One would expect grassland birds to be primarily granivores, in fact, although 50 % of the grassland specialists (Habitat type 1) are omnivorous and the emergence of insects after good rains can cause a shift in this diet preference towards insects. Bird species of Habitat types 1 & 2 are, in general, insectivorous, suggesting that vegetation structure and not food preference is the dominant factor in structuring grassland bird communities. Fire, which is common in the Grassland Biome during the late winter, spring and early summer months, may result in food shortages in terms of seed availability. This might explain why many of the grassland birds are insectivorous (Van Wyk pers. comm. 1998). Large insect emergences after good rains may contribute to high avian richness and abundance in the Grassland Biome. It is suggested that food sources, fire and climate (rainfall) are secondary factors in structuring the grassland avian community.

4.2.10 Habitat selection and Predation

Lima & Valone (1991) provide experimental evidence that predators are a major factor in organising a community of granivorous birds in the semi-desert grasslands of eastern Arizona. They suggest that species differ in their perception of the safety of woody vegetative cover due to differences in antipredator behaviours. It was found that avian species with "cover-dependant" escape tactics increase with the addition of cover to open grasslands, while the abundance of "cover-independent" species decreases greatly. Research to date suggest the existence of differing perceptions of risk, reflecting a diversity of escape tactics in birds. Thus, birds do not settle where they cannot effectively deal with predators, and the nature of the vegetation structure may strongly determine the local community composition (Lima & Valone 1991). Food resources in open plains grassland can support bird species that normally do not occur there, and it is suggested that predators influence the organisation of avian communities via vegetation structure more strongly than does interspecific competition for limited food resources.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

4.2.11 Migration, Breeding status and Nesting sites

4.2.11.1 Migration

Altitudinal migration of birds on both sides of Lesotho's Malathi mountains is well known (e.g. Maclean 1957; Brown & Barnes 1984). Five species migrants (the Orangebreasted Rockjumper *Chaetops aurantius*, Sicklewinged Chat *Cercomela sinuata*, Cape Robin *Cossypha caffra*, Layards's Titbabbler *Parsisoma layardi* and Drakensberg Siskin *Pseudochloroptila symonsi*) are short-distance high-altitude. Mid-to low-altitude migrants include the Black Swift *Apus barbatus*, Fairy Flycatcher *Stenostira scita* and the Alpine Swift *Apus barbatus*. The Threebanded Plover *Charadrius tricollaris* is a migrant that leaves Lesotho during the winter. Johnson & Maclean (1994) suggest that nearly all bird migrations involve moving from a cold place to a warm place, or from a short day-length to a long day-length. This trend should be kept in mind when planning conservation areas so as to ensure the adequate conservation of various threatened and endemic species.

4.2.11.2 Breeding status & Nesting sites

Bird territories and nesting sites within grasslands vary in relation to food availability, microclimatic, predation and habitat structure features. Bird species are generally specific in their nest-site requirements. More productive grasslands and wetlands often lead to coloniality and thus higher bird densities than are found in shorter or less productive grasslands. The spread of trees can also facilitate the range expansion of birds if these trees provide suitable nesting sites. Macdonald (1990) hypothesises that increased reedbeds as a result of man's activities and the expansion of the alien mesquite trees, *Prosopis* spp., provide masked weaver *Ploceus velatlus* nesting sites and that this might also have facilitated the observed range expansion of this species. Apparent range expansions of the Pied Barbet *Lybius leucomelas* into fynbos, karoo, grassland and mesic savanna areas can be explained by the recent increases of alien tree species in areas where indigenous tree species were sparse or absent (Macdonald 1985).

Four-hundred-and-twenty-one Grassland Biome bird species are South African breeders

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

become adapted to different habitats. The structure and extent of some habitats has been altered by human activities, resulting in species either adapting to these changes, or declining in range and density. Brewer's Blackbird *Euphagus cyanocephalus* and Horned Larks *Eremophila alpestris* expanded their range in deforested areas of Ontario (Stepney & Power 1973; Hurley & Franks 1976).

A decline in prairie grassland birds has been widely documented (e.g. Graber & Graber 1963; Dinsmore 1981; Mayfield 1989). Bernstein *et al.* (1990) suggest that this phenomenon can be attributed primarily to the reduced area of grassland. It is further hypothesised that a reduction in prairie habitat throughout the state may be responsible for decline of bird populations in Dickinson County, Iowa, and that the reduction of potential breeders from surrounding habitats have further contributed to this trend.

The Grassland Biome has been severely modified by monoculture cropping, afforestation, urbanisation, mining and other industrial practices, manipulation of the natural fire regime, while stock has replaced the ungulate fauna, leading to the fragmentation of species' populations and causing species endemic to the region to be the most threatened group in the country (Allan *et al.* 1997). Large species with large home ranges are most at risk, while small species are able to persist in small, undisturbed remnants (Harrison *et al.* 1997).

4.2.12.1 Threats posed by human activities

4.2.12.1.1 Agricultural activities

Grazing of natural pastures usually has a low-impact on the environment, but overgrazing and soil erosion lead to the eradication of grass and favours bush or karoo encroachment (Werger 1978), causing a shift in avian communities. Several bird species that breed in the temperate grasslands of North America have declined in abundance because of the conversion of perennial grassland habitat to annually tilled cropland (Johnson & Schwartz 1993).

In southern Africa, species such as the Blue Korhaan *Eupodotis caerulescens*, Helmeted

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

Guinafowl *Numida Meleagris*, Sicklewinged Chat *Cercomela Sinuata*, Red Bishop *Euplectes Orix* And Redbilled quelea *Quelea quelea* are able to utilise a mosaic of habitats adjacent to croplands, with latter two species becoming a pest of small-grained cereals. The Bald Ibis *Geronticus calvus*, classified as rare and threatened, frequents burnt grassland, cultivated pastures, ploughed lands and reaped maize fields (Manry 1982). The bald ibis poses no threat to farmers, in that it mainly feeds on insects and beetles (Allan 1985). Structural changes to the vegetation brought on by fire, grazing and agriculture exert a strong influence on the migration and reproduction of *Geronticus calvus*. Grazing by ungulates, and the subsequent short-grass conditions have been features of the Bald Ibis's environment for a long time, predisposing the species to feed in domesticated areas. However, the reduction of grassland areas through afforestation and bush or karroid encroachment reduces the area of suitable foraging habitat, and may contribute to the declining populations (Manry 1982).

4.2.12.1.2 Afforestation and urban tree planting

It was found that most of the urban bird species in the prairie habitat around/in Saskatchewan consisted of non-grassland and introduced species. Although bird diversity did not differ between urban and rural habitat types, bird abundance was higher in the city. Rural grassland birds may not successfully recolonise urban areas because of the threat cats and dogs pose to ground nesting species, while habitat structure, water availability and food preference also play a significant role in urban habitat selection. In the North American prairie, numerous species invaded grasslands as new habitats were created by human activities (Archibold 1995). Bernstein *et al.* (1990) noted a 95 % increase in forest and forest edge species, which they attributed to a decrease in grass-like species. Along with changes in land usage, chemical application methods have also changed. Increased insecticide and herbicide application is known to affect bird populations, as confirmed by studies in the prairies of Iowa.

The areas of South Africa most suited to commercial afforestation are also regions in which biodiversity, especially botanical diversity, is concentrated. Areas already under plantation, and those planned for further afforrestation, correlate closely with regions and centres of vegetation diversity and endemism (Heydenrych 1995). The areas of highest bird species diversity of grassland specialists overlap extensively with the areas of greatest

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

afforestation and potential additional afforestation. Afforestation has a negative impact on grassland bird diversity even when the area under plantation is relatively small. It has been shown that the grassland vegetation has more bird species and is richer in both endemic and threatened species than the species encountered within the plantation itself (Allan *et al.* 1997). The radical extent of habitat changes brought about by afforestation activities can potentially have a profound impact on the biota inhabiting the regions afforested, especially when open and largely treeless ecosystems are transformed to monocultures of closed-canopy forests consisting of alien tree species (Allan *et al.* 1997). Fraser (1987) has demonstrated how the spread of alien trees in parts of the Gauteng Province resulted in the replacement of grassland bird communities by woodland avian assemblages.

Ninety bird species characteristic of grassland habitats occur in Mpumalanga Province. Ten are considered to be globally threatened and an additional fifteen are nationally or potentially nationally threatened. Allan *et al.* (1997) claim that the areas of highest avian diversity largely correspond with the escarpment region, where afforestation is also concentrated. It is also suggested that the diversity of threatened grassland birds shows a significant negative correlation with the extent of afforestation, in contrast to the significant positive correlation between the diversity of species benefiting from afforestation and the extent of plantation cover. Available evidence suggests that afforestation has significantly reduced the species diversity of grasslands birds in Mpumalanga (11 threatened grassland species have more than 20 % of their respective South African ranges in Mpumalanga) (Allan *et al.* 1997).

Afforestation not only alters the macro-structure of grasslands, with the drying up of streams and wetlands being common, but habitat fragmentation itself may result in the extinction of species with large spatial requirements. Pine and eucalyptus plantations in South Africa, which has a high number of habitat-specific birds, are virtual ornithological deserts (Cody 1975). Both types of monocultures support minimal avifaunal species due to the lack of native insect food resources. Bird species favoured by alien tree planting, are mostly woodland species, but it has come to light that more avian species (many of which show high endemism) are threatened by afforestation than are benefited by this type of grassland modification.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

Urbanisation is a dominant trend in South Africa, and the question arises to what extent particular avian species are able to adapt to human-built habitats and in what way the urban avifauna differs from that of natural habitats. A study by Fraser (1987) classified the Johannesburg avifauna by habitat preference and by incidence of occurrence into five groups: the grassland community, the woodland community, the urban community, sporadics and vagrants. The most dominant birds are those found in gardens elsewhere in the country. Compared to natural communities, there is a lower number of species in the urban garden although the number of individuals is often greater (Fraser 1987). The reduction of species is disproportionately greater for insect-eaters (Winterbottom 1969, 1971). When comparing Johannesburg's suburban bird community with surrounding bird communities, it is found that the majority of garden birds are either bushveld species like the grey lourie, or introduced species, such as the House Sparrow, Feral Pigeon and the Indian Mynah. Few grassland species are adapted to the urban habitat, while insect-eaters found in public gardens belong to fewer species compared to larger suburban gardens. This may imply that larger gardens are the key to higher avian diversity within a city.

Urban tree planting has a negative impact on endemic and threatened southern African Grassland Biome species, in that open grasslands have been transformed to a tree-dominated landscape, favouring woodland birds (e.g. Grey Lourie *Corythaixoides concolor*, Scimitarbilled Woodhoopoe *Rhinopomastus cyanomelas*). Case studies in the American prairies confirm this scenario (Graber & Graber 1963; Stepney & Power 1973; Hurley & Franks 1976; Dinsmore 1981; Bernstein *et al.* 1990).

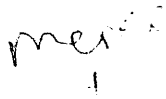
Some birds species (listed below) are favoured (through the criterion of foraging and nesting sites) by the presence of human constructions and activities. This leads to the expansion of their range.

Common name	Species name	Habitat preference
*Indian Mynah	*Acridotheres tristis*	cities, towns, human settlements
Palm Swift	*Cypsiurus parvus*	palm trees, exotic & indigenous trees, manmade structures, gardens
*House Sparrow	*Passer domesticus*	urban, suburban, rural human settlements

* introduced or alien species

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

These species are often better colonisers than are native grassland species, to the cost of the latter species.



4.2.12.1.3 Poisoning

Poisoning of carcasses has resulted in the fragmented distribution and threatened status of some vultures species (Bearded Eagle *Gypaetus barbatus*, Cape Vulture *Gyps coprotheres*) and some grain feeders (e.g. Blue Crane *Anthropoides paradiseas*) (Allan 1993). Agro-chemicals used in maize-growing areas pose a serious threat to birds, notably the Blue Crane *Antropoides paradiseus* and the Wattled Crane *Bugeranus carunculatus*.

4.2.12.1.4 Fire

The absence/incidence and type of fire-regime is an important determinant in the distribution and abundance of several bird species. Historically, prairie fires occurred frequently and were essential for the maintenance of this ecosystem (Herkert 1994). Undisturbed grasslands generally support few bird species and individuals (Skinner 1975; Westemeier & Buhnerkempe 1983). It is suggested that regular burning may enhance breeding bird nesting success (Johnson & Temple 1990). Furthermore, burned prairie can also contain higher insect densities than unburned prairie, which may enhance breeding bird populations by increasing the amount of food available for nestlings (Herkert 1994). Because grassland bird communities are significantly influenced by habitat size (Samson 1980; Herkert 1991b), the responses of bird communities to prescribed burning may not be the same for small as for large prairie fragments. The comparison of relative importance of prescribed burning and habitat-area has shown that habitat-area had a much greater influence on bird species composition than did prescribed burning (Herkert 1994). Prescribed burning, however, significantly influences breeding bird populations, in that some species prefer relatively undisturbed, dense vegetation, while other species frequent recently burned grasslands.

In the Grassland Biome, recently burned grasslands precludes the establishment of the Yellow-breasted Pipit *Hemimacronyx chloris* which prefers dense grassland, whereas Botha's

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

Lark *Spizocorys fringillaris* which prefers short grassland and open areas shows a tendency to be more numerous in these areas. Species preferring low- to medium-height vegetation (Skinner *et al.* 1984; Herkert 1991b) appear to be more abundant in recently burned prairie areas, with southern African grassland birds seeming to follow the same tendency. Bird communities on small prairie fragments are often edge generalists, and the grassland can be burned with little regard to disturb breeding birds, while, in contrast, large prairie fragments must be managed to provide a mosaic of burned and unburned areas to ensure the availability of suitable habitat for management-sensitive bird species (Herkert 1994).

Mentis & Bigalke (1979) found that the optimal fire frequency for francolins in the Natal Drakensberg is inversely rated to elevation, with Greywing Francolins *Francolinus africanus* inhabiting higher elevations dominated by short, sparse grass, and Redwing Francolins *Francolinus levaillantii* — more tolerant to the absence of fire — inhabiting lower elevations with taller, rank grass. Mentis & Bigalke (1979) reasoned that grass height and cover (with severity in climate increasing with elevation and favouring shorter grasses) determine the occurrence of francolins, with short grass becoming more abundant with regular fires. However, other factors such as nesting preference, predation and food preference may also be involved in differential habitat occupation by francolins.

Studies conducted by Barnard (1987) show that foraging site selection by three different raptor species in grassland montane habitat is related to burning, which in turn affects the cover density, prey availability, prey selection, and consequently habitat selection by the raptors. The Rock Kestrel *Falco tinnunculus* and the Jackal Buzzard *Buteo rufofuscus* moved into recently burned and rocky areas in response to increased small mammal, juvenile skink and large insect availability, whereas the Blackshouldered Kite *Elanus caeruleus* hovered over unburned grassland. Kestrels and buzzards are generalist feeders that can exploit a wide range of prey, whereas black-shouldered kites are rodent specialists, remaining in unburnt habitats of old grass to forage on larger adults and breeding females (Barnard 1987).

Recently burnt grassland may act as a dispersal sink for juvenile rodents and reptiles, and enhance insect reproduction and recolonisation as well, thus creating favourable foraging sites for Black-Headed Herons *Ardea melanocephala*, buzzards and kestrels. Yellowthroated

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

Sandgrouse *Pterocles gutturalis* (granivore), and Bald Ibises (insectivores) also frequent burned areas (Allan 1985).

4.2.12.1.5 Trade-off between conservation and agricultural practices

Not all the grassland habitat types are represented in existing nature reserves. Species such as Rudd's Lark *Heteromirafra ruddi* and Botha's Lark *Spizocorys fringillaris*, the Bald Ibis *Geronticus calvus* and Yellow-breasted Pipits *Hemimacronyx chloris* are naturally confined to narrow ranges, making them even more vulnerable to human-imposed threats. The total range of Botha's Lark, for example, is a small portion of the Grassland Biome lying in the upper catchment of South Africa's Vaal River (Tarboton 1997).

Maintaining various grassland habitat types is thus crucial for the conservation of southern Africa's unique grassland avifauna. Effective conservation of many species will not depend on establishing reserves for them, but rather on finding a balance between conservation implementation and the minimisation or prevention of deleterious land-use practices in the areas where the species occur. It has now been recognised that extensive pastoral farming practices in grassland habitats that have been subjected to grazing by game for centuries, are crucial for the survival of several species, such as the Bald Ibis and Botha's Lark (Tarboton 1997).

In the North American tallgrass prairie, it was found that disturbances, such as burning and grazing, had a significant effect on the structure of the tallgrass prairie. Historically, both these disturbance components were important during the evolution of the North American grasslands (Collins 1987). Collins *et al.* (1998) futher suggest that mowing or the reestablishment of grazing in anthropogenically stressed grasslands enhanced biodiversity. This scenario illustrates the importance of disturbance components in maintaining the biodiversity in the grasslands. This principle should be employed in the management of southern African grasslands, but it should be stressed that "sweet" and "sour" grassland types respond differently to these disturbance regimes, and should be managed accordingly.

In the past, the presence of extensive herds of natural ungulates and the occurrence of

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

natural fires has played an essential role in the dynamics of southern African grasslands. Varying stocking rates, grazing pressures and fire regimes created mosaics suitable for a spectrum of species, thus enhancing the avifaunal biodiversity. Botha's Lark *Spizocorys fringillaris* favours closely cropped grassland (Tarboton 1997), as once provided by game herds, enabling this species to adapt better to conditions on sheep-farms than those in nature reserves. By contrast, Yellow-breasted Pipits *Hemimacronyx chloris* are restricted to taller, denser grassland which is less frequently burned and less intensely grazed, making nature reserves the most appropriate conservation area for this species.

The Cape Vulture *Gyps coprotheres* once occurred widely over the interior plains of the southern range, but is now restricted to the rugged areas of the south and south-east arid sector because of human-induced environmental alterations. Raptorial species of the Lesotho montane grasslands show declining numbers because of the absence of prey due to over-exploitation by humans, while ground-nesters (e.g. the Blue Crane *Anthropoides paradiseas*, Crowned Plover *Vanellus coronatus*, Stanley's Bustard *Neotis denhami*) are threatened by subsistence farming. These species will gain benefit only within the boundaries of nature reserves, unless farmers and industries take action to reconcile/integrate agricultural activities with environmentally sound conservation.

4.2.12.1.6 Airport avian communities

The Johannesburg Airport and Swartkops Military Airport, (in the vicinity of Pretoria), are situated within the boundaries of the Grassland Biome. The disruption of aircraft traffic caused by the presence of birds on airport runways has been a problem for years. Birds larger than 400 g (in the case of Boeings – Johannesburg Airport; Bothma & Van Hoven 1991) and birds larger than 200 g (Swartkops Airport; Rasmussen 1992) cause great damage to the motors of aeroplanes. Collisions between aircraft and birds have the potential not only to be financially costly, but, also, potentially fatal for aircraft passengers.

The policy of the abovementioned airports is to regulate bird populations and to eliminate specific habitat requirements of "problem species", whilst taking the environment into consideration. The habitats provided by airports attract numerous birds, with the species

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

varying from airport to airport. Residents may not be the only avian problem. Birds commuting daily between their roosting and feeding habitats can be a serious problem, especially during the early morning and late afternoon, when this activity is at its highest (Bothma & Van Hoven 1991; Rasmussen 1992).

The habitats of Johannesburg and Swartkops Airports and their surrounds comprise remnants of natural grassland, grassland patches between the landing strips, *Eucalyptus* plantations, artificial dams and wetland areas surrounding the airports, the Korsman- and Carlos Rolfes Bird sanctuaries (Johannesburg Airport), recreation areas, smallholdings, dumping sites (Johannesburg Airport), and residential- and industrial buildings.

Various species of birds, including aquatic, open area, grassland, woodland and species that prefer human constructions, occur in the immediate and surrounding vicinity of the airports. "Problem species" identified at the Johannesburg Airport include are The Grey Headed Gull *Larus cirrocephalus*, Sacred Ibis *Threskiornis authiopicus*, Spurwinged Goose *Plectropterus gambensis*. Aquatic birds recorded at the Johannesburg Airport are ,*inter alia*, the Moorhen *Gallinula angulata*, Egytian Goose *Alopochen aegytiacus* and the Little Egret *Egretta garzetta*. Various species utilise the grass areas between the landing-strips: the Crowned- and Blacksmith Plover (*Vanellus coronatus* and *Vanellus senegallus*) prefer open ground to areas with short grass, while the Helmeted Guinafowl *Numida meleagris* and Swainson's Francolin *Francolinus swainsonii* prefer longer grass. Dumping sites and maize fields in the proximity of the Johannesburg Airport give rise to the daily "migration" of birds such as the Grey Headed Gull, Egyptian Goose and Hadeda Ibis that feed there, but which roost in the *Eucalyptus* plantations on the other side of the airport (Bothma & Van Hoven 1991; Kruger pers. comm. 1998). These birds pose a problem to the air traffic, in contrast to the aquatic birds from the bird sanctuary at the end of the airstrip, which display low flight patterns (Kruger pers. comm. 1998) and thus hold little threat to aircraft.

Natural grassland birds, such as lark and cisticola species also occur in this region (Kruger pers. comm. 1998), but pose no threat to aircraft, and it would be desirable to conserve these species within a human-altered environment. Grassland utilisers such as the Black Korhaan *Eupodotis afra*, Secretary Bird *Sagittarius serpentarius*, Redcapped Lark *Calandrella cinerea*

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

and more have also been recorded at the Swartkops Airforce base, indicating that these species can be conserved within an altered terrain within the Grassland Biome, providing that their habitat requirements are met.

Habitat structure appears to be the dominant factor in determining the composition of the avian communities of these two airports, while breeding- and feeding sites are the most important co-operating factors. The manipulation of the habitat structure (i.e. cutting of grass, felling of alien trees) can help to reduce the populations of "problem" species, but a sound knowledge of the habitat requirements of grassland species can help to conserve these species at the same time. The removal of dumping sites to other locations, and agricultural land-use change (Bothma & Van Hoven 1991; Rasmussen 1992; Kruger pers. comm. 1998) were also recommended as means of managing undesirable bird populations at the airports concerned. From international research it appears that environmental management techniques are the most effective means of controlling bird populations at airports (Anon. 1997). The integration of environmental management techniques with a thorough knowledge of avian species' requirements can contribute to the preservation of grassland species within an expanding human environment.

4.2.13 Threatened status

Extensive human pressures on the Grassland Biome pose a threat to 53 RDB species, comprising 9,6 % of the total biome species (Table 13) (Figure 7). When compared to the total number of RDB species found in southern Africa, more than half of the species, as indicated below, occur within the grassland region.

Status	Extinct	Endan-gered	Vulne-rable	Rare	Indeter-minate	Total	% of biome threatend versus South African	% of total South African birds
Grassland Biome	1	4	10	22	16	53	49	6,6
South Africa	2	5	17	42	35	108	*	13,5

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

A few RDB species that are in urgent need of higher conservation priority, include:

Common name	Species name	Habitat preference
Rudd's Lark	*Heteromirafra ruddi*	moist, short montane grassland
Grass Owl	*Tyto capensis*	long grass, near water, vleis, marshes
Wattled Crane	*Grus carunculata*	open grassland, floodplains, swamps, vleis
Blackrumped Buttonquail	*Turnix hottentotta*	open grassland, fallow lands, montane grassland
Blue Swallow	*Hirundo atrocaerulea*	moist montane grassland

Five species endemic to South Africa, the Bald Ibis *Geronticus calvus*, Rudd's Lark *Heteromirafra ruddi* and Botha's Lark *Spizocorys fringillaris*, the Buff-Streaked Chat *Oenanthe bifasciata* and the Yellow-breasted Pipit *Hemimacronyx chloris* are not only considered to be globally threatened, but also have more than 20 % of their world ranges (Allan *et al.* 1997) in areas with the highest afforestation rates in South Africa.

Siegfried (1989, 1992) has stressed the necessity of preserving viable populations of the more vulnerable species by creating several nature reserves in the Karoo and Grassland Biome. However, the continued survival of many other species will depend to a great extent on our predisposition towards harmonising human practices with the requirements of species outside the existing nature reserve network.

In general, human activities have resulted in the reduction and alteration of the Grassland Biome bird communities, causing several species to face possible extinction. This region is the cornerstone of various agricultural and industrial activities, and since many of these conditions are irreversible, the survival of the species can only be ensured in areas where environmental conservation and utilisation is reconciled with human practices, as has already been proven possible in some agricultural areas.

4.2.14 Conclusions

The Grassland Biome is characterised by a high diversity of bird species, many of them

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

grassland and southern African endemics, with vegetation structure being the proximate stimuli of habitat choice, while foraging and breeding sites, climatic oscillations, human activities, competition and altitudinal variation may predominate or operate synergistically at certain times. The combination of these factors results in increasing species diversity towards the east, with grassland specialists being restricted to this Biome. The various habitat types found within the biome, each of which holds its own unique fauna and flora species sensitive to artificial habitat changes, illustrates the importance of conserving not only a proportion of the Grassland Biome, but to include as many of the different habitat types to ensure the survival of many restricted species.

The Grassland Biome is poorly represented in the nature reserve network, necessitating the establishment of more reserves that are able to accommodate larger birds, specialists and birds that seek refuge in the wetlands of the Transvaal Drakensberg Escarpment area. To ensure the continued survival of several species, agricultural practices should be integrated with sustainable utilisation of resources and management of the environment. This much neglected field urgently requires more investigation to understand and conserve the Grassland Biome's avifauna.

4.2.15 Recommendations

The biodiversity of the Grassland Biome avifauna can only be ensured if more reserves are created and non-reserve areas are better managed. A conservation area in the biome should include as many of the habitat types as possible, and be of sufficient size to include species with larger home ranges. Areas needing of priority conservation include the Transvaal Escarpment so as to accommodate species that prefer high altitudes and show altitudinal variation, as well as to facilitate migrators. Priority areas further include the much neglected wetlands/inland pans, the various grassland types and vegetation types such as *Protea* species, within them. The area should also include well-managed pastures and croplands to compensate for the absence of natural game herds that helped in structuring the vegetation, as well as natural ecotonal elements such as scrubby, karroid grasslands which provide a habitat to several habitat-specific species.

The area in need of special conservation within the Grassland Biome, should thus

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

follow and east-south-west direction (from the eastern sector to the a western-southernly direction within the biome), and the "head" lying in the Transvaal Escarpment area (wetlands included), with the "tail" lying in the transitional zone between the Karoo, Grassland and Kalahari Bushveld. This arrangement would enable the inclusion of the area.

In addition a positive contribution from forestry interests is needed to ensure the preservation of the biodiversity of the Grassland Biome in the long term, by identifying alternative land usage such as pastoral farming and ecotourism and assessing their economic value relative to forestry.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

CHAPTER 5

Herpetofauna of the Grassland Biome

Ecological research on reptiles in southern Africa has enjoyed low priority, resulting in a general lack of information on reptiles (Jacobsen 1987; Branch 1988b). Only a limited number of detailed ecological studies on lizards, and a few on tortoises, are available. All reptiles show a distinct habitat preference that usually limits a species to a given geographical region (Branch 1988b). Distribution maps thus give only an indication of the known range of a species, and there are several gaps due to undersampling in various areas, which contribute to our ignorance.

Branch (1997) states that 488 species/subspecies of reptiles and amphibians have been recorded in South Africa, with 52 % (265) of them endemic to the region. Many endemic South African reptiles and amphibians have very restricted distribution ranges. Branch (1988b) suggests that the biodiversity of the herpetofauna refletcs the varying climates and habitats of the region.

Several misconceptions on reptiles about reptiles, such as the belief that they are inherently unsuccessful. This statement holds little truth however, in South Africa more reptile species are able to survive in variable habitats and climates than are mammal species.

Sadlier & Pressey (1994) suggested these the New South Wales reptile species needing special attention in planning and conservation, are those which show one or more of the following characteristics: a restricted distribution, a low population density, or a low survival status reflected by indices such as population trends and vulnerability to current activities. This study employs similar, though modified criteria, to assess the status of the herpetofauna in the southern African Grassland Biome. Detailed information on habitat requirements is necessary to identify species of herpetofauna to complement the reservation of natural environments.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

5.1 Results

A total of 243 herpetofauna species occur within, or show some kind of affinity with, the Grassland Biome (Table 2). This accounts for 65,68 % of South Africa's total herpetofauna species. One-hundred-and-eighty-five reptile and 58 amphibian species/subspecies are included in this study. Species were assessed according to their habitat preference, endemicity status and Red Data Book threatened status.

5.1.1 Habitat preference and endemicity status

One-hundred-and-twenty-one endemic (Grassland Biome, southern Africa) (Table 19) and 122 non-endemic species/subspecies (refer to "Introduction: herpetofauna" for the motivation for including the subspecies level in the data synthesis) are included in the inventory.

Species were categorised according to their habitat preference into the following Habitat type groups (refer to Chapter 3 for a detailed describtion of the Habitat types) (Figure 8 & 9):

- Habitat type 1 has 27 endemic - and two non-endemic species (twenty-nine species in total) (Table 21);
- Habitat type 2 has 48 endemic and 61 non-endemic species (109 species in total);
- Habitat type 3 has one non-endemic species;
- Habitat type 4 has 13 endemic species;
- Habitat type 5 has eight endemics (Table 23);
- Habitat type 6 has 25 endemic and 58 non-endemic species.

5.1.2 Threatened status (according to Scientific Programmes Report 151, Branch 1988)

Forty-seven species are listed in the RDB, with a further 44 species classified as being of unknown or not secure status (Table 20) (Figure 10).

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

The RDB status of the Grassland Biome herpetofauna is summarised below:

Group	Indeterminate	Rare	Vulnerable	Unknown	Total *A/B
Testudines	3	0	1	1	4/1
Squamata	6	4	18	31	28/31
Anura	9	0	5	12	14/12
Crocodylia	0	0	1	0	1/0
Total	18	4	25	44	47/44

* "A" represents RDB species, while "B" represents species of which the status is unknown

Of the grassland specialist endemic species, three species are listed as vulnerable, one species as not secure, one species as rare, one as possibly extinct and one species as restricted. Two species are listed as indeterminate, and the status of a further 12 species is unknown.

5.1.3 Species composition of the Grassland Biome herpetofauna

The composition of the Grassland Biome herpetofauna can be summarised as below. More detailed reports of the various taxons are given in Table 2.

5.1.3.1 Reptiles

- Order Squamata

One hundred and seventy five Grassland Biome lizard and snakes species/subspecies represent the following families, as categorised below (Table 16):

Family	Number of species included in study	Grassland & grassland-/other veld type utilisers	Possible ecotonal species
Agamidae	6	5	1
Amphisbaenidae	2	1	1
Boidae	1	1	0
Chamaeleonidae	7	7	0
Colubridae	45	33	12

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

Cordylidae	27	21	6
Elapidae	10	5	5
Gekkonidae	27	18	9
Lacertidae	13	10	3
Leptotyphlopidae	5	3	2
Scincidae	21	14	7
Typhlopidae	3	2	1
Varanidae	2	2	0
Viperidae	5	3	2
Unknown	1	1	0

- Order Testudines

Nine species/subspecies of the Order Testudines are included in the inventory. The following families are represented in the Grassland Biome (Table 17):

Family	Number of species included in study	Grassland & grassland/other veld type utilisers	Possible ecotonal species
Emydidae	1	0	1
Pelomdusidae	2	0	2
Testudinidae	6	4	2

- Order Crocodylia

The Nile crocodile *Crocodylus niloticus* is an ecotonal species of the Grassland Biome. They also occur in captivity in some areas within the biome's boundaries.

5.1.3.2 Amphibians

- Order Anura

Fifty-eight amphibian species/subspecies, belonging to eight families, are included in the inventory, as summarised below (Table 18):

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

Family	Number of species included in study	Grassland & grassland-/other veld type utilisers	Possible ecotonal species
Bufonidae	10	8	2
Heleophrynidae	1	1	0
Hemisidae	2	1	1
Hyperolidae	7	4	3
Microhylidae	7	5	2
Pipidae	2	1	1
Ranidae	27	19	8
Rhacophoridae	1	0	1

5.2 Discussion and additional information

5.2.1 Grassland Biome Herpetofauna

5.2.1.1 Distribution

5.2.1.1.1 Amphibians

Frog distribution patterns appear to partition southern Africa in a south-western and eastern zone, with the latter zone being characterised by a north-south distribution pattern (Crowe 1990). Frog species richness in southern Africa decreases from east to west. Crowe (1990) suggests that a combination of mean annual rainfall and mean winter temperature are the key factors that influence diversity, explaining 79 % of the geographical variation in species richness.

These findings/observations are consistent with the high species richness and endemism found in the Transvaal Escarpment and Lesotho highland areas, which are the origin of several river courses and smaller streams. The higher degree of endemic amphibian species in the east of the country and in the east of the Grassland Biome can be attributed to the allopatric speciation of ancient Gondwanan elements and, more recently, of Afrotropical groups (Poynton & Broadley 1978).

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

5.2.1.1.2 Lizards

The distribution patterns of lizards partition southern Africa more finely than frogs, especially in the western half of southern Africa (Crowe 1990). Lizard diversity displays a bimodal pattern of variation in species richness, with high values in the west and east of southern Africa separated by low species diversity in the mesic biotopes. However, in contrast to frogs, the highest levels of endemism are found in the western subzone, with moderate to high levels of endemism in all the subzones (national scale).

Regression analyses (Crowe 1990) showed that species richness appears to be affected by topographical diversity, mean rainfall and range of annual rainfall. Lizard diversity shows a positive correlation with rocky habitats, which may be attributed to the increased microhabitat diversity that lizards can exploit, and also to the fact that lizards are ectotherms and that basking in the sun on rocky substrates help them with thermoregulation (Martin & Salvador 1995). This, at least in part, may account for the high lizard species richness and endemism in the Transvaal Escarpment area.

5.2.1.1.3 Snakes

Snakes display a distribution pattern similar to that of frogs, but with a high level of species richness and endemism found in a bimodal pattern in the west and east of southern Africa, similar to that of lizards (Crowe 1990). Species richness appears to be related to annual and maximum solar radiation, topographic diversity and mean annual rainfall (Crowe 1990).

5.2.1.1.4 Tortoises

Geographic coverage of chelonians in southern Africa is not uniform, and large areas have few or no chelonian records (Branch *et al.* 1995). Only two testundinids (*Kinixys spekii* and *Geochelone pardalis*) are widespread in the country, while a number of pelomedusids (e.g. *Pelomedusa subrufa* and *Pelusios sinuatus*) are also common. A well-collected region depauperate in chelonians extent through eastern Cape, Transkei, Lesotho, the Kwa-Zulu midlands, north-eastern Free State and the North-West Province, with the Cape terrapin

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

(*Peltuomedusa subrafa*), the only species known to occur in this region (Branch *et al.* 1995). The mountain tortoise, *Geochelone pardalis*, occupies montane grassland in the southern Free State, but is absent from the adjacent lowlands of the old Transkei region. There is no evidence that this species was either present throughout the region, or that extinctions have resulted from anthropomorphic factors. Distribution patterns of tortoises have not yet been established, and should enjoy further investigation.

The highest number of herpetofaunal species in the Grassland Biome occurs in the Escarpment area, whose montane forest and grassland provide habitats to various species. Lizards and amphibian diversity is highest in two clusters — in the south, the Qwa-Qwa eastern Free State and, in the north, the north-eastern Drakensberg Escarpment. Amphibians show a high level of endemism to the east of the country, while the western zone has virtually no endemic taxa, although this rate of decrease to the west is lower in the southern Cape Province. It is suggested that a combination of mean annual rainfall and mean temperature (which influence edaphic and vegetation characters) are the key factors which influence species richness. Lizards partition southern Africa more finely, displaying a bimodal pattern of high endemism in the east and west, with moderate to high levels of endemism in all the subzones. Snakes display a similar bimodal pattern of endemism as lizards, but species richness follow an east-west partitioning of the country. From maps it can be deduced that central and western southern Africa show a high chelonian species richness, with six tortoise species occurring in the Karoo region. The geographical variation of reptiles can be explained by a combination of the microhabitat diversity created by topographic variation (positive correlation), solar radiation (positive correlation) and mean annual temperature (positive correlation).

5.2.2 Diversity

Drinkow & Cherry (1995) state that biodiversity in general is not uniformly distributed but, rather, are clustered in areas that are more species-rich than others. They advocate that these "hotspots" of amphibian diversity be identified and preserved. Studies have shown that all endemic "hotspots" or areas of high endemism are associated with protected areas; but that several of the areas in the former Northern and Eastern Transvaal are very small and isolated, however, or the area of overlap within protected areas, is too small.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

5.2.2.1 Amphibians

South Africa has a high level of amphibian endemism (44 %), as indicated by the fact that the region has 0,07 amphibian species/100 km^2, compared to the global average of 0,03 amphibian species/100 km^2 and an African average of 0,02 species/100 km^2 (Siegfried 1989). Areas very high in species richness include northern KwaZulu-Natal and Lesotho (Drinkrow & Cherry 1995; Van Dijk 1996).

Amphibian diversity (number of species and subspecies) is highest in the Afromontane north-eastern Free State in the Golden Gate-Qwa Qwa area where 22 taxa have been recorded, of which seven taxa are restricted to this area (Bates 1995b). Bates (1995a,b) claims that although collections of amphibians have been made in 71 % of the 229 quarter-degree units included in the Free State, many of the recordings are scattered throughout the region, indicating that additional collecting is needed for a better understanding of the distribution patterning and diversity in the region.

In the Free State, seven species, namely *Bufo gariepensis nubicolus*, *Heleophryne natalensis* (stream habitat), *Breviceps verrucosus verrucosus, B. adspersus pentheri, Strongylopus hymenopus, Cacosternum nanum nanum* and *Arthroleptella hewitti* (riverine bush, streams and marshy areas) are restricted to the Afromontane north-eastern Free State (*i.e.* quarter-degree units 2828BC, DA, DB, 2829AC), while *Strongylopus fasciatus fasciatus* occurs at only one locality outside this area (Bates 1995b). The distribution of these amphibians fall within the Moist Cool Highveld Grassland and Moist Cold Highveld Grassland, as classified by Low & Rebelo (1996). The species *Bufo gariepensis nubicolus* and *Strongylopus hymenopus* breed in streams in grasslands and marshy habitats, while *Breviceps verrucosus verrucosus* breeds in montane grasslands and forests.

Thirteen species that occur exclusively in the cooler, wetter and more mountainous eastern Free State are listed below:

Heleophryne natalensis	*Bufo gariepensis gariepensis*
Bufo gariepensis nubicolus	*Schismaderma carens*
Breviceps verrucosus verricosus	*Breviceps adspersus pentheri*

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

Tomopterna natalensis	*Strongylopus grayii grayii*
Strongylopus fasciatus fasciatus	*Strongylopus hymenopus*
Arthroleptella hewitti	*Cacosternum nanum*
Semnodactylus wealii	

The species *Bufo poweri* and *Breviceps adspersus adspersus* (dry bushveld) have essentially westerly distributions, while species such as *Xenopus laevis laevis* (permanent waterbodies), *Bufo gutturalis* (pools, dams), *Bufo rangeri* (rivers/streams in grass-or woodlands), *Rana angolensis* (aquatic vegetation) have widespread distributions over the province.

5.2.2.2 Lizards and snakes

Limited detailed information on the distribution of reptiles is available. Lombard *et al.* (1995) report that the lack of abundance data for snakes makes it impossible to incorporate population viability into reserve selection methods, and a spatial "aggregation" procedure was developed to select cells (data digitised into a Geographic Information System – GIS, ARC/INFO) representing contiguous distributions that were more likely to support viable populations than discontiguous distributions (Lombard *et al.* 1995).

Scoring methods defined those geographic regions in South Africa that support exceptionally high snake species richness or rarity. This method is important in reserve-site selection because it allows the reserve designer to ensure that selected sites fall within high scoring cells, which by definition, support higher levels of species richness or greater rarity (Lombard *et al.* 1995). Scoring methods, however, can not be used for final site selection, and iterative algorithms (Lombard *et al.* 1995) were employed in an attempt to identify irreplaceable areas for the protection of the biodiversity of South Africa's snakes.

North-eastern South Africa and the coastal regions appear to support the highest snake richness and rarity. This could be attributed to sampling bias, however, considering that the western interior is largely unsurveyed. The western half of the country supports a greater percentage of rare species, which can be attributed to peripheral, southern distributions of arid

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

zone species extending into South Africa from neighbouring Namibia. If sampling bias is not taken into account, it can be deduced from distribution maps (Lombard *et al.* 1995) that the distribution of snake species richness and snake rarity in South Africa [Rarity (per species) = (Range) + (Endemism) + (Red Data Book Status) + (Commonness)] is very high in the Transvaal Drakensberg Escarpment area, as well as in the central Transvaal. Areas within the Grassland Biome that need to be surveyed include the Lesotho Highlands and the Qwa-Qwa area.

5.2.2.3 Tortoises

Southern Africa has the richest diversity of tortoises in the world (Branch 1985; Boycott & Bourquin 1988), with most endemics clustered in the Cape Fynbos Biome, whilst the area encompassing Lesotho, the former Transkei and adjacent regions, lacks testudinids for unknown, but archaeologically proven and natural reasons (Branch *et al.* 1995). Although comprising only 0,8 % of the world's total surface, South Africa is home to 13 species of tortoise. Information on tortoises, terrapins and turtles has, unfortunately, been available only in scattered accounts, and this lack of information has contributed greatly to the general decline in their numbers (Boycott & Bourquin 1988). Although part of the chelonian diversity has been summarised in recent reviews (Boycott & Bourquin 1988; Branch 1988a), the detailed diversity, distribution and conservation status of chelonians in the region has not previously been reviewed (Branch *et al.* 1995).

The eastern Transvaal Escarpment and north-eastern Free State and Qwa-Qwa areas are "hotspots", of amphibian distribution and endemicity. The Transvaal Escarpment is high in reptile diversity and endemicity. Only limited information regarding a holistic picture of this topic has been published up to date. The distribution of tortoise diversity still requires detailed investigations, but seems to be highest in the Cape Fynbos region and in the western sector of the country.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

5.2.3 Endemics

One hundred and twenty one endemic reptile and amphibian species/subspecies occur in the Grassland Biome (Table 19), with endemics occuring in most of the vegetation types (Table shown below).

Habitat type	Habitat type	Endemic	Non-endemic	Total
Grassland	1	27	2	29
Grassland, savanna/woodland/karoo	2	48	61	109
Grassland/savanna uncertainty	3	0	1	1
Rocky areas/termitaria/streams in grassland	4	13	0	13
Rocky areas in various habitat types	5	8	0	8
Habitats excluding grassland	6	25	58	83
Grassland Biome: Total	*	121	122	243

The various taxa, according to endemicity status, are represented as follows in the Grassland Biome:

Group	Endemic	Non-endemic	Total
Squamata	97	78	175
Anura	21	37	58
Testudines	3	6	9
Crocodylidae	0	1	1
Total	121	122	243

The various Habitat types and their endemics are discussed below:

5.2.3.1 Grassland (Habitat type 1)

Twenty-nine reptile and amphibian species occur in grassland (Table 22). Twenty-seven of the species are Grassland Biome endemics restricted to grassland vegetation types exclusively

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

(Table 21).

The taxa that are represented in Habitat type 1, are summarised below:

Group	Endemic	Non-endemic	Total
Squamata	17	2	19
Anura	10	0	10
Testudines	0	0	0
Crocodylidae	0	0	0
Total	27	2	29

Many of the species show an affinity with montane grassland of the eastern-, south-eastern, and north-eastern Transvaal and Free State, as well as the marshy swamps of the catchment area of the eastern Drakensberg Escarpment. Six of these Grassland Biome endemics, all restricted to the grassland vegetation types, are RDB species: *Acontias breviceps* = vulnerable, *Scelotes mira* = not secure, *Tetradactylus eastwoodae* = possibly extinct), two of the species are of indeterminate status (*Cacosternum nanum nanum*, *Hemachatus haemachatus*) and 12 species are of unknown/uncertain status (e.g. *Afroedura karroica hali*, *Semnodactylus wealii*, *Strongylopus hymenops*) (Table 19).

5.2.3.2 Grassland & savanna/woodland/desert/karoo vegetation (Habitat type 2)

Forty-eight endemic species occur in this habitat type. The taxa are represented as follows in Habitat type 2:

Group	Endemic	Non-endemic	Total
Squamata	39	40	79
Anura	7	18	25
Testudines	2	3	5
Crocodylidae	0	0	0
Total	48	61	109

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

The distribution of species, together with some remarks, is listed below:

Species name	Conservation status	Distribution	Remarks
Pachydactylus vansoni	protected & secure	north-eastern and eastern Transvaal	Afforestation might pose a threat
Typhlosaurus cregoi cregoi	protected & secure	Acocks veld types 8, 67	Endemic to Transvaal
Breviceps verrucosus verrucosus	unprotected & indeterminate	Drakensberg escarpment	Found in cultivated areas
Agama atra atra	protected & status unknown ?	Free State and most of the Transvaal	Widespread & locally common
Lygodactylus nigropunctatus incognitus	unknown	northern Transvaal, rocky grassland	Endemic to the Transvaal
Elapsoidea sundevallii media	partially protected, secure	highveld of Free State and Transvaal	Widespread and uncommon

5.2.3.3 Grassland/savanna (uncertainty) & Rocky outcrops/termitaria/streams in grassland (Habitat type 3 & 4)

Habitat type 3 contains one non-endemic species (*Elapsoidea sundevalli sundevalli*), while thirteen endemic (Grassland Biome/southern Africa) species occur in Habitat type 4. Of these species, *Pseudocordylus langi* (recorded in the Free State), is threatened by illegal collection. These thirteen species, as well as the eight endemic species of Habitat type 5, are lizards. This can be attributed to the same explanation given under the headings of: "Distribution of lizards (5.2.1.1)" and "Habitat types: Rocky outcrops & termitaria (5.2.3.1)".

The taxa are represented as follows in Habitat type 4:

Group	Endemic	Non-endemic	Total
Squamata	12	0	12
Anura	1	0	1
Testudines	0	0	0

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

Crocodylidae	0	0	0
Total	13	0	13

5.2.3.4 Rocky outcrops in various habitat types (Habitat type 5)

Eight endemic Grassland Biome/southern African species are restricted to rocky outcrops in savanna, woodland and other vegetation types (Table 23).

The taxa are represented as follows in Habitat type 5:

Group	Endemic	Non-endemic	Total
Squamata	8	0	8
Anura	0	0	0
Testudines	0	0	0
Crocydylidae	0	0	0
Total	8	0	8

Some of these species/subspecies are not only confined to rocky terrains, but also display altitudinal variation in their distribution range within the Grassland Biome, e.g. *Lygodatylus ocellatus soutpansbergensis* which occurs on rocky outcrops at 850-1500 m above sea level in veld types ranging from rocky montane grassland to mixed grassland, whereas *Lygodactylus ocellatus ocellatus* (Habitat type 4), its allopatric subspecies, inhabits outcrops in open Highveld grasslands at altitudes of 1500-2300 m (Jacobsen 1994).

5.2.3.5 Habitats excluding grassland (Habitat type 6)

Twenty-five Grassland Biome species/subspecies which inhabit vegetation types other than grassland, are endemics (i.e. to the Grassland Biome or southern Africa), with twelve of them being peripheral- and possibly ecotonal species (indicated by * in Table 2).

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

The taxa are represented as follows in Habitat type 6:

Group	Endemic	Non-endemic	Total
Squamata	21	35	56
Anura	3	19	22
Testudines	1	3	4
Crocodylidae	0	1	1
Total	25	58	83

Some of the non-peripheral species prefer woodland vegetation types (e.g. the following reptiles: *Philothamnus natalensis occidentalis*, *Pedioplanis lineoocellatus pulchella*). Other species occur in karroid- and Kalahari vegetation types (e.g. the lizard *Cordylus polyzonus polyzonus* and the amphibian *Xenocalamus bicolor bicolor*), whereas *Heleophryne natalensis* and *Arthroleptella hewitti* (both amphibians) are mainly confined to riverine-, montane forest zones and ravine vegetation types. Most of the peripheral reptile and amphibian species are endemic to the Mpumalanga Province and KwaZulu-Natal.

5.2.4 Habitat selection

Various authors (Brown & Orians 1970; Krebs 1978) maintain that animals are usually not randomly distributed in space but are orientated with respect to animate and inanimate objects in their environment. These objects may ultimately determine the distribution of a population. Numerous species of lizards show preference for specific structural features of the habitat, and a study of the relationship between species abundance and habitat characteristics can therefore have considerable value, as it allows predictions to be made about a species' response to artificial and natural habitat changes.

The majority of tortoise and terrapin species require special conditions under which to live and breed. Thousands of these creatures have died because of human activities that have altered their habitat and, in other cases, removed them from their habitat and kept them in captivity.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

5.2.5 Factors in habitat selection

5.2.5.1 Habitat structure & habitat types

Vegetation cover and structure and not the floristic composition of the habitat, determine the choice of living place of lizard species in sandy grasslands (Gyovai 1984). Vegetation-related (and other related factors) distribution patterns of South African herpetofauna have enjoyed little attention, but the collation of data on the Grassland Biome herpetofauna seems to confirm Gyovai's (1984) results. As in the case of birds, vegetation structure seems to be the proximate stimuli in determining reptile and amphibian distribution, while other factors (climate, soil, food etc.) co-operate synergistically or dominate at times.

5.2.5.2 Thermoregulation & habitat selection

A strategy for precise thermoregulation may require a precise use of the habitat, and rock screes offer a high availability and diversity of such sites (Carrascal *et al.* 1992). Environmental temperatures in high mountains are usually low, careful selection of rocky sites is a trade-off between attaining an appropriate body temperature, avoiding predation risk, and engaging in foraging and mating activities (Carrascal *et al.* 1992; Martin & Salvador 1995).

Martin & Salvador (1995) suggest that the distribution and abundance of the Iberian rock lizard (*Lacerta monticola*) can be related to the presence of rock screes, which in turn are strictly correlated to the microhabitat. *Angolosaurus skoogi*, a cordylid lizard species of the northern Namib Desert, is thermophilic and ultrapsammophilous — adaptations to ensure optimal utilisation of their harsh environment (Mitchell *et al.* 1987).

Caution should be excercised, however, in that factors such as microclimate, temporal food availability, predation risk and mating opportunities should also be considered in the application of habitat models.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

5.2.5.3 Grassland vegetation (Habitat type 1)

Twenty-nine herpetofauna species (Table 22) show a distinct preference for grassland types (twenty seven of these species are endemic to the Grassland Biome). The heterogeneous floristical variation of the grasslands should be stressed, however, with some species prefering dry, mountain grassland (e.g. *Montaspis gihomaculatus*) whilst other species/groups, especially amphibians, prefer marshy grasslands (e.g. *Cacosternum nanum nanum*, *C. n. parvum*, *Strongylopus hymenopus*, *Amplorhinus multimaculatus*).

Termitaria and rocky outcrops within grasslands often provide the shelter and the necessary substrate for thermoregulation in species that forage in grasslands, such as *Chaemausaura anguina anguina* and *Bufo gariepensis nubicolus*. Species such as *Strongylopus hymenopus* and *Rana vertebralis* are confined to the alpine grasslands of the Drakensberg (2000-3000 m).

5.2.5.4 Grassland & savanna/woodland/desert/karoo vegetation (Habitat type 2)

One hundred-and-nine species utilise a combination of grassland and savanna, desert, karoo and other vegetation types within the Grassland Biome and its bordering ecotonal regions. The inclusion of 24 species in the inventories is due to their occurrence in ecotonal regions (indicated by *).

Several species forage in grass patches found in karoo and savanna vegetation types, but shelter under the bark of trees, under debris or rocks (e.g. the reptiles: *Prosymna bivitatta, Mabuya capensis*), or in termitaria. Inactive termitaria provide shelter for many amphibian and reptile species (De Waal 1978, 1980a,b; Lynch 1986, 1988; Douglas 1995). The deliberate destruction of termitaria in the Highveld and eastern Transvaal has led to the decline of various species, such as *Dasypeltis scabra*, *Pachydactylus capensis capensis* (endemic species) and *Homoroselaps dorsalis*, a South African endemic restricted to termitaria and rocks in grassland.

The species *Strongylopus grayii grayii*, found in the mountain ranges of the former

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

northern and eastern Transvaal and eastern Free State (Biome scale), is a montane grassland and forest form, emphasising the importance of preserving the various habitat types both within and around the Grassland Biome.

5.2.5.5 Rocky outcrops, termitaria & streams/riverine habitats (Habitat type 4 & 5)

Thirteen species are confined mainly to rocky terrain in grassland vegetation types, whilst another eight species are chiefly found in rocky outcrops in savanna and woodland vegetation types. All of these species are endemic to the region/Grassland Biome, and are very susceptible to habitat destruction.

These species make use of the rocky terrain to help regulate their body temperature, while they forage in adjacent grassy patches, where invertebrate availability is much higher than amongst rocks (Martin & Salvador 1995). Optimisation of basking is important in high mountains because environmental temperatures are usually low, and lizards thus have to denote a high proportion of time to the attainment of an appropriate body temperature (Van Damme *et al.* 1989). Exposed grassy patches may be useful for lizards as the leaf litter reaches high temperatures earlier in the day than do other habitats, (Martin & Salvador 1993), although little shelter is provided against predators.

The reasons for the high endemicity level are discussed under the heading of: "Distribution of lizards (5.2.1.1)". According to Jacobsen (1989), several reptiles, especially lizard species, occur at specific heights above sea level. Because of this altitudinal preference, translocation of species to areas outside their normal distrubution range may undermine their survival. Jacobsen (1994) states that *Lygodactylus ocellatus ocellatus* is confined exclusively to the crevices and outcrops in open Highveld grasslands at 1500 - 2300 m above sea level, whereas *Lygodactylus ocellatus soutpansbergensis* is found on rocky outcrops at 850 - 1500 m above sea level. Mayr (1969) mentions that subspecies often represent an adaptive response to regional climatic conditions, an observation that which may prove to be true in the Grassland Biome with its topographical variation and its rugged landscapes towards the Drakensberg escarpment.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

5.2.5.6 Termitaria (Habitat type 4)

Several species occur in the Grassland Biome because of the presence of termitaria. Species whose occurrence is determined by the presence of these structures are listed below:

Species name	Conservation status	Habitat preference	Remarks
Pachydactylus capensis capensis	protected & secure	Habitat type 2	Endemic
Pachydactylus affinis	protected & secure	Habitat type 2	Endemic
Agama aculeata distanti	protected & secure	Habitat type 2	Endemic
Typhlops bibronii	partially protected & secure	Habitat type 2	Endemic
Atrataspos bibroniii	partially protected & secure	Habitat type 2	Occur in several reserves
Psammophylax trittaenatus	partially protected & secure	Habitat type 2	Widespread but sporadic
Elapsoidea sundevalli sundevalli	partially protected & indeterminate	Habitat type 4/5	Very rare
Dasypeltis scabra	partially protected & secure	Habitat type 2	Future determined by available termitaria
Leptotyphlops conjuntus conjunctus	partially protected & secure	Habitat type 2	Subjected to habitat destruction: Highveld
Crotaphopeltis hotamboeia hotamboeia	patially protected & secure	Habitat type 2	Occurs widely in reserves

In the cooler areas of southern Africa, snakes and lizards (e.g. *Pachydactylus capensis capensis*, *Duberria lutrix lutrix*) often take refuge in old termitaria and rocky crevices, particularly during the winter.

5.2.5.7 Aquatic environments (Habitat type 6)

The high amphibian diversity and endemicity of the Drakensberg Escarpment, especially the Lesotho- and Free State Escarpment (Qwa Qwa region), can primarily be explained in terms of the high rainfall of the catchment areas, which provide various aquatic microhabitats. The aquatic habitat type preferred by amphibians varies intra- and interspecifically (see: "Area size

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

and territoriality (5.2.3.4)"). The following aquatic habitat types, together with those species common to them, will be addressed briefly:

- Fairly big rivers

Tadpoles of *Heleophryne* spp. in Lesotho disperse along major rivers, invading more suitable torrential tributaries, but are not common in larger rivers (Van Djik 1996). *Rana vertebralis* and *Rana fuscigula* are fairly common in big rivers, provided these have shallow fringes suitable for breeding.

- Fast-flowing streams

Strongylopus hymenops prefers fast-flowing streams in areas 2000 - 3000 m above sea level in the Drakensberg (Sani Pass).

- Small, slow-flowing streams

Strongylopus grayii is found in slowly flowing water or in nearby swamps. Channel pools alongside large rivers serve as dispersal routes.

- Moist seepage areas

Tadpoles of the genus *Arthroleptella* develop in egg capsules kept moist seepage, but they do not enter the water. *Arthroleptella hewitti* occurs in wet, mossy embankments and rapids along the Drakensberg and in KwaZulu-Natal.

- Shallow pools

These habitat types are suitable breeding and residence sites for *Cacosternum* and *Phrynobatrachus* species. Species like *Cacosternum boettgeri* occur near various water bodies, especially on the Highveld of the Free State and former south-western Transvaal.

- Rocky rain and seepage pools

The species *Bufo maculatus* is found in most of the Transvaal, Free State and eastern Cape (Biome scale). The species *Bufo gariepensis gariepensis*, is found in the eastern-, south-eastern Free State and south-eastern Transvaal (distribution within the Grassland Biome) and

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

breeds in rocky rain pools.

- Humid and shady ravines

Ptychadena porosissima and *Heleophryne natalensis* are humidity-preferring species which occur in the Drakensberg mountains and kloofs.

- Swamps and channel pools

Species of *Xenopus*, as well as species such as *Semnodactylus wealii* (Natal Drakensberg: Giant's Castle) and *Ptychadena mascareniensis mascareniensis* (a peripheral species which is also found in grassland) are common in this habitat type.

- Pans

Various species occur in panveld, such as *Pyxicephalus adspersus edulis*, which is common in the Benoni-Kemptonpark area, as well as *Tomoptera* species that occur in shallow pans in sandy soils.

Van Djik (1996) predicts that information on the breeding habits at various localities outside of mountain ranges is needed to evaluate the probable amount of isolation of mountain populations from others in the present, and in the past.

The reptiles and amphibians of the Grassland Biome display marked preferences for certain habitat types, with intraspecific variation being common. Successful conservation of these species requires a thorough knowledge of a species' biology and ecology, as well as its distributions patterns in the past.

5.2.6 Climate and soil

Van Dijk (1982) cautions that, as an ecological factor, temperature is sometimes overrated as a limiting factor. Present distributions may reflect past conditions, and a particular population might thus actually be a relict population. It is also possible that a distribution pattern due to an ecological factor may be brought about indirectly, for instance via the vegetation dependant on that ecological factor. Van Dijk (1982) hypothesises that anuran rainfall-correlated

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

distributions may be mediated by soils produced by a similar rainfall in the past.

Rainfall is an important factor in the forming of soils in tropical and subtropical areas, and such dependence means that association of frog distribution with low, or high, rainfall in Southern Africa may operate, at least partly, via soil produced in different fire regimes (Van Dijk 1982). Information on the correlation between rainfall/soil and reptile distribution requires attention.

5.2.7 Topography and Geographical distribution

The topography of the Grassland Biome is mainly flat to rolling, becoming mountainous in the east. Altitudes vary between 300 m on the coastal plateau to over 3 000m above sea level in the Drakensberg (Figure 3). The Drakensberg Escarpment is recognised as a landscape dissected with many incision breaks (Rutherford & Westfall 1994). Elevation and rainfall generally increase from west to east within the Grassland Biome, whilst temperature increases from east to west (De Waal 1978). The Great Escarpment is home to several isolated, endemic vertebrate and invertebrate species.

5.2.7.1 Topography of the Free State (Grassland Biome)

Studies by Lynch (1983) indicate that about 75 % of the Free State is composed of grassland, while about 20 %, (the south-west), is karoo and 5 %, (the north-west), is thornveld. Large areas of the eastern Free State are mountainous with montane grassland and patches of Afromontane forest. Extensive panveld occurs in the poorly drained, western half of the province. The Lesotho Highlands and the mountainous north-eastern Free State are extremely rich in amphibian diversity and endemic species (5.2.2.1).

5.2.7.2 Topography of the former Transvaal (Grassland Biome)

The Transvaal and Natal Escarpment form the eastern "boundary" of the Grassland Biome, with the Nylsvley wetland situated in the Transvaal Escarpment catchment area. The western "boundary" is characterised by the transition between Highveld grassland and Kalahari-

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

bushveld and savanna elements. A high diversity of reptile species and endemic species are found in the Afromontane grassland of Mpumalanga, areas that are increasingly exploited by commercial agricultural- and afforestation activities. This high diversity might be attributed to the thermoregulatory nature of reptiles, and to the various habitat niches that are provided by the broken landscape (see 5.2.3).

5.2.8 Area size and territoriality

5.2.8.1 Territorium size

Territorium size differs from area to area and from species to species. Factors that may influence residence size are; territoriality, competition, food, intraspecific niche differentiation (explained below), intraspecific body size (explained below and various other factors. These may act independently, or be interrelated in determining the distribution of a species.

Most lizards occupy areas large enough to provide them with food throughout their active period. Gyovai (1984) maintains that the spatial structure of *Lacerta* species, which live in sandy grassland, is primarily determined by their territorial behaviour.

Pearman (1993) has stated that the natural histories of tadpoles of *Bufo americanus* and *Rana clamitans* (North Carolina, North America) might respond differently to variation in habitat size, and that subdivision of their habitats has important effects on population and community processes. Subdivided habitat results in a higher edge-to-interior ratio, and this may lead to edge effects, (Lovejoy *et al.* 1986), in which habitat-interior species show decreased population density in small patches of habitat. Conversely, some species have been shown to exhibit decreased population densities in larger habitats. Pearman (1993) suggests that studies on habitat size are necessary because habitat size may affect the fitness of individuals, and not just the equilibrium population size. Intra-population variation in response to change in area size may occur, necessitating further studies, such information may be helpful in both the management and conservation context.

Krekorian (1984) states that range requirements between adult and hatchling desert

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

iguanas, (*Dipsosaurus dorsalis*) differ, as recapture studies have indicated that home range size increases with body size.

To determine the territorium size of a species, several models (territoriality, food preference, soil, climate, vegetation, etc.) should be considered. Such studies on the South African herpetofauna are still required. They will help to gain a better understanding of species' ecology, and help in selecting areas that can sustain viable populations.

5.2.8.2 Habitat fragmentation

Habitat fragmentation may result in the concentration of endemic and threatened species in natural remnants (Wood *et al.* 1994), increasing their vulnerability to habitat destruction, natural disasters, urbanisation, agricultural and industrial practices. Buffer zones around those areas conserving anurans will help to reduce the impact of some of these processes.

5.2.9 Habitat selection and foraging

Analysis by Whiting *et al.* (1993) indicates that habitat, and not prey, governs the spatial distribution of a Texas Horned Lizard, (*Phrynosoma cornutum*), population. The importance of food as a structural factor in habitat selection by South African reptile and amphibian species, still requires further investigation.

The differences in body size, head size and overall mean prey size (of anurans) suggest at least partial partitioning of prey on the basis of size amongst snakes (Vitt 1983), accentuating the importance of conserving amphibians as an important link in the trophic pyramid.

5.2.10 Human impact

The herpetofauna of South Africa is subjected to various harmful human activities, resulting in the reduction of species richness and abundance in some areas. This is especially so in the Grassland Biome region, with its high rate of urbanisation, high population density and its related human practices. Habitat destruction is the most important threat facing reptiles and

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

amphibians (Branch 1988). More than 65 % of the Highveld pans and wetlands have been altered by habitat destruction (Allan & Sharpe 1985), which has had a major effect on amphibians in particular (Lambiris 1988a).

Tortoises and turtles have been exploited heavily for their meat, eggs, shells, as well as in the pet trade. In South Africa, rural people eat tortoises, while some farmers and landowners will kill tortoises because of the belief that they compete with stock animals for grazing and that they spread tick-borne diseases.

The draining and destruction of wetlands, and the building of dams, disrupt the flow of water in upper catchments, whilst seasonal growth patterns become exaggerated (Kok & Seaman 1989). This results in and absence of anurans because of habitat destruction, and also because they are exposed to harmful iron and other precipitates that accumule below dams.

Unlike birds and larger mammals, reptiles and amphibians are less mobile, and, being habitat-specific, this makes these species very susceptible to habitat destruction. Several species are under threat because of the transformation and destruction of their natural habitat (e.g. *Agama aculeata distanti*, an endemic to South Africa which is placed under strain especially in south-western Transvaal, *Hemachatus haemachatus,* a South African endemic restricted to grassland and *Bufo rangeri*, endemic to South Africa).

Some species, however, are favoured by man-made construction. The species *Bufo gutturalis*, is widespread and common in urban areas. The species *Hyperolius marmoratus taeniatus* occurs commonly around dams and canals in the eastern and north-eastern Transvaal.

5.2.10.1 Habitat destruction

Various human activities contribute to reptiles and amphibians being increasingly endangered. As herpetofauna are not as mobile as birds and larger mammals, destruction of the habitats to which they are restricted, or direct mortality increasingly contribute to the threatened herpetofauna of the Grassland Biome. Intensive practising of the following activities pose a threat to the herpetofauna:

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

5.2.10.1.1 Agricultural development

Agricultural practices are the most important factor transforming vast areas of the Highveld, forming virtual floristic and faunal deserts. Maize farming has destroyed much of the habitat of the giant girdled lizard (*Cordylus giganteus*) (Newbery *et al.* 1983; Branch 1988). This species only inhabit relatively undisturbed grasslands and rejects fallow lands. It has therefore suffered a considerable reduction in range.

Various species are threatened by agricultural development. *Pedioplanis lineoocellata lineoocellata,* (an endemic grassland subspecies), utilises various vegetation types (Habitat type 2) of the Free State, north and north-western Transvaal (distribution within the Grassland Biome). *Platysaurus intermedius wilhelmi*, an endemic to the eastern Transvaal, has become extinct in certain areas. Much of *Psammophis phillipsii*'s habitat has been destroyed by agricultural practises, while *Prosymna sundevalli sundevalli* is a vulnerable endemic threatened by the destruction of termitaria by land owners.

5.2.10.1.2 Afforestation

Afforestation has not only caused the fragmentation of the herpetofauna of the Transvaal montane grassland (Jacobsen 1989), but has also changed in the flow of small perennial streams, as a result of the establishment of alien tree plantations. This may have drastic effects for the recruitment of indigenous frogs. Jacobsen (1989) states that afforestation has a greater effect on the herpetofauna than agriculture, which can be attributed to already mentioned factors. The establishment of tree plantations poses a serious threat to herpetofauna, as these monocultures destroy habitats suitable for amphibians (Drinkrow & Cherry 1995).

Grassland Biome endemics, that are also restricted to grassland vegetation types (Habitat type 1) (Table 24), such as *Tetradactylus breyeri* (Rare), *Nucras lalandii* (Restricted; tentatively secure) and *Bufo gariepensis gariepensis* (secure) are threatened by afforestation, fire and habitat destruction. Other species of Habitat type 2 (grassland & savanna/desert/forest/pans etc.) that are threatened (Table 19) by afforestation are listed below:

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

Species name	Habitat preference	Conservation status	Remarks
Ptychadene unzungewensis	montane grassland, bushveld	secure & unprotected	Habitat depleted; not represented in reserves
Hemisus guttatus	wooded grassland or grassy areas	currently secure & unprotected	Rare and peripheral
Breviceps sylvestris sylvestris	grassland, montane forest	vulnerable & unprotected	Endemic; habitat depleted
Dasypeltis inornata	montane grassland, mixed woodland	Vulenrable & partially protected	Endemic
Acontias plumbeus	woodland, savanna, highveld grassland	secure & protected	Seriously affected by afforestation
Acontias lineatus	montane grasslands, rocky outcrops	vulnerable & protected	Endemic

The endemic reptile species *Cordylus vittifer vittifer*, *Cordylus warreni depressus*, *Lygodactylus ocellatus soutpansbergensis* and *Lygodactylus o. ocellatus* are restricted to Highveld crevices and the rocky terrain of the mountains of the former Transvaal, Natal, and eastern Free State.

Most of the species mentioned above are restricted to the former eastern, south-eastern & north-eastern Transvaal, eastern Cape, Natal and northern Free State. These are all areas which are heavily exploited by afforestation.

5.2.10.1.3 Mining and industrial development

The south-eastern Transvaal is endowed with coal deposits that, underly the habitat distribution of *Cordylus giganteus* (Jacobsen 1989). Habitat destruction is detrimental to sensitive herpetofauna communities. The leaching of slime dams and ashing dams influences the water quality, and, therefore, the populations that depend on the water resources. Ther rare species *Prosymna sundevalli sundevalli*, which occurs in the Highveld grasslands, savanna and arid areas of the Free State and Transvaal (within the Grassland Biome context), is listed as vulnerable due to mining, urbanisation and agricultural activities.

Construction of the Majuba Power Station site in the southern Transvaal affects many of

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

the areas in which the giant girdled lizard (*Cordylus giganteus*) occurs. Some of the threatened colonies were translocated to undisturbed areas. Open-cast mining further contributes to local extinctions. Sulphur dioxide released by power stations in the Gauteng Province results in acidification of the Highveld. This is detrimental to the water quality, vegetation and thus the herpetofaunal community. The construction of power stations and open-cast coal mines in the south-eastern Transvaal, together with illegal collection and maize production, threaten the few remaining sites of the girdled lizard (Branch 1997).

5.2.5.10.1.4 Urbanisation

Conflict between ongoing urban development and preserving/conserving threatened habitats consequently results in the reduction of herpetofauna species restricted to those habitats. According to Jacobsen (1989), the diversity of reptiles and amphibians in the vicinity of the Pretoria region has declined, despite the presence of veld patches and hills close by. The growing human population is highest in the former Transvaal, and the increased pressure on natural resources, through overgrazing, also subjects various species to possible extinction.

Some species that have declined in abundance and distribution range because of urbanisation, are listed below:

Species name	Distribution	Remarks
Bradypodion transvaalensis	eastern & north-eastern Transvaal	vulnerable
Prosymna sundevalli sundevalli	Transvaal & Free State Highveld	vulnerable species endemic to the South Africa
Cordylus giganteus	north-eastern Free State, south-eastern Transvaal & Natal	Endemic to the Grassland Biome with very restricted range
Homoroselaps dorsalis	Free State, Transvaal, Swaziland and Natal grasslands	Vulnerable endemic especially threatened the in PWV area

5.2.5.10.1.5 Overgrazing

Busack & Bury (1974) state that ungrazed areas have twice as many reptiles and amphibians

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

than adjacent grazed areas, while diversity and species richness is also higher on ungrazed areas (Jones 1981). Overgrazing exposes the herpetofauna to predation, unfavourable temperatures, and it also has an effect on the food availability. This pertains especially to the Highveld grassland, where moribund termitaria form an important refuge for reptiles.

The species *Bufo vertebralis*, which utilises open grasslands with scattered tree clumps, is listed as indeterminate and declining because of habitat destruction by overgrazing and agricultural activities in the Free State, south-western Transvaal and the north-eastern Free State. *Pachydactylus affinis*, an endemic to the Transvaal, and *Afrixalus aureus* are threatened by the synergistic co-operation of overgrazing and human-induced fires outside the natural fire-regime.

5.2.5.10.1.6 Irrigation

Irrigation and dams along rivers can deplete the water supply, with devastating consequences for amphibian species. The construction of dams has led to the destruction of habitats, and thus threatens species restricted to these former habitats. Dams can, however, promote the proliferation of certain species of amphibians, often at the expense of others (Jacobsen 1989).

5.2.5.10.2 Road mortalities

Some amphibians experience high seasonal road mortalities when they migrate to their breeding sites. This can be seen especially after summer rains in the Grassland Biome. The seasonal casualty rate of bullfrogs (*Pyxicephalus adspersus edulis*) in the Benoni-Kempton Park area is very high, while bullfrogs around Hartebeeshoek and Krauseville have disappeared during the past few years, mainly because of road mortalities. Only species such as *Varanus albigularis* and *Kinixys spekii* (an endemic species: Habitat type 2) are also frequently killed whilst crossing roads.

5.2.5.10.3 Pet trade and over exploitation

The giant girdled lizard *Cordylus giganteus* is listed in CITES, but despite this, they continue

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

to be smuggled abroad. The status of *Pachydactylus bibronii*, a peripheral species to the Grassland Biome, found in termitaria and rocky outcrops in grassy areas, is currently secure, but threatened by trade in this species. Other species that are currently secure, provided that commercial exploitation is prevented, are *Cordylus warreni barbertonensis* which inhabits rocky outcrops in savanna, woodland and grasslands in the Grassland Biome, *Pseudocordylus langi* (Habitat type 3) and *Pseudocordylus melanotus transvaalensis*, which inhabits grassland rocky outcrops in the study area. These three species are endemic to the Transvaal. *Homopholis wahlbergii*, a peripheral species to the Biome, is currently secure, with trade in this species being the only threat.

Dried skins of the giant girdled lizard are used occasionally by traditional healers for "muti". Serum production may have serious implication for certain species. Some species, such as *Naja nivea* (snake), are listed as endangered because of the high rate of habitat destruction of their ranges in south-western Transvaal, south-western Free State and Lesotho, and because of persecution.

5.2.5.10.4 Pollution

Chemical pollutants, as well as human and industrial effluent pose a threat to reptiles and amphibians, especially in the Gauteng. Pesticides intended for the red-billed quelea (*Quelea quelea*) have resulted in the unintentioned death of various reptiles (e.g. *Chamaeleo dilepis dilepis*) and amphibians.

Frogs do not drink water and most of their water requirements are met by absorption throug the skin. Areas such as the belly and limbs are well supplied with blood vessels, which enhances water uptake (Passmore & Carruthers 1995). This also makes aquatic and terrestrial forms particularly susceptible to poisoning by pollutants through the skin (Kok & Seaman 1989). Species such as *Breviceps sylvestris taenitus*, a montane grassland and -forest form, have been severely affected by silvicultural and agricultural activities.

5.2.5.10.5 Alien introductions

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

In many cases, alien introductions have detrimental effects on the indigenous herpetofauna. Such introductions may result in direct or indirect competition for food or habitat, or lead to increased mortality due to predation or parasitism. These effects may occur on biome level, via effects on some aspects such as nutrient cycling and fire regime, or at species level.

The American red-eared terrapin, *Chrysemys scripta elegans*, is a threat to South Africa's beleaguered ecosystems (Newbery 1984). Baby red-eared terrapins are illegally imported into South Africa by the hundred and sold as "pets". The usual consequence is that the owner decides to dump the adult, outgrown terrapin into the nearest available waterbody. red-eared terrapins have already been found in dams and rivers around Pretoria, in the Zoo Lake in Johannesburg and in Moreletta Spruit near Silverton. The reproductive success of animals kept in large open pits on the Transvaal highveld has been very good, and it is safe to assume that reproductive success will also be good for those individuals released into the natural environment (Newbery 1984). Lately a number of salmonella infections in human beings have been traced back to pet terrapins, most of which were *Chrysemys scripta*. Illegal release of an exotic animal into the wild in this country could have far-reaching and harmful consequences for our natural ecosystems.

5.2.11 Fire

Tortoises are vulnerable to veld fires. If exposed to a fast burn, the tortoise will survive, but slow burns will expose the tortoise to intense heat and the chances of survival would virtually be nil (Boycott & Bourquin 1988). Winter fires are less likely to affect tortoises as most will be overwintering beneath termite mounds, in burrows or in rock crevices, while summer fires, when tortoises are more active, could have a detrimental effect on populations.

In grasslands and savanna, fires have been part of the natural order, and some tortoise species could well be fire-adapted (Boycott & Bourquin 1988). Under natural conditions, the fires occur when the eggs of the tortoises are under the ground, and hatching only commences after the first rains have softened the hard-baked ground. The disturbance of the natural fire regime as induced by human activities may very well be having detrimental effects on tortoise populations.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Snyders (1987) has further observed that injudicious fire use by humans has resulted in the destruction of many grassland herpetofauna, especially tortoises, while species in burned areas were also more prone to predation. He also found that lizards prefer areas exposed to different fire regimes. The creation of reserves should ensure that a variety of post-fire stages are present, and that key habitats are protected from inappropriate fire regimes.

A species-rich lizard community responded variably to a range of experimental fire regimes in the savanna forest of Kakadu National Park, Kapalga (Australia). Lizard composition after fire was affected by changes in microclimate, trophic relations, reproduction and vegetation structure (Mushinsky & Gibson 1991). Changes in the abundance of lizard species may be related to changes in habitat variables, especially changes in the vegetation structure (Trainor & Woinarski 1994).

In the short term, lizard mortality during fires has been found to be low, but in the period after the fire, lizard survival and reproduction may be indirectly affected by fire because of reduced food and shelter (Fox 1978) and increased rates of predation. Litter-dwelling lizards, particularly skinks, have been found to decrease after fire, while studies by Patterson (1984) showed that the density of skinks in a New Zealand grassland was reduced by 28 % after a fire.

Trainor & Woinarski (1994) suggest that lizards select particular habitat cues relating to the environmental gradient, and thus the patterning of lizards is largely a product of the broader environment (interrelated conditions of soil, vegetation structure, moisture), rather than the effect of fire treatment.

Mesic-adapted lizards may be sensitive to intense, late, dry-season fires, which can alter the structure, and presumably the microclimate of this habitat type (Trainor & Woinarski 1994).

Nucras lalandii, an endemic restricted to the Highveld and montane grasslands of the Drakensberg Escarpment (Grassland Biome distribution: south-eastern-, north-eastern Free State, eastern Cape), is an uncommon lizard threatened by afforestation and veld fires

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

(Jacobsen 1989). *Chaemsaura anguina anguina*, a South African endemic restricted to rocky montane grasslands of the eastern Transvaal, Natal and southern Cape, is a species whose habitat has largely been destroyed by annual fires and afforestation. It is suggested that the occurrence of this species should be monitored. Several other species are threatened by fire, especially fires induced by humans and that fall outside the natural fire regime. Some of these species are:

Species name	Habitat preference	Remarks
Pachydactylus affinis	Habitat type 2	Transvaal endemic
Chamaesaura macrolepis	Habitat type 2	A rare Grassland Biome endemic
Pedioplanis burchelli	Habitat type 3	Endemic with restricted range
Amplorhinus multimaculatus	Habitat type 1	Vulnerable & very uncommon

5.2.12 Threatened status of the Grassland Biome Herpetofauna

The RDB status of Grassland Biome herpetofauna (Table 19) (Figure 10) compared to that of the South African Herpetofauna is summarised below:

Scale	Extinct	Endangered	Vulnerable	Rare	Indeterminate	Total
Grassland Biome	1	1	24	7	18	51
South Africa	1	6	15	12	2	36

From the figures quoted above it may be deduced that the number of threatened species has increased, and that threatened Grassland Biome species outnumber that of threatened South African species. In total, 93 reptile and amphibian species are recorded in the RDB (Branch 1988), while the Grassland Biome employs another category, namely species with status unknown, totalling 29 species.

Therefore, eighty Grassland Biome species are listed as species which should enjoy a higher conservation priority. Some RDB species include the following:

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

Species name	Threatened status
Mabuya homalocephala smithi	vulnerable
Acontia brevicepts	vulnerable
Chamaesaura macrolepis	rare
Naja nivea	endangered
Homoroselaps dorsalis	vulnerable
Dasypeltis inornata	vulnerable

Various species that occur in the Grassland Biome are secure, and sufficiently protected within reserve networks, especially those species that are not restricted only to the grassland vegetation types within the area. Grassland specialists (Habitat type 1), however, are not well represented in protected areas. Among the 27 endemic grassland species, four species are considered vulnerable (with *Tetractdactylus eastwoodae* possibly extinct), two species as not secure, one species is considered rare, two species are considered indeterminate, while the status of 12 species is unknown. Only six species are of secure status (one species has a restricted range). Of these 27 endemic grassland species, only eight species are protected (or possibly protected), three species are partially protected (e.g. *Homoroselaps dorsalis*, considered vulnerable), two species are unprotected, (*Acontias breviceps*) is considered vulnerable while the conservation status of twelve of the species are unknown (Table 20). *Cacosternum nanum nanum*, an endemic inhabitant of montane and Highveld grassland of the Transvaal- and eastern Cape Escarpment, does not appear to be represented in any provincial reserve, while *Tetracdactylus eastwoodae* (extinct ?) and *Cordylus giganteus*, two grassland endemics, are conservation priority species.

Various species, as listed below, are well represented in reserves, but not all species' conservation status is secure. This could be caused by insufficient area size for viable populations, as in the case of *Dendroaspis polylepis* (central & northern Transvaal) (Jacobsen 1989), or to small, surrounding buffer zones.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

Species occurring in reserves are listed below:

Species name	Habitat preference	Conservation status
Mabuya capensis	Habitat type 2	Protected & secure
Atractaspis bibronii	Habitat type 2	Partially protected & secure
Crotaphopeltis hotamboeia hotamboeia	Habitat type 2	Partially protected & secure
Schismaerma carens	Habitat type 6	Unprotected & secure
Pelomedusa subrufa subrufa	Habitat type 6	Protected & secure
Bufo garmani	Habitat type 6	Unprotected & secure
Kassina senegalensis	Habitat type 2	Unprotected & secure
Rana angolensis	Habitat type 2	Unprotected & secure
Breviceps adspersus adspersus	Habitat type 6	Unprotected & secure

5.2.13 Conservation

Suitable sites for the conservation of the Grassland Biome herpetofauna urgently need to be identified and secured. Understanding the processes that threaten the species is therefore of essential concern for their conservation. Even if reserves and appropriate management successfully prevent or mitigate threatening processes, their value will depend to a large extent on the condition and use of surrounding unreserved land.

A locality record in a protected area does not guarantee either the short- or long-term preservation of species. The establishment of buffer zones around areas conserving anuran diversity should be considered, as these could considerably increase the effective core reserve size (Drinkrow & Cherry 1995). Protected areas in South Africa are well distributed in that they favour overall species richness, but they do not conserve endemics adequately (Drinkrow & Cherry 1995).

The chelonian fauna of southern Africa is relatively well protected in existing reserves, but several tortoise species are still inadequately protected. It is recommended that further

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

protected areas with sufficient buffer zones around the areas be established.

Although three parks have been selected with the prime purpose of protecting the habitat of tortoises, (none of which are situated in the Grassland Biome), the co-operation of all farmers and landowners, in areas where rare species of tortoises still survive, is essential to succeed in their conservation. Tortoises are protected in South Africa, and to ensure their continued existence it is of utmost importance to preserve their habitat and not to remove the animals from the veld.

Protective legislation varies from province to province. Indigenous terrapins are protected in the former Transvaal and the Cape Provinces, while in the Free State, trade and the captivity of terrapins without a permit is prohibited. In Kwazulu-Natal, terrapins may be kept in captivity without a permit.

5.2.14 Conclusions

The Grassland Biome is characterised by a high diversity of reptile and amphibian species. Nearly half of the species are endemic to the Grassland Biome or to southern Africa. Studies on lizards in other countries have indicated that vegetation structure plays an important role in the spatial structuring of lizard communities, while prey availability, soil, climate, altitudinal variation, optimisation of thermoregulation by lizards and human activities also co-operate or dominate at times. Limited research on the factors, (and their synergistical interaction), that determine the distribution of South African herpetofauna species, has been conducted and published.

There are high levels of endemics in the Drakensberg Escarpment of the eastern Transvaal and Free State, emphasising the importance of conserving these areas, where habitat destruction by afforestation in particular, is the order of the day. The majority of the grassland specialists are threatened, necessitating the establishment of more reserves in the Grassland Biome to preserve not only species richness, but also the endemic species.
To attain this goal, it is necessary to obtain more information on the herpetofauna's ecology and biology to ensure the maintenance of the Grassland Biome's diversity.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

5.2.15 Recommendations

The conservation of the Grassland Biome herpetofauna is justified by the high species diversity and endemicity, as well as by the threatened status of numerous species. Although various species occur within a reserve network, several grassland endemics and -specialists are insufficiently protected and conserved. Conservation of such species can only be ensured if more reserves are added, with the adjacent buffer zones being adequately large enough to accommodate viable populations. If one were to select such an area, it should include the Drakensberg Escarpment, with as much grassland vegetation included as possible (especially in the Qwa-Qwa area), so that it accommodates species with different altitudinal preferences. This area should also include the various aquatic- and marshy vegetation- and habitat types to accommodate the various amphibian species, as well as with termitaria and rocky outcrops, which should be protected against any destructive activities.

The selected area should thus follow a east-south-west direction, similar to that proposed for birds. In order to preserve the South African herpetofauna and their habitat requirements adequately, more detailed information is needed.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

CHAPTER 6

Butterflies of the Grassland Biome

The South African Grassland Biome has a relatively large number of endemic species of birds, grasshoppers, and butterflies (Dirsh 1956; Brown 1962; Siegfried 1992; Pringle *et al.* 1994), but has been largely transformed by human activity. Remaining grassland areas are under constant pressure from, especially, agriculture and commercial afforestation, resulting in the decline of species diversity of grassland birds and grasshoppers (Samways & Moore 1991; Allan *et al.* 1995).

Carcasson (1964) suggested that biogeographical classification of African butterflies should be based on habitat rather than on semi-arbitrary, geographic barriers. Accordingly, the Lepidoptera of the southern African Grassland Biome are geographically placed into the Cape sub-region. Butterfly genera of the grassland, mountains and the Karoo of southern Africa show a high level of local endemism, in contrast to the impoverished butterfly fauna of the dry bush areas and forests (Carcasson 1964). Increasing destruction and the conversion of grasslands by industrial, agricultural, afforestation and urbanisation practices, have resulted in 16 % of the butterfly species included in this study, being recorded in the RDB of Butterflies. Effective conservation and maintenance of the Grassland Biome butterfly diversity can only be achieved if their habitat requirements and their interaction with the biotic and abiotic environment are known.

6.1 Results

A total of 195 butterfly species/subspecies are included in the inventory of the butterflies of the Grassland Biome (Table 3). Data were assessed and categorised under the following headings: Habitat preference, "Boundary status" (definition explained under "Methods: Butterflies"), Red Data Book status, Grass feeding species and Family grouping of Grassland Biome butterflies.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

6.1.1 Habitat preference

Butterflies were grouped into four classes according to their habitat preference (Figure 11). These classes, with the number of species in each, are given below:

Habitat type in Grassland Biome	Number of species
Grassland	49
Grassland in combination with other vegetation types	65
Habitats other than grassland	80
Habitat unknown	1

6.1.2 "Boundary" status

In distribution maps of butterflies, ranges are not always clearly delimited, and locality records do not always agree with the distribution areas shown by these maps. Three categories (Biome species, Marginal species, Ecotonal/Edge species) were used to explain to which degree species belong to the Grassland Biome. At least 148 butterfly species (Biome species) definitely occur in the Grassland Biome (Table 26) as delimited by Low & Rebelo (1996). Another twenty-five species are classified as Marginal species, i.e. species whose locality records indicate that they do occur within the Grassland Biome (species that also prefer grassland as habitat), but where the distribution maps do not necessarily agree with the map of Low & Rebelo (1996). Twenty-two species are classified as ecotonal/edge species. These are species whose locality records indicate that they are occasionally recorded in grasslands, but according to their distribution maps and main habitat preference, they occur in the ecotones, or immediately outside the Grassland Biome "boundaries".

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

The three "boundary" classes, with the number of species occurring in each defined habitat type class (Figure 11), are listed below:

Habitat types	Non-edge species	Marginal species	Ecotonal/Edge species	Total
Grassland	34	11	4	49
Grassland/other vegetation types	57	6	2	65
Non-grassland	56	8	16	80
Unknown	1	0	0	1
Total	148	25	22	195

6.1.3 Red Data Book status (according to Scientific Programmes Report 158, 1989)

Increasing destruction and conversion of grasslands by industrial, agricultural, afforestation and urbanisation practices, have resulted in 16 % (32 species) of the butterfly species included in the present study, to be recorded in the Red Data Book (RDB) of Butterflies. One grassland species (*Lepidochrysops hypopolia*) has presumably become extinct, while two species are vulnerable, 20 are rare, and nine species are listed as indeterminate (Table 27) (Figure 12).

6.1.3.1 Habitat preferences of RDB species

Twenty species occur in grassland only, five species in grassland and other habitats, and seven RDB species prefer habitats other than grassland. The following table gives an indication of the number of RDB species occurring in each habitat type, as well as species depending on grass as a food plant in each vegetation type:

Habitat preference	Number of RDB species	Grass-feeding species
Grassland	20	8
Grassland and other habitats	5	3
Other habitats	7	11
Total	32	22

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

- Grassland habitat

Lepidochrysops hypopolia is listed in the RDB as extinct, whilst two species are listed as vulnerable, thirteen species as rare and four species as indeterminate. Eleven of these species depend on grass as a larval food plant. Of these 11 grassland specialists feeding on grasses, one is extinct, five species are rare, and five species are classified as indeterminate.

- Grassland and other habitats

Two butterfly species are listed as rare, and another three species as indeterminate. Three of these species feed on grass: two species are rare, one is of indeterminate status.

- Other habitats

The seven RDB butterfly species occurring in habitat types other than grassland, consist of five rare, and two indeterminate species. None of them feed on grass.

6.1.3.2 Subdivision according to "Boundary" status

- Non-edge species

Twelve of these RDB species have their distribution range in the Grassland Biome. *Lepidochrysops hypopolia* is thought to be extinct, whilst nine species are listed as rare and two species as indeterminate.

- Marginal species

Thirteen marginal species are recorded in the RDB. Eight of these are rare and five are of indeterminate status.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

This category comprises five of the RDB species that are occasionally found in the grasslands of southern Africa. Three of the species are rare, and two of the species are of indeterminate status.

It is suggested that RDB species that occur in grassland only, and whose larval stage depends on grass swards, given a high conservation priority. In the table below, each RDB category is explained in terms of the number of species which occur in each "Boundary" type, the number of species that are restricted to grasslands (Grassl. inhabitant), and the number of species that feed on grass only.

RDB status	*Non-edge species (Total) Grassl. inhabitant/Grass feeder	*Marginal species (Total) Grassl. inhabitant/Grass feeder	*Ecotonal/Edge species Total) Grassl. inhabitant/Grass feeder	*Total A/B**
Extinct	1 1 Unknown	0 0 0	0 0 0	1 1 0
Vulnerable	0 0 0	0 0 0	2 2 0	2 2 0
Rare	9 7 4	8 2 1	3 2 1	20 11 6
Indeterminate	2 0 0	5 3 4	2 3 4	9 6 8
Total	**12** **8 4**	**13** **5 5**	**7** **7 5**	**32** **20 14**

* These values are given in the top, middle of each block. The figure given left in each block is explained by the heading given on the left in the column headings, (the same applies to the figure given in the right of each block). ** The A/B values represent the totals of the left (A) figures and right (B) figures in each row.

6.1.4 Grass-feeding species

The larvae of 33 butterfly species feed exclusively on grass swards. This number comprises 13 grassland specialist species, ten species which utilise grassland in combination with other

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

grassland specialist species, ten species which utilise grassland in combination with other vegetation types, and 11 species which utilise vegetation types other than grassland (Table 28).

The 13 grassland specialists are comprised of eight non-edge-, three marginal- and two ecotonal/edge species. Due to the specificity of their habitat and food resources, it is suggested that these species be given a high conservation priority. A summary of the grass feeding (larval stage)butterflies' "boundary" status, together with their habitat preference, is listed below:

Habitat type	Non-edge grass feeder	Marginal grass feeder	Ecotonal/Edge grass feeder	Total
Grassland	8	3	2	13
Grassland & other vegetation types	7	2	1	10
Non-grassland	5	4	1	10
Total	20	9	4	33

6.1.5 Family/subfamily grouping of Grassland Biome butterflies

Data on butterfly family grouping were assessed according to the butterflies' Habitat preference, "Boundary Status", Red Data Book status, and Larval grass-feeding status of each family.

The total number of Grassland Biome butterfly species represented by each family, are listed below:

Family	Subfamily	Number of species/subspecies
Lycaenidae	*	77
Hesperiidae	*	41
Pieridae	*	23
Paplionidae	*	2
Nymphalidae	Satyridae	22
Nymphalidae	Danainae	4
Nymphalidae	Acraeinae	9

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

Nymphalidae	Charaxinae	5
Nymphalidae	Unknown	1
Nymphalidae	Nymphalinae	11
Total	*	195

6.1.5.1 Habitat preference

The habitat preference of the respective butterfly families in relation to their "Boundary-" and RDB status are summarised in Table 29. Forty-nine of the species/subspecies included in the study are grassland specialists . Twenty-eight (36 %) butterflies of the Lycaenidae, 59 % (13 species) of the Satyridae, 18 % (2 species) of the Nymphalinae 12 % (5 species) of the Hesperiidae, and one species (10 %) of the Acraeinae are grassland specialists (Table 25).

6.1.5.2 "Boundary status"

The subdivision of the butterfly families according to their "Boundary status", are summarised in the text below. The results show that the largest proportion of most families are represented in the Non-edge boundary class. One hundred percent of the Papilionidae falls in this category, 91 % of the Nymhalinae, 88 % of the Hesperiidae, 83 % of the Pieridae, 74 % of the Lycaenidae and 64 % of the Satyridae fall within this category (other percentages are listed in Table 29). Fifty percent of the Danainae are Marginal species, whilst 80 % (four species) of the Charaxinae are Ecotonal/Edge species.

6.1.5.3 Red Data Book species

Thirty-two Grassland Biome butterflies are RDB species (Table 27). The RDB status of the various Grassland Biome butterfly families are listed below. Thirty-five percent of the Satyridae (five rare and three indeterminate), 24 % of the Lycaenidae (one extinct, two vulnerable, 12 rare and four indeterminate), ten percent of the Hesperiidae (three rare and one indeterminate) and one species of the family Acraeinae (ten percent) are threatened by various activities(see discussion below).

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

6.1.5.4 Larval Grass feeding species

Thirty-three Grassland Biome butterfly species feed on grasses during their larval stage (Table 28). Eighty-two percent (18 species) of the Satyridae feed on grass as larvae, while two of the Danainae (50 percent), 24 % (ten species) of the Hesperiidae and four percent (three species) of the Lycaenidae depend on grass as food during this stage.

6.1.5.5 Summary of data based on Family grouping of Grassland Biome butterflies

From the table summarised below, it can be seen that the Satyridae are mainly grassland specialists (59 %), while the Satyridae (81 %), the Danainae (50 %) and the Hesperidae (24 %) are the family groups which depend mostly on grass as laval food. In terms of RDB species, the subfamily Satyridae (24 %) and the Lycaenidae (24 %) are the most threatened families in the Grassland Biome. The Satyridae is also the family which features most prominently in all the categories.

6.2 Historical relict elements

The palaeogenic invertebrates are among the most archaic animals in the southern African fauna, and they contribute to its temperate facies (Stuckenberg 1962). These elements are mostly relict types belonging to a stock of ancient invertebrates confined to South Africa within the Ethiopian Region. The distribution of some of these palaeogenic elements is related to a certain range of temperature and humidity conditions peculiar to montane areas (such as alpine grasslands).

The distribution of Blepharoceridae (flies) (Diptera) shows three foci of speciation in the Eastern Highlands Centre. The distribution of Megaloptera , family Corydalidae and family Sialidae, are indicated by four endemic genera. The genera *Taeniochauliodes* (Cordydalidae) and *Leptisialis* (Sialidae) occur on the mountains of the eastern Drakensberg escarpment. One species of the genus *Taeniochaliododes* occurs in the south-west Cape and is distributed along the Fold Mountains. It also occurs in Kwa-Zulu-Natal on the Drakensberg and on the Karkloof Range in the Lesotho-Drakensberg Highlands. One species of the genus

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

The butterfly composition of the Grassland Biome is given below:

Family	Subfamily	Non-edge species	Marginal species	Ecotonal/Edge species	Grassland specialists	Larval Grass feeder	RDB Species	Total species
Lycaenidae		57 (74)	14 (18)	6 (8)	28 (36)	3 (4)	19 (25)	77
Hesperiidae		36 (88)	3 (7)	2 (5)	5 (12)	10 (24)	4 (10)	41
Pieridae		19 (83)	0	4 (17)	0	0	0	23
Papilionidae		2 (100)	0	0	0	0	0	2
Nymphalidae	Satyridae	14 (64)	4 (18)	4 (18)	13 (59)	18 (82)	8 (36)	22
Nymphalidae	Danainae	2 (50)	2 (50)	0	0	2 (50)	0	4
Nymphalidae	Acraeinae	6 (70)	2 (20)	1 (10)	1 (10)	0	1 (10)	9
Nymphalidae	Charaxinae	1 (20)	0	4 (80)	0	0	0	5
Nymphalidae	Nymphalinae	10 (91)	0	1 (9)	2 (18)	0	0	11
Nymphalidae	Unknown	1 (100)	0	0	0	0	0	1
Total		147	25	22	49	33	32	195

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Leptosialis occurs in the south-west Cape, as well as in Kwazulu-Natal on the Escarpment. The Dermapteran, *Esphalmenus peringueyi* (Bormans), is strictly montane and has been found in the Lesotho highlands, southern Drakensberg and in the Cape Fold Mountains, westward to the Cape Peninsula. At least two species of the genus *Atherimorpha*, (a genus of the Diptera) occur in the Lesotho-Drakensberg Highlands. The endemic genus, *Arthroteles*, is strictly montane, with one species in the Kwa-Zulu-Natal Drakensberg, and two to three species in the south-west Cape (Stuckenberg 1956). The genus *Peripatopsis* has its centre in the Cape Fold Mountains, with one species extending its range eastwards from the Western Cape to KwaZulu-Natal.

A synopsis of the patterns shown by these groups indicates that the overall distribution of the palaeogenic elements can be attributed to the altitude, relief, aspect, rainfall and the distribution of the Stormberg Volcanic Series. This series of lavas is responsible for the altitude and relief of the highlands of Lesotho and the fringing Escarpment. The range of the montane palaeogenic elements falls into two parts: the Cape Centre and the Eastern Highlands Centre.

The Eastern Highlands Centre, which falls within the Grassland Biome, can be subdivided into three centres: the Lesotho-Drakensberg Highlands and Eastern Plateau Slopes (today occupied by alpine grassland and represented by Cape macchia elements), the Amatola range (built of Karoo rocks), and the Eastern Transvaal Subcentre.

Palaeogenic elements in the Lesotho-Drakensberg Highlands and Eastern Plateau Slopes subcentre are represented by aquatic immature stages in the Blepharoceridae and Megaloptera, whilst among the grassland insects, there are relatively few palaeogenic elements up to about 2 100 m at Cathedral Peak in the Drakensberg. Above 2 280 m, however, a change is evident (Stuckenberg 1962). Lowland insect species decrease, and the number of endemic species increases. Above 2 700 m, the number of fauna and flora species is greatly reduced, but most of these species are endemics, many belonging to palaeogenic groups.

The Lesotho-Drakensberg Highlands, although poorer in genera than the Cape Centre, is considered the node from which palaeogenic elements have spread. This statement is based on

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

the fact that these highlands are an ancient physiographic entity (King 1942), and will not be discussed in finer detail in this section.

- **Lepidoptera of southern Africa and the Grassland Biome**

Carcasson (1964) claims that butterflies are ideal for studying zoogeographical distributions: many species are restricted to particular habitats by their dependence on special food plants and by the narrow ranges set by their climatic optima.

The Cape sub-region, to which the Lepidoptera of southern Africa belong (Carcasson 1964), is further subdivided into four zones. These are the high level grasslands of the Free State, Natal, Transvaal, the mountains of the Cape, as well as small montane areas in the eastern districts of Southern Zimbabwe are one such entity. The Cape sub-region is characterised by a high percentage of endemic genera and species, particularly of the families Satyridae and Lycaenidae. These families are associated with a very rich and ancient fauna (Carcasson 1964). Butterfly genera of the grassland, mountains and the Karoo of southern Africa show a high level of endemism in contrast to the impoverished butterfly fauna of the dry bush areas and forests. It is believed that the Cape sub-region butterflies used to occur over a much larger area in the past. The butterfly genus *Lepidochrysops* has an exceptionally high concentration of endemic species in the highveld of the Transvaal and Natal (Carcasson 1964). *Durbania* is an endemic genus, with the family Satyridae also having many endemics distributed throughout the South African mountains and the eastern border of Zimbabwe (Carcasson 1964). Various other endemics occur in southern Africa.

Species richness of butterflies is greatest at low altitude (< 1500 m) in the north-eastern Cape, South Africa, but lowest at intermediate altitude, owing to the large numbers of endemic species above 1700 m, especially on basalt mountains (Armstrong & Van Hensbergen 1997). Species richness was found to be the highest in valleys, with the fewest butterflies recorded on crests (Armstrong & Van Hensbergen 1997).

The following endemic species were recorded by Amstrong & Van Hensbergen (1997) in the Eastern Cape grassland, but more endemics are found in the Grassland Biome in its entirety

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

(data from Armstrong & Van Hensbergen 1997). M indicates Afromontane endemics; B represents South African montane endemics and S South African endemics):

Species name	Endemic status	Species name	Endemic status
Aeropetes tulbaghia	M	*Lepidochrysops asteris*	B
Hyalites anacreon	M	*Metisella malgacha orina*	B
Kedestes mohozutza	M	*Paralethe dendrophilus*	S
Dingana b. bowkeri	B	*Cassionympha cassius*	S
Pseudonympha varii	B	*Aloeides macmasteri*	S
Pseudonympha magoides	B	*Poecilmitis chrysaor*	S
Stygionympha s. scotina	B	*Lycaena clarki*	S
Durbania a. amakosa	B	*Eretis u. umbra*	S
Capys alphaes extentus	B	*Acrea horta*	S
Harpendyreus noquassa	B		
Lampides boeticus	B		

The Grassland Biome, and in particular the Afromontane and Alpine grasslands have proven to be the origin of several invertebrate evolutionary lines. It is also high in endemic invertebrate species. This also applies to butterflies, with several species being restricted to these areas.

6.3 Butterflies as an indicator group

The basic criteria for a good indicator group is that it should be diverse, with a sound taxonomic base, and effective and simple sampling techniques should be available. The group should be sensitive to environmental change, and if it is sensitive to vegetation change, a phytophagous group should be indicated. Butterflies have a high public profile, especially in Britain, and are considered a sign of a "healthy" environment (Woiwod & Stewart 1990). It has been suggested by many researchers that butterflies are well suited as indirect measures of environmental variation because they are sensitive to local weather, climate, and light levels (Watt *et al.* 1968; Ehrlich *et al.* 1972; Weiss *et al.* 1988). Butterflies are directly dependent on plants, and butterfly diversity may serve as a surrogate for plant diversity.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

Erhardt (1985) maintains that butterfly communities act as a very sensitive indicator of vegetation structure and changes in the primary natural and anthropogenetic vegetation. Because butterflies are such sensitive indicators of habitat structure, they are important animals for the evaluation of nature reserves. It is important to realise that each vegetation type is inhabited by its own characteristic Lepidoptera fauna (Erhardt 1985). Where successional stages with young trees and shrubs may be poor for butterflies, it may be favourable for mammals and birds (Erhardt 1985). Therefore, the optimal strategy for nature conservation would be to preserve a balanced combination of all possible types of vegetation, especially as whilst butterflies may not be favoured by some successional stages, it may be beneficial to birds and other avifauna.

6.4 Factors determining butterfly distribution

Various factors can influence the suitability of an area as habitat for butterfly species. Elements such as the presence of the host plant and its growth stage, the microdistribution of the host plant, the presence of parisitoids and predators, other host organism, edaphic factors, climate and the application of pesticides can influence the suitability of a habitat for the persistence of butterfly species (Van der Merwe & Van Wyk 1997). Thus, all aspects of butterfly behaviour are adapted to enable them to find food and mates, to avoid predation and to avoid or endure climatic conditions (Henning *et al.* 1997).

Herbivorous insects are regulated at low densities by interactions with their host plants, predators, parasites, and/or pathogens (Berryman *et al.* 1987). These authors suggest that interactions between herbivores and these factors could all be potentially involved in negative feedback regulation, because they respond to herbivore density and feed back negatively to reproduction and survival. Exogenous factors such as climate, soil and land-form; which do not change in response to population density, are not considered to be part of the regulatory process.

Factors that influence the habitat selection of *Anthocharis cardamines* (Lepidoptera) (Switzerland), are the availability of host plants, nectar-source plants and habitat selection of males and females. Males tend to be more sedentary, while females are more vagrant (Wiklund

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

& Ahrberg 1978).

Habitat preferences of male and female butterflies may differ. Mated females spend most of their time flying around trying to locate suitable host plants to deposit their eggs, whilst males remain restricted to their habitat preferences, searching for females and selecting habitats with their preferred nectar source plants (Wiklund & Ahrberg 1978).

Several factors determining butterfly distribution and abundance are addressed under 6.5.1 – 6.5.8.

6.5.1 Vegetation

In general, the species richness of butterflies is closely correlated with species richness of vascular plants, but factors such as cultivation methods and degree of succession after abandonment of lightly cultivated grassland have different influences on species richness of Lepidoptera and vascular plants (Erhardt 1985).

In the subalpine region of Central Switzerland (Tavetsch Valley), studies have shown that a close correlation between butterfly fauna and vegetation type concerning species composition and species richness of Lepidoptera exists (Erhardt 1985). In this area, the vegetation consists of different types of cultivated grassland in various stages of development, abandoned grassland and woodland vegetation. Results show that species richness of butterflies is highest in early abandoned stages of grassland, falling rapidly with the arrival of shrubs and trees and intensively cultivated grassland.

The butterflies of the Grassland Biome were categorised according to their habitat preference (which may be the result of the interaction of various factors) into three classes: Grassland species, Grassland & other vegetation type species and species that prefer "Other habitat types" (excluding grassland).

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

6.5.1.1 Grassland Biome vegetation

6.5.1.1.1 Grasslands types (Habitat type 1)

The grassland specialist species, which belong to this category, show a variation in their preference of grassland type, stressing how important it is to conserve a variety of habitat types to maintain species diversity (floral & faunal).

- Wooded grassland:

Species name	Habitat	Larval food
Dira jansei	wooded grassland on south facing slopes	grass species
Lepidochrysops jeffreyi	grassy hilltops and slopes with scattered trees	*Becium obovatum*

- Rocky grassland:

Species name	Habitat	Larval food
Aloeides rossouwi	rocky gullies below the summit of grassy escarpment: south-west Stofberg	Unknown
Aloeides merces	rocky edge of Drakensberg mountain	Unknown?
Stygionympha vigilans	rocky areas in open grasslands in mountainous country	various grass species & *Restio cincinnatus*
Pardopsis punctatissima	rocky habitats	*Hybanthus capensis*
Durbania amakosa amakosa	rocky grassland	Lichen

- Shrub & sandy grassland:

Species name	Habitat	Larval food
Aloeides macmasteri	grassland, Karoo	Unrecorded
Aloeides pringlei	coarse grass and shrub on sandy loam	*Merxmuellera* grass
Aloeides dentatis maseruna	flat grassland on sandy gravel soil	*Hermannia jacobifolia*

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

- High elevation grassland:

Species name	Habitat	Larval food
Dingana alaedeus	high elevation grassy ridges of Mpumalanga Drakensberg escarpment: Wakkerstroom	Unknown
Torynesis orangica	high elevation grassland of Golden Gate	Unknown

- Grassy slopes:

Species name	Habitat	Larval food
Pseudonympha magoides	grassy slopes of hills	Various grasses
Lepidochrysops lotana	grassy slopes	*Becium obovatum*
Lepidochrysops pephredo	grassy slopes	*Becium obovatum*

- Moist grassland:

Species name	Habitat	Larval food
Aloeides nubilus	moist highland areas & rocky outcrops in grassland near forested areas	flowers
Poecilmitis aureus	slopes of hills on grassy, damp patches	*Clutia pulchella*
Kedester lenis	grassy areas, marshy areas	*Imperata cylindrica*
Lycaena clarki	grassland, marshes	*Rumex* spp.
Catacroptera cloanthe cloanthe	wet grassland	*Justicia rottracta*, other

6.5.1.1.2 Grassland & other habitat types (Habitat type 2)

Butterflies present in this category include more generalist species which are able to exploit a wider variety of habitats.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

- Grassland around trees & thickets:

Species name	Habitat	Larval food
Pseudonympha swanepoeli	marshy valley high up in the mountains	grass?
Pseudonympha camdeboo	open grassland on the edges of thick bush	grass ?
Thestor compassbergae	low bushes and tufts of grass	grass species

- Gardens, grassland & other habitat types:

Species name	Habitat	Larval food
Gonatomyrina lara	gardens, various	succulents
Gonatomyrina gorgias gorgias	gardens, various	succulents
Metisella malgacha orina	gardens, grassland, vleis	*Ehrharta erecta*
Metisella malgacha	gardens, grassland, vleis	*Ehrharta erecta*

- Various vegetation types:

Species name
Thestor basutus basutus
Leptotes pirithous
Pinacopteryx eriphia eriphia
Colias electo electo
Catopsilia florella)
Eurema brigitta brigitta

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

- Fynbos

Species name	Habitat	Larval food
Capys alphaeus	fynbos, grassy fynbos	*Protea* spp.
Pseudonympha varii	grassy slopes of hills, stream banks, fynbos	grass, further unrecorded

6.5.1.1.3 Other habitat types (Habitat type 3)

Butterflies that are categorised in this class, may occur in the Grassland Biome due to the presence of other vegetation types, or because of their ecotonal status. Many of these species are favoured by urbanisation trends such as with alien plants.

- Gardens & thicket loving species:

Species name	Habitat	Larval food
Acraea horta	gardens, thickets	*Kigelia africana*, *Passiflora* species
Junonia octavia sesamus	gardens, bushveld, rocky areas, thickets	*Coleus* spp., *Plectranthus* spp.
Gonatomyrina lara	gardens, various	succulents
Gonatomyrina gorgias gorgias	gardens, various	succulents
Metisella malgacha orina	gardens, grassland, vleis	*Ehrharta erecta*
Metisella malgacha	gardens, grassland, vleis	*Ehrharta erecta*
Anthene definita definita	gardens, coastal bush, bushveld, forest edge, karoo	*Schmidelia africana*, *Acacia karoo etc.*

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

- Forest & coastal bush:

Species name	Habitat	Larval food
Cassionympha cassius	coastal bush, rainforest	*Juncus capensis, Afrachneria capensis*
Pelopidas thrax	woodland, forest margins	*Imperata cylindrica, Ehrharta erecta*
Borbo fallax	coastal bush, savanna, woodland	*Ehrharta erecta, Saccharum* sp., various grass species
Coeliades forestan forestan	rainforest, coastal bush	*Combretum* spp., *Millettia sutherlandii*, etc.
Mylothris ruepellii haemus	drier thickets, forests	*Viscum* spp.
Belenois zochalia zochalia	coastal bush, thickets, forests	*Maerua* spp.
Lachnocnema bibulus	coastal & inland bushveld	plant lice
Paralethe dendrophilus	Unknown	various grass species
Henotesia perspicua	Unknown	various grass species.

- Bushveld habitat

Species name	Larval food
Charaxes jahlusa rex	*Pappea capensis*
Charaxes jahlusa jahlusa	*Pappea capensis*
Charaxes achaemenes achaemenes	*Pterocarpus rotundifolius, Dalbergia boehmii* etc.

6.5.1.2 Habitat structure

Butterfly communities are very sensitive indicators of vegetation structure and changes in the natural vegetation (Erhardt 1985). This conclusion is supported by studies of Thomas (1983b,

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

1984).

Protective cover and microclimatic stability are two key factors that are determined by the vegetation structure. They influence the abundance of various invertebrate species.

6.5.1.2.1 Grassland habitat structure

Stratification of plant species in tall grassland is an important factor in determining the fauna of grasslands (Morris 1981). Grassland Auchenorhyncha are greatly influenced by the vertical structure of the vegetation in which they occur (Andrzejewska 1965; Whittaker 1969; Morris 1971a, b; Waloff & Solomon 1973; Denno 1977). Tall grassland biotopes usually support more species because of the stratification of the fauna, but short grasslands have their own characteristic assemblages of species, though generally less rich than those of tall grasslands (Andrzejewska 1965). A general relationship between the height of vegetation and the abundance and species-richness of Auchenorhyncha has been shown for chalk grassland (Morris 1971b) and carboniferous grassland (Morris 1974).

Stratification of leafhopper fauna (Andrzejewska 1962) in tall grasslands means that potentially more species inhabit tall grasslands, though this is not necessarily reflected in abundance and biomass. Also, short grassland supports its own unique fauna. Vegetation structure also appears to be very important to the abundance of other invertebrates, such as Orthoptera (Samways & Moore 1991).

Lowland and medium-altitude butterfly species live in open scrub or grassland habitats, while butterflies of high altitudes live in climax grasslands maintained by harsh climatic conditions. Grazing often plays an important role in maintaining suitable conditions (Thomas 1984) and to in maintaining populations of ants which can play an important role in the life cycle of many Lycaenid butterflies (Munguira & Martin 1993). Habitat structure proves to be very important for certain butterfly species, which depend critically on high densities of particular host ant species (Thomas 1980).

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

- Grass length

In various European countries, butterflies appear to be sensitive to grass length. Butterflies that prefer taller grassland swards have benefitted in the short term from the relaxation of stock grazing (Thomas 1983b). On the other hand, several species requiring short turf have declined (Thomas 1983b).

Oates (1995) stresses the importance of maintaining turf at a suitable height for butterflies, as habitat deterioration of grassland and invasion by shrub elements may result in the extinction of butterfly species. Light grazing may be applied as a management practice.

The Ruimsig Entomological Reserve in Roodepoort, Gauteng, is situated in the Rocky Highveld Grassland of South Africa. This vegetation type is characterized by various grass species as well as an abundance of dicotyledons (Low & Rebello 1996). The extensive climax stage of vegetation represented by *Themeda triandra – Trahchypogon spicatus* grassland was found to be too dense and tall, resulting in an unsuitable habitat for the butterfly *Aloeides dentatis dentatis,* which lives in association with the ant, *Acantholepis capensis*. Disturbed, open patches with sufficient butterfly larval food-plants, (*Hermannia depressa*), favoured the occurrence and interaction of these two species (Deutschländer & Bredenkamp in press). Four major vegetation communities were identified in the Reserve, one with two sub-communities and two further variants. The major communities are: *Themeda triandra - Trachypogon spicatus* grassland, *Eragrostis curvula - Eragrostis lehmanniana* disturbed grassland, *Hyparrhenia hirta* grassland and *Dombeya rotundifolia* hillocks. In spite of the availability of the food-plant in the *Themeda triandra - Trachypogon* grassland, no individuals of the butterfly were noted in this grassland. The disturbed grassland community is characterized by the pioneer grasses, *Eragrostis curvula* and *Eragrostis lehmanniana*, which are the dominant grasses. Although the density of the food plant is lower here than in the *Themeda triandra - Trachypogon spicatus* community, it is the main breeding locality of the butterflies, due to the presence of the host ant in these open areas (Deutschländer & Bredenkamp in press). The other two plant communities were found to be unsuitable for butterflies due to the absence of the food plant *Hermannia depressa*.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

It can be concluded that the endangered and rare butterfly *Aloeides dentatis dentatis* prefers disturbed grassland communities in pioneer or early stages of succession, such as the *Eragrostis curvula - Eragrostis lehmanniana* disturbed grassland. This can be explained by the fact that the host ant, which is a prerequisite for the butterfly to be present, prefers more open and disturbed areas. Vegetation structure, the presence of the food plant and the presence of the host ant (which is determined by the vegetation structure) govern the distribution of *Aloeides dentatis dentatis*, and thorough knowledge of the interaction of the above-mentioned factors should be incorporated in conservation management strategies developed to preserve this and other grassland butterflies.

- Mosaic of grasslands

The richest butterfly sites in Britain, in terms of species diversity, are mosaics of grassland, scrub and woodland. Homogeneous grassland sites support fewer breeding species (Oates 1995). The southern African Grassland Biome is characterised by a heterogeneity of landscapes with their own particular grasslands and/or other vegetation types. Each butterfly species present in this Biome has its own distinct habitat preference, whether it is for tall grassland, coarse grassland or other vegetation types within the grasslands. This contributes to the butterfly diversity of the Grassland Biome, and accentuates the importance of conserving various grassland types in order to maintain the areas' faunal diversity.

Grassland butterflies are sensitive to successional changes that alter the microclimate, microhabitat structure, the availability of food plants and the chances of locating a mate. Grassland maintained by light grazing might create favourable habitats for some butterfly species. The preferred habitat of grassland specialists varies due to different grass lengths and thus different microclimates, food plants etc.. This emphasises the importance of preserving various vegetation types (and thus grassland types) to preserve butterfly diversity.

6.5.1.3 Habitat patches

The turnover (extinctions and colonisations) of patches within butterfly metapopulations in North Wales was found to be higher in small patches than in larger patches. Turnover was also

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

higher in habitats of various successional stages, than in limestone grassland where the habitat remained unchanged for longer periods (Thomas & Harrison 1992). The persistence of spatially dynamic species depends on suitable habitats being continuously available within relatively large areas of biotope. The spatial dynamics of metapopulations of a single species may differ, depending on the biotope in which they occur (Thomas & Harrison 1992).

The distribution of suitable but unoccupied habitat patches indicates that these patches are situated too far from populated patches to be recolonised. Although the probability of patch turnover is higher on small patches, Thomas & Harrison (1992) claim that the area size is not the proximate reason for the extinctions and colonisations within the patches, but that turnover appears to be influenced by the habitat quality of the patches. Succession stages on limestone grassland resulted in the extinction of butterfly species (loss of microclimate favoured by butterflies for oviposition). An increase in turnover is more likely to occur in small patches, because succession status and changes in grazing intensity are more likely to occur throughout a small patch than to occur throughout a large patch. Spatial changes in patches seem to be governed by the interaction between two extrinsic factors: area and habitat quality (Thomas & Harrison 1992). Opdam (1990) claims that both demographic and environmental stochasticity affects the extinction rate. Corridors alone are not a measure to conserve metapopulations: habitat quality and patch size should enjoy high consideration in the conservation of butterflies. The optimal solution depends on the biological characteristics of the species considered and the spatial dimensions of the landscape (size, patch shape, connectivity). In order to conserve butterflies adequately, there should be enough suitable patches providing the correct habitat quality. The persistence of metapopulations thus depends on suitable habitat being continuously available, with each patch being within colonisation distance from other populated patches.

Habitat patches of varying sizes have their own unique microclimates, vegetation composition and butterfly communities. This topic is discussed in more detailed under 6.6.3: "Fragmentation".

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

6.5.2 Climate

Knowledge of natural factors, such as weather, is necessary to assess human impact, which may be harmful, (e.g. atmospheric pollution), or beneficial, (e.g. the management of nature reserves to favour particular butterflies) (Pollard 1988). Emergence patterns of butterflies are complex combinations of macroclimatic and microclimatic conditions, as well as historical factors (Weiss *et al.* 1993).

6.5.2.1 Spatial and temporal distribution of butterflies

Butterfly distribution in space and time is affected by climate, particularly temperature (Thomson 1980, Heath *et al.* 1984). Climatic factors account for nearly 80 % of the variance of butterfly diversity in Britain (Turner *et al.* 1987). Studies on butterflies have indicated that both temperature and sunshine, which are independent of latitude explain to some extent the distribution of butterfly and moth diversity, (Turner *et al.* 1987). This holds for the environment during the active season.

Thermal and radiant energy can have a direct causal influence on butterfly and moth diversity. Indirect influences are exerted via some other factors, such as habitat diversity or the existence of an overall causal factor that independently determines climate and butterfly diversity. Ectothermic regulation as practised by butterflies, is the most causal explanation. Butterflies fly chiefly when it is warm and sunny, their activity increasing with high air temperatures, which reduce heat loss from the body. Increased thermal and radiant energy thus significantly increases their reproductive rate (Stern & Smith 1960; Kingsolver 1983a).

Temperature can have an indirect effect, via the overall productivity of the environment, increasing butterfly and moth diversity through the greater energy available to their phytophagous larvae in the form of sunlight fixed by plants during the growing season, or the greater flow of nectar available to adults (Turner *et al.* 1987).

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

6.5.2.2 Solar energy

All organisms are dependent, with varying degrees of directness, on solar energy, suggesting that much of the global, latitudinal gradient in species diversity is produced by the gradient of incoming solar energy. Some butterfly species are adapted to cooler climates, but species richness still remains lower here than in areas with warmer climates. This relationship between climate and diversity supports the species-energy hypothesis that, given certain preconditions, such as non-limiting water supplies in the liquid state, diversity within terrestrial habitats is more or less directly controlled by the amount of solar energy available. Dviersity correspondingly declines with latitude as input from the sun to the earth's surface declines, although historical causes should also be borne in mind. Ricklefs (1973) and Wright (1983) suggest that small areas have a lower energy input, and having smaller population sizes, have lower numbers of species at equilibrium. This might explain how solar energy could control the number of species (Turner *et al.* 1987).

In Britain, the diversity of butterflies is highly correlated with sunshine and temperature during the summer months (Turner *et al.* 1987). Diversity shows a negative correlation with the average temperature of the winter months. This relationship might be explained by the ectothermic behaviour of adult butterflies, which depend on both warm air and direct sunshine to maintain normal activity. Butterfly and moth diversity, however, are also influenced by habitat diversity (Turner *et al.* 1987). Turner *et al.* (1987) suggest that Wright's species-energy hypothesis holds only during the time of year when the insects are actively absorbing energy, and can not be detected when they are in diapause. They also suggest that temperature and sunshine provide predictions of diversity, which are independent of latitude, thus agreeing with the findings of Dennis (1977, 1985).

6.5.2.3 Temperature

Butterflies are poikilothermic and their body temperatures vary with that of their environment. They derive heat from the sun, and flight is impossible unless the temperature of the flight muscles is high enough. If the temperature falls below 20°C, few species remain in flight (Henning *et al.* 1997).

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

Thermal conditions influence activity patterns and the growth of insects in all life stages. In Lepidoptera, thermoregulatory behaviour in the ovipositioning for eggs and pupae has been widely described (e.g. Sherman & Watt 1973; Casey 1976; Kevan *et al.* 1982). Adult thermoregulatory behaviour has also long been studied (Weiss *et al.* 1988). *Leptidea sinapis* and *Ladoga camilla* (British species) overwinter as adults and require warm weather in which to feed on flowers before hibernation.

6.5.2.4 Shade

Findings by various authors (Warren 1984; Thomas 1991; Thomas *et al.* 1992; Greatorex-Davies *et al.* 1993) strongly suggest that butterflies are much more abundant in open sunny woodland rides and glades than in shady ones, and that local or rare grassland species find refuge in open areas within woodland (Britain) where suitable herb-rich grasslands outside woodlands have been improved for agriculture (Greatorex-Davies *et al.* 1993). This may be because irradiance and ride orientation are more important when the larvae of many butterfly species begin to feed after hibernation, and that direct sunlight may be important at this stage of larval development.

6.5.2.5 Rainfall

The amount of rainfall received by a site is important in determining soil moisture when rains stop, and hence in determining the timing of plant senescence (Weiss *et al.* 1988). The emergence of larvae often coincides with plant senescence, ensuring a sufficient food supply for the larvae throughout its life cycle. The butterfly species *Hyalites anacreon* is found in high-rainfall mountains within the Grassland Biome and feeds on *Adenia* spp., *Cliffortia liearifolia* and some other species.

The ectothermic behaviour of butterflies plays an important role in their species distribution within the Grassland Biome. The floristically heterogeneous and rolling landscape character of the southern African grasslands gives rise to various microtopographical gradients that are characterised by their own floral and faunal communities, with different temperatures, rainfall intensities, amounts of solar energy received, and times of plant senescence. The climate thus

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

directly and indirectly influences the habitat quality and suitability of an area as refuge for butterflies. Each butterfly species has its own prerequisites, and the response of each species to climate, habitat quality and area size should enjoy careful consideration when selecting areas for conservation.

6.5.3 Microclimate

Weather and large-scale climatic patterns have long been recognised as major factors in the population dynamics of small, ectothermic animals (Andrzewartha & Birch 1954, 1984). The population-level influence of much smaller scale heterogeneity has been appreciated only relatively recently (Dobkin *et al.* 1987 *cite* Riechert & Tracy 1975; Rawlins & Lederhouse 1981; Kingsolver 1983b; Kingsolver & Watt 1983; Dobkin 1985).

The microclimate associated with habitat aspect, local shelter, vegetation and soil type may help to explain the distribution and restriction of butterfly species (Ravenscroft & Young 1996).

6.5.3.1 Microclimatic diversity

Even small reductions in overall range of microclimates or disturbance of areas of high local topographic diversity within a habitat patch can reduce long-term habitat quality. The importance of microclimate diversity to population dynamics probably applies to numerous small ectothermic animals (Weiss *et al.* 1988). The conservation of such species should thus take habitat size, as well as habitat heterogeneity, into account. Smaller, more topographically diverse areas might constitute a higher quality, long-term habitat than would larger, more homogeneous areas. The persistence of butterfly populations in fragments is largely determined by microclimates that result from differences in aspect and microtopographic relief (Dobkin *et al.* 1987).

6.5.3.2 Temporal & Spatial differences

Microclimatic differences resulting from topographic heterogeneity largely determine the

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

temporal and spatial pattern of senescence of the larval host plants of checkerspot butterflies, *Euphydras editha*, inhabiting serpentine grassland in California's outer Coast Range (Dobkin *et al.* 1987). In order to understand population-level processes in small ectothermic animals, it is necessary to emphasise the importance of microclimatic heterogeneity (Dobkin *et al.* 1987). This underlines the importance of such heterogeneity in the establishment of reserves designed to protect such species.

6.5.3.3 Aspect

Thermal environments created by different slope exposures play an important role in determining choice of oviposition site, development rates of the immature stages of the butterfly, and the timing of plant senescence. When laying eggs, some butterfly species will select slopes facing the sun, with a proportion of bare ground around the eggs.

The preference of many species for south-facing slopes in Britain is probably caused by the warmer microclimate of such slopes, which allows greater adult activity and better survival rates of eggs, larvae and pupae. Some species are restricted to these slopes because of the higher abundance of larval food-plants than are found on north-facing slopes.

6.5.3.4 Height of vegetation

Grass height has a major impact on the microclimate around a food plant. A 40 mm reduction in turf height can increase the temperature at ground level in chalk grassland by 5°C during the spring larval growing period (Thomas 1983b). Several butterfly species will only choose grass of a specific height when a lying eggs, probably because they are selecting a certain microclimate (Thomas 1991).

6.5.3.5 Basking behaviour

The selection of basking sites is a common feature of many insects, and increases their rate of warming. Basking behaviour by butterflies is thought to enable the larvae to be relatively independent of ambient temperatures and to allow them to develop faster (Porter 1982). The sooner peak metabolic rate is reached, the sooner food assimilation rate can be maximised.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

The aggregation of individuals promotes warming at low temperatures (Porter 1982). It is suggested that larval behaviour is adapted to use solar radiation as a heat source whilst avoiding losses from predators of parasitoids (Porter 1982).

Microclimatic gradients resulting from the heterogeneous, topographical character of the Grassland Biome can, by means of various factors, determine the distribution of butterflies. The amount of solar radiation received varies from slope to slope, a phenomenom which proves to be important for the ectothermic butterflies. The habitat quality and height of vegetation, (which chiefly depends on climatic and edaphic features), differs on a macro- and micro scale, giving rise to different basking behaviours, site selection for oviposition, and different predator avoidance tactics in different species. The fragmentation of areas may alter the microclimatic features and -preferences of butterflies, and when areas are to be developed, this point should be taken into consideration. The butterfly diversity of the Grassland Biome can only adequately be conserved if the various microclimatic features in the various grassland types are represented in a reserved area.

6.5.4 Topography

Topographically heterogeneous habitats give rise to microclimatic gradients, which in turn influence adult emergence times in insect populations such as butterflies (Weiss *et al.* 1993). Historical variation, (yearly shifts in larval distribution across slopes), is an important determinant of mean population emergence dates. An understanding of an insect's history and the heterogeneous thermal habitats that it inhabits can be useful in conserving and managing insect populations.

Microtopography provides an array of thermal environments that can affect larval growth. Shaded slopes inhibit larval growth, since larvae cannot bask and thereby raise body temperatures above ground-level ambient temperature (Weiss *et al.* 1988).

Local topographic diversity also can influence the survival of prediapause larvae. Prediapause larvae on a warm slope immediately adjacent to a cool slope might find edible plants on the cooler slope, conversely, larvae searching for diapause sites may select warmer

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

areas, and develop faster as postdiapause larvae. Several topographic elements contribute to long-term habitat quality. A wide variety of microclimates assures that at least some survival, development, and reproduction can occur under most macroclimatic conditions. Areas with high local diversity of slope exposures confer to populations' greater resilience in the face of extreme macroclimate variability when postdipause larvae disperse.

Topographic relief plays an important role in providing different microclimatic regimes for larvae; the warm slopes, receiving (higher irradiation), lead to the earlier senescence of larval host plants. Within-slope spatial heterogeneity in microclimates results in extreme variability in host plant densities (Dobkin *et al.* 1987). Microclimates created by topographically diverse environments also affects the phenology of host plants of larvae and nectar sources of adults (Weiss *et al.* 1988). Topographic diversity on several scales is a prime indicator of habitat quality for *Euphydryas editha bayensis*, (Morgan Hill, San Francisco Bay). Areas of high local diversity should be of sufficient size to ensure long-term population persistence under variable climatic conditions (Weiss *et al.* 1988).

6.5.4.1 Aspect and slope

6.5.4.1.1 Aspect

Aspect and slope are known to have a pronounced effect on microclimate, soil chemistry and plant distribution (Warren 1993 *cite* Perring 1959, 1960; Geiger 1965; Grime *et al.* 1988). In Britain, several rare butterflies are known to inhabit the south-facing calcicolous slopes which receive a higher degree of insolation.

The tilt and aspect of the habitat slope on which postdiapause larvae reside is the most important influence on their eventual emergence date, (Weiss *et al.* 1993). Larvae on cool slopes face the fundamental constraint of low insolation early in the growth season, compounded by slow mass gains in the fourth instar. The exact calendar date of emergence on each slope is determined by the yearly pattern of sunny and cool days (Weiss *et al.* 1993). The historical variation in larvae distribution across the insolation gradient can cause a variation in the population-wide emergence dates under the same weather conditions.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

The aspect preferences found for butterflies in calcicolous grassland have important implications for conservation in Britain as they suggest that some aspects are inherently more suitable than others (Warren 1993). This should be kept in mind in the selection of conservation areas.

6.5.4.1.2 Slope

Trends in butterfly species richness are principally the same on slopes that do not face the sun than the reverse, except that butterfly densities is generally lower. This is due to the preference of various butterfly species for warm and sunny habitats (Erhardt 1985).

Studies of thermal environments in a large, topographically serpentine soil-based grassland have indicated that larvae developed to pupation earlier on warm slopes than on progressively cooler slopes. In general, European Lepidoptera species richness is higher on slopes facing the sun, due to the preference of many butterfly species for warm and sunny habitats. However, some species, generally rare, are restricted to the cooler slopes (Erhardt 1985).

In the Grassland Biome, *Aloeides pringlei* has a very restricted range. The species is confined to a small area covering a slight depression at approximately 2100 m in the Great Winterberg, Eastern Cape. The entire area is covered with coarse *Danthonia* grass and *Chrysocoma tenuifolia* shrub. The depression faces cold west winds. *Pseudonympha paragaika*, a rare (RDB) endemic restricted to the grasslands of the Free State and Lesotho, prefers high elevation grassland on the southern (cooler) aspects of mountains. *Pseudonympha machacha* is a common species found at high altitudes of 2 743 – 3048 m in the Drakensberg-, Lesotho and Eastern Cape montane and alpine grasslands. This species also prefers southern aspects, which can be explained by the fact that the butterfly's food plant species (tuft grass) grows only on the cooler southern aspects. Other species that prefer the cooler, southern aspects are:

Species name	Habitat
Dira jansei	wooded grassland on south facing slopes
Pseudonympha paragaika	high elevation grassland on the southern aspects of mountains

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

6.5.4.2 Altitude

Altitude and rainfall influence the distribution of some grasshoppers and butterflies (Carcasson 1964). Males of the Lycaenidae in particular, often gather at hilltops where they defend a territory, and mate with females which come to the hilltop. The males ascend to the hilltops to be in a conspicuous spot so that newly emerged females can find them. Hilltopping species are low-density, strong flying species (Henning *et al.* 1997). *Charaxes jasius saturnus* is a low-density, hilltopping species. Male butterflies may remain several days on the hilltop, while females that have mated, will descend into the valleys because of the lack of larval food plant on the hilltops. Henning *et al.* (1997) maintain that hilltopping is only feasable for low-density species, because high densities would interfere with the mating process between males and females. Also, should a species be common, it is likely that females will encounter males before reaching the hilltop, making hilltopping less important for common species. Various butterflies occur in the high elevation grasslands of the Grassland Biome:

Species name	Altitude	Locality	Habitat
Lepidochrysops variabilis	2 438 m, higher	Lesotho	grassy hillsides & mountains peaks
Lepidochrysops loewensteini	approx. 2438 m	Lesotho	grassy mountain slopes, not found on peaks
Lepidochrysops swanepoeli	high altitudes	Barberton	grassy hilltops
Lepidochrysops jefferyi	high altitudes	Barberton	grassy hilltops & mountain peaks
Leopidochrysops victori	high altitudes	Lesotho	high altitudes of Great Winterberg mountains
Pseudonympha machacha	up to 3 084 m	Lesotho	montane & alpine grassland, Giant's Castle
Pseudonympha penningtoni	up to 3200 m	Lesotho	montane & alpine grassland, Giant's Castle
Torynesis orangica	high altitudes	Free State	grasslands on peaks of Golden Gate Highland

Males of *Lepidochrysops pephredo* tend to congregate during the hot midday hours at the highest points, while the rarely occuring female of the species is to be met on patches of *Becium obovatum* on the slopes below.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

6.5.4.3 Conservation (topography)

For conservation planning purposes, it is critical to spread the risk of reproductive failure across thermal gradients within habitat patches. This spreads the risk of simultaneous population declines or extinctions among habitat patches, a measure which appears to be critical for the persistence of regional insect metapopulations (Weiss *et al.* 1993). Topographic heterogeneous habitats should strongly be considered in reserve design for the conservation of butterfly species. Maximising the range of available microclimates can be an effective strategy to spread the risk of reproductive failure across spatially heterogeneous areas (Weiss *et al.* 1993).

Armstrong & Van Hensbergen (1997) found that valleys and north slopes in South Africa are priority areas for conserving of butterflies, where choices have to be made between landscape elements.

The topographical gradient resulting from the heterogeneous variety of aspects and altitudinal variation within the Grassland Biome contributes to the butterfly diversity of the area. The topography determines the microclimate and, consequently, the basking behaviour of the ectohermic butterflies, microdistribution of food plants, sites selected for oviposition and short distance migration of hilltopping species. The high altitudes of the Lesotho highlands and Drakensberg Escarpment are the habitat of various endemic species, especially of the hilltopping family Lycaenidae. Topographical heterogeneity, which is scale dependent, also applies to fragmented areas. This aspect should be carefully considered when areas are developed or sites for conservation selected.

6.5.5 Larval and adult food plants

The interaction of ecological, mechanical and chemical factors, as well as the relationship with predators, parisitoids and ants, (as in the case of Lycaenidae), are also important in the choice of food plants. The relationship between butterflies and plants is important in nectar feeding species. Specialist foragers (adults) visit only one, or a limited number of nectar source plants, whilst generalist feeders utilise a large number of the available nectar sources.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

The larvae consume nearly all the food utilised by each butterfly in its entire life cycle. Butterflies are attracted to suitable food by odour or colour (Carcasson 1964; Henning *et al.* 1997). Despite the presence of suitable food, some Lepidopteran species will only colonise areas when the habitat is suitable: their requirements involve; large amounts of bare ground that produce elevated temperatures, enhancing larval microclimates; shelter, and; enough food plants (Ranvenscroft & Young 1996). Grazing or disturbance is often beneficial in creating a favourable habitat (Thomas 1983b; Thomas *et al.* 1986). The distribution of the following species strongly depends on the presence of the food plant:

Species name	Habitat	Distribution	Larval food
Iolaus pallene	nearby larval host	Tvl., Natal	*Ximenia caffra*
Iolaus mimsae mimosae	nearby larval host	Tvl., Eastern Cape, Eastern Karoo, Natal	*Viscum* spp.
Tarucus sybaris sybaris	near host plant	Frees State, Tvl., Eastern Cape, Natal	*Ziziphus* spp.
Azanus jesous jesous	various, near host	Eastern southern Africa	flowers of *Acacia* spp., *Entada spicata*
Oraidium barberae	various, near host	Widespread in southern Africa	*Exomis microphylla*

6.5.5.1 Microdistribution of food plants and oviposition sites

Various factors determine the food choice of butterfly species. Phytophagous insects must draw their food supply from plants available within their geographical and ecological range. The choice of oviposition site is also important. Food plants must also be numerous and close enough to each other, or the larvae will perish. Appropriate choices in ovipostion can overcome this restriction (Erhlich & Raven 1964).

The microdistribution of plants is important to the extent that they are used as host plants. Females of *Anthocharis cardamines* prefer ovipositing on isolated plants, rather than in stands (Wiklund & Ahrberg 1978). Females will only lie eggs on a plant when presented with certain stimuli. Suitable temperatures, the chemical and mechanical composition of the larval food plant, degree of exposure to the sun, the presence of predators and ants (Lycaenidae) and

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

the odour of the plant affect the selection of oviposition sites.

A survey of seven sites in southern England showed a strong correlation between butterfly density and the number of lush food plants that were growing in the form chosen for ovipostion (Bourn & Thomas 1993). Ravenscroft & Young (1996) claim that *Zygaena loti,* (the scotch burnet moth), colonies in western Scotland do not persist when vegetation becomes too established, even though the food plant remains abundant. Investigations have shown that the fecundity of *Speyeria mormonia*, (Lepidoptera: Nymphalidae), decreased dramatically with decreasing food availability (Boggs & Ross 1993)

6.5.5.2 Chemical and mechanical composition of food plant

Chemical factors are important in the choice of larval food. Various Lycaenids feed on flowers, but are unable to utilise the tough foliage of the same plants. Metabolical adjustments on the part of the insect to exploit plants are costly, and tend to restrict its choice of food plants. Secondary metabolic substances can act as repellents, and further influence the choice of food plant selection. Environmental factors, such as rainfall and exposure to sunlight, as well as factors, such as ageing, often change the chemical composition of plants. This strongly effects phytophagous insects – in that some species prefer to feed on older, more odourless leaves of Umbelliferae, while some insects that feed on alkaloid-rich species of Papaveraceae prefer the younger leaves, which are poor in alkaloids (Ehrlich & Raven 1964). The rich representation of alkaloids in the family Rubiaceae, restricts the ability of larvae to feed on plants in this family.

Chemical properties such as milky juice, alkaloids, quinones, essential oils, glycosides, flavonoids, curcurbitacoms and also morphological and biochemical traits such as raphides cause plants of the following families to be poorly represented among butterfly food: Begoniaceae, Bignoniaceae, Cornaceae, Ranunculaceae, Amaranthaceae, Cactaceae, and Araceae.

A greater number of butterfly larvae feed on dicotyledons than on monocotyledons, with the subfamilies Satyrinae and Morphinae (Nymphalidae) being the exception (Ehrlich & Raven 1964). Several genera of in the Nymphalidae and Lycaenidae utilise monocotyledons in

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

part or as whole, whilst no member of the Papilionidae, Pieridae or Libytheidae is known to feed on monocotyledons. Plants are usually fed upon by a single, phenetically cohort group of butterflies or several very closely related groups. The plant utilised by a group, also displays phenetic similarity (Ehrlich & Raven 1964).

Several butterfly groups of Pieridae and Lycaenidae feed on Fabaceae *sensu latstu*, whilst butterfly species of the Papilionidae and Nymphalidae show a strong preference for woody Ranales. The tribe Liptenini (Lycaeninae) feeds on lichens, while the tribe Liphyrini (Lycaeninae) is carnivorous. Various other Lycaenids are tended by ants, while a number of species exhibit cannibalism.

Larval survival, fitness of Lepidoptera species and plant nitrogen concentration are often correlated (Myers & Post 1981; Lincoln 1985; Bink 1986; Bourn & Thomas 1993), and it is known that larvae may select nitrogen-rich plants and leaves to eat. Egg-laying females of *Aricia agestis* appear to be very selective in the oviposition of eggs, and select larval food plant with a high nitrogen concentration (Bourn & Thomas 1993). Major changes in plant nitrogen, resulting from fluctuations in moisture, may be critical in the initiation and development of sudden population increases in insects (White 1978).

High ingestion rates of nitrogen by lycaenids cause larvae to secrete more, or higher quality amino acids. This may be beneficial in encouraging myrmecophily, attracting larger ant guards that increase the survival of the butterfly (Bourn & Thomas 1993).

Plant biochemistry and mechanical plant defences are thus very important in governing the relationship between butterflies and plants. Ehrlich & Raven (1964) maintain that the evolution of secondary plant substances, and the evolutionary responses to these by butterflies, have been the dominant factors in the evolution of butterflies and other phytophagous groups.

Suitable habitats for butterflies include favourable microclimatic conditions with sufficient food plants to sustain the larvae throughout its life cycle. The senescence of various food plants is determined by the microtopography and consequently the microclimate, which in turn may

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

determine the chemical and mechanical composition of the food plant. By destroying certain habitats (and thus reducing the food plants and enhancing the invasion by alien plant and faunal species), favourable oviposition sites are reduced. This may result in the extinction of butterflies, especially those species which depend on grass as a food source.

6.5.6 Breeding sites

Factors that influence the choice of habitat selected by females to deposit their eggs are:

- the presence of the larval food plant in sufficient quantities and in close proximity to other food plants, so as to sustain the larvae throughout its life-cycle;
- the correct microclimate (temperature and degree of exposure to direct sunlight);
- the presence of particular ants (Lycaenidae);
- the selection of food plants in order to minimise predation where possible.

Light grazing aids in creating suitable habitats for oviposition sites. Females of the species *Hesperia comma* are very specific when depositing eggs, usually examining several plants before one is chosen (Thomas *et al.* 1986). The largest colonies bred on sites that were grazed by rabbits alone, whilst other colonies thrived under grazing by cattle, sheep and ponies – separately as well as in most combinations. Experimental results suggest that differences in adult density are a reflection of the suitability of the swards on different sward sites for the young stages, as defined by egg-laying preferences (Thomas *et al.* 1986). Analysis showed that there was a strong preference for laying eggs on small *Festuca ovina* plants that were largely surrounded by bare ground, or scree, and which also grew in local sunspots. The ideal habitat for oviposition is determined by the presence of larval food plants of which the swards are grazed to a short, sparse length, as well as by warm, bare ground surrounding the swards, which increases the temperature of the breeding habitat. Bourn & Thomas (1993), who claim that the distribution and population size of *Aricia agestis* (in Britain) is influenced by the availability of highly specific egg sites, found similar results.

The small copper coloured butterfly, *Aloeides dentatis dentatis* , is a rare and endangered species, restricted to the Ruimsig Entomological Reserve at Roodepoort in the Rocky Highveld grassland (Low & Rebello 1996). The reserve has an area of twelve hectares set

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

aside for the conservation of the butterfly. It lives in association with the ant, *Acantholepis capensis,* and the female butterfly will only lay eggs if the larval food plant, *Hermannia depressa,* is present, and, in addition, after she has detected the host ant, or its pheromones, on the food plant (Deutschländer & Bredenkamp in press).

Three other butterfly species live and breed only in the Ruimsig nature Reserve. They are:

Species name	Habitat preference	Red Data Book status
Aloeides trimeni trimeni	karoid habitats & grassland	common
Lepidochrysops ignota	grassland	common
Spialia asterodia	grassy hillsides	common

Breeding sites are selected to maximise the persistence of larvae. In order the maintain the butterfly diversity of the Grassland Biome, areas should be selected in such a way to allow hill topping in mate-seeking butterflies, (microtopographic influence), while the microclimatic influence of the aspect/slope on plant senescence and microdistribution of larval food plants should also be considered. Measures should be taken against invasion by predators favoured by exotic vegetation. By applying the correct grazing regimes, fire regimes, controlling habitat fragmentation and application of pesticides, larval development can be allowed. This could prove to be of especial importance for grassland specialists that are restricted to a few localities.

6.5.7 Predators

No stage of the butterfly lifecycle is free of predators. Larvae and pupae are heavily parasitised by certain species of the Hymenoptera (wasps) and Diptera (flies). Many hymenopterous paristoids find their host larvae by searching for them on their host plants. The parisitoid oviposit on the butterfly larvae, which is killed when the hymenopteran larva emerges by eating its way out through the lateral body wall of the butterfly. The hymenopteran larva then prepares its cocoon on the same host plant. Predators can thus exert a strong influence on the host plant strategy of butterflies, as in the case of *Anthocaris cardamines* (Switzerland) (Wiklund & Ahrberg 1978). By ovipositing on another host plant, predation and parasitation

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

can be avoided, depending on how favourable the new habitat is for other predator species.

Inappropriate management practices and destructive development in natural grassland may not only deprive butterflies of their food plant (grass feeding species), but may also alter the favoured microclimate and microhabitat structure, and enhance the invasion by predators detrimental to the persistence of butterfly larvae.

6.5.8 Mutualistic interactions

Mutualistic interactions between different kinds of organisms are very common in nature (Boucher 1985). The butterfly family Lycaenidae is a case in point. A large number of lycaenid species live in association with ants during part of their life cycle, mostly as larvae (Fiedler 1991). The relationships between certain lycaenid species and their host ant are clearly parasitic, and other lycaenid-ant associations may be commensalistic (Pierce & Young 1986). The majority of lycaenid species are facultative myrmecophiles (Fiedler 1991; Fiedler & Saam 1995).

The distribution of *Aloeides dentatis dentatis* in the Ruimsig Entomological Reserve, which can be classified as Rocky Highveld grassland (Low & Rebelo 1996), may be directly ascribed to the distribution of the host ant, *Acantholepis capensis*. The host ant prefers more open and disturbed areas within the *Themeda triandra* grassland. It was noted that *Aloeides dentatis dentatis* does not occur in dense grassland, despite the food plant *Hermannia depressa* being abundant. The dense grass stands apparently hamper the butterfly from reaching the food plant, while the host ant is also absent from these habitats. It was found that females will oviposit only if the host ants or their pheromones are present on the host plant (Deutschländer & Bredenkamp in press).

Two species from the Knysna Heads, South Africa, *Orachrysop niobe* (the Brenton Blue) and the recently described Brenton Copper *Poecilmitis mithras,* disappeared from several localities in the vicinity of Brenton (Pringle 1995). These butterfly species breed in restricted habitats, and require two elements before they it will lay eggs: a food plant, and a particular ant species (*Camponotus* sp., in the case of the former, and *Crematogaster* sp. for the latter). The

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

larvae of both species are protected and tended by the ant species, presumably because the larvae are able to communicate with the ants, using the same chemical communication system. The Brenton Blue larvae, in turn, produce highly attractive secretions on which the ants feed. The butterflies thus need the correct combination of host ant and food plant to maintain their colonies (Pringle 1995).

The introduction of the alien Argentine ant has resulted in the decline of various indigenous ant species, and thus poses a threat to several Lycaenids that depend on the commensalistic and mutualistic interactions with indigenous ants.

6.6 Human impact

The decline of most butterfly species in Britain is thought to be the result of a combination of habitat destruction and isolation, together with changes in habitat management (Warren 1993). These factors may have caused losses directly or indirectly, by making populations more susceptible to climatic variation (Warren 1993). Habitat loss in surrounding areas can also result in the local extinction, because of increased isolation of populations.

In California, USA, the species richness and Shannon diversity index of butterflies peaked at moderately disturbed sites, whilst the relative abundance decreased from the natural to the urban areas. These patterns are significantly related to shifts in habitat structure that occur along the gradient (Blair & Launer 1997). In South Africa, habitat destruction though urbanisation and other human activities threatens the survival of many butterflies (Henning & Henning 1989; Pringle 1995).

6.6.1 Agricultural activities

Modern intensive agriculture provides a hostile environment for many insects, unless they are pests that feed on the crops. Lepidopterans are particularly vulnerable to farming practices. Agricultural activities may be detrimental to butterflies due to the following factors:

- the preferred habitat of the butterfly is altered;
- habitat patches may result in the extinction of species (demographic and environmental

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

stochasticity);

- isolation may impede recolonisation from other patches;
- application of herbicides and pesticides can kill butterflies directly or indirectly;
- grazing regimes can alter the microhabitat and microclimate favoured by butterflies;
- invasions by alien fauna species and predators;
- reduction in larval and adult nectar food resources;
- human-induced fire.

Fragmentation is not a phenomenon in man-made landscapes only. Natural disturbances such as fire, flooding and soil erosion may cause disturbance patterns at different spatial scales. In the agricultural landscape, however, fragmentation is a man-made disturbance (Opdam 1990). From a conservation point of view, agricultural fields are considered to be of low value for many butterflies.

Cultivated farmland supports a relatively impoverished butterfly fauna. The butterflies are then largely restricted to non-cultivated areas and field boundaries (Sparks & Parish 1995). The field margin is often the only suitable habitat for woodland and grassland butterflies in an arable landscape. Abundance and diversity butterfly species in Cambridgeshire, UK, are related to field boundary features and to the vegetation (floral composition and structure) of the field boundary (Sparks & Parish 1995).

Improved agricultural grassland in Britain generally fails to support any breeding butterflies, and the grassland butterfly fauna has declined dramatically during the course of the twentieth century (Oates 1995). Improved grassland may contain populations of butterflies, although far less than would be found in unimproved, natural pasture (Woidwod & Stewart 1990).

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

Several butterfly species of the Grassland Biome are seriously threatened by agricultural activities:

Species name	Habitat	Larval food
Aloeides dentatis maseruna	flat grassland on sandy gravel soil	*Hermannia jacobifolia*
Aloeides rossouwi	rocky gullies below the summit of grassy escarpment	Unknown
Aloeides nubilus	moist highland areas of the eastern Tvl.	flowers
Lepidochrysops hypopolia	grassland	Unknown
Lepidochrysops lotana	grassy slopes	*Becium obovatum*

6.6.2 Habitat fragmentation

Habitat fragmentation can lead to the loss of invertebrate species, and encourage invasion by alien species. Depending on the mobility patterns of the species, fragmentation can restrict or enhance movement patterns of insects within and between landscapes (Samways 1989). In a fragmented landscape, the habitat of many species is dissected into small, isolated patches with sharp, unnatural boundaries. Species must be capable of crossing fields and recolonise empty patches, otherwise total extinction in the landscape will be inevitable (Opdam 1990). The size of patches, extensiveness of the matrix and the barrier or refuge effect of the corridor are important factors influencing invertebrate migration (Samways 1989).

Habitat patches in the UK act as archipelagos in which the long-term persistence of fauna relies on networks of suitable habitats, close enough to allow dispersion. Rare UK butterflies were found to be restricted to relatively large and non-isolated habitat patches, while small patches and those that were isolated from population resources, remained vacant (Thomas *et al.* 1992).

Local extinction is most frequently observed in small patches in *Hesperia comma* and *Plebejus argus* colonies, which would lead to the reduced occupancy of relatively small habitat patches (Thomas *et al.* 1992). However, extinction can hit habitat fragments of any size, especially if habitat quality deteriorates (Thomas 1985; Thomas & Harrison 1992). Often local

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

extinction depends more on the time since habitat creation than on patch area, especially if species are sensitive to, or rely on the successional stages of vegetation. It was found in Britain that, although larger habitat patches are more important in the persistence than others, none of these patches could be regarded as eternally populated. This time-dependant rather than area-dependant extinctions of some butterfly species conforms more closely to Levins-type models (1969, 1970), in which all patches are equally susceptible to extinction, than to a Boorman-Levitt model (1973), in which the largest patches are regarded as eternally populated (Thomas *et al.* 1992).

The more isolated the patches are, the higher the risk of the patches remaining vacant because of the longer time it takes for colonisation to occur. The scope of recolonisation will depend on the distribution of population refuges, and on the ability to recolonise through a network of habitat patches (Thomas *et al.* 1992). Stepping-stone habitats have proved to be of great importance to sedentary butterfly species. Conservation of butterfly species will depend on the integrated protection and management of viable networks of patches, in which metapopulations occupying networks of habitat patches, not all of which lie within a single protected area, are protected.

Fragmentation may result in a heterogeneous, floristically diverse area. Generalist butterfly species can exploit such areas more sufficiently than grassland specialists that are often restricted to a few localities too far away to be recolonised by other metapopulations. This might be because the species are restricted to certain isolated habitats too far away from similar areas, or because of low species diversity, (especially among the hill topping lycaenids in the high elevation grasslands), or because the species are unable to migrate over large distances. Fragmented areas' microclimate and -structure are altered, and may vary, depending on the size of the fragment. The natural history of a species, together with the above-mentioned factors should be integrated when it is hoped to preserve butterfly species in a fragmented system.

6.6.3 Grazing

No information on the effects of grazing on butterfly distribution is available for southern

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

Africa. Investigations in Britain on the effect of grazing on butterfly diversity are used as guideline to predict what may happen in the grasslands of southern Africa.

6.6.3.1 Habitats created by grazing

Hesperia comma is sensitive to the structure of the sward of its host plant (larval stage), *Festuca ovina*, and hence, to changes in the grazing intensity on British sites. Research on the larval and pupal stages might elucidate this. Larval stages of *Hesperia comma* need a warm microclimate and adults need warmer weather than any other butterfly in Britain before they are active (Thomas *et al.* 1986). Grazing by rabbits and domestic grazing provide the ideal habitat, which consists of roughly 45 % food plant and 40 % bare ground. Overgrown sites resulted in the disappearance of *Hesperia comma* colonies, illustrating how sensitive *Hesperia comma* is to changes in the structure of the sward. This is discussed in more detail under the heading "breeding".

6.6.3.2 Effect of grazing regime

For many butterflies, the intensity and timing of grazing is likely to be more important than the type of grazing animal (Thomas 1983b). However, *Erodryas arina* and *Cupido minimus* (Britain) were found to avoid areas grazed by sheep, presumably because sheep selectively graze herb-rich areas containing the larval food plant. These butterflies will survive only if sheep grazing is very light or intermittent (Warren 1993). By contrast, cattle-grazed swards usually contain some taller patches of vegetation with the larval food, unless grazing is extremely heavy.

On lightly grazed meadows the cattle graze selectively and always leave parts of the sward undisturbed. This allows free development of the early butterfly stages (eggs, larvae, pupae) (Erhardt 1985). Larvae and adults of other invertebrate groups, such as Cicadellidae and Delphacidae, were found to be more numerous on ungrazed grassland plots than grazed areas (Morris 1971a).

Periodic, light grazing can slow the process of vegetation succession, ensuring the persistence of *Zygaena loti,* (scotch burnet moth), on the slopes of southern England

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

(Ravenscroft & Young 1996).

6.6.3.3 Management by grazing

Grazing regimes can be employed successfully to manage butterfly communities in grassland (Oates 1995). The correct choice of animals, the right timing, intensity and location of grazing are essential in the controlling selective grazing. The use of inappropriate stock can jeopardise the existence of grassland butterflies (Oates 1995).

6.6.3.4 Timing of grazing

Grazing is important in creating and maintaining different grassland structures essential for the various stages of butterfly life cycles. The time of year, length of the grazing sessions, as well as period between sessions, can exert a strong influence on butterfly abundance (Oates 1995). Timing of grazing is important and should provide adequately for the pairing, roosting, night sheltering, and feeding of adult butterflies on nectar resources in the sward.

Cyclical grazing of grassland creates mosaics of various vegetation structures, and can be fundamental to the conservation of butterflies within grassland. However, many grassland sites do not require annual grazing, depending on the climatic conditions and soil characteristics, to ensure good habitat for butterflies.

6.6.3.5 Creation of microhabitats

Grazing can create suitable microhabitats of vegetation/bare ground, and by applying correct grazing regimes, habitat patches can potentially remain suitable for very long periods (Thomas & Harrison 1992).

In North Wales, turnover (extinctions and colonisations) of butterfly metapopulations was lower on grassland patches being grazed, compared with ungrazed patches associated with succession, and where the bare ground which are favoured for oviposition had been eliminated. Turnover within metapopulations was also found to be greater in small patches.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

6.6.3.6 Cutting

Cutting differs from grazing as a method of managing grasslands – it is sudden and catastrophic, rather than gradual and prolonged. Cutting has a severe effect on species that overwinter in cut grasslands. Auchenorhyncha, the phytophagous Heteroptera, are more abundant on uncut grassland. Timing, intensity, frequency and spatial organisation of cutting can be implemented as method of management, as some species of Auchenorhyncha, unlike Heteroptera, respond positively to cutting experiments (Morris 1981).

Overgrazing, successional types of vegetation, and the alteration of the microclimate and microhabitat can cause the decline of butterflies. However, by applying correct grazing regimes and by selecting the stock to graze grassland, butterflies inhabiting long grassland, (which should preferably be grazed by cattle) and short grassland, (preferably grazed by sheep) can be adequately conserved in agricultural areas, provided that sufficient food plants are available.

6.6.4 Afforestation

Large-scale afforestation of montane grasslands in high rainfall areas of South Africa necessitates wildlife conservation evaluations (Armstrong & Van Hensbergen 1995). The following two RDB species are seriously threatened by afforestation:

Species name	Habitat	RDB status	Larval food	Endemic
Pseudonympha swanepoeli	marshy mountain areas	Rare	Grass	Transvaal
Alaena margaritacea	steep grassy slopes	Vulnerable	Rock lichen	Transvaal

6.6.5 Pesticides

Studies by Rands & Sotherton (1986) suggest that pesticide use on cereal crops in southern England may reduce butterfly numbers, and that arable farmland is a habitat in need of further study for butterfly conservation. The modification ("improvement") of grasslands by draining and by applications of lime and chemical fertiliser, and the increasing amounts of pesticides that

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

are used on arable crops, can have profound detrimental effects on farmland wildlife. Herbicide use, together with drainage and chemical fertilisers, can indirectly reduce butterfly abundance by turning unimproved grassland into improved pasture that supports a greatly impoverished butterfly fauna (Rands & Sotherton 1986). While unimproved grassland is the most butterfly-rich farmland habitat, cereal fields are considered of very little value (Thomas 1983). However, it is suggested that intensively farmed cereal fields should not be completely ignored when considering butterfly conservation measures (Thomas 1983, Heath *et al.* 1984).

In Cambridgeshire, UK, it was found that butterfly populations can be enhanced in the margins of cultivated fields by reducing the amount of pesticide applied, or by maintaining a strip of non-cultivated land. Pesticides can reduce butterflies directly, by subjecting adult butterflies or larvae to lethal or sublethal doses of agricultural chemicals, or indirectly, by herbicide application which may result in reduced floral diversity and consequently, to a reduction in larval food sources (Sparks & Parish 1995).

Although pesticide application is not always lethal, and no other measure of pest control is available, pesticides should be applied in such a way as to allow larval development.

6.6.6 Urbanisation & introduction of alien plants/fauna

The major cause in the decline of insect populations throughout the world is habitat destruction. Butterflies should serve as good indicators of the environmental changes that occur as humans develop the landscape, and as excellent indicators of urbanisation (Blair & Launer 1997). Resources, (such as larval food, adult nectar sources) that are vital to butterflies are likely to change as an area becomes developed and this should affect the distribution and abundance of individual species and the communities to which they belong. These changes may affect the distribution and abundance of individual species directly, as well as indirectly, by altering the microclimate (Blair & Launer 1997).

Urban exploiters are adept at exploiting these changes, and reach their highest abundance in developed sites. Urban avoiders, on the other hand, are sensitive to human-induced changes, and reach their highest densities in natural sites. Suburban-adaptable species

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

should be able to exploit ornamental vegetation (Blair & Launer 1997). If a substantial number of species are found to be urban avoiders, conservation measures specifically designed to preserve undeveloped habitat need to be implemented to ensure long-term persistence.

Studies conducted by Blair & Launer (1997) suggest that golf courses are not as benign a use of land as some assume. Various species may occur in the wide-open spaces, but they maintain neither the original species composition nor the abundance of the predevelopment community. Pesticide and fertiliser runoff pose further problems. Ornamental gardening influences individual species, and consequently, the communities to which they belong. Urban-avoiders show a decline in abundance.

In South Africa, the butterflies most at risk are the ant-associated Lycaenidae. These butterflies are rare, local, and require the presence of host ants, as well as optimal climatic conditions. Destruction of the habitat of a species restricted to a single locality can result in its extinction. Draining of marshes and vleis in the Witwatersrand led to the extinction of several colonies of *Metisella meninx* (Henning *et al.* 1997). Agricultural conversion of natural habitats in the Free State and North-West Province led to the decline of *Aloeides dentatis maseruna* colonies. Introduction of alien woody plants, especially from Australia, has had a pronounced effect on South African butterfly populations in the past forty to fifty years. The alien Argentine ant, *Iridomyrmex humilis*, drives away various other ants such as termites, the black marsh ant (*Camponotus niveosetosus*), the small black sugar ant (*Acantholepis capensis*) and the spotted sugar ant (*Camponotus maculatus*). These indigenous ants play an important role in the life cycles of the Lycaenidae. The Argentine ant not only causes the disappearance of ants and their associated butterflies, but also of the larval food plants of which the seeds need to be dispersed by the indigenous ants (Henning *et al.* 1997).

Population growth and the rate of urbanisation are the highest in the highveld grassland region of South Africa. The conversion and fragmentation of grasslands into exotic gardens and agricultural monocultures, alters the structure and microclimate of an area, as well as the availability and microdistribution of food plants. Grassland specialist species decline in abundance, while generalist species which can exploit various habitats and food plants, are favoured.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

6.7 Succession

A survey of British colonies of *Hesperia comma* revealed that populations declined or that some populations had gone extinct when many unfertilised downs in Britain became overgrown, after rabbits were killed by myxomatosis (Thomas *et al.* 1986). A high proportion of the existing colonies on nature reserves had become extinct by 1982, due to inadequate grazing. Although its larval food plant, *Festuca ovina* L., is common and widespread in calcareous grassland throughout central and southern Europe, extinctions have been attributed to "habitat loss" (Anon. 1977) and to a lack of grazing (Frazer 1977; Anon. 1981). The introduction of myxomatosis in the mid-1950's resulted in a decline of rabbits, and most downland swards grew tall and dense. This coincided with a spate of local extinctions of *Hesperia comma*, while at the same time, some very large populations survived on a few sites where domestic grazing continued. The invasion of the grassland by coarse vegetation and shrubs, following myxamotis, led to the disappearance of *Hesperia comma* in such sites. *Hesperia comma* needs a warm microclimate and can survive only in the hottest places where *Festuca ovina* grows in Britain, and a slight relaxation in grazing results in a substantial cooling of the ground where the young stages live, and the rapid extinction of the colonies (Thomas *et al.* 1986).

Early stages of abandoned grassland, dominated by grasses and herbs, are the habitats richest in butterflies of all vegetation types investigated in the subalpine grassland of Switzerland. This can be attributed to the following favourable circumstances: the vegetation is still rich in plant species; no disturbance by cultivation occurs, allowing butterflies to complete their life cycles, sites with shallow humus layers are quite stable habitats, because development of abandoned grassland is very much delayed. The microclimate created is warm and favourable to butterflies, enabling such sites to support a rich Lepidoptera fauna (Erhardt 1985).

In the subalpine region of Switzerland, a pronounced decrease of Lepidoptera species occurs with the arrival of bushes and shrubs (Erhardt 1985). Species richness of butterflies is high in traditionally lightly cultivated grassland (unfertilised mown and lightly grazed meadows), but it declines drastically with increasing intensity of cultivation.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

The persistence of the endangered grassland butterfly *Aloeides dentatis dentatis* in the Ruimsig Entomological Reserve near Roodepoort can only be guaranteed if a number of principles are followed. The butterfly species prefer short, open pioneer grassland to ensure the food plant *Hermannia depressa* is easily accessible, and also because the host ant, *Acantholepis capensis,* with which the butterfly occurs in mutualistic association, prefers open areas. The shorter, disturbed grassland may also create a more suitable habitat for oviposition and thermoregulatory conditions for *Aloeides dentatis dentatis* (Deutschländer & Bredenkamp in press).

6.7.1 Abandoned grassland

Erhardt (1985) maintains that if cultivated grasslands are abandoned, a succession of different vegetation types (plant succession on abandoned grassland is quite complex) with their own faunas occurs. Succession in the subalpine region of the Swiss Central Alps follows the following trends: the early successional stages are dominated by grasses and herbs, which are then invaded either by dwarf shrubs or by young trees. Later, climax vegetation may be dominated by forest or spruce (Erhardt 1985). It was found that early stages of abandoned grassland, dominated by herbs and grasses, are the habitat richest in butterflies. This can be attributed to the plant species richness still being high. Undisturbed areas also allow complete development of larvae life-cycles. The microclimate of areas with shallow humus layers are also warm and being favourable to butterflies. Later successional stages result in reduced plant diversity and decrease in butterfly species. Lepidopteran fauna of spruce-dominated woods and of unfertilised mown meadows are species poor (Erhardt 1985). Investigations on other invertebrates and vertebrates show parallels to butterflies, in terms of species richness and species composition (Erhardt 1985).

It was found that early successional stages of grassland increased the suitability of habitats for butterflies, but the encroachment of dwarf shrubs, eliminates bare ground and vegetation margins that are required by some butterflies for oviposition. The microclimatic feature of the area is altered, resulting in a shift of suitable habitat (Thomas & Harrison 1992).

Agricultural activities such as overgrazing can exert a strong influence on the successional

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

character of grassland. Invasion of grassland by shrubs may not only deprive grass-feeding butterflies of their food plant, but can also alter the favoured habitat, and enhance the introduction of alien predator and competitor faunal species.

6.8 Fire

Investigations of butterflies in tallgrass prairies in Illinois, Iowa, Minnesota, Missouri and Wisconsin USA showed that while each butterfly species had its own individual response to fire, the prairie specialists showed the most negative response to fire. Butterfly specialists were higher in hayed than burned prairies, while generalists and invaders showed little decline in response to haying (Swengel 1996). Specialist butterflies decline strongly after fire (this pattern can persist for 3 – 5 or more years), while butterfly invaders with a broader habitat niche, are most abundant in recently burned units and scarcest in longest unburned areas (Swengel 1996).

The following factors may influence butterfly abundance relative to fire management (Swengel 1996):

- direct mortality;
- voltinism;
- location of species during fire;
- vagility;
- response of key food plants;
- continuity of resources.

Generalist butterflies with broad habitat niches are more widespread and source populations can successfully recolonise burned areas, whereas specialist are restricted to certain localities have smaller sources to recolonise burned areas. Species with high dispersal abilities can reoccupy a burned site faster. Species that are powerful flyers were found to be more abundant in burned areas of USA prairies, than were species with short, slow fly-patterns (Swengel 1996).

Larvae overwintering underground are somewhat protected from fire, while Swengel (1996) found larvae overwintering in basal areas of bunchgrass to decline markedly after fire.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

Some species of the genus *Lepidochrysops* appear to be unable to emerge if the grass is not burned before the rainy season. These species often pupate underground in association with ants, and the early instars feed on *Becium* spp. Unless the grass is burned, this food-plant often remains dormant (Carcasson 1964). *Dira jansei* is a grassland specialist that is limited to the wooded grassland on south facing slopes of the Grassland Biome. It feeds on grass species, and is listed in the RDB (indeterminate) as a species threatened by veld fires.

6.9 Threatened species

Various factors contribute to the RDB status of thirty-two butterflies species (Table 27) (Figure 12) occurring in the Grassland Biome . Grassland specialists and grass feeding species are at greatest risk of extinction, as deduced from the results. Agricultural activities, habitat destruction (destruction of preferred microclimate, food plants etc.), urbanisation, afforestation, overgrazing, veld fires and other human activities have contributed to the decline of various butterflies, and the possible extinction of *Lepidochrysops hypopolia*.

6.9.1 Afforestation

Pseudonympha swanepoeli (rare) and *Alaena margaritacea* (vulnerable) both inhabit grassy, high elevation slopes of Mpumalanga, but are threatened by afforestation.

6.9.2 Agriculture & overgrazing

Six RDB species are seriously threatened by agricultural activities. Four of these species occur in grasslands only, while one, *Spialia paula,* (indeterminate) also occurs in savanna and another, *Anthene minima,* (rare) in thornveld. The four grassland species are:

Species name	Habitat	Distribution	RDB status
Aloeides dentatis maseruna	flat grassland on sandy gravel soil	throughout the Free State and former western Tvl.	Indeterminate
Aloeides rossouwi	rocky gullies below the summit of grassy escarpment of south-west Stofberg	near Stofberg in the former Tvl.	Rare

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Poecilmitis aureus	slopes of hills on grassy, damp patches	endemic to the former Tvl.; Heidelberg and Suikerbosrand Nature Reserve	Rare
Lepidochrysops lotana	grassy slopes	endemic to the Tvl.	Vulnerable

Overgrazing and soil erosion of grassy slopes of the Lesotho Highlands contributed to *Torynesis pringlei* being a rare species.

6.9.3 Habitat destruction and urbanisation

The destruction of marshy habitats and urbanisation trends, have resulted in the decline of the rare *Metisella meninx,* (northern Free State, Mpumalanga and KwaZulu-Natal), while urbanisation has also a profound negative effect on *Spialia paula* (indeterminate), a savanna species, and on *Aloeides dentatis maseruna* (indeterminate), a short grassland specialist.

6.9.4 Veld fires

Dira jansei, endemic to the Transvaal (indeterminate status), is seriously reduced in numbers by veld fires.

Fire can kill butterflies directly by killing the larvae, or can cause mortality indirectly, by altering the habitat and by reducing the availability of food plants. Human-induced fires outside the natural fire regimes can have serious detrimental effects on butterfly populations. However, with fire being a natural phenomenum in the highveld grassland during the winter months, several larvae survive this by pupating underground during the winter. By changing the natural fire regime, this situation may be reversed, holding negative effects, especially to grassland butterflies restricted to certain localities.

6.10 Conservation

Butterflies are highly sensitive to environmental changes (Thomas 1984; Pollard *et al.* 1986;

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Warren 1993), and often decline when their larval food-plants are abundant and widespread on local and national scale. Thomas (1984, 1991) claims that butterfly populations are early indicators of habitat changes that will in the future affect other wildlife groups.

Effective butterfly conservation requires sound habitat management, particularly the management of traditional regimes under which populations have survived in the past (Warren 1993). This can only be achieved if we know their habitat requirements and host plants.

Warren (1992) stresses the importance of the consequences of habitat fragmentation and isolation on butterfly conservation. A network of habitat patches is required for effective butterfly conservation to ensure the long-term persistence of butterfly populations on small reserves. Field margins can connect patches, and serve as refuges for various faunal species (Sparks & Parish 1995). For the U.K., Thomas (1983a) maintains that butterflies were more abundant in hedges of unimproved grassland than in improved grassland and arable lands.

Various butterfly species are restricted to particular habitats by their dependence on certain ranges set by the microdistribution of food plants, the topography, their ectothermic character and the ability to find mates. The butterflies of the Grassland Biome are increasingly threatened by the transformation of the grasslands. Species restricted to certain localities within the grasslands, especially those species that depend on grass as food source, are most at risk. Changes in the microstructure and -climate of their habitats (succession etc.), the reduction of food plants and the introduction of alien floral and faunal species, might be the causal factors. The fragmentation of natural habitats and the application of incorrect grazing- and fire regimes, can also result in the reduction of butterfly species, especially in the Highveld region. The increasing population growth, especially in Gauteng Province, results in the transformation of many grasslands by cropping activities and stocking of areas. This situation can not be reversed, but scientifically based agricultural activities practised on carefully selected areas, may not only optimise the economic income from such farming practises, but also preserve the butterfly diversity of the Grassland Biome in the long term. Each butterfly species has its own preferred habitat. Therefore, various grasslands types, especially high altitude grasslands rich in endemics (but also seriously threatened by afforestation), and other vegetation types should be included in reserves, or at least in areas where the human impact are

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

controlled.

6.11 Conclusions

The butterfly faunas of the Grassland Biome show a high level of endemism, in particular the Afromontane and Alpine grasslands, which have proved to be the origin of several invertebrate evolutionary lines. Butterflies measure up to the criteria as good indicators of environmental change and deterioration. The composition of Lepidopteran faunas may be determined by the individual effect or by the combined interaction of the following factors: larval food plant; part of host used; phenology and voltinism; habitat; predators, parasites, and adult food preference. Butterflies are thus an important group of animals for the evaluation of nature reserves, and it is important to realise that each vegetation type is inhabited by its own Lepidopteran fauna (Erhardt 1985).

Grassland specialist are very sensitive to changes in the habitat composition, which may result in changing the microclimate, the microdistribution of food plants and changes in the microstructure of the habitat. This is often followed by the invasion of alien plant species and faunal competitors/predators. The various climatic, microclimatic, edaphic and floristic features of areas within the Grassland Biome are often the result of the heterogeneous topographic nature of the grasslands. The interaction of these factors exerts a strong influence on the timing of plant senescence, microdistribution of food plants and consequently, the distribution of the ectothermic butterflies in the biome. The summits and peaks of the Afromontane and Alpine grasslands are of great importance to various hilltopping endemic species.

The mechanical and chemical composition of plants, the microdistribution of food plants, the presence of species required in mutualistic interactions, and the presence of predators also play an integral role in butterfly diversity.

The transformation of natural habitats, and in particular, grasslands, alters the favoured microhabitat of butterfly species, resulting in the high proportion of grassland specialists being recorded in the RDB of Butterflies of South Africa.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

The preservation of the Grassland Biome Lepidoteran diversity can only be ensured if the preferred habitat of each species is known. This means that the habitat quality and area, the size of patches required by each species, with its own characteristic demographic stochastisity, should be known and be of such a nature as to preserve metapopulations in the long term and allow recolonisations from nearby areas.

6.12 Recommendations

Effective conservation and preservation of the Grassland Biome butterfly fauna will depend on the inclusion of various habitat types with reserve networks, or in areas with moderate human interference. Topographical heterogeneous areas, recognised by their own faunal and floristic communities, should be included in these areas. The Lesotho Highlands and high elevation grasslands should enjoy high conservation priority, in order to conserve the various high altitude endemics. Various types of grasslands should also be protected, as each vegetation type has its own microstructure, -climate and butterfly compositions.

Agricultural practices should try to implement scientifically based methods to optimise production with the minimum disturbance to natural habitats. Fragmentation of natural habitats may enhance heterogeneity, but the size of the area and the habitat quality should be considered if one hopes to preserve butterfly species in the long term in such areas. A sound knowledge of a species dispersal abilities and demographic features is required in such cases. Afforestation poses an increasing threat to grassland butterflies, especially to endemics restricted to the high altitude grasslands that are transformed by alien *Pinus* and *Eucalyptus* plantations.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

CHAPTER 7

Mammals of the Grassland Biome

Southern Africa's resident terrestrial mammal fauna, excluding naturalised aliens, includes 226 species, (or nearly 300 terrestrial mammals according to Gelderblom & Bronner 1995), which accounts for approximately 6 % of the world's terrestrial mammals. Thirty seven (16 %), (forty, or 33 % according to Gelderblom & Bronner 1995), of these species are endemic to southern Africa, which includes the kingdoms of Swaziland and Lesotho (Siegfried & Brown 1992).

Owing to the broken, undulating character of the Grassland Biome, several vegetation types, each consisting out of a mosaic of plant communities, are found. Mammal diversity in the Grassland Biome is enhanced through vegetation stratification and niche differentiation, which explain the high number of species included in the inventory.

Because of the complex of factors that might be involved in the distribution of mammals in the Grassland Biome, only the results are listed, as well as relevant data sources that provided to be useful.

7.1 Results

One-hundred and eighty-two mammal species/subspecies are included in the inventory of the Grassland Biome mammals (Table 4). Four of these species are now extinct in this Biome, while another six species used to occur within the grasslands of southern African in historical times, but have contracted their range due to habitat destruction, and over-exploitation by humans. These ten species were included in the main inventory, but were not considered in further data analysis.

The Grassland Biome mammals were assessed according to their habitat preference, food preference, Red Data Book (RDB) status and endemicity status. Several queries were

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

performed from the database, and mammals were categorised into groups under the following headings:

7.1.1 Habitat preference

Mammals are categorised into seven groups according to their main habitat preference (Figure 13), as indicated below:

Habitat type in Grassland Biome	Table	Habitat type code	Number of species
Grassland	29	Habitat type 1	8
Grassland/vlei	*	Habitat type 2	16
Grassland & other habitat types	*	Habitat type 3	63
Habitat types other than grassland	*	Habitat type 4	83
Human settlements	*	Habitat type 5	2
Historical distributions	30	Habitat type 6	4
Extinct species	31	Habitat type 7	6
Total	*	*	182

7.1.2 Endemicity status

Twenty-three species (three are subspecies) of the Grassland Biome mammals (12,79 %) are endemic to South Africa, and another seven species are limited in their distribution to southern Africa (Table 32) (Figure 32). The endemicity status of mammals is related to topics below (Extinct and Historical species are omitted):

7.1.2.1 Habitat preference

The habitat preference of mammal species included in this study, are summarised below:

Habitat type in Grassland Biome	Number of endemic species	Number of limited species	Non-endemic species
Grassland	5	0	3

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

Grassland/vlei	4	1	11
Grassland & other habitat types	7	4	52
Habitat types other than grassland	7	2	74
Human settlements	0	0	2
Total	23	7	142

7.1.2.2 Food preference

Mammals species of the Grassland Biome, were catergorised into seven classes according to their food preference:

Food preference	Number of endemic species	Number of limited species	Total
Insectivore	9	2	11
Carnivore	0	2	2
Herbivore/fructivore	7	1	8
Granivore	0	0	0
Insects/vertebrates	3	1	4
Omnivore	1	1	2
Unknown	3	0	3
Total	23	7	30

7.1.2.3 RDB status

Eighteen (10,5 %) of the endemic/restricted species which occur in the Grassland Biome, are threatened (Table33) (Figure 15):

RDB status	Number of endemic species	Number of limited species	Total RDB Endemic/limited
Vulnerable	3	2	5

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

Rare	3	4	7
Indeterminate	5	1	6
Total	11	7	18

7.1.3 Food preference

The mammals of the Grassland Biome were subdivided into seven categories according to their dominant food preference. This is related to the habitat preference, endemicity status and RDB status of the mammals (Extinct and Historical species omitted).

7.1.3.1 Habitat preference

The food preferences of mammal species, in relation to their habitat types, are given below:

Food preference	Habitat 1	Habitat 2	Habitat 3	Habitat 4	Habitat 5	Total
Insectivore	1	6	16	29	0	52
Carnivore	0	0	5	1	1	7
Herbivore/Fructivore	5	5	19	25	0	54
Granivore	0	0	1	0	0	1
Insects/Vertebrates	0	0	9	6	0	15
Omnivore	2	5	12	18	1	38
Unknown	0	0	1	4	0	5
Total	8	16	63	83	2	172

7.1.3.2 Endemicity status

The food preferences of Grassland Biome mammal species related to their endemicity status as follows:

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

Food preference	Number of endemics	Number of limited species	Non-endemics	Total
Insectivore	9	2	41	52
Carnivore	0	2	5	7
Herbivore/Fructivore	7	1	46	54
Granivore	0	0	1	1
Insects/Vertebrates	3	1	11	15
Omnivore	1	1	36	38
Unknown	3	0	2	5
Total	23	7	142	172

7.1.3.3 RDB status

The Grassland Biome mammal species food preferences in relation to their RDB status are given below:

Food preference	Vulnerable	Rare	Indeterminate	Non-threatened	Total
Insectivore	5	1	6	40	52
Carnivore	0	2	0	5	7
Herbivore/Fructivore	1	0	0	53	54
Granivore	0	0	0	1	1
Insects/Vertebrates	2	3	0	10	15
Omnivore	0	2	1	35	38
Unknown	0	0	3	2	5
Total	8	8	10	146	172

7.1.4 Red Data Book status (according to Scientific Programmes Report)

Twenty-six of the Grassland Biome mammals are recorded in the RDB (Table 33) (Figure 15),

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

whilst four mammal species have gone extinct during recent historical times, and six species which occurred formerly in the grasslands, have contracted their range. Only species which still occur in the Grassland Biome, were considered in the data synthesis.

RDB status	Habitat 1	Habitat 2	Habitat 3	Habitat 4	Habitat 5	Total
Vulnerable	0	3	5	0	0	8
Rare	0	0	5	3	0	8
Indeterminate	0	1	4	5	0	10
Total	0	4	14	8	0	26

7.2 Species richness

Distributions and species richness for birds, mammals, snakes, reptiles and frogs tend to vary along an east-west axis within southern Africa, with the eastern and western subzones being subdivided latitudinally into various subzones (Crowe 1990). The east-west dichotomy is primarily determined by the rainfall, whose effect is mediated through vegetation. The eastern subzone has a relatively predictable rainfall, and is dominated by grassland, woodland and forest biotopes. All vertebrate groups have high species richness values in the east, and high values of endemism in centres which may have remained stable and environmentally complex during the Tertiary and/or Quaternary (Crowe 1990). Davis (1962) claims that the use of vegetation as a primary factor influencing distribution/diversity patterns can be justified as it is the result of the interaction of the soil, climate, topography and other environmental factors.

Large mammal species richness shows a northeast-southwest species distribution pattern. Large mammal species richness in southern Africa decreases from east to west, but southern Africa appears not to have been a major centre of allopatric evolution for larger mammals, and speciation that has occurred, has been more profound in the arid west. Species richness are greatest in the north-eastern corner of the region (Siegfried & Brown 1992).

7.3 Species distribution

Distributional patterns of African mammals correspond well with those of present-day

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

vegetation types and of resident non-aquatic birds. The degree of zonation between groups differs, reflecting their different ecological requirements. Diversity of mammals is positively correlated with the vegetation type diversity, with the distributional and diversity patterns of mammal groups also being affected by past environmental factors. Large mammal diversity increases towards the equator, but diversity patterns vary within groups (Turpie & Crowe 1994).

The zonation patterns of African birds, small mammals and large mammals closely follow that of the major vegetation types. The zonation of Africa by ungulates corresponds closely to that for African aquatic birds (Crowe & Crowe 1982). Boundaries which can not be explained by existing physical or environmental barriers, are related to past environmental conditions, and resulting speciation events (Bigalke 1972; Crowe & Crowe 1982).

The increase of larger African mammal diversity towards the equator is steeper than for North American mammals, but each major group has its own specific factors which contribute to this gradient. Each mammal group is restricted to the vegetation type to which each group is historically, and generally, most adapted (Turpie & Crowe 1994).

Within the Grassland Biome, mammals follow north-east to south distribution pattern, with the highest diversity of animals being animals that are not exclusively restricted to grassland, but utilise a variety of vegetation types, especially woodlands. However, most grassland species (e.g. Oribi, Mountain Reedbuck) are found towards the Drakensberg Escarpment and Highveld grassland vlei areas (Slogget's Rat), while some species such as the Blesbok and the Black Wildebeest used to occur over a wider range, but have contracted their former ranges due to habitat destruction.

7.4 Endemics

Endemic species have restricted distributions, and they are inherently vulnerable. Local species radiation may give rise to endemics, or they may be the product of local species radiation. Endemics thus can be new species, or archaic relicts, all of which require special protection.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

There are 36 endemic mammal species in southern Africa, of which 15 species are listed in the South African Red Data Book. Most of the endemic species tend to cluster down in the south-western part of southern Africa (Siegfried & Brown 1992; Gelderblom & Bronner 1995). However, according to Gelderblom & Bronner (1995) forty mammal species are endemic to South Africa, of which twenty species are recorded in the RDB. They are predominantly small mammals.

Twenty-three endemic mammal species occur in the Grassland Biome. The Natal Red Rock Rabbit *Pronolagus crassicaudatus*, Rough-Haired Golden Mole *Chrysopalax villosus*, Laminated Vlei Rat *Otomys laminatus*, Blesbok *Damaliscus dorcas phillipsi*, and The Black Wildebeest *Connachaetus gnu* are endemic to the Grassland Biome. Sloggett's Rat *Otomys sloggetti*, Sclater's Golden Mole *Chlorotalpa sclateri*, Gunning's Golden Mole *Amblysomus gunningi* and Saunders' Vlei Rat *Otmys saundersiae* have their distributional centres in montane grassland.

The less vagile species, such as the subterranean families Chrysochloridae and Bathyergidae, show particularly high levels of endemism (Gelderblom & Bronner 1995). Several of these species are present in the Grassland Biome. The succulent Karoo, fynbos and Knysna-Tsitsikamma forest show a high level of endemism, whereas the savanna, grasslands and Nama-Karoo contain relatively few endemics. Many of the endemic species found in the Grassland Biome also occur in the transitional zones between the grasslands and the bushveld. Grassland specialists that are endemic are mostly restricted to the montane grasslands and vlei areas, while larger ungulates have now contracted their former ranges.

7.5 Hotspots

Point and range map data indicate that coastal regions, the northern Transvaal and Knysna-Tsitsikamma are important for the endemic Insectivora. In addition, a hotspot is found in the Eastern Cape Province. The two biomes which are inadequately protected are the Nama- and Succulent Karoo.

Although no mammalian "hotspots" are primarily situated within the Grassland Biome,

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

several grassland endemic species do occur in the Grassland Biome, with several grassland species being restricted to the montane grasslands.

7.6 Conservation & Recommendations

Most mammal species are adequately conserved in the reserve network, and although many of the larger grassland ungulates, (i.e. Black Wildebeest, Oribi, Mountain Reedbuck, Springbok) have contracted their ranges, they are fairly well conserved. Several small rodents are very habitat specific, however, and the destruction of vleis in the Highveld grassland threatens several of these species that are not as mobile as larger ungulates. Large numbers of ungulates also formerly occured in the Grassland Biome. Although many of these species were migrational, they fulfilled a role in the region's dynamics, creating suitable habitats for other species (e.g. birds, invertebrates, reptiles) by grazing etc. By applying correct grazing regimes, this balance can still be aspired to in agricultural areas.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

CHAPTER 8

General discussion

The South African Grassland Biome has a relatively large number of endemic species of birds, grasshoppers, butterflies (Dirsh 1956; Siegfried 1992; Pringle *et al.* 1994), amphibians (Siegfried 1989), and tortoises (Branch *et al.* 1995), while detailed records on the distribution of reptiles are incomplete (Lombard *et al.* 1995).

8.1 Motivation

The Grassland Biome is under constant pressure from commercial activities such as afforestation, agriculture, mining and urbanisation. Transformation of the grassland types resulted in the inevitable decline of the grassland fauna (Samways & Moore 1991; Allan *et al.* 1995; Armstrong & Van Hensbergen 1997) and vegetation, thus irreversibly upsetting the delicate interaction between the biotic and abiotic factors.

Birds are recognised as good indicators of habitat conditions (Bock & Webb 1984), with changes in vegetation composition and physiognomic structure resulting in a change in the avian community composition (Anderson 1980; Johnston & Odum 1956). Butterfly communities are also considered to be sensitive indicators of vegetation structure and environmental change, and consequently, this taxon is often employed as an indirect measure of plant diversity and habitat quality. Information on the Grassland Biome butterflies is rarely available, especially data concerning the extent to which grassland butterfly diversity, as well as the rest of the trophic web, is impaired by the destruction and modification of grasslands.

Reptiles and amphibians are very habitat specific, and sensitive to environmental change, especially to habitat destruction. This can be ascribed to several factors, and especially to the fact that these species are less mobile than birds and larger mammals, precluding survival through long-distance migration. Several reptiles are restricted to rocky sites or termitaria in the grassland, while various amphibian species are not only sensitive to habitat destruction, but

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

are also severely affected by pollutants that are absorbed through the skin. Unfortunately, little attention is given to these taxa when developing areas, causing several of the Grassland Biome herpetofauna species to be threatened.

Most of the large grassland mammals (e.g. the Blesbok *Damiliscus dorcas phillipsi*, Oribi *Ourebia Ourebia*, Black Wildebeest *Connachaetus gnu*) have contracted their ranges due to the destruction of their habitats and migration routes. However, eight species/subspecies of small rodents are restricted to grassland in the Grassland Biome. These species' persistence relies on the maintenance of the correct environmental conditions, which necessitates the investigation of parameters which should be met to preserve the mammal diversity of the Grassland Biome.

The five faunal groups employed in this study were chosen because they act as good surrogates for vegetation diversity, and are sensitive to environmental change. The collation of data on the fauna has proved that the Grassland Biome is comprised of many complicated ecosystems, with each faunal species holding its own particular habitat preference. It has also come to light that, owing to the complex topographical features of the Grassland Biome, and through the interaction of other biotic and abiotic factors, the region hosts a high diversity of fauna and endemic species. This study attempts to identify which criteria should be met, and what parts of the Grassland Biome should be conserved, in order to maintain its biodiversity in the long-term. Taxa such as the Reptilia, Anurans and Lepidoptera are very sensitive to habitat destruction and should enjoy higher consideration in the development of areas and selection of conservation sites.

8.2 Species distribution

Various geographical variables determine the distribution of birds. Vegetation type is the most important parameter (MacArthur & MacArthur 1961; Pianka & Huey 1971; Gentilli 1992; Herremans 1993). The east-west biogeographical distribution pattern of Grassland Biome birds is primarily mediated through the effect of the annual rainfall on biotic diversity. Avian distribution within the Grassland Biome shows a high diversity towards the eastern sector (Drakensberg Escarpment), while the number of endemic species increases towards the west of

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

the country. Although more bird species occur in habitat types other than grassland in the Grassland Biome, all endemic species are restricted to grassland or grassland-associated habitats (many of them recorded in the RDB), suggesting they should be given a higher conservation priority.

Herpetofaunal biodiversity reflects the varying climates and habitats of the region (Branch 1988), but a lack of information on reptiles (Jacobsen 1987; Branch 1988), contributes to peoples' ignorance. Many of the grassland herpetofauna specialists show an affinity for the montane grassland of the eastern-, southeastern, and northeastern Transvaal and Free State, and with the marshy swamps of the catchment area of the eastern Drakensberg. Within the grasslands, several lizard species/subspecies are confined to rocky habitats (this can be attributed to thermoregulatory characteristics & predator avoidance), and also display different preferred altitudes of occupancy. Areas of a high level of amphibian endemicity and species richness include northern Natal, Lesotho, the Afromontane north-eastern Free State and Qwa-Qwa region (Bates 1995b; Drinkrow & Cherry 1995; Van Dijk 1996) and diversity in these areas, succeed that of the global amphibian diversity (Siegfried 1989). Many of the amphibians are restricted to this area. Detailed information on the distribution of Grassland Biome reptiles in particular still needs to be established, but from scoring records and iterative algorithms (Lombard *et al.* 1995), it can be deduced that the Transvaal Drakensberg Escarpment and central Transvaal are high in species richness, -rareness and endemism, while the distribution of reptiles within the Lesotho Highlands and Qwa-qwa still needs to be surveyed.

Distribution patterns of butterflies in southern Africa, and of the Grassland Biome butterflies in particular, are not known. Butterflies of the Grassland Biome show a preference for the Afromontane and Alpine grasslands of the Drakensberg Escarpment, Lesotho highlands and eastern Cape, with many endemic species being restricted to these high altitude grasslands.

The majority of mammals included in this study show a preference for bushveld elements, and their distribution is concentrated towards the northern "boundary" of the Grassland Biome. The Grassland species, however, show a preference for grassland, ranging from the Moist Cold- and Moist Cool Highveld Grassland to the Moist Sandy- and Wet

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

Highveld Grasslands (Low & Rebello 1996) of the Grassland Biome. The high altitude grasslands of the Lesotho highlands prove to be poor in mammal diversity.

The fauna species of the Grassland Biome each display their own distribution pattern, but within each taxon there is a congruence in the patterns of species richness and -endemicity. When the distributions of the Grassland Biome fauna are regarded in their entirety, however, the distribution patterns of endemic species and species richness across the taxa (i.e not the distribution patterns of the entire taxon as such), show a high degree of correspondence. Although each taxon differs in the distribution of species diversity, (especially on a national scale), this phenomenon is less pronounced on a regional scale in the Grassland Biome, with endemic species and species diversity displaying similar patterns across the faunal groups. Endemic species, species diversity and threatened species (the two former categories very often include species in this latter category) are three of the criteria that were employed to determine which species can act as sensitive surrogates of environmental health. This gives an indication which vegetation types of the Grassland Biome should be preserved to maintain their diversity. Hence, it can be concluded (as found in this preliminary study) that the Mpumalanga Afromontane grasslands, the north-eastern Free State- and Lesotho Cold Highveld grasslands and Alpine grasslands should be recognised as important areas to conserve and preserve the floristic and faunal properties of this southern African Grasslands. It should be stressed, however, that other endemic species prefer the transitional zones between the Grassland Biome and other biomes, and that their habitat preferences should also be understood, and these plant communities should be managed accordingly. The Grassland Biome as a whole should be recognised as a heterogeneous region, with a variety of complex interactions existing between the biotic and abiotic environment.

8.3 Endemics

Birds are widely used as measures of plant- and faunal diversity and distribution, with passerines being recognised as most useful as indicating the faunal affinities of South African birds (Winterbottom 1959). A high level of endemic birds (Grassland Biome, South Africa, sub-Region) is found in the Grassland Biome, with the six species of Grassland Biome endemic species being restricted primarily to the Afromontane grasslands of Mpumalanga, south-eastern

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

Free State, and the Qwa-Qwa region. An endemic bird centre has also been identified by the ICBP (1992) which occurs in the Mpumalanga province, based on the distribution of these endemic grassland specialists, but it is suggested that this centre should be extended, and concentrated, in the south-eastern Free State-, Qwa-Qwa- and Lesotho highlands regions. This is because of the high level of South African and sub- Region endemics that are concentrated here.

The palaeogenic invertebrates of South Africa show high levels of speciation in the Fynbos and Grassland Biome, with the distribution of many of the elements being attributable to the altitude, relief, aspect of the Cape Centre and the Eastern Highlands Centre mountains. The Grassland Biome butterfly fauna show a high level of endemism, and it is believed that these species formerly occupied a wider range (Carcasson 1964). Species richness of butterflies is highest at altitudes below 1700 m, but with a large proportion of endemics found on the high altitude mountains of the Grassland Biome (Armstrong & Van Hensbergen 1997).

Many reptiles and amphibians endemic to South Africa, have very restricted ranges. A combination of mean annual rainfall and mean winter temperature are the key factors in causing frog species richness in southern Africa to decrease from east to west. The Transvaal Drakensberg Escarpment and Lesotho Highlands show a high level of species richness and endemism. Lizards display a bimodal pattern of variation in species richness on a national scale, with high levels of species richness found in the western zone of southern Africa and high levels of species richness and endemism found in the Transvaal Escarpment area. Mean rainfall and variations thereof, as well as topographical diversity created by the rocky habitats of the eastern "boundary" of the Grassland Biome, contribute positively to the Grassland Biome lizard diversity. The increased microhabitat diversity and the thermoregulatory nature of the ectothermic lizards may account to some extent for the distribution pattern of this taxon in the Grassland Biome. Snake species richness seems to be related to the amount of solar radiation received, topographic diversity and mean annual rainfall (Crowe 1990). A high level of species richness is found in the eastern (and consequently the Mpumalanga Escarpment in the Grassland Biome) and western sector of southern Africa, with species richness decreasing from east to west on a national scale (similar to that of frogs). Chelonian distribution records are scanty and distribution patterns of tortoises should still be established, but the Grassland

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

Biome in general is poorly represented in chelonian distribution. This area includes the former Transkei, Lesotho, eastern Cape, Kwa-Zulu Natal midlands, northeastern Free State and the North-West Province. However, the Mountain Tortoise *Geochelone pardalis*, is found in the montane grassland of the southern Free State. Its former distribution patterns still need to be established to determine whether this species used to be present in other areas during historical times.

Several of the large endemic mammals, (e.g. Blesbok, Black Wildebeest, Oribi) have contracted their range in response to the growing agricultural and commercial activities of man. The largest number of endemics found in the Grassland Biome prefer habitat types other than grassland (savanna- and woodland species), but if one looks at the ratio of endemics: inhabitants in a particular habitat type, grasslands have the highest percentage of endemic mammals.

8.4 Habitat selection

The evolution of an animal's habitat preference is determined by its morphological structure, behaviour, its ability to obtain food and presence of host and predators. Habitat preferences of birds are chiefly determined by the habitat structure, (Elton & Miller 1954; MacArthur & MacArthur 1961; MacArthur *et al.* 1962; Pianka & Huey 1971; Gentilli 1992; Herremans 1993), with the densities and ranges of grassland species fluctuating in response to the interaction of the habitat structure with other factors (Stepney & Power 1973).

Butterfly distribution is determined by the habitat structure, microclimate, suitable breeding areas, microdistribution of the host plant and host organisms, edaphic and climatic factors, presence of predators and the influence of man's activities on the butterfly's natural habitat.

The high annual rainfall of the Drakensberg Escarpment, especially that of Lesotho and the Free State Escarpment (Qwa-Qwa region), provides various aquatic habitats, and thus contributes to the high amphibian diversity and endemicity of the area. Reptile distribution, especially of several Grassland Biome endemics, largely agrees with rocky habitats. This can

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

be attributed to their thermoregulatory behaviour, which is regulated by basking on the rocks, while the forage is provided by surrounding grassy patches.

Habitat structure, and in particular vegetation structure, is the primary factor that determines the distribution, and diversity of faunal species within the Grassland Biome. The effect of the abiotic factors (e.g. the climate, soil, topography etc.) on the diversity and distribution of fauna species within the Grassland Biome, is often mediated indirectly through the vegetation structure and – composition. Although one grassland type might be homogenous in structure, the Grassland Biome is characterised by a mosaic of grassland types intergrated by other vegetation types (owing to the topographical gradient which enhances the faunal diversity of this region. People are still too ignorant about the habitat requirements of the Grassland Biome butterflies, reptiles and amphibians, and these species should be monitored more closely.

8.5 Vegetation

The southern African subcontinent has a high diversity of vegetation types and plant communities, (Rutherford & Westfall 1994), which are represented in seven major biomes (Low & Rebelo 1996). It is said that vegetation, (structure and species composition), governs the geographical lines along which speciation has taken place (Hall & Moreau 1970), but that every species' distribution has its own exception to this rule.
Vegetation patterns reflect numerous environmental factors such as the topography, rainfall, temperature, fire, latitude, height above sea level, and atmospheric circulation.
The floristically heterogeneous Grassland Biome is not only characterised by different grassland types, but also by grassland ravines, riverine vegetation, grassland wetlands and pans, which provide a wide spectrum of habitats for species restricted to veld types within the Grassland Biome.

Vertical and horizontal vegetation structure is the primary determinant of bird distribution (Moreau 1966; Cody 1985), and any alterations may cause a shift in species composition and diversity. Structural differences of the grassland types found within the Grassland Biome contribute to the area's high avian diversity. The birds of Grassland Biome

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

have different nesting-, foraging- and song display characteristics, with bird species of taller grassland being more sensitive to vegetation height and density than short-grassland species (Cody 1968).

The species richness of butterflies is closely related to the species richness of vascular plants. The Grassland Biome butterflies also show a preference for different habitat types where the habitat structure, vegetation height and -density are concerned. Microclimatic stability and protective reasons may be key explanatory factors in this instance. Grass length is critical in determining which butterfly species will be present, stressing how important it is to maintain grass length at a suitable height. The habitat preference of *Aloeides dentatis dentatis* of the Ruimsig Entomological Reserve in the Grassland Biome illustrates this point. Successional changes in the Grassland Biome vegetation alter the microclimate, microhabitat structure, availability of food plants and the chance of locating a mate. Grassland specialists habitat preferences differ, emphasising how important it is to preserve various grassland vegetation types and, where necessary, manage these with correct grazing regimes

Vegetation/habitat structures, (not floral composition), is also the proximate stimulus in determining the species distribution patterns of reptiles and amphibians, with other factors co-operating or dominating at times. Habitat selection by the reptiles and amphibians of the Grassland Biome is influenced by a balance that needs to be reached between attaining an appropriate body temperature, avoiding predation risk, optimising foraging and locating mates. Grassland Biome herpetofauna often rely on structures such as termitaria for this purpose, necessitating the conservation of these structures within grasslands.

Maintaining the correct environment, i.e. preserving physiognomically different grassland types, is essential to ensure that the faunal and floristic species of the Grassland Biome, especially those species restricted to certain localities, are conserved adequately.

8.6 Succession

Vegetation successional stages exert a strong influence on which invertebrate and vertebrate communities can be expected to be present in grasslands. Several grassland butterflies

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

disappear if shrubs and coarse vegetation invade grasslands (unfavourable microclimate, habitat structure, and absence of food plant), while overgrazed and cultivated areas can also contribute to a decline in species richness. Habitat quality proves to be of primary importance for butterflies and their mutualistic hosts to be present, while the presence of the larval food plant plays an important, yet secondary role.

The grasslands of the Grassland Biome are also recognised by their own, characteristic avifaunas, with grassland specialists (i.e. species exclusively restricted to grassland) being especially sensitive to grass length and density, and the succession thereof. Invasion by woodland bird species following the introduction of alien or other woody species, may cause a shift in the structure of the avian community, to the detriment of the restricted grassland species.

The impact of succession on the Grassland Biome reptiles and amphibians urgently needs to be addressed, as little or no information on this aspect has been published to date. The relevance of this factor on small mammals also requires attention

8.7 Climate

Weather patterns, and rainfall, (annual rainfall and variations thereof) in particular, exert a strong influence on the abundance and distribution of bird communities within the Grassland Biome. Rainfall patterns influence bird diversity by providing waterbodies for waterbirds, by influencing the vegetation structure, (depending on the amount and seasonality of the rainfall), by affecting the emergences of insects and small rodents after good rains, and by determining the length of the breeding season (Zimmerman 1992). Temperature can structure avian communities by causing the altitudinal migration of species, (e.g. the Yellow-breasted Pipit *Hemimacronyx chloris*, Sentinel Rock Thrush *Monticola explorator*) (Harrison *et al.* 1997) along the Drakensberg Escarpment, and by its effect on the breeding season of birds.

The emergence patterns of butterflies are the result of the interaction of macroclimatic and microclimatic conditions, as well as the history of the species and its environment (Weiss *et al.* 1993). Temperature in particular, directly and indirectly, determines butterfly

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

distribution. The ectothermic behaviour of butterflies and the indirect effect of temperature on overall productivity of the environment (Turner *et al.* 1987) can explain this. Thermal conditions influence activity patterns of insects in all their life stages, and it has been found that although each habitat type holds its own peculiar species, species richness is highest in warmer places Many of the Grassland Biome butterflies perch on grass swards until the ambient tempe ature rises, as seen in the case of several of the Lycaenidae. The amount of solar energy and ra nfall received may also determine butterfly diversity indirectly via habitat diversity, distrib ıtion of the food plant and habitat structure. The microclimate associated with habitat aspect local shelter, vegetation and soil type, determines the distribution and restriction of ectoth ermic animals on a much smaller scale (Dobkin *et al.* 1987 *cite* Riechert & Tracy 1975; Rawlir s & Lederhouse 1981; Kingsolver 1983b; Kingsolver & Watt 1983; Dobkin 1985; Raven croft & Young 1996). Microclimatic differences resulting from topographical hetero geneity determine the habitat structure of the given area, the microclimate, the distribu tion of the food plant and time of senescence of the larval host plant. The microclimate thus in luences the habitat quality, which in turn determines which butterfly species will be presen . The various grassland types of the Grassland Biome, each one with its own specific set of r nicroclimatic conditions, mediate butterfly diversity through the above-mentioned factors In the Grassland Biome, many butterflies bask in sites to increase their metabolic rate, so that the food assimilation rate and reproduction rate can be increased. Other species prefer shadier areas because of the restriction of the larval host plant to these sites, (e.g. *Dira jansei*). This en phasises the importance of preserving microclimatic heterogeneity, (Dobkin *et al.* 1987), n order to maintain the butterfly diversity of the Grassland Biome.

Climate, (temperature, rainfall etc.), in itself is not the limiting factor in the distribution of ampl ibians and reptiles (Van Djik 1982), but may determine herpetofaunal distribution indirect y, via the vegetation, or soils produced by certain climatic conditions.

8.8 Top ography

The top ographically diverse features of the Grassland Biome results in a mosaic of microha itats and -climates, contributing to the faunal diversity of the grasslands. The Great Escarpn ent is the home of several vertebrates and invertebrates.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

Various endemic bird species, (Grassland Biome, southern Africa, sub-Region), are confined to the mountainous grasslands of the Grassland Biome. These species also display different habitat preferences with some species occuring at high altitudes, and others prefering lower altitudes (species presence is determined through vegetation structure and -height). Some Grassland Biome species avoid the mountainous areas, whereas other species follow the Transvaal Drakensberg Escarpment.

The variety of aspects gives rise to an array of microclimatic environments, which results in the variability of host plant densities, time of senescence and the phenology of plants. The butterflies *Lepidochrysops variabilis*, *Lepidochrysops victori* and *Torynesis orangica* are some of the species that occur at high altitudes in the Grassland Biome. These species are low-density species, which remain at the hilltops to mate. In order to conserve these species adequately, habitats along the topographical gradient (and thus the thermal gradient) should be considered and included in the conservation of butterfly species. North slopes in the Grassland Biome host a larger butterfly diversity, and should be included across landscape elements (Armstrong & Van Hensbergen 1997), but south facing slopes should also be included to favour species such as *Dira jansei*. Several endemic and restricted species occur in the Lesotho highlands and Drakensberg Escarpment, and these areas should be adequately protected.

The amphibians and reptiles of the Grassland Biome show a marked preference for certain habitat types. Several species (most of them endemic to the Grassland Biome) are restricted to rocky habitat types within the grasslands. These species prefer rocky terrain to help regulate their body temperature, while they forage in the adjacent short grass patches. The Mpumalanga Escarpment is one such centre high in reptile endemicity and species diversity. The amphibians of the Grassland Biome also show a high level of endemism in the eastern sector, i.e. the Lesotho highlands, southeastern Free State and Qwa-Qwa region, and the Mpumulanga-KwaZulu-Natal Drakensberg Escarpment.

The Mpumalanga Drakensberg Escarpment, and the high altitudes of the northeastern Free State and Lesotho Highlands are a broken terrain characterised by different vegetation types and microclimatic conditions. The rocky terrain is the preferred habitat of several lizard

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

species, and the high altitude mountains are rich in endemic species of butterflies, birds and amphibians. Lizard endemicity is also high in these areas, but their distribution and diversity within the Grassland Biome needs still to be established. Mammal diversity of at these high altitudes is low, although some grassland species such as the oribi and mountain reedbuck do occur in these grasslands.

8.9 Area size

The territory size required for the survival of plant and animal species varies from area to area and from species to species. Several models have to be considered in order to determine the territory size of a species. The intraspecific body size, habitat quality, food availability, competition, intraspecific niche differentiation, presence of predators and parasitoids, and human intervention may influence residence size by acting independently, or co-operating in varying degrees.

Birds' sensitivity to habitat size varies, but in general larger birds need a large critical area in order to avoid extinction (Cody 1985). Food availability, competition and suitable breeding sites may increase or decrease territory size of species. Fragmentation of habitats may impair Grassland Biome bird diversity, as larger species such as the Wattled Crane *Bugeranus carunculatus* and the Bearded Vulture *Gypaetus barbatus* are not only very sensitive to area size, but also to the type of grassland preferred.

Habitat patches of varying sizes each have their own microclimatic features, floral composition and structure and butterfly communities which inhabit them. The spatial dynamics of metapopulations within a species may differ, depending on the patch size, degree of connectivity, habitat quality and -diversity, and successional stage. Demographic and environmental factors determine the extinction of rare populations (Opdam 1990), with the persistence of species depending on the area size (and related factors), and the habitat quality. *Aloeides dentatis dentatis*, a grassland species preferring non-climax grassland areas in the Grassland Biome, is adequately conserved in an area of 12 ha, with habitat quality and structure proving to be more important than areas size .

Studies in South Africa on the area size required by amphibians and reptiles, urgently

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

need to be undertaken. This is of especially great importance for the Grassland Biome herpetofauna, since large areas of their habitat are under growing pressure of habitat destruction. If one can established the habitat type and -quality needed by a species, their translocation may be more successful.

Habitat size is of great importance to bird- and larger mammal species, (such as the ungulates), but in general, habitat quality proves to co-operate, or dominate at times (as can been clearly illustrated in the case of butterflies). It has been found that on airports within the Grassland Biome, grassland species still frequent these areas, providing their natural habitat is present, and that the area is of adequate size to forage and breed successfully in.

8.10 Habitat fragmentation

Fragmentation can severely affect invertebrate communities, depending on their mobility, degree of isolation from other colonies, intrinsic demographic features and the habitat quality of the patch. Generalists can utilise a wider mosaic of habitats, whereas specialists depend on the presence of certain habitat features. The conservation of Grassland Biome fauna species, and in particular butterflies, will depend on the management of a network of patches that are connected to some degree, with viable metapopulations being preserved in all the patches.

Birds and mammals are very sensitive to habitat fragmentation. Fragmentation alters the macro-, microstructure, microclimate and other features of an area. Destruction of grasslands, especially in the case of larger grassland birds, may cause a shift in species composition, or a reduction in species diversity. The role of fragmentation on reptiles, amphibians and butterflies of the Grassland Biome, needs to be addressed in more detail.

8.11 Habitat selection and foraging

Vegetation structure, food availability and abundance govern niche differentiation in foraging birds. Most of the Grassland Biome birds, especially those that forage in grasslands only, are omnivorous with a higher intake of insects during the summer months, (when the energetically costly breeding seasons for most birds starts), while the rest are primarily insect feeding

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

species. Only one species feeds exclusively on grain.

A combination of mechanical-, ecological-, chemical factors, the presence of predators, mutualistic hosts, microhabitat-and climate and the microdistribution of food plants are important in the choice of food plant by butterflies. Environmental factors can influence the chemical and mechanical composition of food plants. These chemical properties of plant families cause several butterfly groups to be selective in food plant choice. Certain habitats, with their particular microclimatic conditions, may not only determine the microdistribution of food plants, but also the mechanical and chemical composition of the food plants, time of senescence of the plants and thus the suitability of an area as oviposition site. *Aloeides dentatis dentatis* will only oviposit if the preferred habitat quality is met, i.e. disturbed areas which are favourable to their host ant, and areas where the food plant, *Hermannia depressa*, is not concealed by the vegetation. It was found that the presence of the food plant was of secondary importance to the distribution of this butterfly in the Rocky Highveld grassland of southern Africa, as the food plant occurs over a much wider area than the butterfly.

To date, nothing has been published about the extent to which food availability plays a role in structuring amphibian- and reptile communities in southern Africa, and thus the Grassland Biome.

When the food preference of the Grassland Biome mammals are considered, most species are found to be either omnivorous or insectivorous, with only one species being a granivore.

The phenomenon that most of the Grassland Biome mammals and birds are omnivorous or insectivorous, and not granivorous, as might be expected, can possibly be explained in terms of energetic constraints. Insects are an abundant food source in the Grassland Biome, and emergences of termite alates and other insects are especially high after the rainy season in summer. This attracts high densities of birds and can sustain large numbers of small mammals (such as rodents). Insects also provide a high nutrition/energy value, which is especially important during the breeding season. Grain, although very high in energy, releases it quickly, and is not the favoured food source of breeding animals. The availability of grain in the

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

Grassland Biome is also restricted (mostly) to the winter season, thus not providing a constant, abundant food source.

8.12 Breeding sites

The nesting requirements of birds vary in relation to the habitat structure, predation-, microclimatic-, climatic- and food availability features. Most birds that occur in the Grassland Biome are South African Breeders, with nine of the twelve grassland specialists falling in this category. Bird diversity and -abundance in the Grassland Biome are enhanced by the presence of wetlands, (permanent or temporary), while the emergence of large amounts of insects and termites provide food to breeding birds, often resulting in coloniality of birds, (especially in wetland areas). Various bird species, (such as the widow-, cisticola- and finch species) make their nests in tall grass on various heights above ground. The introduction of monocultures (i.e. maize, sorghum, alien trees), not only destroys the nesting and foraging sites of grassland birds, but may also enhance the spread of more dominant, woodland species and alien species such as the Indian Mynah *Acridotheres tristis*.

Ideal habitats for oviposition of butterflies are determined by the complex interaction of several factors, as discussed under 6.5.6. The ideal habitat is not only determined by the presence of sufficient larval food plants, but also by the habitat quality (i.e. vegetation height and density, microclimate, presence of hosts and predators etc.). Breeding sites are selected to optimise larval survival, and breeding site preference differs from species to another. Some prefer open, disturbed areas, which can be maintained by light grazing, whereas other species prefer more dense, shadier ovipostion sites. The habitat preference of species, especially those that feed on various grass species, should be carefully recorded and various landscape and grassland types with as much topographical variation should be conserved in order to preserve all the species adequately.

Several lizard species lay their eggs in debris, between bark flakes, and rock crevices, but no studies up to date have been conducted to shed more light on which reproduction conditions in the Grassland Biome are required (and should thus be protected) by reptiles and amphibians. Reptiles are ectotherms and the high diversity and high endemic level of lizards

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

found towards the Drakensberg Escarpment (Jacobsen pers. comm. 1997) (no articles have been published to date on the diversity and endemicity of the Mpumalanga grassland herpetofauna), can be ascribed to their thermoregulatory nature. Rocky habitats and termitaria in the Grassland Biome not only allow this type of behaviour, but also provide protection against predators, while the lizards forage in the surrounding grass patches. Although not all amphibians require water to spawn in, many of the endemic species found in the Lesotho highlands lay their eggs in the slow-flowing streams, with each species having specific aquatic requirements.

Habitat structure, habitat quality and food availability exert a strong selection of breeding site selection by the faunas of the Grassland Biome. Modification of the grasslands results in an altered microclimate, food availability and predators/species composition, to the detriment of several grassland fauna species. The Rocky Highveld grassland, and the Afromontane and Alpine grasslands of the Grassland Biome are favoured by several species, with a high level of endemics occurring in these grasslands.

8.13 Human impact

The Grassland Biome is increasingly subjected to, and modified by industrial-, mining-, afforestation and other cultivation activities, while the rate of urbanisation is the highest in the country. This results in the fragmentation of the grasslands, and the reduction of species' (floristic & faunal) diversity and abundance. Habitat destruction through human activities also threatens the survival of various butterfly species (Henning & Henning 1989; Pringle 1995).

Habitat destruction is the most important threat to amphibians and reptiles (Branch 1988), with the amphibians being seriously affected by the destruction of Highveld pans and wetlands (Lambiris 1988a). With reptiles and amphibians being less mobile than birds and mammals, they are also more susceptible to habitat destruction and exploitation by humans. However, birds are also, to varying degrees, sensitive to habitat destruction. Large grassland birds are sensitive to habitat fragmentation, while the modification of grasslands by monocultures (agricultural and urban- and commercial tree planting) may result in "ornithological deserts". This applies especially to the Afromontane grasslands of

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

Mpumalanga, the grasslands of the northeastern Free State, Lesotho and the Eastern Cape, while more generalistic woodland bird species may suppress grassland birds.

8.13.1 Agriculture & grazing

Low-impact grazing is favourable for the maintenance of the structure of natural pastures, whereas overgrazing may result in soil erosion and bush encroachment, and conversely, a change in the avian community structure (Werger 1978). Sound grazing regimes and cultivated fields in the Grassland Biome may enhance bird diversity, as species such as the Sicklewinged Chat *Cercomela sinuata* and the Blue Korhaan *Eupodotis caerulescens*, and the Bald Ibis *Ceronticus calvus* utilise these areas, and also areas adjacent to cultivated fields. However, some species such as the Redbilled Quelea *Quelea quelea* have become a pest of small-grained cereals.

Agricultural activities prove to be detrimental to butterflies on grounds of several factors discussed under 6.6.1. Agricultural conversion of grasslands and the draining of wetlands in the Grassland Biome, have resulted in the decline and extinction of several butterfly colonies (Henning *et al.* 1997). Also, by altering the natural habitat, host ants, with which several of the Lycaenidae live in mutualistic association, are not favoured by the modified habitat (competition with alien invertebrate species, inaccessible habitat, etc.). Consequently many of the butterflies species dependant on these ant decline or disappear.

The effect of grazing of the grassland on southern African butterflies is not known. However, it can be predicted that responses will be similar to case studies followed in other countries. Stock farming (sheep & cattle) in the Grassland Biome is common, and many natural fields are either devoid of wild ungulates (and consequently undergrazed), or irreversibly transformed by incorrect, environmentally destructive grazing regimes. The type of grazing regime, to a large extent, determines the suitability of a habitat for butterflies to be present. Grazing alters the microstructure and -climate of the environment, while periodic disturbance in terms of light grazing can slow the succession of vegetation. By applying correct grazing regimes in the various grassland types of the Grassland Biome, stock-potential and -yield can be optimised, the environment, and consequently butterfly communities, can be successfully managed and conserved.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

Agricultural practices have transformed large areas of the Highveld grasslands into faunal deserts. Consequently, many endemic species are now being threatened because of their preference for relatively undisturbed grasslands (*Cordylus giganteus*, Newbery *et al.* 1983; Branch 1988), while the destruction of termitaria threatens other species *(Prosymna sundevalli sundevalli*) that shelter in them.

Continued overgrazing is detrimental to all the faunas of the Grassland Biome. It results in impoverished species diversity by altering the abiotic- and biotic environment, by exposing fauna species to predators and by reducing the availability of food plants. However, light grazing regimes (sheep and cattle farming), can enhance species diversity, as discussed in earlier chapters. By applying correct farming practices, both humans and the natural environment may benefit.

8.13.2 Afforestation and urban tree planting

The areas in South Africa which are most intensively exploited by afforestation activities coincide with those regions in which diversity and endemism, especially botanical diversity, is concentrated. Avian diversity is the highest in the escarpment region, where afforestation has significantly reduced grassland bird diversity (Allan *et al.* 1997). Grassland birds are severely affected by afforestation, even when the areas under plantation are small, and this negative effect radiates outwards. It is a pity, since the plantations can be considered as "ornithological deserts" depauperate of endemic birds and species richness. The transformation of grassland to closed-canopy forest may also favour woodland species (and generalists), further replacing grassland bird communities (and hence grassland specialists). Plantations do not only change the macro-structure and functioning of the natural habitat, but fragmentation of natural grasslands may also reduce species richness and abundance.

Butterflies are very sensitive to environmental change, and serve as good indicators of urbanisation (Blair & Launer 1997). Modified resources such as food plants, habitat structure, microclimate, and alien predators, may affect the distribution and abundance of butterfly species. Butterfly species are also threatened by the large-scale afforestation of the montane grasslands, and this situation urgently needs conservation evaluation (Armstrong & Van

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

Hensbergen 1997).

Urbanisation also increases the pressure on natural resources, and the destruction of natural habitats further contributes to the decline of herpetofauna species (Jacobsen 1989). Chemical pollutants, industrial effluent and silvicultural activities also feature strongly among activities threatening the fauna of the Grassland Biome. The afforestation of Mpumalanga grasslands has caused the fragmentation of the reptile and amphibian distributions (Jacobsen 1989), while the natural habitats of several more species along the Drakensberg Escarpment, Lesotho highlands and Eastern Cape are increasingly exploited by this activity. Stream-living amphibians are very particular in their habitat requirements, and reduced flow of small perennial rivers because of the growth of pine and eucalyptus plantations, can destroy suitable habitats (Drinkrow & Cherry 1995).

Urban tree planting and commercial afforestation change the vegetation characteristics preferred by fauna species, and may cause a shift in the faunal communities of an area, favouring woodland species and causing the decline of grassland species. Many endemic and threatened reptile-, bird and butterfly species occur in grasslands that are under the imminent threat of afforestation and agricultural activities. The Afromontane and Alpine grasslands of the Grassland Biome are such areas, while the destruction of termitaria also contributes to the decline of habitats favoured by grassland reptiles, snakes and small mammals. Mammals, such as the oribi, the mountain reedbuck and the black wildebeest have largely reduced their habitat range due to habitat destruction. These species still occur in the mountainous grasslands of the Free State, Lesotho and Drakensberg Escarpment. Unfortunately, these areas are increasingly exploited by commercial afforestation industries.

8.13.3 Poisoning & pesticides

The poisoning of carcasses and the application of insecticides and pesticides in cultivated areas, causes the decline of many, often endangered, species. The application of herbicides, pesticides and chemical fertilisers, can directly and indirectly alter butterfly communities and reduce the diversity of several invertebrate and vertebrate species. Modified grasslands can reduce butterfly diversity indirectly because of the altered habitat structure, microclimate,

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

availability of food plants, and introduction of alien predators and competitors, while pesticides can reduce larvae directly if lethal doses are applied.

8.13.4 Other

Mining and industrial activities, especially those concentrated in Gauteng, destroy the habitat of several herpetofauna species, (e.g. *Cordylus giganteus*), while polluted rivers and dams are detrimental to species which rely on water resources for their habitat. Road mortalities, pet trade and commercial exploitation of reptiles, and persecution of snake species, (such as *Naja nivea*), pose a threat to several species.

8.14 Fire

Since historical times, fire has featured in grasslands and savannas, with many fauna species being well fire-adapted. However, a disturbance outside the natural fire regime (as manipulated by humans), may cause a reduction in species abundance and diversity, especially of those species that are less mobile.

Fire-regimes also contribute to the structuring of grassland bird communities. Grassland areas that have recently been burned (inside their natural fire regime period), host a larger diversity and abundance of birds. It is suggested that these veld fires might promote nesting and breeding success, while the exposure of large amounts of invertebrates also attracts birds. Areas selected by foraging birds, and the effect of fire frequency on birds depend on the size of the grassland, whether the bird is a generalist or specialist feeder, and whether it prefers tall or short grass.

Butterflies are killed directly or indirectly by fire, either by altering the habitat, by reducing the food plant, or by killing the larvae. However, if the natural fire regimes in the highveld are maintained, the larvae survive by pupating underground in the winter.

Reptiles of grasslands show low mortality rates in natural fires, but human-induced fires expose these animals, as well as other vertebrates and invertebrates, to modified microclimates, vegetation structures, food availability etc., and may affect species survival indirectly because

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

of reduced shelter, food and thermal unsuitable environments. Fires threaten several lizard species in the Drakensberg Escarpment region, especially because most of the fires intended to burn old stumps and debris fall outside the natural fire regime.

The influence of fire on the vertebrates and invertebrates of the Grassland Biome needs to be studied more closely. Most animals are well adapted to survive, providing that fires occur within the natural fire regime (late winter/spring in the Grassland Biome). These fires help to maintain the habitat structure favoured by faunal species, but fire regimes started by humans at other times of the year, may create unfavourable habitat conditions. Some bird species, such as the Yellowbreasted Pipit can be conserved adequately only within areas where fire is controlled, while the Bald Ibis and Botha's Lark frequent burned and cultivated areas. This emphasises the importance of conserving a mosaic of grassland types.

8.15 Threatened status

Several bird species of the Grassland Biome are recorded in the RDB, particurlarly several endemic birds that fall within afforested areas. It should be stressed that, although the Grassland Biome is the cornerstone of several industrial and agricultural practices, several faunal species, such as the Bald Ibis *Geronticus calvus* and Botha's Lark *Spizocorys fringillaris* may be adequately protected within these areas if their habitat requirements can be reconciled with sustainable development and management of these areas.

Various factors contribute to the threatened status of butterflies, with grassland species and grass-feeding species being at a higher risk.

The number of RDB herpetofauna species found in the Grassland Biome is extremely high, and although several of the species fall within a reserve network, grassland specialists and endemic species are often threatened and not well protected. Various species of the Highveld grassland and of the Transvaal- and Eastern Cape Escarpment (e.g. *Cacosternum nanum nanum*) are not well represented in reserves. Existing reserves are often not of adequate size to ensure the persistence of viable population of restricted and rare reptile and amphibian species.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

Factors that contribute to the threatened status of the Grassland Biome fauna are mentioned in more detail in the previous chapters. Endemic species, often the most threatened species and restricted to grassland areas, should enjoy immediate consideration in the selection of conservation areas, or areas should at least be sustainably utilised so that these species can be preserved in developing areas.

8.16 Conservation

Avian diversity of the Grassland Biome can only be ensured if more conservation areas, including various landscapes and vegetation types, are established. Areas outside the reserve network should be managed in such a way that the basic habitat requirements of species that can utilise such areas, are met. This will allow cropping and agricultural activities, but by applying, for instance, correct grazing regimes, the absence of natural game may be compensated for whilst enhancing bird diversity at the same time.

Butterflies act as early indicators of habitat changes that in the future will affect other faunal taxa (Thomas 1984, 1991). Butterflies are restricted to certain localities due to their dependence on certain food plants, the topography, and the habitat structure, microclimate, presence of host ants and predators. The effect of grassland fragmentation will depend on the butterfly's ability to migrate, its intrinsic demographic features, and the degree to which the preferred habitat is modified.

It is necessary to gain a better understanding on the ecology of the reptiles and amphibians of the Grassland Biome so that suitable sites for the conservation of these species can be identified. These "core" conservation areas should buffer zones around them, while areas urgently need to be identified, not only to protect species diversity, but also to protect endemic species (Drinkrow & Cherry 1995).

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

CHAPTER 9

General Conclusions and recommendations*

9.1 General conclusions

- Inventories of the Grassland Biome's birds, herpetofauna, butterflies and mammals were compiled to assess the diversity of the area (Figure 16), to identify endemic-, threatened species as well as the conservation status of the species included in the study.

- This study also attemped to indicate some intra- and intertaxon faunal affinities, as well as their associations with the floristic environment.

- A synthesis of literature collated on the various fauna taxons is given, and aspects in need of further research are identified.

- The Grassland Biome is characterised by a high diversity of birds, butterflies, amphibians, reptiles, and mammals to some extents. Several Grassland Biome-, southern African- and sub-Region endemic species, grassland specialists and threatened species, (often restricted to grasslands), occur in the Grassland Biome.

- A total of 554 bird species (12 grassland specialist species/subspecies), 243 herpetofauna species, (29 grassland specialist species/subspecies), at least 198 butterfly species, (50 grassland specialist species/subspecies) and 173 mammal species, (eight grassland specialist species/subspecies), have been recorded in the southern African grasslands.

- One-hundred-and twenty-six of bird species occurring in the Grassland Biome, are endemics (i.e. endemic to Grassland Biome/South Africa/southern Africa), while six of these species are restricted to the Grassland Biome. The herpetofauna of the Grassland Biome comprises 121 endemics (term already defined), the Grassland Biome butterflies ± 156 endemics (at least), and the Grassland Biome mammals comprise 23 endemics (8 species/subspecies endemic to the Grassland Biome).

* statistics not in accordance with updated database (i.e. subspecies not considered)

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

- Several Grassland Biome fauna species, many of them endemic to the Grassland Biome or South Africa, are listed in the Scientific Programmes Report. Fifty-nine bird species, 47 reptile and amphibian species, (29 species are of unknown conservation status), 32 butterfly species, and 26 mammal species occuring in the Grassland Biome, are threatened.

- A combination of factors determines the choice of habitat selection by species. The vegetation structure/habitat structure proved to be directly or indirectly, the proximate stimuli of habitat choice in all the taxons, with other factors co-operating or dominating at times.

- Vegetation structure, vegetation successional stage, and area size, (in birds and mammals), are the most important determinants of avian-, butterfly- and mammal species diversity and distribution patterns in the Grassland Biome. Reptile and amphibian distributions are primarily mediated through the effect of abiotic factors, (climate, edaphic, topography), on the vegetation structure.

- Although each taxon displays its own specific distribution patterns on a regional and national scale, an increasing number of endemic species, as well as species diversity accross all the faunal groups, are concentrated towards the Mpumalanga Drakensberg Escarpment, north-eastern Free State, Lesotho Highlands and Eastern Cape. Several other endemic species also occur in the Highveld grassland, however, and transitional zones between the Grassland Biome and other biomes.

- The majority of grassland specialists present in all the taxa, are endemic to the Grassland Biome, and are increasingly threatened by habitat destruction.

- The high urbanisation rate in the Grassland Biome results in an increase of agricultural practices, industrial activities, and commercial- and urban treeplanting, which transform and fragment large areas of the Highveld- and Afromontane grasslands. Destruction of the floristical component results in a decline of faunal species diversity. Grassland specialists and -endemics are severely threatened, especially in the geographical areas mentioned above.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

- The Grassland Biome is poorly represented in the nature reserve network, and although much emphasis is put on species diversity, the habitat requirements of endemic species that are restricted to certain localities, threatened species and grassland specialists, should be given to attain a higher conservation priority.

- Several questions about the Grassland Biome fauna, especially concerning reptiles, amphibians, butterflies, (three faunal groups are very sensitive to environmental change), as well as other invertebrates, need to be investigated.

- Little is known about how large grassland areas need to be in order to preserve viable populations of grassland birds, reptiles, amphibians and butterflies. The effect of vegetation succession in southern African grasslands on fauna species distributions need to be identified.

- The effect of soil type and climate on the distribution of reptiles, amphibians, butterflies and other invertebrate groups needs to be investigated. This is of great importance in the Grassland Biome, which is characterised by a heterogeneous mosaic of landscape types, each with its own specific soil characteristics and climatic, (macro- and micro), conditions. This will enable the identification of vegetation/habitat types that need to be conserved, once the ecology of the faunal species has been established.

- Faunal species can be protected within agricultural/developed areas in the Grassland Biome, provided that these areas are sustainably utilised, allowing development at the one end of the scale, and the conservation and preservation of the environment at the other end of the scale.

- The biodiversity of the Grassland Biome can only be ensured if the correct set of criteria is employed, the habitat requirements of biotic species are known, and areas managed accordingly.

- This study thus has established the following:
  - Grassland Biome endemic species, (both fauna & flora), are concentrated

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

especially towards the eastern "boundary" of the Grassland Biome, i.e. Mpumalanga Drakensberg Escarpment, with the main centre of endemism being concentrated towards the Afromontane- and Alpine grasslands of the north-eastern Free State, Qwa-Qwa, Lesotho Highlands and Eastern Cape;
- several aspects of the dynamics of the Grassland Biome are still unknown;
- the function of invertebrates of the grasslands is not known;
- distribution records and information on the ecology of several species, especially reptiles and amphibians, still need to be established;
- a wider variety of vegetation types within the Grassland Biome needs to be conserved, and more reserves need to be established.

9.2. General recommendations

- The biodiversity of the Grassland Biome fauna can only be ensured if more reserve networks are added and non-reserve areas are managed to include certain conservation measures. These areas should include a variety a vegetation types, landscape types, and should be of sufficient size to accommodate viable populations of species that require large home ranges.

- Species of the high altitude grasslands should be monitored closely and these vegetation types should enjoy higher conservation priority.

- Alternative land usage, such as sound grazing regimes and ecotourism, should be economically assessed relative to other, destructive practices, such as forestry.

- Dispersal activities and demographic features of fauna species should be established when areas are considered for reserve networks, or when grasslands are fragmented.

- Buffer zones large enough to accommodate viable populations should be allowed adjacent to reserves.

- A more thorough knowledge of endemic Grassland Biome fauna species, their conservation

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

status, and habitat requirements need to be established and plotted by using a Geographic Information System (GIS), and iterative algorithm procedures. This is of especially great importance in Gauteng Province and the Afromontane areas of high floristic/faunal endimicity.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

SUMMARY

Aspects of the biodiversity of in the southern African Grassland Biome

by

Marisa Moolman

Supervisor: Prof. Dr. A.E. van Wyk

Co-supervisor: Prof. Dr. G.J. Bredenkamp

Submitted in partial fulfilment of the requirements for the degree

MAGISTER SCIENTIAE

Efficient land use and conservation objectives can only be attained with a thorough knowledge of the ecology of the area. Little information has been collated to dateon the biodiversity, including the endemic, rare and threatened species of both the fauna and floristic components of the Grassland Biome.

The aims of this study were to compile inventories of five faunal groups (birds, reptiles, amphibians, butterflies and mammals) and to collate literature on these groups in order to assess diversity patterns within and between groups, and between groups and the grassland communities of the Grassland Biome. By employing various criteria, priority weights were given to each faunal species. Where possible, faunal-habitat- (-vegetation) associations were identified in order to determine which species might face extinction, should the grasslands of the Highveld and Drakensberg not enjoy a higher conservation priority.

From the results it can be deduced that vegetation structure (habitat structure) is the primary determinant of faunal distribution, while the effect of the climate, topography and edaphic factors directly or indirectly regulate the distribution of animal species within the Grassland Biome. The undulating, broken landscape of the Grassland Biome gives rise to various microclimatic conditions. This in turn results in the heterogeneity of vegetation communities that characterise the Grassland Biome. Grasses can be categorised into two main

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

groups: sweetveld grasses and sourveld grasses, each with its own specific physiognomic character. Forest communities and fynbos elements occur in the ravines on the high altitude mountains of the Escarpment mountains. Karoo shrubs, savanna and bushveld communities intrude into the grasslands in the transitional zones. This mosaic of plant communities increases the diversity of plant and animal species present, with several of these species endemic to the Grassland Biome, South Africa, or the sub Region.

Each group studied, displays its own characteristic distribution pattern in terms of species diversity and endemism on a regional and a national scale. However, all the faunal groups show a high concentration of endemic species towards the eastern "boundary" of the Grassland Biome, although each vegetation type can be recognised by its specific, often restricted, endemic species. The majority of the grassland specialists are endemic to the Grassland Biome, with most of these species being restricted to the high rainfall areas of the Escarpment. The Mpumalanga Escarpment, the mountains of the north-eastern Free State and the Lesotho Highlands are high in species diversity and endemic species, although some endemic species are restricted to the grasslands of the Highveld.

A total of 554 bird species, (12 grassland specialist species/subspecies), 243 herpetofauna species, (29 grassland specialist species/subspecies), at least 195 butterfly species, (49 grassland specialist species/subspecies and 172 mammal species (eight grassland specialist species/subspecies), have been recorded in, or utilise the southern African grasslands to some extent.

Endemic fauna species and species restricted to certain habitats are listed as seriously threatened in the Red Data Books. Ever-increasing utilisation, (agriculture, industrialisation, afforestation) and development, (urbanisation, expansion of the infrastructure) in the Grassland Biome, results in large areas being irreversibly modified and destroyed. The growing population, especially in the Gauteng Province, makes this situation irreversible. Sustainable development of the environment and the correct application of agricultural activities might ensure that both plant- and animal species are preserved. The persistence of various biotic species can be ensured if more conservation areas that are representative of a species' preferred habitat, are proclaimed. These areas should include the various plant communities of

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

the Grassland Biome. Several questions concerning the interaction between the grassland fauna species and the physical environment they inhabit, still need to be answered.

A thorough, holistic approach to the biodiversity of the Grassland Biome will give a better insight into the processes, origin and dynamics of the biome. This will allow for efficient, yet conservationally orientated and ecologically based utilisation of the Grassland Biome's natural resources.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

OPSOMMING

Aspekte van die biodiveristeit in die suider-Afrikaanse Grasveld Bioom

deur

Marisa Moolman

Studieleier: Prof. Dr. A.E. van Wyk

Mede studieleier: Prof. Dr. G.J. Bredenkamp

Voorgelê ter gedeeltelike vervulling van die vereistes vir die graad

MAGISTER SCIENTIAE

Effektiewe landgebruik en bewaringsdoelwitte kan slegs verkry word deur 'n deeglike kennis van die ekologie van 'n area. Tans is 'n beknopte samevatting van inligting oor the biodiversiteit, insluitende die endemiese, skaars en bedreigde spesies van die floristiese en faunistiese komponente van die Grasveld Bioom, nie beskikbaar nie.

Die doel van hierdie studie is om inventarislyste van vyf fauna groepe (voëls, reptiele, amfibieë, skoenlappers, soogdiere) saam te stel om diverisiteitspatrone binne en tussen taksons en die grasveldgemeenskappe van die Grasveld Bioom, te identifiseer. Deur verskeie kriteria toe te pas, word 'n prioriteitsgewig aan elke fauna spesie toegeken, en deur fauna-habitat (-plantegroei) assosiasies te identifiseer, kan daar moontlik vasgestel word watter dierspesies sal uitsterf indien die grasvelde van die Hoëveld en Drakensberg Eskarpement nie 'n hoër bewaringstatus geniet nie.

Die resultate dui daarop dat die plantegroeistruktuur (habitat struktuur) in al die groepe die bepalende faktor van dierverspreiding is, terwyl die invloed van die klimaat, topografie en edafiese faktore, direk of indirek, die verspreiding van die fauna groepe in die Grasveld Bioom reguleer. Die golwende en gebroke landskap van die Grasveld Bioom gee aanleiding tot verskeie mikroklimaats toestande. Dit weer gee aanleiding tot die heterogene plantegroeigemeenskappe wat die Grasveld Bioom karakteriseer. Daar word basies twee

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

kategorië grasse aangetref: soetveldgrasse en suurveldgrasse, elk gekenmerk deur sy eie spesifieke fisionomie, terwyl woudgemeenskappe en fynbos-elemente in die klowe en hoogtes van die Eskarpement berge voorkom. Karoo struikgewasse, savanna en bosveld plantegroeitipes dring die grasvelde in die oorgangsones binne. Hierdie mosaïek plantegroeigemeenskappe dra by tot die hoë diversiteit plant- en dierspesies, waarvan verskeie endemies (tot die Grasveld Bioom, Suid Afrika en die sub-Omgewing) is.

Elke fauna groep, toon sy eie kenmerkende verspreidingspatroon ten opsigte van spesiesdiversiteit en endemiese spesies op 'n plaaslike sowel as 'n nasionale skaal. Daar is egter gevind dat al die groepe 'n konsentrasie van endemiese spesies (Grasveld Bioom, Suid- of sub Omgewing) in die oostekant van die Grasveld Bioom toon, alhoewel elke plantegroeigemeenskappe sy spesifieke, beperkte endemiese spesies besit. Die meerderheid grasveld spesialiste is endemies tot die Grasveld Bioom, en die meeste van hierdie spesies in elke groep is beperk tot die hoër reënval Eskarpment areas van die bioom. Die Mpumalanga Eskarpement, berge van die noord-oos Vrystaat en die Lesotho hooglande kan geïdentifiseer word as areas wat hoog is in spesiediversiteit en endemiese spesies, alhoewel sommige endemiese spesies beperk is tot die Hoëveld se grasvelde.

'n Totaal van 554 voël spesies (12 grasveld spesialis spesies/subspesies), 243 herpetofauna spesies (29 grasveld spesialis spesies/subspesies), ten minste 195 skoenlapper spesies (49 grasveld spesialis spesies/subspesies) and 172 soogdier spesies (agt grasveld spesialis spesies/subspesies) is aangeteken, of benut die grasveld van suider- Afrika .

Endemiese en habitats-beperkte fauna spesies van al die groepe wat in die studie ingesluit is, vertoon prominent bo-aan die Rooi Data Boeklyste. Grootskaalse ontginning (landbou, industrieë, bosbou) en ontwikkeling (verstedeliking, uitbreiding van infrastruktuur) veroorsaak dat groot gedeeltes van die Grasveld Bioom onherroeplik gemodifiseer en vernietig word. Die groeiende populasie, veral in die Gauteng Provinsie, maak hierdie situasie onomkeerbaar. Sinvolle, onderhoubare ontwikkeling van die omgewing en die toepassing van korrek bedryfde landbou-metodes kan egter verseker dat plant en dierspesies bewaar word. Die voortbestaan van verskeie biotiese spesies sal egter berus op die proklamering van meer bewaringsareas – wat verteenwoordigend is van die spesie se habitatsvoorkeur – in die

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

onderskeie plantgemeenskappe van die Grasveld Bioom. Verskeie gapings in die wisselwerking tussen grasveld fauna spesies en hul fisiese omgewing moet voorts dringend ondersoek word.

'n Grondige, holistiese kennis van die biodiversiteit van die Grasveld Bioom sal meer lig werp op die prosesse, oorspong en dinamiek van die bioom, wat deegliker, bewarings- en ekologiesgeoriënteerde benutting van die natuurlike bronne moontlik maak.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

ACKNOWLEDGEMENTS

Aknowledgements and thanks are due to the following persons and institutions for their contribution and help in the preperation of this thesis:

- Prof. A.E. van Wyk and Prof. G.J. Bredenkamp for their advice, interest, time and support.
- Mr. Niels Jacobsen for his advice on this study, assistance and sharing his knowledge on the reptiles, amphibians and other issues.
- Martin Whiting for his friendship, his help in providing literature and other information and sharing his knowledge.
- Dr. M. Krüger, Mike Bates and Ben Orban for providing me with information and checking my inventories.
- Jasmyn van den Heever for providing me with data records.
- My family, for their support, ecouragement and interest in my studies.
- My friends, in particular Berndt, Danie, Rentia, Stefan and Fransie for their encouragement, friendship and support throughout this study.
- Mrs. E.P. van Wyk for her administrative help and friendliness, and Mrs. M. Dednam for her support, encouragement and friendliness.
- Mr. Willem de Frey, for his patience and help in compiling the maps.
- Mr. J.C. Hollmann for proofreading the manuscript.
- The FRD and the University of Pretoria for financial support.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

References

ACOCKS, J.P.H. 1953. Veld types of South Africa. *Mem. bot. Surv. S. Afr.* No. 28.

AKIN, W.E. 1991. Global patterns: Climate, Vegetation and Soils.University of Oklahoma Press, Norman.

ALLAN, D.G. 1985. Die Kalkoenibis – 'n Vals Alarm? *Veld & Flora* 42: 16–21.

ALLAN, D.G. 1993. Aspects of the biology and conservation status of the Blue Crane in the Karoo and the south-western Cape. In: Proceedings of the First Southern African Crane Conference, eds. Porter, D.J. *et al.* p. 29–46. Southern African Crane Foundation, Durban.

ALLAN, D.G., HARRSION, J.A., NAVARRO, R.A. 1995. The impact of commercial afforestation on bird opulatkions in the Eastern Transvaal Province of South Africa-insights from bird atlas data. *Avian Demography Unit Research Report* No. 11. University of Cape Town.

ALLAN, D.G., HARRSION, J.A., NAVARRO, R.A., VAN WILGEN, B.W. & THOMPSON, M.W. 1997. The impact of commercial afforestation on bird population in Mpumalanga province, South Africa – Insights from bird-atlas data. *Biol. Conserv.* 79: 173–185.

ALLAN, D.G. & SHARP, I.C. 1985. The conservation status of the pans of the Transvaal highveld. Internal Report, Transvaal Nature Conservation Division, Pretoria.

ANDERSON, R.C. 1970. Prairies in the prairie state. *Trans. Ill. State Acad. Sci.* 63: 214–221.

ANDERSON, S.H. 1980. Habitat selection, succession, and bird community organization. In: Management of western forests and grasslands for nongame birds, De Graff, R.M. (tech. coord.), p. 13–26. USDA Forestry Service. Gen. Tech. Rep. INT-86.

ANDRZEJEWSKA, L. 1962. *Macrosteles laevis* Rib. As an unsettlement index of natural meadow associations of Homoptera. *Bull. Acad. Po. Sci., Classe II, Ser des Sci. Biol.* 10: 221–226.

ANDRZEJEWSKA, L. 1965. Stratification and its dynamics in meadow communities of Auchenorhyncha (Homoptera). *Ekol. Pol, Ser. A* 13: 685–715.

ANDREWARTGA, H.G. & BIRCH, L.C. 1954. The distribution and abundance of animals. University of Chicago Press, Chicago, Illinois, USA.

ANDREWARTGA, H.G. & BIRCH, L.C. 1984. The ecological web. University of Chicago, Illinois, USA.

ANON. 1977. Nature conservation and agriculture. Nature Conservancy Council, London.

ANON. 1981. The conservation of butterflies. Nature Conservancy Council, London.

ANON. 1997. On the wing. *Environmental Planning & Management* 8(6): 30–31.

ARCHIBOLD, O.W. 1995. Ecology of World Vegetation. Chapman & Hall, London.

ARMSTRONG, A.J. & VAN HENSBERGEN, H.J. 1997. Evaluation of afforestable montane grasslands for wildlife conservation in the north-eastern Cape, South Africa. *Biol. Conserv.* 81: 179–190.

AXELROD, D.I. 1985. The rise of the grassland biome, central North America. *Bot. Rev.* 51: 163–201.

BARNARD, P. 1987. Foraging site selection by three raptors in relation to grassland burning in a montane habitat. *Afr. J. Ecol.* 23: 35–45.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

BATES, M.F. 1991. A provinsional check list of the reptiles and amphibians of Golden Gate Highlands National Park. *Koedoe* 34(2): 153–155.

BATES, M.F. 1992. The herpetofauna of the Orange Free State – with special emphasis on biogeographical patterning. M.Sc. thesis, University of Natal, Pietermaritzburg.

BATES, M.F. 1995a. Atlas of frog distribution in the Free State, South Africa. *African Herpetological News* 23: 15–31.

BATES, M.F. 1995b. Distribution and diversity of amphibians in the Free State, South Africa. *Madoqua* 19(1): 3–14.

BERNSTEIN, N.P., KRISTINE, K.B. & WILMOT, S.H. 1990. Changes in a Prairie Bird Population From 1940-1989. *J. Iowa Acad. Sci.* 97(4): 115–120.

BERRYMAN, A.A., STENSETH, N. CHR. & ISAEV, A.S. 1987. Natural regulation of hervorous forest insect populations. *Oecologia* 71: 174–184.

BIGALKE, R.C. 1972. The comtemporary mammal fauna of Africa. In: Evolution, mammals, and southern continents, eds. Keast, A., Erk, F.C. & Glass, B. State University of New York Press, Albany.

BINK, F. 1986. Acid stress in Rumex hydrolapathum (Polygonaceae) and its influence on the phytophage Lycena dispar (Lepidoptera: Lycaenidae). *Oecologia, Berl.* 70: 447–451.

BLAIR, R.B. & LAUNER, A.E. 1997. Butterfly diversity and human land use: species assemblages along an urban gradient. *Biol. Conserv.* 80: 113–125.

BOCK, C.E. & WEBB, B. 1984. Birds as grazing indicator species in southeastern Arizona. *J. Wildl. Manage.* 48: 1045–1049.

BOGGS, C.L. & ROSS, C.L. 1993. The effect of adult food limitation on life history traits in speyeria mormonia (Lepidoptera: Nymphalidae). *Ecology* 74(2): 433–441.

BOND, W.J. 1997. Fire. In: The Vegetation of Southern Africa, eds. Cowling, R.M., Richardson, D.M. & Pierce, S.M. Cambridge University Press, Cambridge.

BOORMAN, S.A. & LEVITT, P.R. 1973. Group selection on the boundary of a stable population. *Theor. Popul. Biol.* 4: 85–128.

BOTHMA, J. DU P. & VAN HOVEN, W. 1991. 'n Studie van die habitatvoorkeure en vliegpatrone van voëls in die Jan Smutslughawe-gebied. Unpublished Report. Bothma & Van Hoven Wildlife Consultants, Pretoria.

BOUCHER, D.H. (ed.). 1985. The biology of mutualism. Oxford University Press, Oxford, London.

BOURN, N.A.D. & THOMAS, J.A. 1993. The ecology and conservation of the brown argus butterfly *Aricia agestis* in Britain. *Biol.Conserv.* 63: 67–74.

BOURQUIN, O. & CHANNING, A. 1980. Herpetofauna of the Natal Drakensberg: an annotated checklist. *Lammergeyer* 30: 1–20.

BOYCOTT, R.C. & BOURQUIN, O. 1988. The South African Tortoise Book. A Guide to South African Tortoises, Terrapins and Turtles. Southern Book publishers. Johannesburg.

BRANCH, B. 1988a. Veldgids tot die slange en ander reptiele van Suider-Afrika. Struik Uitgewers, Cape Town.

BRANCH, B. 1997. Endangered reptiles and amphibians in South Africa. *Afr. Wild.* 43(4): 195–201.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

BRANCH, W.R. 1985. Tortoises – primitive, but specialised. *Custos* 14: 4–9.

BRANCH, W.R.(ED). 1988b. South African Red Data Book – Reptiles and Amphibians. *South African National Scientific Programmes Report* No. 151. NMB Printers, Port Elizabeth.

BRANCH, W.R., BAARD, E.H., JACOBSEN, N., POYNTON, J.C. & BROADLEY, D.G. 1988. A provinsianal and annotated checklist of the Herpetofauna of Southern Africa. *J. Herpetol. Assoc. Afr.* 34: 1–19.

BRANCH W.R., BENN, G.A. & LOMBARD, A.T. 1995. The tortoises (Testudinidae) and terrapins (Pelomedusidae) of southern Africa: their diversity, distribution and conservation. *S. Afr. J. Zool.* 30(3): 91–102.

BREDENKAMP, G.J. & THERON, G.K. 1980. A synecological account of the Suikerbosrand Nature Reserve II. The phytosociology of the Ventersdorp Geological System. *Bothalia* 13: 199–216.

BREDENKAMP, G.J. & VAN VUUREN, D.R.J. 1987. Note on the occurrence and distribution of *Aloe marlothi* Berger on the Pietersburg Platcau. *S. Afr. J. Sci.* 83: 498–500.

BROADLEY, D.G. 1983. Fitzsimons' snakes of southern Africa. Delta Books, Johannesburg.

BROOKE, R.K. 1984. South African Red Data Book-Birds. South African National Scientific Programmes Report 97.

BROWN, C.J. & BARNES, P.R. 1984. Birds of the Natal alpine belt. *Lammergeyer* 33: 1–13.

BROWN, H.D. 1962. New and interesting grasshoppers from southern Africa-3 (Orthoptera: Acridoidea). *J. Entomol. Soc. South Africa* 25: 198–229.

BROWN, J.L. & ORIANS, G.H. 1970. Spacing patterns in mobile animals. *Ann. Rev.Ecol.Syst.* 1: 239–262.

BUSACK, S.D. & BURY, R.B. 1974. Some effects of off-road vehicles and sheep grazing on lizard populations in the Mojave Desert. *Biol. Conserv.* 10: 1–14.

CARCASSON, R.H. 1964. A preliminary survey of the zoogeography of African butterflies. *East Afr. Wild. J.* 2: 122–157.

CARRASCAL, L.M., LÓOEZ, P., MARTIN, J. & SALVADOR, A. 1992. Basking and antipredator behaviour in a high altitude lizard: implications of heat-exchange rate. *Ethology* 92: 143–154.

CARRUTHERS, V. 1976. A Guide to the identification of the frogs of the Witwatersrand. Conservation Press (PTY) LTD, Johannesburg.

CASEY, T.M. 1976. Activity patterns, body temperature and thermal ecology in two desert caterpillars. *Ecology* 57: 485–497.

CLANCEY, P.A. 1986. Endemicity in southern African avifauna. *Durban Mus. Novit.* 13: 245–284.

CLINNING, C. 1986. Transvaal grasslands. *Fauna and Flora* 44: 3–6.

COETZEE, J.P., BREDENKAMP, G.J., VAN ROOYEN, N. 1995. Plant communities of the Sub-humid cool temperate mountain bushveld of the Pretoria-Witbank-Heidelberg aea, South Africa. *S. Afr. Tydskr. Plantk.* 61(3): 114–122.

CODY,M.L. 1968. On the methods of resource division in grassland bird communities. *Am. Nat.* 102: 107–147.

CODY, M.L. 1970. Chilean bird distribution. *Ecology* 51: 455–464.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

CODY, M.L. 1975. Towards a theory of continental species diversity: Bird distributions over Mediterranean habitat gradients. In: Ecology and Evolution of Communities, eds. Cody, M.L. & Diamond, J.M., p. 214–257. Harvard Univ. Press (Belknap), Cambridge, Massachusetts.

CODY, M.L. 1983. Bird diversity and density in Southern African forests. *Oecologia* 59: 201–215.

CODY, M.L. 1985 An introduction to habitat selection in birds. In: Habitat selection in birds, eds.Cody, M.L., p. 3–56. Academic Press, London.

COOKE, H.B.S. 1974. The fossil mammals of Cornelia, O.F.S., South Africa. In: The Geology, Archaeology and Fossil mammals of the Cornelia Beds, O.F.S., K.W. Bulzer, eds. Clark, D., & Cooke, H.B.S. *Mem. nas. Mus., Bloemfontein* 9: 63-84.

COLLINS, S.C. 1987. Interaction of disturbances in tallgrass prairie: a field experiment. *Ecology* 68(5): 1243-1250.

COLLINS, S.C., KNAPP, A.K., BRIGGS, J.M., BLAIR, J.M., STEINAUER, E.M. 1998. Modulation of Diversity by Grazing and Mowing in Native Tallgrass Prairie. *Science* 280: 745-747.

COWLING, R.M. & HILTON-TAYLOR, C. 1994. Patterns of plant diversity and endemism in southern Africa: an overview. *Strelitzia* 1: 31–52.

COWLING, R.M. & HILTON-TAYLOR, C. 1997. Phytogeography, flora and endemism. In: The Vegetation of Southern Africa, eds. Cowling, R.M., Richardson, D.M. & Pierce, S.M. Cambridge University Press, Cambridge.

CROWE, T.M. 1990. A quantitative analysis of patterns of distribution, species richness and endemism in southern African vertebrates. In: Vertebrates in the tropics, eds. Peters, G. & Hutterer, R., p. 145–160. Museum Alexander Koenig, Bonn.

CROWE, T.M. & CROWE, A.A. 1982. Patterns of distribution, diversity and endemism in Afrotropical birds. *J. London Zool.* 198: 417–442.

DAVIS, D.H.S 1962. Distribution patterns of southern Africa Muridae, with notes on some of their fossil antecedents. *Ann. Cape. Prov.Mus.* 2: 56–76.

DE GRAAFF, G. 1981. The rodents of southern Africa: notes on their indentification, distribution, ecology and taxonomy. Butterworths, Pretoria.

DENNIS, R.L.H. 1977. The British Butterflies: Their Origin and Establishment. Classey, Faringdon.

DENNIS, R.L.H. 1985. Voltinism in British *Aglais uritcae* (L) (Lep. Nymphalidae): variation is space and time. *Proc. Trans. Brit. ent. nat. Hist. Soc.* 18: 51–61.

DENNO, R.F. 1977. Comparison of the assemblages of sap-feeding insects (Homoptera-Hemiptera) inhabiting two structurally different salt marsh grasses in the genus *Spartina*. *Environ. Entomol.* 6: 359–372.

DEUTSCHLäNDER, M.S. & BREDENKAMP, G.J. In press. Application of a vegetationsurvey in the Ruimsig Entomological Reserve, Roodepoort, South Africa in the conservation management of the rare and endangered butterfly: *Aloeides dentatis dentatis* (Swierstra). Unpublished report, University of Pretoria.

DE WAAL, S.W.P. 1978. The squamata (Reptilia) of the Orange Free State, South Africa. *Mem. Nas. Mus. Bloemfontein* 11: 1–160.
DE WAAL, S.W.P. 1980a. The Testudines (Reptilia) of the Orange Free State, South Africa. *Navors. Nas. Mus. Bloemfontein* 4(2): 85–89.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

DE WAAL, S.W.P. 1980b. The Salientia (Amphibia) of the Orange Free State, South Africa. *Navors. Nas. Mus. Bloemfontein* 4: 93–120.

DICKSON, C.G.C. & KROON, D.M. (EDS.). 1978. Pennington's butterflies of southern Africa. AD. Donker, Johannesburg.

DINSMORE, J.J. 1981. Iowa's avifauna: changes in the past and prospects for the future. *Proc. Iowa Acad. Sci.* 88: 28–37.

DIRSH, V.M. 1956. Orthoptera Acridiodea. In: South African animal life, eds. Hanstrom, B., Brinck, P. & Rudebeck, G., Vol. 3: p. 121-272. Almqvist & Wiksell, Stockholm.

DOBKIN, D.S. 1985. Heterogeneity of tropical floral microclimates and the response of hummingbird flower mites. *Ecology* 66: 536–543.

DOBKIN, D.S., OLIVIERI, I. & EHRLICH, P.R. 1987. Rainfall and the interaction of microclimate with larval resource in the population dynamics of cherspot butterflies (*Euphydryas editha*) inhabiting serpentine grassland. *Oecologia* 71: 161–166.

DOUGLAS, R.M. 1995. The Herpetofauna of Florisbad Research Station as largely determined by array trapping. *Navors. Nas. Mus. Bloemfontein* 11(6): 121–147.

DRINKROW, D.R. & CHERRY, M.I. 1995. Anuran distribution, diversity and conservation in South Africa, Lesotho and Swaziland. *S-Afr. Tydskr. Dierkd.* 30(3): 82–89.

DU PLESSIS, S.F. 1969. The past and present geographical distribution of the Perissodactyla and Artiodactyla in southern Africa. Unpublished M.Sc thesis, University of Pretoria, Pretoria.

EDWARDS, D. 1972. Botanical survey and Agriculture. *Proc. Grassld. Soc. sth. Afr.* 7: 15–19.

ELLERY, W.N. 1992. Classification of Vegetation of the South African Grassland Biome. Ph.D. thesis. Univeristy of the Witwatersrand, Johannesburg.

ELTON, C.S. & MILLER, R.S. 1954. The ecological survey of animal communities: with a practical system of classifying habitats by structural character. *J. Ecol.* 42: 460–496.

ERHARDT, A. 1985. Diurnal Lepidoptera: sensitive indicators of cultivated and abandoned grassland. *J. Appl. Ecol.* 22: 849–861.

EHRLICH, P.R. 1988. Tomorrow's world: Why saving biodiversity is today's priority. *World Birdwatch* 10(2): 6–9.

EHRLICH, P.R. & RAVEN, P.H. 1964. Butterflies and plants: a study in coevolution. *Evolution* 18: 586-608.

EHRLICH, P.R., BREEDLOVE, D.E., BRUSSARD, P.F. & SHARP, M. 1972. Weather and the regulation of subalpine populations. *Ecology* 53: 243–247.

FARKAS, T. 1988. The Birds of Korannaberg, Eastern Orange Free State, South Africa. *Navors. Nas. Mus. Bloemfontein* 6(3): 35–108.

FEELY, J.M. 1987. Review. Biomes of southern Africa. *Bulletin of the South African Institute of Ecologists* 6(3): 57-61.

FIEDLER, K. 1991. Systematic, evolutionary and ecological implications of myrmecophily within the Lycaenidae (Insecta: Lepidoptera: Papilionidea). *Bonner Zool. Monogr.* 31: 1–210.

FIEDLER, K. & SAAM, C. 1995. Ants benefit from attending facultatively myrmecophilous Lycaenidae caterpillars: evidence from a survival study. *Oecologia* 104: 316–322.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

FITZGERALD, S.M. & TANNER, G.W. 1992. Avian community response to fire and mechanical shrub control in south Florida. *J. Range Manage.* 45: 396–400.

FITZSIMONS, V.F. 1943. The lizards of South Africa. *Transvaal Museum Memoir* No. 1. Pretoria.

FORMAN, R.T.T. & GIFFEN, N.R. 1991. Neotropical migrant birds and edge effects at a forest-stream ecotone. *Wils. Bull* 103: 204–217.

FORMAN, R.T.T. & GODRAN, M. 1986. Landscape ecology. J. Wiley, New York.

FOX, A.M. 1978. The '72 fire of Nadgee Nature Reserve. *Parks and Wildlife* 2: 5–24.

FRASER, W. 1987. The urban birds of Johannesburg. *Bokmakierie* 39: 67–70.

FRAZER, J.F.D. 1977. The chalkhill blue butterfly (Lysandra coridon) at Burham Down 1955–74. *Trans. Kent Field Club* 6: 71–74.

FREEMARK, K.E. & MERRIAM, H.G. 1986. Importance of ara and habitat heterogeneity to bird assemblages in temperate forest fragments. *Biol. Conserv.* 36: 115–141.

FREITAG, S. 1996. An assessment of mammalian diversity in the Transvaal: consequences for conservation evaluation and planning. Unpubl. Ph.D thesis. University of Pretoria, Pretoria.

FULS, E.R. 1991. The effect of nutrient enriched sediment deposits on the vegetational traits of a patch-grazed semi-arid grassland. *Vegetatio* 96: 177–183.

GEIGER, R. 1965. The Climate near the Ground, 4th edition. Harvard University Press, Cambridge, Massuchusetts.

GELDENHUYS, J.N. 1982. Classification of pans in the western Orange Free State according to vegetation structure, with reference to avifaunal communities. *S. Afr. J. Wildl. Research Suppl.* 1: 55–62.

GELDERBLOM, C.M. & BRONNER, G.N. 1995. Patterns of distribution and protection status of the endemic mammals in South Africa. *S. Afr.J. Zool.* 30(3): 127–135.

GENTILLI, J. 1992. Numerical clines and escarpments in the geographical occurrence of avian species; and a search for relevant environmental factors. *Emu* 92: 129–140.

GEORGE, T.L., FOWLER, A.C., KNIGHT, R.L. & McEWEN, L.C. 1992. Impacts of a severe drought on grassland birds in western North Dakota. *Ecol. Appl.* 2: 275–284.

GILBERT, L.E. 1980. Food web organisation and the conservation of Neotropical diversity.In: *Conservation Biology: an evolutionary ecological perspective*, eds.Soulé, M.E. & Wilcox, B.A. Sinauer Associates, Massaschusetts.

GRABER, R.R. & GRABER, J.W. 1963. A comparative study of bird populations in Illinois, 1906-1909 and 1956-1958. III. *Nat. Hist. Surv.Bull.* 28: 528pp.

GREATOREX-DAVIES, J.N., SPARKS, T.H., HALL, M.L. & MARRS, R.H. 1993. The influence of shade on butterflies in rides of coniferised lowland woods in southern England and implications for conservation management. *Biol. Conserv.* 63: 31–41.

GREYLING, T. & HUNTLEY, B.J. (EDS.). 1984. Directory of southern African conservation areas. *South African National Scientific Programmes Report* No. 98. CSIR, Pretoria.

GRIME, J.P., HODGSON, J.G. & HUNT, R. 1988. Comparative Plant Ecology. Unwin Hyman, London.

GYOVAI, F. 1984. Synbiological study of the lizard populations of sandy grasslands. *Acta Biol. Szeged* 30:

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

159-174.

HALL, B.P. & MOREAU, R.E. 1970. An atlas of speciation in African passerine birds. British Museum (Natural History), London.

HANSON, H.C. 1962. Dictionary of ecology. Philosophical Library, New York.

HARRIS, L.D. 1988. Edge effects and conservation of biodiversity. *Conserv. Biol.* 2: 330–332.

HARRISON, J.A., ALLAN, D.G., UNDERHILL, L.G., HERREMANS, M., TREE, A.J., PARKER, V. & BROWN, C.J. 1997. The Atlas of Southern African Birds. Avian Demography Unit, University of Cape Town. BirdLife South Africa, Johannesburg.

HEATH, J., POLLARD, E. & THOMAS, J.A. 1984. Atlas of Butterflies in Britain and Ireland. Viking, London.

HENNING, S.F. & HENNING, G.A. 1989. South African Red Data Book Butterflies. *South African National Scientific Programmes Report* No. 158.

HENNING, G.A., HENNING, S.F., JOANNOU, J.G. & WOODHALL, S.E. 1997. Living butterflies of southern Africa, Vol. 1. Umdaus Press.

HERKERT, J.R. 1991a. Prairie birds of Illinois: population response to two centuries of habitat change. *Ill. Nat. Hist. Surv. Bull.* 34: 393–399.

HERKERT, J.R. 1991b. An ecological study of breeding birds of grassland habitats within Illinois. Ph.D dissertation. University of Ilinois, Champaign-Urbana.

HERKERT, J.R. 1994. Breeding Bird Communities of Midwestern Prairie Fragments: The Effects of Prescribed Burning and Habitat-area. *Nat. Areas J.* 14: 128–135.

HERREMANS, M. 1993. Mid – winter waterbird census in Botswana and prospects for future surveys: trip report 28 June–6 August 1993. Unpublished report. Department of Wildlife and National Parks, Gabarone.

HEYDENRYCH, B. 1995. Forestry vs Biodiversity: Is a win-win situation possible? *Veld & Flora* 81: 20–21.

HOCKEY, P.A.R., ALLAN, D.G., REBELO, A.G. & DEAN, W.R.J. 1988. The Distribution, Habitat Requirements and Conservation Status of Rudd's Lark *Heteromirafra ruddi* in South Africa. *Biol. Conserv.* 45: 255–266.

HOFFMAN, M.T. 1997. Human impacts on vegetation. In: The Vegetation of Southern Africa, eds. Cowling, R.M., Richardson, D.M. & Pierce, S.M. Cambridge University Press, Cambridge.

HOLMES, R.T. & RECHER, H.F. 1986. Determinants of guild structure in forest bird communities: an intercontinental comparison. *Condor* 88: 427–439.

HOOIJER, D.A. 1958. Pleistocene remains of hippopotamus from the Orange Free State. *Navors. nas. Mus., Bloemfontein* 1: 259–266.

HUNTLEY, B.J. 1978. Ecosystem conservation in southern Africa. In: Biogeography and ecology in southern Africa, ed. Werger, M.J.A., p. 1333–1384. Junk, The Hague.

HURLEY, R.J. & FRANKS, E.C. 1976. Changes in the breeding ranges of two grassland birds. *Auk* 93: 108–115.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

ICBP, 1992. Putting biodiversity on the map: priority areas for global conservation. International Council for Bird Preservation, Cambridge.

JACOBSEN, N.H.G. 1987. Akkedisse. Gutenberg Boekdrukkers, Pretoria.

JACOBSEN, N.H.G. 1989. A herpetological survey of the Transvaal. Unpublished Ph.D. thesis, University of Natal, Durban.

JACOBSEN, N.H.G. 1992. New *Lygodactylus* taxa (Reptilia: Gekkonidae) from the Transvaal. *Bonn.zool. Beitr.* 43(4): 527–542.

JACOBSEN, N.H.G. 1994. A new subspecies of *Lygodactylus occellatus* (Roux) (Lacertilia: Gekkonidae) from the Soutpansberg, South Africa. *J. Afr. Zool.* 108: 231–236.

JARVIS, C.M. 1984. The use of fossil ungulate communities as indicators of climate and environment. In Fossils and climate, ed. Brenchley, P. John Wiley & Sons, Chichester.

JOHNSON, D.H. & SCHWARTZ, M.D. 1993. The Conservation Reserver Program and Grassland Birds. *Conserv. Biol.* 7(4): 934–937.

JOHNSON, D.N. & MACLEAN, G.L. 1994. Altitudinal migration in Natal. *Ostrich* 65: 86–94.

JOHNSTON, D.W. & ODUM, E.P. 1956. Breeding bird populations in relation to plant succession on the piedmont of Georgia. *Ecology* 37: 50–62.

JOHNSON, R.G. & TEMPLE, S.A. 1990. Nest predation and brood parasitism of tallgrass prairie birds. *J. Wildlife Management* 54: 106–111.

JONES, K.B. 1981. Effects of grazing on lizard abundance and diversity in western Arizona. *Southwest. Nat.* 26(2): 107–115.

KEVAN, P.G., JENSEN, T.S. & SHORTHOUSE, J.D. 1982. Body temperatures and behavioral thermoregulation of high arctic woolly-bear caterpillars and pupae (*Gynaephora rossii*, Lymantriidae: Lepidoptera) and the importance of sunshine. *Arctic and Alpine Research* 14: 125–136.

KILLICK, D.J.B. 1978. The Afro-Alpine gegion. In: Biogeography and ecology of southern Africa, ed. Werger, M.J.A., p. 515–560. Junk, The Hague.

KING, L.C. 1942. South African Scenery. Oliver & Boyd, Edinburgh.

KINGSOLVER, J.G. 1983. Ecological significance of flight activity in *Colias* butterflies: implications for reproductive strategy and population structure. *Ecology* 64: 546–551.

KINGSOLVER, J.G. 1983a. Ecological significance of flight activity in *Colias* butterflies: thermal stress and the limits to adaptation in temporally varying environments. *Am. Nat.* 121: 32–55.

KINGSOLVER, J.G. & WATT, W.B. 1983b. Thermoregulatory strategies in temporally varying environments. *Am. Nat.* 121: 32–55.

KLEIN, R.G. 1980. Environmental and cultural implications of large mammals fron Upper Pleistocene and Holocene sites in Southern Africa. *Ann. S. Afr. Mus.* 81: 222-283.

KOK, D.J. & SEAMAN, M.T. 1989. Aspects of the biology, habitat requirements and conservation status of *Natalobatrachus bonebergi* (Anura: Ranidae). *Lammergeyer* 40: 10–17.

KREBS, C.J. 1978. Ecology: the environment analysis of distribution and abundance. Harper International,

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

New York.

KREKORIAN, C.O. 1984. Life history of the desert iguana, *Dipsosaurus dorsalis*. *Herpetologica* 40(4): 415–424.

KUSHLAN, J.A. 1976. Site selection for nesting colonies by American White Ibis *Eudocinus albus* in Florida. *Ibis*. 34: 590–593.

LACK, D. 1933. Habitat selection in birds. *J. Anim. Ecol*. 2: 239–262.

LAMBIRIS, A.J.L. 1988a. A preliminary survey of the amphibians of Natal/KwaZulu. M.Sc. dissertation, University of Natal, Durban.

LAMBIRIS, A.J.L. 1988b. Frogs & Toads of the Natal Drakensberg. Ukhahlamba Series, Number 3. University of Natal Press, Pietermaritzburg.

LAMBIRIS, A.J.L. 1989. A review of the amphibians of Natal. *Lammergeyer* 39: 1–210.

LIMA, S.L. & VALONE, T.J. 1991. Predators and avian community organization: an experiment in a semi-desert grassland. *Oecologia* 86: 105–112.

LINCOLN, D.E. 1985. Host-plant protein and phenolic resin effects on larval growth and survival of a butterfly. *J. Chem. Ecol*. 11: 1459–1467.

LOMBARD, A.T., NICHOLLS, A.O. & AUGUST, P.V. 1995. Where Should Nature Reserves Be Located in South Africa: A Snake's Perspective. *Conserv. Biol*. 9(2): 363–372.

LOVEJOY, T.R.E., BIERREGAARD, R.O., RYLANDS, A.B., MALCOLM, J.R., BROWN, K.S., QUINTELA, C.E., HARPER, L.H., POWELL, G.V.N., SCHUBAR, H.O.R. & HAYS, M.B. 1986. Edged and other effects of isolation on Amazon forest fragments. In: Conservation biology: the science of scarcity and diversity, ed. Soule, M.E. Sinauer Associates, Masschusetts.

LOW, A.B. & REBELO, T.G. (EDS.). 1996. Vegetation of South Africa, Lesotho and Swaziland. Department of Environmental Affairs & Tourism, Pretoria.

LYNCH, C.D. 1983. The mammals of the Orange Free State. *Mem. Nas. Mus. Bloemfontein* 18: 1-218.

LYNCH, C.D 1985. Mammalian distribution patterns in the Orange Free State. *Navors. Nas. Mus., Bloemfontein* 4(16): 473–500.

LYNCH, C.D. 1986. The ecology of the Lesser dwarf shrew, *Suncus varilla* with reference to the use of termite mounds of *Trinervitermes trinervoides*. *Navors .Nas. Mus. Bloemfontein* 5: 277–297.

LYNCH, C.D. 1988. Occurrence of Squamata in termitaria in the Orange Free State, South Africa. *J. Herpetol. Assoc. Afr*. 34: 42–43.

LYNCH, C.D. 1994. The mammals of Lesotho *Navors. Nas. Mus. Bloemfontein* 10(4): 177–237.

LYNCH, C.D. & WATSON, J.P. 1990. The mammals of Schlabathebe National Park, Lesotho. *Navors. Nas. Mus., Bloemfoentein* 6(12): 523–554.

MACARTHUR, R.H. & MACARTHUR, J.W. 1961. On bird species diversity. *Ecol. Monogr*. 42: 594–598.

MACARTHUR, R.H., MACARTHUR, J.W. & PREER, J. 1962. On bird species diversity II. Prediction of bird census from habitat measurement. *Am. Nat*. 96: 167–174.

MACDONALD, I.A.W. 1985. Range expansion of the Pied Barbet and the spread of alien tree species in

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

southern Africa. *Ostrich* 57: 75–94.

MACDONALD, I.A.W. 1990. Range expansion of the Masked Weaver *Ploceus velatus* in the Karoo facilitated by the spread of alien mesquite trees. *Ostrich* 61: 85–86.

MACLEAN, G.L. 1957. A summary of the birds of Westminister O.F.S. and surroundings (1953-1955). *Ostrich* 27: 217–232.

MACLEAN, G.L. 1985. Robert's Birds of Southern Africa. Trustees of the John Voelcker Bird Book Fund, Cape Town.

MACLEAN, G.L. 1993. Robert's Birds of Southern Africa. Trustees of the John Voelcker Bird Book Fund, Cape Town.

MACDONALD, I.A.W. 1985. Range expansion in the Pied Barbet and the spread of alien tree species in southern Africa. *Ostrich* 57: 75–94.

MANRY, D.E. 1982. Habitat use by foraging Bald Ibises *Geronticus calvus* in western Natal. *S. Afr. J. Wildl. Research* 12: 85–93.

MARTIN, J. & SALVADOR, A. 1995. Microhabitat selection by the Iberian rock lizard *Lacerta monticola*: Effects on density and spatial distribution of individuals. *Biol. Conserv.* 79: 303–307.

MATTHEWS, W.S., VAN WYK, A.E. & BREDENKAMP, G.J. 1993. Endemic flora of the north-eastern Transvaal escarpment, South Africa. *Biol. Conserv.* 63: 83–94.

MAYFIELD, H.E. 1989. Changes in bird life at the western end of Lake Erie. *Am. Birds* 43: 46–49.

MAYR, E. 1969. Principles of Systematic Zoology. McGraw-Hill Book Company. New York, London.

MCALLISTER, J.I. 1994. The Transformation and Desertisation of the South African Grassland Biome and the need to implement Integrated Environmental Mangagement Procedures (with special reference to the erstwhile Province of the Transvaal). Unpublished thesis: The National Higher Diploma in Forestry: Conservation, Saasveld.

McKENZIE, B. 1989. Medium term changes of vegetation pattern in Transkei. *S. Afr. For. J.* 150:1–9.

MEESTER, J.A.J. 1976. South African Red Data Book: Small mammals. *South African National Scientific Programmes Report* No. 11.

MENTIS, M.T. & BIGALKE, R.C. 1979. Some effects of fire on two grassland francolins in the Natal Drakensberg. *S. Afr. J. Wildl. Research* 9: 1–8.

MIGDOLL, I. 1987. Ivor Migdoll se veldgids tot die skoenlappers van Suid-Afrika. Struik, Cape Town.

MITCHELL, D., SEELY, M.K., ROBERTS, C.S., PIETRUSZKA, R.D., McCLAIN, E., GRIFFIN, M., YEATON, R.I. 1987. On the biology of the lizard *Angolosaurus skoogi* in the Namib desert. *Madoqua* 15(3): 201–216.

MOREAU, R.E. 1966. The bird communities of some African vegetation types. *Ostrich Suppl* 6: 265–270.

MORRIS, M.G. 1971a. Differences between the invertebrate faunas of grazed and ungrazed chalk grassland. IV. Abundance and diversity of Homoptera-Auchenorhyncha. *J. Appl. Ecol.* 8: 37–52.
MORRIS, M.G. 1971b. The management of grassland for the conservation of invertebrate animals. In: The Scientific Management of Animal and Plant Communities for Conservation, eds. Duffey, E. & Watt, A.S., p. 527–552. Symposia of the British Ecological Society 11.

MORRIS, M.G. 1974. Auchenorhyncha (Hemiptera) of the Burren, with special reference to species-

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

asscociations of the grasslands. *Proc. R. Ir. Acad.* 74(B): 7–30.

MORRIS, M.G. 1981. Responses of grassland invertebrates to management by cutting. *J. Appl. Ecol.* 18: 107–123.

MUNGUIRA, M.L. & MARTIN, J. 1993. The conservation of endangered Lycaenid butterflies in Spain. *Biol. Conserv.* 66: 17–22.

MUSHINSKY, H.R. & GIBSON, D.J. 1991. The influence of the fire periodicity on habitat structure. In: Habitat structure: The Physical Arrangement of Objects in Space, eds. Bell, S.S., McCoy, E.D. & Mushinsky, H.R., p. 23–59. Chapman & Hall, London.

MYERS, J.H. & POST, B.J. 1981. Plant nitrogen and fluctuations of insect populations – a test with the cinnabar moth-tansy ragwort system. *Oecologia*, Berl. 48: 151–156.

NEWBERY, R. 1984. The American Red-eared terrapin in South Africa. *Afr. Wildl.* 38(5): 186–189.

NEWBERY, R.E., PETERSON, W. & JACOBSEN, N.H.G. 1983. Management proposals: *Cordylus giganteus.* Internal report, Transvaal Nature Conservation Division, Pretoria.

NEWMAN, K. 1996. Newman's birds of southern Africa. Southern Books, Halfway House, South Africa.

OATES, M.R. 1995. Butterfly conservation within the management of grassland habitats. In: Ecology and Conservation of Butterflies, ed. Pullin, A.S., p. 98–112. Chapman & Hall, London.

OATLEY, T.B. & PRYS-JONES, R.P. 1986. A comparitive analysis of movements of southern African waterfowl based on ringing recoveries. *S. Afr. J. Wildl. Res.* 16: 1–6.

O'CONNOR, T.G. & BREDENKAMP, G.J. 1997. Grassland. In: Vegetation of Southern Africa, eds. Cowling, R.M., Richardson, D.M., & Pierce, S.M., p. 215–257. Cambridge University Press, London.

OPDAM, P. 1990. Dispersal in fragmented populations: the key to survival. In: Species dispersal in agricultural habitats, eds. Bunce, R.G.H. & Howard, D.C., p. 3–17. Belhaven Press, London.

PARTRIDGE, T.C. 1997. Evolution of landscapes. In The Vegetation of Southern Africa, eds. Cowling, R.M., Richardson, D.M. & Pierce, S.M. Cambridge University Press, Cambridge.

PASSMORE, N.I. & CARRUTHERS, V.C. 1995. South African frogs – a complete guide. Southern Book Publishers, Witwatersrand University Press.

PATTERSON, G.B. 1984. The effect of burning-off tussock grassland on the population density of common skinks. *N. Z. J. Zool.* 11: 189–194.

PEARMAN, P.B. 1993. Effects of habitat size on tadpole populations. *Ecology* 74(7): 1982–1991

PERRING, F. 1959. Topographical gradients of chalk grassland. *J. Ecol.* 47: 447–481.

PERRING, F. 1960. Climatic gradients of chalk grassland. *J. Ecol.* 48: 415–442.

PIANKA, E.R. & HUEY, R.B. 1971. Bird species density in the Kalahari and Australian deserts. *Koedoe* 14: 123–129.

PIERCE, N.E. & YOUNG, W.R. 1986. Lycaenid butterflies and ants: two-species stable equilibria between larvae and ants. *Science* 112: 1185–1187.

POLLARD, E. 1988. Temperature, rainfall and butterfly numbers. *J. Appl. Ecol.* 25: 819–828.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

POLLARD, E., HALL, M.L. 7 BIBBY, T.J. 1986. Monitoring the abundance of butterflies 1976-1985. *Research and Survey in Nature Conservation* No. 2. Nature Conservancy Council, Peterborough.

PORTER, K. 1982. Basking behaviour in larvae of the butterfly *Euphydryas aurinia*. *Oikos* 38: 308–312.

POYNTON, J.C. & BROADLY, D.G. 1978. The herpetofauna. In: Biogeography and ecology of southern Africa, ed. Werger, M.J.A., p. 925–948. Junk, The Hague.

POYNTON, J.C. & BROADLEY, D.G. 1985. Amphibia Zambesiaca 1. Scolecomorphidae, Pipidae, Microhylidae, Hemisidae, Arthroleptidae. *Ann. Natal Mus.* 26(2): 503–553.

PRINGLE, E. 1995. Hovering on the brink. A compromise may safe Tsitsikamma butterflies from extinction. *Afr. Wildl.* 49(5): 20–22.

PRINGLE, E.L.L., HENNING, G.A. & BALL, J.B. 1994. Pennington's butterflies of Southern Africa. 2nd edition. AD. Donker, Johannesburg.

RANDS, M.R.W. & SOTHERTON, N.W. 1986. Pesticide use on cereal crops and changes in the abundance of butterflies on arable farmland in England. *Biol. Conserv.* 36: 71–82.

RASMUSSEN, L.A. 1992. The Habitat and daily activities of birds at Waterkloof and Swartkops Airforce Bases and the hazards they pose to aircraft. Unpublished Hons. thesis, University of Pretoria.

RAUTENBACH, I.L. 1982. Mammals of Transvaal. *Ecoplan Monograph* No. 1: 1–211.

RAVENSCROFT, N.O.M. & YOUNG, M.R. 1996. Habitat specificity, restricted range and metapopulation persistence of the slender scotch burnet moth *Zygaena loti* in western Scotland. *J. Appl. Ecol.* 33: 979–992.

RAWLINS, J.E. & LEDERHOUSE , R.C. 1981. Developmental influences of thermal behavior on monarch caterpillars (*Danaus plexippus*): an adaptation for migration (Lepidoptera: Nymphalidae: Danainae). *J. Kans. Entomol. Soc.* 54: 387–408.

RAY, G.C. 1982. Obstacles to the conservation of ecosystems. In Conservation of ecosystems: theory and practice, eds. W.R. Siegfried & B.R. Davies. *South African National Scientific Programmes Report* No. 61: 10–16. CSIR, Pretoria.

REBELO, A.G. 1997. Conservation. In: The Vegetation of Southern Africa, eds. R.M. Cowling, D.M. Richardson & S.M. Pierce. Cambridge University Press, Cambridge.

RECHER, H.F. 1969. Bird species diversity and habitat diversity in Australia and North America. *Am.Nat.* 103: 75–79.

RICKLEFS, R.E. 1973. Ecology. Chiron Press, Newton, M.A.

RIECHERT, S.E. & TRACY, C.R. 1975. Thermal balance and prey availability: bases for a model relating web-site characteristics to spider reproductive success. *Ecology* 56: 265–284.

ROBBINS, C.S. 1979. Effect of forest fragmentation on bird populations. In: Management of north central and northeastern forests for nongame birds. *U.S. For. Serv. Gen. Tech. Rep.* NC-51: 198–212.

ROBINSON, S.K. & HOLMES, R.T. 1984. Effects of plant species and foliage structure on the foraging behaviour of forest birds. *Auk* 101: 672–684.

ROSE, W. 1962. The Reptiles and Amphibians of Southern Africa. Maskew Miller, Cape Town.

ROTENBERRY, J.T. 1978. Components of avian diversity along a mulifactorial climatic gradient. *Ecology* 59: 693–699.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

RUTHERFORD, M.C. & WESTFALL, R.H. 1994. Biomes of southern Africa: an objective catergorisation. *Mem. bot. Surv. S. Afr.* 63.

SADLIER, R.A. & PRESSEY, R.L. 1994. Reptiles and amphibians of particular conservation concern in the western division of New South Wales: A preliminary review. *Biol. Conserv.* 699: 41–54.

SAMSON, F.B. 1980. Island biogeography and the conservation of prairie birds. *Proceedings of the Seventh North American Prairie Conference,* In ed. C.L. Kucera, 293–305. Southwest Missouri State University, Springfield.

SAMWAYS, M.J. 1989. Insect conservation and the disturbance landscape. *Agric. Ecosyst. Environ.* 27: 183–194.

SAMWAYS, M.J. & MOORE, S.D. 1991. Influence of exotic conifer patches on grasshopper (Orthoptera) assemblages in a grassland matrix at a recreational resort. Natal, South Africa. *Biol. Conserv.* 57: 117–137.

SAUNDERS, D.A., HOBBS, R.J. & MARGULES, C.R. 1991. Biological Consequences of Ecosystem Fragmentation: A Review. *Conserv. Biol.* 5(1): 18–32.

SCHEEPERS, J.C. 1983. The present status of conservation in South Africa. *J. S. Afr. Biol. Soc.* 23: 64-71.

SCHULZE, R.E. 1965. Climate of South Africa. Part 8. General survey. Goverment Printer and Weather Bureau, Pretoria.

SCHULZE, R.E. 1997. Climate. In The Vegetation of Southern Africa, eds. Cowling, R.M., Richardson, D.M. & Pierce, S.M. Cambridge University Press, Cambridge.

SCHULZE, R.E. & MCGEE, O.S. 1978. Climatic indices and classifications in relation to the biogeography of southern Africa. In: Biogeography and ecology of southern Africa, ed. Werger, M.J.A., p. 19–52. Junk, The Hague.

SHERMAN, P.W. & WATT, W.B. 1973. The thermal ecology of some Colias butterfly larvae, *Choristoneura fumiferana*. *J. Comp. Physiol.* 83: 24–40.

SIEGFRIED, W.R. 1989. Preservation of species ins Southern African nature reserves. In: Biotic diversity in southern Africa. Concepts and conservation, ed. Huntley, B.J., p. 186–201. Oxford University Press, Cape Town.

SIEGFRIED, W.R. 1992. Conservation status of the South African endemic avifauna. *S. Afr. J. Wildl. Res.* 22: 61–64.

SIEGFRIED, W.R. & BROWN, CA.A. 1992. The distribution and protection of mammals endemic to southern Africa. *S. Afr. J. Wildl. Research* 22(1): 11–16.

SKINNER, J.D. & SMITHERS, R.H.N. 1990. The mammals of the Southern African Subregion. University of Pretoria Mammal Research Institute, Pretoria.

SKINNER, R.M. 1975. Grassland use patterns and prairie bird populations in Missouri. In: Prairie: A Multiple View, ed. Wali, M.K., p. 171–180. University of North Dakota Press, Grand Forks.

SKINNER, R.M., BASKETT, T.S. & BLENDEN, M.D. 1984. Bird habitat on Missouri prairies. Terrestrial Series No. 14. Missouri Department of Conservation, Jefferson City.

SMIT, C.M. 1992. Phytosociology of the Newcastle-Memel-Chelmsford Dam area. M.Sc thesis, University of Pretoria, Pretoria.

SMITH, R.L. 1974. Ecology and field biology. Harper & Row, New York.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

SMITHERS, R.H.N. 1983. The mammals of the southern African Subregion. University of Pretoria, Pretoria.

SMITHERS, R.H.N. 1986. South African Red Data Book: terrestrial mammals. *South African National Scientific Programmes Report* No. 125. CSIR, Pretoria.

SNYDERS, M. 1987. Die invloed van rotasiebrande of die reptielfauna van die Wolkberg-wildernisgebied. Unpublished manuscript, Saasveld Forestry College, George.

SPARKS, T.H. & PARISH, T. 1995. Factors affecting the abundance of butterflies in field boundaries in Swavesey Fens, Cambridgeshire, UK. *Biol. Conserv.* 73: 221–227.

SQUIRES, J.R., ANDERSON, S.H. & OAKLEAF, R. 1993. Home range size and habitat-use patterns of nesting prairie falcons near oil developments in northeastern Wyoming. *J. Field Ornithol.* 64(1): 1–10.

STEPNEY, P.H.R. & POWER, D.M. 1973. Analysis of the eastward expansion of Brewer's Blackbird plus general aspects of avian expansions. *Wils. Bull.* 85: 452–464.

STERN, V.M. & SMITH, R.F. 1960. Factors affecting egg production in populations of *Colias eurytheme* Boisduval (Lepidoptera, Pieridae). *Hilgardia* 29: 411–459.

STORY, R. 1951. A botanical survey of the Keiskammahoek district. *Mem. Bot. Surv. South Africa* 27: 1–184.

STUCKENBERG, B.R. 1956. New species of *Artherimorpha* White from South Africa (Diptera: Erinnidae). *Proc. R. Ent. Soc. Lond.* (B) 25: 142–146.

STUCKENBERG, B.R. 1962. The distribution of the montane palaeogenic element in the South African invertebrate fauna. *Ann. Cape Prov. Mus.* 2: 190–205.

SWENGEL, A.B. 1996. Effects of fire and hay management on abundance of prairie butterflies. *Biol. Conserv.* 76: 73–85.

TAINTON, N.M. 1981. The ecology of the main grazing lands of South Africa. In: Veld and passture management in South Africa, ed. Tainton, N.M., p. 25–56. Shuter & Shooter, Pietermaritzburg.

TAINTON, N.M. & MENTIS, M.T. 1984. Fire in grassland. In: Ecological effects of fire in South African ecosystems, eds. Booysen, P. de V. & Tainton, N.M., p. 115–147. Springer, Berlin.

TARBOTON, W. R. 1991. The eastern Transvaal highveld and its birdlife. *WBC News* 155: 2–5.

TARBOTON, W. 1997. Grasslands. The way forward. *Africa Birds & Birding* 2(3): 41–44.

TARBOTON, W.R. & ALLEN, D.G. 1984. The Status and conservation of Birds of Prey in the Transvaal. Transvaal Museum, CTP Book Printers, Cape.

TARBOTON, W.R., KEMP, M.I. & KEMP, A.C. 1987. Birds of the Transvaal. Transvaal Museum, Guttenberg Book Printers.

TAYLOR, P.B. 1994. The biology, ecology and conservation of four flufftail species, *Sarothrura*, Aves: Rallidae. Ph.D thesis, University of Natal, Pietermaritzburg.

TEMPLE, S.A. & CARY, J.R. 1988. Modeling dynamics of habitat – interior bird populations in fragmented landscapes. *Conserv. Biol.* 2: 340–347.

THOMAS, C.D. 1985. The status and conservation of the butterfly *Plebejus argus* (Lepidoptera: Lyaenidae) in North West Britain. *Biol. Conserv.* 33: 29–51.

THOMAS, C.D. & HARRISON, S. 1992. Spatial dynamics of a patchily distributed butterfly species. *J. Anim. Ecol.* 61: 437–446.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

THOMAS, C.D., THOMAS, J.A. & WARREN, M.S. 1992. Distributions of occupied and vacant butterfly habitats in fragmented landscapes. *Oecologia* 92: 563–567.

THOMAS, J.A. 1980. Why did the large blue become extinct in Britain? *Oryx* 15: 243–247.

THOMAS, J.A. 1991. Rare species conservation; case studies of European butterflies. In: Scientifica Management of Temperate Communities for Conservation, eds. Spellerberg, I.F., Goldsmith, F.B. & Morris, M.G., p. 149–197. Blackwell Scientific, Oxford.

THOMAS, J.A. 1983. A "WATCH" census of common British butterflies. *J. Biol. Educ.* 17: 333–338.

THOMAS, J.A. 1983. The ecology and conservation of *Lysandra bellargus* (Lepidoptera: Lyaenidae) in Britain. *J. Appl. Ecol.* 20: 59–83.

THOMAS, J.A. 1984. The conservation of butterflies in temperate countries: past efforts and lessons for the future. In: Biology of Butterflies, eds. Vane-Wright, R.I. & Ackery, P.R., p. 333–353. Academic Press, London.

THOMAS, J.A., THOMAS, C.D., SIMCOX, D.J. & CLARKE, R.T. 1986. Ecology and declining status of the silver-spotted skipper butterfly (*Hesperia comma*) in Britain. *J. Appl.Ecol.* 23: 365–380.

THOMSON, G. 1980. The butterflies of Scotland. A natural history. Croom Helm, London.

TINLEY, K.L. 1982. The influence of soil moisture balance on ecosystem patterns in southern Africa. In: Ecology of Tropical Savannas, eds. Huntley, B.J. & Walker, B.H., p. 175–192. Springer Verlag, Berlin.

TOMLINSON, F.R. 1970. Optimale bodembewaring in die landbou – 'n nuwe benadering. In Optimale bodembenutting in die landbou, p. 7–11. Agricultural Technical Services, Pretoria.

TRAINOR, C.R. & WOINARSKI, J.C.Z. 1994. Responses of Lizards to Three Experimental Fires in the Savanna Forest of Kadu National Park. *Wildl. Res.* 21: 131–148.

TROLLOPE, W.S.W. 1984. Fire in savanna. In: Ecological effects of fire in South African Ecosystems, eds. Booysen, P. de V. & Tainton, N.M. *Ecological Studies* 48: 151–175. Springer-Verlag, Berlin.

TURNER, J.R.G., GATEHOUSE, C.M. & COREY, C.A. 1987. Does solar energy control organic diversity? Butterflies, moths and the British climate. *Oikos* 48: 195–205.

TURPIE, J.K. & CROWE, T.M. 1994. Patterns of distribution, diversity and endemism of larger African mammals. *S. Afr. J. Sci.* 29(1): 19–32.

TYSON, P.D. 1986. Climatic change and variability in southern Africa. Oxford University Press, Cape Town.

VAN DAMME, R., BAUWENS, D., CASTILLA, A.M. & VERHEYEN, R.F. 1989. Altitudinal variation of the thermal biology and running performance in the *lizard Podarcis tiliguerta*. *Oecologia. Berl.* 80: 516–524.

VAN DER MERWE, M. & VAN WYK, B. 1997. Butterfly conservation: is the presence of the host plant enough ? *PlantLife* 16 (March): 12–14.

VAN DIJK, D.E. 1982. Anuran distribution, Rainfall and Soils in Southern Africa. *S. Afr. J. Sci.* 78: 401-406.

VAN DIJK, D.E. 1996. Anuran fauna of the Lesotho Highlands in the Khatse Dam catchment area and Jorodane River region. *Koedoe* 39: 77–90.

VAN HOEPEN, E.C.N. 1932. Voorlopige beskrywing van Vrystaatse soogdiere. *Pal. Nav. Nas. Mus. Bloemfontein* 2: 63-65.

VITT, L.J. 1983. Ecology of an anuran-eating guild of terrestrial tropical snakes. *Herpetologica* 39(1): 52–66.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

VOGEL, J.C., FULS, A. & ELLIS, R.P. 1978. The geographical distribution of Kranz grasses in South Africa. *S.Afr. J. Sci.* 74: 209–214.

WALCOTT, C.E. 1974. Changes in bird life in Cambridge, Massachusetts from 1860–1964. *Auk* 91: 151–160.

WALOFF, N. & SOLOMON, M.G. 1973. Leafhoppers (Auchenorhyncha: Homoptera) of acid grassland. *J. Appl.Ecol.* 10: 189–212.

WARREN, M.S. 1984. The biology and status of the wood white butterfly, *Leptidea sinapis* (L.)(Lepidoptera: Pieridae) in the British Isles. *Entomol. Gaz.* 35: 207–223.

WARREN, M.S. 1992. The conservation of British butterflies. In: The ecology of butterflies in Britain, ed. Dennis, R.L.H., p. 73–92. Oxford University Press, Oxford.

WARREN, M.S. 1993. A review of butterfly conservation in central southern Britain: I. Protection, evaluation and extinction on prime sites. *Biol. Conserv.* 64: 25–35.

WATT, W.B., CHEW, F.S., SNYDER, L.R.G., WATT, A.G. & ROTHSCHILD, D.E. 1968. Population structure of pierid butterflies, I. Numbers and movements of some montane Colias species. *Oecologia, Berl.* 27: 1–22.

WEBBS, L.H. 1962. Pleistocene faunas and the distribution of mammals in southern Africa. *Ann. Cape Prov. Mus.* 2: 37-40.

WEBBS, L.H. 1965. Antelopes in the Pleistocene of southern Africa. *Zool. Africana* 1: 115-120.

WEBBS, L.H. 1969. Faunal subdivision of the Quaternary in southern Africa. *S. Afr. archaeol. Bull.* 24: 93-95.

WEISS, S.B., MURPHY, D.D., EHRLICH, P.R. & METZLER, C.F. 1993. Adult emergence phenology in checkerspot butterflies: the effects of macroclimates, topoclimate, and population history. *Oecologia* 96: 261–270.

WEISS, S.B., MURPHY, D.D. & WHITE, R.R. 1988. Sun, slope, and butterflies: topographic determinants of habitat quality for *Euphydryas editha. Ecology* 69(5): 1486–1496.

WELLS, P.V.1965. Scarp woodlands, transported grassland soils, and concept of grassland climate in the Great Plains region. *Science* 148: 246–249.

WELLS, P.V. 1970. Postglacial vegetational history of the Great Plains. *Science* 167: 1574–1582.

WERGER, M.J.A. (ED.) 1978. Biogeography and Ecology of southern Africa. Junk, The Hague.

WESTEMEIER, R.L. & BUHNERKEMPE, J.E. 1983. Responses of nesting wildlife to prairie grass management on prairie chicken sanctuaries in Illinois. In: *Proceedings of the Eigth North American Prairie Conference*, ed. Brewer, R., p. 36–46. Western Michigan University, Kalamazoo.

WHITE, F. 1978. The Afromontane region. In: Biogeography and ecology of Southern Africa, ed. Werger, M.J.A., Vol. 1: 465–513. Junk, The Hague.

WHITING, M.J., DIXON, J.R. & MURRAY, R.C. 1993. Spatial distribution of a population of Texas horned lizards (*Phrynosoma cornutum*: Phrynosmatidae) relative to habitat and prey. *Southwest. Nat.* 38(2): 150–154.

WHITTAKER, J.B. 1969. Quantitative and habitat studies of the froghoppers and leafhoppers (Homoptera, Auchenorhyncha) of Wytham Woods, Bershire. *Entomologist's Monthly Magazine* 105: 27–37.

WIKLUND, C. & AHRBERG, C. 1978. Host plants, nectar sources, and habitat selection of males and females of *Anthocharis cardamines* (Lepidoptera). *Oikos* 31: 169–183.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

WILCOVE, D.S., McLELLAN, C.H. & DOBSON, A.P. 1986. Habitat fragmentation in the temperate zone. In: Conservation Biology – The Science of Scarcity and Diversity, ed. Soulé, M.E., p. 237–256. Sunderland, Massachusetts.

WINTERBOTTOM, J.M. 1959. Some zoogeographical remarks on the South African avifauna. *Ostrich Suppl.* 3: 40–46.

WINTERBOTTOM, J.M. 1962. The zoo-geographical affinities of the avifauna of the northern and eastern Transvaal. *Ostrich* 33: 34–37.

WINTERBOTTOM, J.M. 1969. Results of the garden bird counts organised by the Percy FitzPatrick Institute of African Ornithology, Part 2. *Ostrich* 42: 110–118.

WINTERBOTTOM, J.M. 1971. Results of the garden bird counts organised by the Percy FitzPatrick Institute of African Ornithology. Part 3. *Ostrich* 43: 125–129.

WINTERBOTTOM, J.M. 1973. Systematic notes on birds of the Cape Province. Three species-pairs. *Ostrich* 44: 144.

WINTERBOTTOM, J.M. 1974. The zoogeography of the South African avifauna. *Ann. S. Afr.Mus.* 66: 109–149.

WINTERBOTTOM, J.M. 1978. Birds. In Biogeography and ecology of southern Africa, ed. Werger, M.J.A., p. 949–979, Vol. 2. Junk, The Hague.

WOIWOD, I.P. & STEWART, A.J.A. 1990. Butterflies and moths – migration in the agrilcultural environment. In: Species dispersal in agricultural habitats, eds. Bunce, R.G.H. & Howard, D.C., p. 189–202. Belhaven Press, London.

WOOD, J., LOW, A.B., DONALDSON, J.S. & REBELO, A.G. 1994. Threats to plant species diversity through urbanization and habitat fragmentation in the Cape Metropolitan Area, South Africa. *Strelitzia* 1: 259–274.

WRIGHT, D.H. 1983. Species-energy theory: an extension of species-area theory. *Oikos* 41: 496–506.

YAHNER, R.H. 1988. Changes in wildlife communities near edges. *Conserv. Biol.* 2: 333–339.

ZIMMERMAN, J.L. 1992. Density-independant factors affecting the avian diversity of the tallgrass prairy community. *Wils. Bull.* 104: 85–94.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

CURRICULUM VITAE

Marisa Moolman was born on 8 September 1973 in George. She attended the Stellenberg High School, Bellville, where she matriculated in 1991.

In 1992 she enrolled at the University of Stellenbosch, and in 1995 was awarded a B.Sc. Agric. degree with Zoology, Animal Physiology, Animal Husbandry and Nature Conservation as majors. This was followed by a B.Sc. (Hons) in Zoology in 1996 at the University of Pretoria.

In 1997 she registered for a M.Sc. in Botany at the same university, specialising in biodiversity aspects and criteria.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

PART TWO

TABLE OF CONTENTS

Tables and Figures

Tables and figures are arranged in numberical order.

1. Criteria and score awardings

2. List of tables and figures

Table 1. Inventory of birds recorded in the Grassland Biome

Table 2. Inventory of reptiles and amphibians recorded in the Grassland Biome

Table 3. Inventory of butterflies recorded in the Grassland Biome

Table 4. Inventory of mammals recorded in the Grassland Biome

Table 5. Birds categorised as grassland specialists (Habitat type 1)

Table 6. Birds endemic to the Grassland Biome

Table 7. Birds recorded in the Grassland Biome, endemic to South Africa (non-cumulative)

Table 8. Birds recorded in the Grassland Biome, endemic to the sub-Region (non-cumulative)

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 9. Grassland Biome and sub-Region endemics birds of Habitat type 1

Table 10. Grassland Biome and sub-Region endemics birds of Habitat type 2

Table 11 Endemic birds of Habitat type 3

Table 12 Endemic birds of Habitat type 4

Table 13. Red Data Book birds recorded in the Grassland Biome

Table 14. Grassland Biome birds that are South African breeders

Table 15. Omnivorous Grassland Biome birds

Table 16. Reptiles (lizards and snakes) of the Grassland Biome

Table 17. Turtles and tortoises of the Grassland Biome

Table 18. Amphibians recorded in the Grassland Biome

Table 19. Endemic herpetofauna recorded in the Grassland Biome

Table 20. Herpetofauna of the Grassland Biome listed in the
Red Data Book (1988), or with unknown conservation status

Table 21. Grassland Biome endemic herpetofauna of Habitat type 1

Table 22. Herpetofauna that utilise Habitat type 1 within the Grassland Biome

Table 23. Herpetofauna in Habitat type 5 within the Grassland Biome

Table 24. Grassland Biome Herpetofauna species of the Grassland Biome of Habitat type 1,

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

and their conservation status

Table 25. Butterflies of Habitat type 1 within the Grassland Biome

Table 26. Non-edge butterflies of the Grassland Biome

Table 27. Red Data Book butterflies of the Grassland Biome

Table 28. Butterflies recorded in the Grassland Biome, of which the larvae feed on grass swards

Table 29. Mammals restricted to the grasslands within the Grassland Biome

Table 30. Mammals recorded within the Grassland Biome, with contracted distribution ranges due to habitat destruction and fragmentation

Table 31. Extinct mammals that historically occurred in the Grassland Biome

Table 32. Mammals endemic to southern Africa, recorded in the Grassland Biome

Table 33. Mammals listed in the Red Data Book, recorded in the Grassland Biome

Table 34. Summary of mammals recorded in the various habitat types within the Grassland Biome, according to their Endemicity status, Red Data Book (RDB) status and food preference

Figures 1–3. Shown in Part One: Text.

Figure 4. Bird endemicity of the Grassland Biome, with the number of species within each habitat type expressed as a percentage of the number of total endemics found in the Grassland Biome.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Figure 5. Breeding status of Grassland Biome birds, with the number of species occurring within each habitat type presented in the pie diagram as a percentage of the total of bird species included in the inventory.

Figure 6. Breeding status of Grassland Biome birds, with the number of endemic breeders within each habitat type. The numbers of species found within each category, are expressed as percentages of its category's total. The dotted bars represent South African breeders.

Figure 7. Threatened Grassland Biome birds, with the number of species in each threatened category expressed as a percentage the total number of species.

Figure 8. Grassland herpetofauna recorded in the various habitat types, with endemic species within each habitat type. The number of species in each category is expressed as a percentage of the total number of species listed in this inventory.

Figure 9. The number of endemic herpetofauna species represented in each vegetation type within the Grassland Biome, with each value also expressed as a percentage of the total number of species recorded in the Grassland Biome.

Figure 10. Red Data Book (RDB) herpetofauna species recorded in the Grassland Biome. The total number of species within each herpetofauna group is expressed as a percentage of the total number of species recorded in that group, whereas the totals of the various RDB categories are given as percentages of the total number of herpetofauna species included in this study.

Figure 11. The number of butterfly species present in the habitat types within the Grassland Biome, as well as their "Boundary status". The total number of species within each category is given as a percentage of the total number of butterfly species included in this study.

Figure 12. The Red Data Book status of the butterflies recorded in the Grassland Biome, with the total total number of species within each category expressed as a percentage of the total number of species included in this study.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Figure 13. Mammal distribution in the various Grassland Biome habitat types, expressed as percentages of the total of mammal species found within the Grassland Biome.

Figure 14. The number of endemic mammal species found in each habitat type within the Grassland Biome, also expressed as a percentage of the total number of Grassland Biome mammals.

Figure 15. Red Data Book status of Grassland Biome mammals, expressed as percentages of the total number of mammal species recorded in the biome.

Figure 16. The number of faunal species found in the Grassland Biome, expressed as a percentage of the total number of species found in South Africa for each faunal group.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Criteria and score awardings

1. Birds of the Grassland Biome

In this study, all the bird species/subspecies that have been recorded within the Grassland Biome, were included in the inventories (Table 1). Marginal Grassland Biome species/subspecies that were included in the inventories/tables, are indicated with an asterisk (*). This applies for the other faunal groups as well.

1.1 Criteria employed

1.1.1 Habitat preference

Score	Habitat type	Habitat preference	Rank
5	1	grassland	1st
4	2	grassland & vlei/cultivated areas	2nd
3	3	grassland & shrub/savanna/desert/other habitat types/ecotonal elements	3rd
2	4	habitats other than grassland	4th
1	5	human settlements	5th

1.1.2 Endemicity

Score	Scale of endemicity	Rank
5	Grassland Biome	1st
4	South Africa	2nd
3	sub-Saharan Africa/southern Africa/ sub-Afrotropical	3rd
2	non-endemics	4th
1	vagrants/Stragglers	5th

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

1.1.3 Breeding status

Score	Breeder	Rank
5	South African	1st
3	Breeding migrant	2nd
1	Nonbreeding migrant	3rd

1.1.4 Abundance

Score	Abundance	Rank
5	rare (low density/vagrant)	1st
4	scarce/uncommon	2nd
3	locally common/relatively uncommon	3rd
2	fairly common	4th
1	common/abundant	5th

1.1.5 Threatened status (According to Scientific Programmes Report 97, 1984; Harrison *et al.* 1997)

Score	Threatened status	Rank
5	endangered	1st
4	vulnerable	2nd
3	rare/indeterminate/vagrant	3rd
2	uncommon/locally common/uncertain	4th
1	common	5th

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

2. Reptiles and amphibians of the Grassland Biome

Reptiles and amphibians are treated under the mutual heading of "herpetofauna". The Grassland Biome herpetofauna (Table 2) were categorised according to their endemic status, habitat preference and Red Data Book (RDB) Status.

2.1 Criteria employed

2.1.1 Habitat preference

Species/subspecies were subdivided in the following classes according to their habitat preference:

Score	Habitat type	Habitat preference	Rank
5	1	grassland	1 st
3	2	grassland & savanna/woodland/desert/karoo/shrub	2 nd
4	3	grassland/savanna uncertainty	3 rd
4	4	rocky areas/termitaria/streams within grassland	4 th
2	5	rocky areas within several habitat types	5 th
1	6	habitats excluding grassland	6 th

2.1.2 Endemicity

Score	Endemicity	Rank
5	endemic	1 st
3	unknown	2 nd
1	non-endemic	3 rd

In the main inventory of the herpetofauna (Table 2), he endemicity status are described as detailed possible.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

2.1.3 Red Data Book status (National Scientific Programmes Report 151, 1988)

Score	Threatened status	Rank
1	vulnerable	1st
2	rare	2nd
3	indeterminate	3rd
4	unknown	4th

3. Butterflies of the Grassland Biome

This approach attempts to give a fair account of butterfly species that occur in the Grassland Biome (Table 3), or species that may utilise the grassland of southern Africa to some extent.

3.1 Criteria employed

3.1.1 Habitat preference

Species were calssified into four classes according to their habitat preference within the Grassland Biome and the transitional zones.

Score	Habitat preference	Rank
5	grassland	1 st
4	grassland & other vegetation types	2 nd
3	habitats other than grassland	3 rd
2	habitat unknown	4 th

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

3.1.2 "Boundary status"

Score	Boundary status	Rank
5	Non-edge species	1 st
3	Marginal species	2 nd
1	Edge/Ecotonal species	3 rd

3.1.3 Red Data Book status (National Scientific Programmes Report 158, 1989)

Butterflies of the Grassland Biome were assessed according to their Red Data Book Status with respect to their "Habitat preference", "Boundary Status", "Family grouping", and "Grass-feeding status". Factors that contribute to the threatened status of these species, are also listed.

3.1.4 Grass-feeding species

Species of which the larvae feed on grass swards, were assessed according to their "Habitat preference", "Boundary status", Family grouping" and "Red Data Book status". Butterfly species of which the larvae feed on grass, were awarded the top score of "5".

4. Mammals of the Grassland Biome

Information on mammals of the Grassland Biome (Table 4) was captured in a single data base.

4.1 Criteria employed

4.1.1 Habitat preference

Species/subspecies were classified into seven classes according to their main habitat preference:

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

Score & Rank	Habitat type	Habitat preference
5	1	grassland
4	2	grassland & vlei
3	3	grassland & other habitat types
2	4	habitats other than grassland
1	5	human settlements
0	0	extinct species
8	8	historical occurence

4.1.2 Endemics

Species were assessed according to their endemicity status (endemic to South Africa, near-endemic to South Africa):

Score	Endemicity
5	Endemic
4	restricted
0	Non-endemic

4.1.3 Food preference

Food preference	Code
Insectivore	1
Carnivore	2
Herbivore/Fructivore	3
Insects/Vertebrates	4
Omnivore	5
Granivore	6
Unknown	7
Extinct species	0
Historical distribution	8

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

4.1.4 Red Data Book status (National Scientific Programmes Report 125, 1986)

The Grassland Biome mammals were assessed according their Red Data Book (RDB) Status (ranking from first to third: vulnerable score = 5, rare score = 4, indeterminate score = 3). This is related to their habitat preference, food preference, and endemicity status.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

Table 1. Inventory of the bird species that have been recorded in the Grassland Biome

Order	Family	Species name	Common name	Habitat	Abundance	Food	Habitat type	Endemicity	RDB and Abundance status	Population trend	Remarks	Habitat score	Endemicity score	Abundance score	Threatened status score	Breeding status score	Total
Alcediniformes	ALCEDINIDAE	*Alcedo cristata*	Malachite Kingfisher	lakes, dams, irrigation canals	common	fish, insects, frogs, tadpoles, crustaceans	2, 5					2	2	1	1	5	11
Alcediniformes	ALCEDINIDAE	*Alcedo semitorquata*	Halfcollared Kingfisher	fast-flowing perennial streams, dense river vegetation	uncommon	fish, crabs, insects	2					2	2	4	2	5	15
Alcediniformes	ALCEDINIDAE	*Ceryle rudis*	Pied Kingfisher	rivers, lakes, dams	common	fish, insects, crustaceans	2					2	2	1	1	5	11
Alcediniformes	ALCEDINIDAE	*Halcyon albiventris*	Brownhooded Kingfisher	denser savanna, thickets in woodland, gardens	common	insects, lizards, rodents, birds	3					2	2	1	1	5	11
Alcediniformes	ALCEDINIDAE	*Halcyon chelicuti*	Striped Kingfisher	any woodland, savanna	common	insects, small lizards	3					3	2	1	1	5	12
Alcediniformes	ALCEDINIDAE	*Halcyon leucocephala*	Greyhooded Kingfisher	well-developed woodland	uncommon to locally fairly common breeding intra-African migrant	insects, lizards	3					2	1	3	2	3	11
Alcediniformes	ALCEDINIDAE	*Halcyon senegalensis*	Woodland Kingfisher	woodland, denser savanna, riverine forest	common	insects, snakes, fish, crabs	3					2	2	1	1	5	11
Alcediniformes	ALCEDINIDAE	*Ispidina picta*	Pygmy Kingfisher	edges of woodland, riverine forest	locally fairly common breeding intra-African migrant	insects, frogs, lizards	3					2	1	3	2	3	11
Alcediniformes	ALCEDINIDAE	*Megaceryle maxima*	Giant Kingfisher	rivers, lakes, wooded streams	uncommon to locally common	fish, crabs, frogs	2					2	2	3	2	5	14
Alcediniformes	MEROPIDAE	**Merops persicus*	Bluecheeked Bee-eater	large rivers, woodland around pans, vleis	locally fairly common	insects, butterflies, dragonflies	3, 2				Vagrant to Grassland Biome.	2	1	2	2	1	8
Alcediniformes	MEROPIDAE	*Merops apiaster*	European Bee-eater	woodland, savanna, shrubby grassland	common Palearctic populations	insects	1, 3					2	1	1	1	1	6
Alcediniformes	MEROPIDAE	*Merops bullockoides*	Whitefronted Bee-eater	woodland	very common	flying insects, butterflies	3				Recorded in grassy Karoo and sweet grassland	2	2	1	1	5	11
Alcediniformes	MEROPIDAE	*Merops hirundineus*	Swallowtailed Bee-eater	*Acacia* savanna, edges of woodland	locally common	flying insects	3					2	2	3	2	5	14
Alcediniformes	MEROPIDAE	*Merops pusillus*	Little Bee-eater	bushveld, savanna, open woodland	common	flying insects	3					2	2	1	1	5	11
Anseriformes	ANATIDAE	**Anas clypeata*	European Shoveller	shallow inland waters	very rare irregular nonbreeding straggler	aquatic invertebrates	2		Rare straggler		Straggler	2	1	5	3	1	12
Anseriformes	ANATIDAE	*Alopochen aegyptiacus*	Egyptian Goose	inland waters, dams, pans, cultivated fields	very common	grass, leaves, grain, tubers, crop seedlings	2, 5					2	2	1	1	5	11
Anseriformes	ANATIDAE	*Anas capensis*	Cape Teal	shallow inland waters, vleis	common in drier western regions	99 % insect material & 1 % plants	2					2	2	1	1	5	11
Anseriformes	ANATIDAE	*Anas erythrorhyncha*	Redbilled Teal	inland waters, pans, floodplains	common, less common to the east	water plants, aquatic invert.	2					2	2	1	1	5	11
Anseriformes	ANATIDAE	*Anas hottentota*	Hottentot Teal	inland waters, vleis, floodplains	uncommon to locally common	seed, fruit, insects, molluscs	2					2	2	3	2	5	14
Anseriformes	ANATIDAE	*Anas querquedula*	Garganey	inland waters and sewage ponds	rare nonbreeding Palerctic migrant	insects, molluscs, frogs, tadpoles	2, 5		Rare migrant			2	1	5	3	1	12
Anseriformes	ANATIDAE	*Anas smithii*	Cape Shoveller	shallow tempory pans, vleis	common highveld, uncommon elsewhere	planctonic invertebrates, insects, tadpoles, seed	2	Endemic to southern Africa.			Endemic to southern Africa.	2	3	2	1	5	13
Anseriformes	ANATIDAE	*Anas sparsa*	African Black Duck	rivers, wooded banks & streams, rarely dams	uncommon	larvae, pupae, aquatic insects, grain, plant, fish	2					2	2	4	2	5	15
Anseriformes	ANATIDAE	*Anas undulata*	Yellowbilled Duck	dams, pans, marshes, floodplains	very common (most common duck agric areas)	plants, seed, stems, grain, grass, insects, larvae	2					2	2	1	1	5	11
Anseriformes	ANATIDAE	*Dendrocygna bicolor*	Fulvous Duck	larger inland waters, pans, floodplains, dams	common in subtropical areas & Witwatersrand, uncommon else	seed, fruit of aquatic material, little insects	2					2	2	1	1	5	11
Anseriformes	ANATIDAE	*Dendrocygna viduata*	Whitefaced Duck	larger inland waters, dams, rivers, pans, floodplains	common	seeds, buds, insects, fruit, grass, grain	2					2	2	1	1	5	11
Anseriformes	ANATIDAE	*Netta erythrophthalma*	Southern Pochard	deeper inland waters, dams, vleis, pans	common to very common	seed, aquatic vegetation, crustacea	2					2	2	1	1	5	11
Anseriformes	ANATIDAE	*Nettapus auritus*	Pygmy Goose	clear water, floodplains, dams, pools	uncommon to rare, nomadic resident	seeds, insects, fish fry	2				Found mainly in subtropical east and north Africa.	2	2	4	2	5	15
Anseriformes	ANATIDAE	*Oxyura maccoa*	Maccoa Duck	deep inland waters, small dams, lakes	uncommon to locally common	larvae, pupae, seeds, insects, algae	2					2	2	3	2	5	14
Anseriformes	ANATIDAE	*Plectropterus gambensis*	Spurwinged Goose	larger inland waters, floodplains, dams, vleis	common to very common	grass shoots and seed, grain, crops	2					2	2	1	1	5	11
Anseriformes	ANATIDAE	*Sarkidiornis melanotos*	Knobbilled Duck	floodplains, pans	locally common, straggler to highveld	seed of grass, lilies, insect larvae	2					2	2	3	2	5	14
Anseriformes	ANATIDAE	*Tadorna cana*	South African Shelduck	inland waters, dams, pans, vleis, temporay waters	common (especially in Freestate & highveld)	seeds, algae, insects, crustaceans	2	Endemic to southern Africa.			Endemic to southern Africa.	2	3	1	1	5	12
Anseriformes	ANATIDAE	*Thalassornis leuconotus*	Whitebacked Duck	inland waters	uncommon	waterlilly seeds,water plant parts, larvae,seed	2					2	2	4	2	5	15
Apodiformes	APODIDAE	*Apus affinis*	Little Swift	cliffs, gorges, forages in adjacent open country	very common	aerial arthropods	3, 4, 5					2	1	1	1	3	8
Apodiformes	APODIDAE	*Apus apus*	European Swift	open country, almost anywhere	common	aerial arthropods, insects	3, various					2	1	1	1	1	6
Apodiformes	APODIDAE	*Apus barbatus*	Black Swift	open country near cliffs, gorges, any habitat	very common	aerial arthropods, insects	3, 4, various					2	2	1	1	3	9
Apodiformes	APODIDAE	*Apus caffer*	Whiterumped Swift	cliffs, bridges	very common	aerial arthropods	3, 4, 5, urban areas				Recorded in grassland.	2	1	1	1	3	8
Apodiformes	APODIDAE	*Apus horus*	Horus Swift	vertical sandbanks along rivers, dongas	locally common, breed in highveld in summer	aerial arthropods	4, sand banks					2	1	3	2	3	11
Apodiformes	APODIDAE	*Apus melba*	Alpine Swift	mountains, gorges, forages over any veldtype	common	aerial arthropods	3, 4, 5					2	1	1	1	3	8
Apodiformes	APODIDAE	*Cypsiurus parvus*	Palm Swift	Palm trees, gardens, parks	locally common, numbers increasing	aerial arthropods, termite alates	5					1	2	3	2	5	13
Caprimulgiformes	CAPRIMULGIDAE	*Caprimulgus europaeus*	European Nightjar	woodland, savanna, gardens, plantations	common, Palearctic migrant	flying insects	3, 5					2	1	1	1	1	6
Caprimulgiformes	CAPRIMULGIDAE	*Caprimulgus pectoralis*	Fiery-necked Nightjar	dense woodland, plantations, bushveld, gardens	common	insects and spiders	3, 5					2	2	1	1	5	11
Caprimulgiformes	CAPRIMULGIDAE	*Caprimulgus rufigena*	Rufous-cheeked Nightjar	open woodland, exotic plantations, semi-arid shrub	fairly common	flying insects	3, desert, 5					2	1	2	2	3	10
Caprimulgiformes	CAPRIMULGIDAE	*Caprimulgus tristigma*	Freckled Nightjar	wooded hills, outcrops, koppies	locally common to very common	flying insects espially moths	3, 4					2	2	3	2	5	14
Caprimulgiformes	CAPRIMULGIDAE	*Macrodipteryx vexillaria*	Pennantwinged Nightjar	stony hillsides, sandy grounds in woodland	common in North, Indeterminate	flying insects espially termites	3		Indeterminate	Stable	No decrease, road traffic pose threat.	2	1	3	3	1	10
Charadriiformes	BURHINIDAE	*Burhinus capensis*	Spotted Dikkop	open grassland, savanna, lawns	common	insects, worms, crustaceans, seeds	1, 3, 5					3	2	1	1	5	12
Charadriiformes	CHARADRIIDAE	*Actitis hypoleucos*	Common Sandpiper	dams, pans, rivers, marshes	common	insects, crustaceans, fish, molluscs	2					2	1	1	1	1	6
Charadriiformes	CHARADRIIDAE	*Calidris alba*	Sanderling	tidal mudflats	common	crustaceans, molluscs, insects, fish	2					2	1	1	1	1	6
Charadriiformes	CHARADRIIDAE	*Calidris alpina*	Dunlin	inland pans, marshes, tidal mudflats	very rare, vagrant	molluscs, crustaceans, insects, seeds	2					2	1	5	2	1	11
Charadriiformes	CHARADRIIDAE	*Calidris canutus*	Knot	tidal flats	rare inland, uncommon to locally common	aquatic vertebrates	2					2	1	1	4	2	10
Charadriiformes	CHARADRIIDAE	*Calidris ferruginea*	Curlew Sandpiper	inland pans, dams, vleis	very common	worms, molluscs, crustaceans, fly larvae	2					2	1	1	1	1	6
Charadriiformes	CHARADRIIDAE	*Calidris minuta*	Little Stint	lakes, pans, dams, tidal flats	common	crustaceans, molluscs, insects, worms	2					2	1	1	1	1	6
Charadriiformes	CHARADRIIDAE	*Calidris temminckii*	Temminck's Stint	inland shores	very rare, vagrant	crustaceans, molluscs, insects, worms	2					2	1	5	2	1	11
Charadriiformes	CHARADRIIDAE	*Charadrius asiaticus*	Caspian Plover	open grassland, arid plains, near water	common in west, uncommon elsewhere	insects, grass seeds	1, 3 , arid areas					3	1	1	1	1	7
Charadriiformes	CHARADRIIDAE	*Charadrius hiaticula*	Ringed Plover	inland waters, dry pans	common	insects, invertebrates	2					2	1	1	1	1	6
Charadriiformes	CHARADRIIDAE	*Charadrius marginatus*	Whitefronted Plover	marine and inland waters, pans	common resident	insects, worms, molluscs	2					2	2	1	1	5	11
Charadriiformes	CHARADRIIDAE	*Charadrius pallidus*	Chestnutbanded Plover	brackish pans	locally common, rare	insects	2	Endemic to southern Africa.	Rare	Stable	No decrease, endemic to southern Africa.	2	3	3	3	5	15
Charadriiformes	CHARADRIIDAE	*Charadrius pecuarius*	Kittlitz's Plover	inland waters, short grass, dry pans	common	insects, invertebrates	2, short 1					4	2	1	1	5	13
Charadriiformes	CHARADRIIDAE	*Charadrius tricollaris*	Threebanded Plover	dams, pans, lakes, marshes	common	insects, invertebrates	2					2	2	1	1	5	11
Charadriiformes	CHARADRIIDAE	*Gallinago nigripennis nigripennis*	Ethiopian Snipe	vleis, marshes, flooded grassland	locally common	insects, worms, crustaceans, molluscs	1, 2					4	2	1	3	2	5	16
Charadriiformes	CHARADRIIDAE	*Numenius arquata arquata*	Curlew	shallow inland waters	uncommon	molluscs, crustaceans, insects, berries	2					2	1	4	2	1	10
Charadriiformes	CHARADRIIDAE	*Numenius arquata orientalis*	Curlew	shallow inland waters	uncommon	molluscs, crustaceans, insects, berries	2					2	1	4	2	1	10
Charadriiformes	CHARADRIIDAE	*Numenius phaeopus*	Whimbrel	inland waters, dams, pans	common	molluscs and crustaceans	2					2	1	1	1	1	6
Charadriiformes	CHARADRIIDAE	*Philomachus pugnax*	Ruff/Reeve	inland waters, moist grassland	very common	molluscs, berries, grain, seeds	1, 2					4	1	1	1	1	8
Charadriiformes	CHARADRIIDAE	*Pluvialis squatarola*	Grey Plover	tidal flats and shallow inland waters	fairly common to common nonbreeding Palearctic migrant	worms, molluscs, crustaceans, rarely seeds	3		Vagrant			2	1	2	2	1	8
Charadriiformes	CHARADRIIDAE	*Tringa erythropus*	Spotted Redshank	dams, pans, mudflats	very rare, vagrant	aquatic invertebrates, fish	2					2	1	5	2	1	11
Charadriiformes	CHARADRIIDAE	*Tringa glareola*	Wood Sandpiper	pools, vleis, flooded grassland, sewage ponds	common	insects, crustaceans, fish, worms	2, 1, 5					4	1	1	1	1	8
Charadriiformes	CHARADRIIDAE	*Tringa nebularia*	Greenshank	dams, pans, swamps, vleis	common	insects, fish, crustaceans, worms, tadpoles	2					2	1	1	1	1	6
Charadriiformes	CHARADRIIDAE	*Tringa ochropus*	Green Sandpiper	swampy vegetation, woodland streams, ponds	rare, vagrant to South Africa	insects, crustaceans, worms, molluscs	2					2	1	5	2	1	11
Charadriiformes	CHARADRIIDAE	*Tringa stagnatilis*	Marsh Sandpiper	shallow inland waters, saltpans, mudflats	fairly common	molluscs, worms, crustaceans, insects	2					2	1	2	2	1	8
Charadriiformes	CHARADRIIDAE	*Tringa totanus*	Redshank	tidal mudflats, inland on shallow pans	rare	molluscs, worms, crustaceans, insects	2					2	1	5	2	1	11
Charadriiformes	CHARADRIIDAE	*Tryngites subruficollis*	Buffbreasted Sandpiper	tidal mudflats, short grassland, golf courses	very rare, vagrant	insects, spiders, seeds	1, 2, 5					4	1	5	2	1	13
Charadriiformes	CHARADRIIDAE	*Vanellus armatus*	Blacksmith Plover	dams, pans, short grassy verges, play fields	common	insects, worms, molluscs	2, 5					2	2	1	1	5	11
Charadriiformes	CHARADRIIDAE	*Vanellus coronatus*	Crowned Plover	short dry grassland, burned veld.	common	insects, earthworms	1, 5					4	2	1	1	5	13
Charadriiformes	CHARADRIIDAE	*Vanellus melanopterus minor*	Blackwinged Plover	open short grassland, fallow lands, pastures	locally fairly common breeding migrant	insects, molluscs	1, 2, 5	Endemic to southern Africa.			Endemic to southern Africa.	4	3	3	2	3	13
Charadriiformes	CHARADRIIDAE	*Vanellus senegallus*	Wattled Plover	upland grassland along streams, vleis, lakes, pans	locally common, otherwise migrant	insects, grass seed	2, 1					4	2	3	2	5	16
Charadriiformes	CHARADRIIDAE	*Xenus cinereus*	Terek Sandpiper	estuaries, mangrove swamps, tidal mudflats	uncommon	crustaceans, molluscs, worms, insects	2					2	1	4	2	1	10
Charadriiformes	GLAREOLIDAE	*Cursorius rufus*	Burchell's Courser	open or burned grassland, overgrazed veld, karoo	locally fairly common	insects, seeds	1, 3, 5	Endemic to southern Africa.			Endemic to southern Africa.	3	3	2	2	5	15
Charadriiformes	GLAREOLIDAE	*Cursorius temminckii*	Temminck's Courser	short grassland, burned grassland, vleis, ploughed land	uncommon to locally common	insects, seeds, molluscs	1, 2, 3				Scarce in Highveld.	4	2	3	2	5	16
Charadriiformes	GLAREOLIDAE	*Glareola nordmanni*	Blackwinged Pratincole	open grassland	locally abundant, highveld	insects	1					5	1	3	1	1	11
Charadriiformes	GLAREOLIDAE	*Glareola pratincola*	Redwinged Pratincole	open ground, burned grass, overgrazed veld, pans	locally common	insects, spiders, molluscs	1, 2, 3, 5		Rare	Down	Threatened by economical development.	3	1	3	3	1	11
Charadriiformes	GLAREOLIDAE	*Rhinoptilus africanus*	Doublebanded Courser	overgrazed grassland, stunted shrubdesert	locally common, sparesely distributed	insects	1, 3, 5					3	2	3	2	5	15
Charadriiformes	GLAREOLIDAE	*Smutornis africanus*	Doublebanded Courser	plains of grass, near pans, shrubs	common through the Highveld	insects, seeds, molluscs	1, 2, 3					3	2	3	2	5	16
Charadriiformes	JACANIDAE	*Actophilornis africanus*	African Jacana	lakes, pans, vleis	common, only at Bloemfontein in Highveld	insects, invertebrates, waterlily bulbs	2	Endemic to sub-Saharan Africa.			Endemic to sub-Saharan Africa.	2	3	1	1	5	11
Charadriiformes	JACANIDAE	*Microparra capensis*	Lesser Jacana	vleis, dams with lilies	uncommon and localized resident	insects, molluscs, crustaceans	2		Rare	Stable		2	2	4	3	5	16
Charadriiformes	LARIDAE	*Chlidonias hybridus*	Whiskered Tern	inland waters, pans, vleis in Kalahari, sweet, sour and mixed grassland	locally common nomad	insects, frogs	2					3	2	3	2	5	14
Charadriiformes	LARIDAE	*Chlidonias leucopterus*	Whitewinged Tern	inland dams, lakes, marshes, vleis in sweet and mixed grassland	common to abundant	insects, fish, crustaceans	2					2	1	1	1	1	6
Charadriiformes	LARIDAE	*Chlidonias niger*	Black Tern	inland lakes, pans, dams, coastal	uncommon nonbreeding Palaearctic vagrant inland	insects, offal	2		Vagrant			2	1	4	2	1	10
Charadriiformes	LARIDAE	*Hydroprogne caspia*	Caspian Tern	larger inland pans and dams	uncommon inland	fish	2		Rare	Down	Human disturbance and weather fluctuations are threats.	2	2	4	3	5	16
Charadriiformes	LARIDAE	*Larus cirrocephalus*	Greyheaded Gull	larger dams, pans, coastal lakes, sweet and coastal grassland	common to abundant resident or togal migrant	scrabs, fish, insects	2					2	2	1	1	5	11
Charadriiformes	LARIDAE	*Larus fuscus*	Lesser Blackbacked Gull	inland and coastal waters	uncommon nonbreeding Palaearctic migrant, straggler to South Africa	dead fish, offal, crabs, molluscs, worms	2		Straggler			2	1	4	2	1	10
Charadriiformes	LARIDAE	*Sterna bergii*	Swift Tern	marine shores, estuaries	common resident	mainly fish	2		Vagrant			2	2	1	1	5	11
Charadriiformes	RECURVIROSTRIDAE	*Himantopus himantopus*	Blackwinged Stilt	shallow water, dams, vleis, marshes, sweet grassland	locally common	insects, worms, crustaceans, seeds	2					2	2	3	2	5	14
Charadriiformes	RECURVIROSTRIDAE	*Recurvirostra avosetta*	Avocet	shallow water, dams, pans, ponds	locally common	insects, crustaceans, worms, seeds, plants	2					2	2	3	2	5	14
Charadriiformes	ROSTRATULIDAE	*Rostratula benhalensis*	Painted Snipe	swamps, marshes, lakes	uncommon resident	insects, crustaceans, worms, seeds, plants	2, open water				Widespread, but uncommon.	2	2	4	3	5	16
Charadriiformes	RYNCHOPIDAE	*Rynchops flavirostris*	African Skimmer	lakes, pans	rare vagrant to South Africa	small fish	2, open water		extinct	Down	Habitat alterations pose threat.	2	1	5	3	5	16
Charadriiformes	SCOLOPACIDAE	*Arenaria interpres*	Turnstone	marine shores, mudflats, sandy shores	common	crustaceans, molluscs, worms, insects	2					2	1	1	1	1	6
Charadriiformes	SCOLOPACIDAE	*Calidris melanotos*	Pectoral Sandpiper	flooded grassland, vleis, marshy pans	nonbreeding Nearctic vagrant	aquatic vertebrates	1, 2		Vagrant			4	1	5	2	1	13
Charadriiformes	SCOLOPACIDAE	*Calidris subminuta*	Longtoed Stint	coastal and inland waters	very rare nonbreeding Palaearctic vagrant	aquatic vertebrates	2					2	1	5	2	1	11
Charadriiformes	SCOLOPACIDAE	*Limosa lapponica*	Bartailed Godwit	tidal flats, dams	uncommon to locally common nonbreeding Palaearctic migrant	molluscs, insects, worms, crustaceans	2				Local points	2	1	4	2	1	10
Charadriiformes	SCOLOPACIDAE	*Limosa limosa*	Blacktailed Godwit	dams, pans, marshes	very rare nonbreeding Palaearctic vagrant	molluscs, crustaceans, worms, seeds	2				Local points	2	1	5	2	1	11
Charadriiformes	SCOLOPACIDAE	*Phalaropus fulicarius*	Grey Phalarope	pans,dams, open sea, sewage ponds	rare inland, nonbreeding Holarctic migrant	plankton, insects, worms, molluscs	2					2	1	5	2	1	11
Charadriiformes	SCOLOPACIDAE	*Phalaropus lobatus*	Rednecked Phalarope	coastal and inland pans, sewage ponds	rare nonbreeding Holarctic migrant	plankton, insects, worms	2		Vagrant			2	1	5	2	1	11
Ciconiiformes	ARDEIDAE	*Ardea cinerea*	Grey Heron	shallow inland waters, grassland near water	relatively uncommon	aquatic animals, small mammals, rarely plants	2, 1					4	2	3	2	5	16
Ciconiiformes	ARDEIDAE	*Ardea goliath*	Goliath Heron	shallow inland water	uncommon	carnivorous, aquatic vertebrates, fish	2					2	2	4	2	5	15
Ciconiiformes	ARDEIDAE	*Ardea melanocephala*	Blackheaded Heron	open grassland, inland waters	common	carnivorous, aquatic vertebrates, fish	2, 1				Endemic to sub-Saharan Africa	4	3	1	1	5	13

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 1. continue...

Ciconiiformes	ARDEIDAE	*Ardea purpurea*	Purple Heron	inland waters, aquatic vegetation	uncommon, locally common	2	carnivorous, aquatic animals, fish					2	2	3	2	5	14
Ciconiiformes	ARDEIDAE	*Ardeola ralloides*	Squacco Heron	inland waters, dense vegetation	uncommon to locally abundant	2	insects, small invertebrates					2	2	3	3	5	15
Ciconiiformes	ARDEIDAE	*Botaurus stellaris*	Bittern	reedbeds, marshes	uncommon to rare	2	small vertebrates, aquatic animals, fish		Vulnerable	Down	Habitat destruction, human activity.	2	2	4	4	5	17
Ciconiiformes	ARDEIDAE	*Bubulcus ibis*	Cattle Egret	grassland, inland waters	common	1, 2	insects, small vertebrates					4	2	1	1	5	13
Ciconiiformes	ARDEIDAE	*Butorides rufiventris*	Rufoubellied Heron	marshy shallows, floodplains	uncommon to rare	2	insects, fish, frogs	Endemic to south and central Africa.	Rare	Stable	Endemic to south and central Africa.	2	3	4	3	5	16
Ciconiiformes	ARDEIDAE	*Butorides striatus*	Greenbacked Heron	dense vegetated rivers, ponds, waters	uncommon, locally abundant	2	insects, fish, small vertebrates					2	2	3	3	5	15
Ciconiiformes	ARDEIDAE	*Egretta alba*	Great White Egret	inland waters	uncommon	2	carnivorous, aquatic animals, fish					2	2	4	1	5	14
Ciconiiformes	ARDEIDAE	*Egretta ardesiaca*	Black Egret	inland waters	common, rare in Free State	2	aquatic animals, fish					2	2	1	1	5	11
Ciconiiformes	ARDEIDAE	*Egretta garzetta*	Little Egret	inland waters	fairly common	2	carnivorous, aquatic animals, fish					2	2	2	1	5	12
Ciconiiformes	ARDEIDAE	*Egretta intermedia*	Yellowbilled Egret	inland waters, grassland near water	uncommon to locally common	1, 2	aquatic vertebrates, fish, small vertebrates					4	2	3	2	5	16
Ciconiiformes	ARDEIDAE	*Egretta vinceigula*	Slaty Egret	marshes, pans, floodplains	uncommon resident, formerly western Tvl	2	fish, insects, molluscs		Vagrant			2	2	4	2	5	15
Ciconiiformes	ARDEIDAE	*Gorsachius leuconotus natalensis*	Whitebacked Night Heron	streams, marshes	Uncommon to rare	2	insects, small vertebrates	Endemic to sub-Saharan Africa.	Indeterminate, probably rare	Down	Destruction of trees . Endemic to sub-Saharan Africa.	2	3	4	3	5	16
Ciconiiformes	ARDEIDAE	*Ixobrychus minutus minutus*	Little Bittern	reedbeds	Palearctic immigrant	2	small vertebrates, aquatic animals, fish		Rare	Stable	Unknown	2	2	5	3	5	17
Ciconiiformes	ARDEIDAE	*Ixobrychus sturmii*	Dwarf Bittern	reedbeds, trees in floodplains, marshes	uncommon to rare, but locally common when breeding	2	fish, frogs, arthropods		Indeterminate, probblaly rare	Stable	No decrease	2	1	4	3	3	13
Ciconiiformes	ARDEIDAE	*Nycticorax nycticorax*	Blackcrowned Heron	marshes, rivers with dense vegetation	common	2	small vertebrates, fish, aquatic animals					2	2	1	1	5	11
Ciconiiformes	CICONIIDAE	**Anatomus lamelligerus*	Openbilled Stork	inland waters, marshes	uncommon to locally common, intra-African migrant	2	snails, mussels	Endemic to tropical sub-Saharan Africa.	Rare	Stable	No decrease, vagrant to Free State and Tvl. Highveld.	2	2	3	2	3	11
Ciconiiformes	CICONIIDAE	**Ephippiorhynchus senegalensis*	Saddlebilled Stork	floodplains, flooded grassland, inland water	fairly common resident, but local	2, 1	fish, frogs,small mammals, reptiles, molluscs		Rare	Stable	Habitat destruction poses threat. Vagrant to the Free State.	4	2	3	3	5	17
Ciconiiformes	CICONIIDAE	*Ciconia abdimii*	Abdim's Stork	highveld grassland, cultivated land, inland water	common, nonbreeding intra-African migrant	1, 2, 5	insects, small vertebrates					4	1	1	1	1	8
Ciconiiformes	CICONIIDAE	*Ciconia ciconia*	White Stork	highveld grassland, cultivated lands, marshes, karoo	common to abundant, Nonbreeding Palearctic	1, 2, 3, 5	insects, small vertebrates		Rare	Stable	No decrease.	3	1	1	1	1	7
Ciconiiformes	CICONIIDAE	*Ciconia episcopus*	Woollynecked Stork	grassland, wetland, breeds in trees	uncommon to rare	1, 2	fish, frogs, insects, lizards		Rare	Stable	No decrease, habitat site has been destroyed.	4	2	4	3	5	18
Ciconiiformes	CICONIIDAE	*Ciconia nigra*	Black Stork	marshes, dams	uncommon to rare, locally common	2	small vertebrates, fish		Indeterminate, probably rare	Stable	No decrease.	2	2	4	2	5	15
Ciconiiformes	CICONIIDAE	*Leptoptilos crumeniferus*	Marabou Stork	open woodland, rubbish dumps	rare to locally common	3, 5	carrion, insects, small vertebrates; fish		Rare	Down	Sugar cane plantations destroyed breedings sites.	2	2	5	3	5	17
Ciconiiformes	CICONIIDAE	*Mycteria ibis*	Yellowbilled Stork	inland waters, pans. marshes	rare nonbreeding intra-African migrant	2	small vertebrates, fish aquatic animals		Rare	Stable	No decrease.	2	1	1	5	3	12
Ciconiiformes	PLATALEIDAE	*Bostrychia hagedash*	Hadeda Ibis	grassland, savanna, gardens, forest edge	very common	1, 2, 3, 5	insects, small invertebrates & vertebrates					3	2	1	1	5	12
Ciconiiformes	PLATALEIDAE	*Geronticus calvus*	Bald Ibis	high grassland, burned & cultivated lands, mountains	uncommon, out of danger	1, 5	insects, small vertebrates, carrion	Endemic to Grassland Biome.	Out of danger, Rare	Stable	Overgrazing aand invation by the False Karoo.	4	3	4	2	5	18
Ciconiiformes	PLATALEIDAE	*Platalea alba*	African Spoonbill	shallow inland waters, pans, various	locally common, alpine and sour grassland	2	fish, aquatic invertebrates	Endemic to sub-Saharan Africa.			Endemic to sub-Saharan Africa	2	3	3	1	5	14
Ciconiiformes	PLATALEIDAE	*Plegadis falcinellus*	Glossy Ibis	shallow inland waters, wet grassland	locally common to rare	1, 2, 5	insects, small vertebrates & invertebrates, fish					4	2	3	2	5	16
Ciconiiformes	PLATALEIDAE	*Threskiornis aethiopicus*	Sacred Ibis	inland waters, cultivated lands, open grassland	common to very common	2	various, insects, small vertebrates, seed, carrion				Grassland species	4	2	1	1	5	13
Ciconiiformes	SCOPIDAE	*Scopus umbretta*	Hamerkop	inland waters, temporary pools	common	3, 5	small vertebrates, fish, invertebrates					2	2	3	2	5	14
Coliiformes	COLIIDAE	*Colius colius*	Whitebacked Mousebird	arid shrub, gardens, farmyards	common	3, 5	fruit, flowers, leaves, nectar	Endemic to southern Africa			Endemic to southern Africa.	2	3	1	1	5	13
Coliiformes	COLIIDAE	*Colius striatus*	Speckled Mousebird	bushveld, gardens, tangled thickets	common	3, 5	fruit, leaves, seed, nectar, insects (rarely)					2	2	1	1	5	11
Coliiformes	COLIIDAE	*Urocolius indicus*	Redfaced Mousebird	savanna with thickets, gardens	common	3, 5	fruit, flowers, leaves, nectar					2	2	1	1	5	11
Columbiformes	COLUMBIDAE	*Columba arquatrix*	Rameron Pigeon	canopy of lowland, evergreen forest, exotic plantations	locally common	3, 5	fruit	Afrotropical endemic.			Afrotropical endemic.	2	3	3	2	5	14
Columbiformes	COLUMBIDAE	*Columba guinea*	Rock Pigeon	cliffs, mountains, feeds in open, cultivated land	common to abundant	3, 4	seed, grain, shoots					2	2	1	1	5	11
Columbiformes	COLUMBIDAE	*Columba livia*	Feral Pigeon	urban areas, seldom farms, various	abundant	3, 5	seeds, berries, farinaceous foods					2	2	1	1	5	11
Columbiformes	COLUMBIDAE	*Oena capensis*	Namaqua Dove	dry bushveld, arid shrub, rural gardens, fallow lands	very common	3, 5, desert	small seeds					2	2	1	1	5	11
Columbiformes	COLUMBIDAE	*Streptopelia capicola*	Cape Turtle Dove	woodland, savanna, farmland, gardens, city parks	very common	3, 5	seeds, insects, grain, termite alates				Occurs in sour and mixed grassland due to afforestation, manmade water points.	2	2	1	1	5	11
Columbiformes	COLUMBIDAE	*Streptopelia semitorquata*	Redeyed Dove	woodland, riverine forest, exotic plantations, gardens	common	3, 5	seeds, bulbs, termite alates					2	2	1	1	5	11
Columbiformes	COLUMBIDAE	*Streptopelia senegalensis*	Laughing Dove	open woodland, savanna, gardens, veld with trees, parks	very common	3, 5	seeds, insects, termite alates, snails				High occurence in sweet, sour and mixed grassland and fynbos.	2	2	1	1	5	11
Columbiformes	COLUMBIDAE	*Turtur chalcospilos*	Greenspotted Dove	most woodland, *Acacia* shrub, savanna, gardens	common	3, 5, arid savanna	seeds, berries, termite alates					2	2	1	1	5	11
Coraciiformes	BUCEROTIDAE	*Bucorvus leadbeateri*	Ground Hornbill	woodland, savanna, open grassland	locally common, scarce elsewhere	3, 1	carnivorous, reptiles, snakes, mammals, frogs					3	2	3	2	5	15
Coraciiformes	BUCEROTIDAE	*Tockus erythrorhynchus*	Redbilled Hornbill	savanna, mopani woodland	common resident	3	insects, seeds, scorpions, weaver eggs					2	2	1	1	5	11
Coraciiformes	BUCEROTIDAE	*Tockus leucomelas*	Southern Yellowbilled Hornbill	bushveld, woodland, savanna	common resident	3	rodents, insects,scorpions				Near-endemic to southern Africa.	2	3	1	1	5	11
Coraciiformes	BUCEROTIDAE	*Tockus nasutus*	Grey Hornbill	bushveld, savanna, woodland	common, absent most highveld	3	insects, frogs, fruit, rodents		Near-endemic to southern Africa.		Near-endemic to southern Africa.	2	2	2	1	5	12
Coraciiformes	CORACIIDAE	*Coracias caudata*	Lilacbreasted Roller	savanna or open woodland	common	3	insects, birds, snakes, lizards					2	2	1	1	5	11
Coraciiformes	CORACIIDAE	*Coracias garrulus*	European Roller	woodland, grassland, savanna	fairly common	1, 3	insects, frogs, lizards, scorpions					3	1	2	2	1	9
Coraciiformes	CORACIIDAE	*Coracias naevia*	Purple Roller	savanna, open woodland	uncommon to fairly common	3	insects, lizards, reptiles					2	2	3	2	5	14
Coraciiformes	PHOENICULIDAE	*Phoeniculus cyanomelas*	Scimitarbilled Woodhoopoe	woodland, savanna, farmland, gardens, city parks	common	3	insects, seeds, buds, nectar					2	2	1	1	5	11
Coraciiformes	PHOENICULIDAE	*Phoeniculus purpureus*	Redbilled Woodhoopoe	*Acacia* thornveld, gardens, parks	common, mainly absent highveld	3, 5	insects, millipeds, lizards, nectar	Endemic to sub-Saharan Africa.			Endemic to sub-Saharan Africa.	2	3	2	1	5	12
Coraciiformes	UPUPIDAE	*Upupa epops*	Hoopoe	savanna, woodland, gardens	sparse to common	3, 5	insects, snakes, frogs					2	2	3	2	5	14
Cuculiformes	CUCULIDAE	*Centropus bengalensis*	Black Coucal	rank grass in vleis	locally common, but uncommon intra-African migrant	2, 1	insects, spiders, reptiles, seeds		Indeterminate	Down	Habitat destruction poses threat.	4	1	3	3	3	14
Cuculiformes	CUCULIDAE	*Centropus burchelli*	Burchell's Coucal	riverine bush, gardens, marshes, parks	common	3, 5	insects, frogs, reptiles, small mamals, snails					2	2	1	1	5	11
Cuculiformes	CUCULIDAE	*Chrysococcyx caprius*	Diederik Cuckoo	savanna, woodland, farmland, exotic plantations	very common	3, 5	caterpillars, insects				Recorded in sweet and mixed grassland.	2	1	1	1	3	8
Cuculiformes	CUCULIDAE	*Chrysococcyx klaas*	Klaas's Cuckoo	savanna, edges of woodland, wooded rocky hills	uncommon to fairly common	3, 5	caterpillars, insects					2	1	3	2	3	11
Cuculiformes	CUCULIDAE	*Clamator glandarius choragium*	Great Spotted Cuckoo	woodland, savanna	locally common, intra-African migrant	3	insects, caterpillars					2	1	3	2	3	11
Cuculiformes	CUCULIDAE	*Clamator glandarius glandarius*	Great Spotted Cuckoo	woodland, savanna	locally common, nonbreeding Palaearctic migrant	3	insect, caterpillars					2	1	2	2	1	8
Cuculiformes	CUCULIDAE	*Clamator jacobinus jacobinus*	Jacobin Cuckoo	savanna, thornveld, woodland, bushveld	fairly common, Indian migrant	3	hairy caterpillars, insects, termite alates					2	1	2	2	1	8
Cuculiformes	CUCULIDAE	*Clamator jacobinus pica*	Jacobin Cuckoo	savanna, thornveld, woodland, bushveld	fairly common, Palearctic migrant	3	hairy caterpillars, insects, termite alates					2	1	2	2	3	10
Cuculiformes	CUCULIDAE	*Clamator jacobinus serratus*	Jacobin Cuckoo	savanna, thornveld, woodland, bushveld	fairly common, intra-African migrant	3	hairy caterpillars, insects, termite alates					2	1	2	2	3	10
Cuculiformes	CUCULIDAE	*Clamator levaillantii*	Striped Cuckoo	woodland, riverine bush and forest edge, not open savanna	uncommon breeding intra-African migrant	3	caterpillars and other insects					2	1	4	2	1	10
Cuculiformes	CUCULIDAE	*Cuculus canorus canorus*	European Cuckoo	woodland, open rolling foothills with trees	uncommon	3	insects, larvae, hairy caterpillars					2	1	4	2	1	10
Cuculiformes	CUCULIDAE	*Cuculus canorus subtelephonus*	European Cuckoo	woodland, open rolling foothills with trees	uncommon	3	insects, larvae, hairy caterpillars					2	1	2	2	3	10
Cuculiformes	CUCULIDAE	*Cuculus clamosus*	Black Cuckoo	woodland, forest edges, farmland, exotic plantations	fairly common	3, 5	insects					2	1	3	2	3	11
Cuculiformes	CUCULIDAE	*Cuculus gularis*	African Cuckoo	woodlans, *Acacia* thornveld	uncommon to common	3	caterpillars					2	1	1	1	3	8
Cuculiformes	CUCULIDAE	*Cuculus solitarius*	Redchested Cuckoo	forest, woodland, parks, gardens, exotic plantations	common	3, 5	insects, seeds		Rare	Stable	No decrease.	2	2	4	3	5	16
Cuculiformes	CUCULIDAE	*Pachycoccyx audeberti*	Thickbilled Cuckoo	woodland, savanna, bushveld	uncommon to rare resident	3	grasshoppers, caterpillars, mantises		Endangered	Down	Poisoning, shooting, trapping pose threat.	2	2	5	5	5	19
Falconiformes	ACCIPITRIDAE	*Neophron percnopterus*	Egyptian Vulture	cliffs, open country, semidesert but not woodland	very rare	1, 3, 5	carrion, bird's eggs, insects, refuse		Rare	Down	Urbanization poses threat, vagrant in Grassland Biome.	2	2	4	3	5	16
Falconiformes	ACCIPITRIDAE	**Macheiramphus alcinus*	Bat Hawk	dense woodland, riverine forest	uncommon, rare	3	smaller bats, birds					2	2	1	1	5	11
Falconiformes	ACCIPITRIDAE	*Accipiter badius*	Little Banded Goshawk	savanna, exotic plantations, woodland	common	3, 5	lizards, nestlings, bats					2	2	3	2	5	14
Falconiformes	ACCIPITRIDAE	*Accipiter melanoleucus*	Black Sparrowhawk	forest, exotic plantations in grassland	uncommon to fairly common	3, 5	birds, small mammals, reptiles					3	2	3	2	5	15
Falconiformes	ACCIPITRIDAE	*Accipiter minullus*	Little Sparrowhawk	woodland, forest, exotic plantations, mixed grassland	generally uncommon	1, 3, 5	small birds, reptiles, insects					3	2	3	2	5	15
Falconiformes	ACCIPITRIDAE	*Accipiter ovampensis*	Ovambo Sparrowhawk	savanna, any woodland, exotic plantations, sour grassland	generally uncommon, locally common	1, 3	birds					3	2	4	2	5	16
Falconiformes	ACCIPITRIDAE	*Accipiter rufiventris*	Redbreasted Sparrowhawk	montane grassland, open grassland, savanna	uncommon	3, 5	birds, bats, insects, rarely mice				Isolated records in alpine grassland	2	2	1	1	5	11
Falconiformes	ACCIPITRIDAE	*Accipiter tachiro*	African Gowshawk	indigenous forest, dense woodland,exotic plantations	common resident	3	birds, mammals, frogs, snakes, insects					2	1	1	1	1	6
Falconiformes	ACCIPITRIDAE	*Aquila nipalensis*	Steppe Eagle	woodland, open savanna,semi-arid savanna	common but unpredictable Palaearctic migrant	3	termites, queleas, small mammals, carrion					2	1	4	2	1	10
Falconiformes	ACCIPITRIDAE	*Aquila pomarina*	Lesser Spotted Eagle	savanna, woodland	uncommon	3	small vertebrates, termites					3	2	3	2	5	15
Falconiformes	ACCIPITRIDAE	*Aquila rapax*	Tawny Eagle	woodland, savanna, grassland with *Acacia*	common in reserves, rare elsewhere	1, 3	small mammals, fish, amphibians, carrion					2	2	2	1	5	12
Falconiformes	ACCIPITRIDAE	*Aquila verreauxii*	Black Eagle	rocky hills, gorges	fairly common in suitable habitats	3, 4	dassies, hares, other mammals, reptiles					2	1	1	1	3	8
Falconiformes	ACCIPITRIDAE	*Aquila wahlbergi*	Wahlberg's Eagle	woodland, savanna, cultivated land	common	3, 5	reptiles, birds, small mammals, insects					2	2	3	3	5	15
Falconiformes	ACCIPITRIDAE	*Aviceda cuculoides*	Cuckoo Hawk	woodland, forest	uncommon to fairly common resident	3, 5	insects, lizards, snakes		Indeterminate, probably rare	Down	Evidence tenuous.	2	2	3	3	5	15
Falconiformes	ACCIPITRIDAE	*Buteo buteo*	Steppe Buzzard	grassveld, open country, farmland	common	1, 3, 5	insects, small birds, small mammals, reptiles					3	1	1	1	1	7
Falconiformes	ACCIPITRIDAE	*Buteo rufofuscus*	Jackal Buzzard	mountainous, hilly grassland terrain, savanna	locally common in mountains, less common elsewhere	3, 1, 4	small mammals, reptiles, insects	Endemic to southern Africa			Endemic to southern Africa.	3	3	3	2	5	16
Falconiformes	ACCIPITRIDAE	*Buteo trizonatus*	Forest Buzzard	indigenous or exotic forest	uncommon localized resident	3, 5	small rodents, small lizards, birds, frogs	Endemic to South Africa.			Endemic to South Africa.	2	4	4	2	5	17
Falconiformes	ACCIPITRIDAE	*Circaetus cinereus*	Brown Snake Eagle	woodland, savanna	uncommon, common in Zimbabwe	3	snakes, lizards					2	2	4	2	5	15
Falconiformes	ACCIPITRIDAE	*Circaetus pectoralis*	Blackbreasted Snake Eagle	highly variable	uncommon	1, 3	snakes, rodents, reptiles, fish					2	2	4	2	5	15
Falconiformes	ACCIPITRIDAE	*Circus aeruginosus*	European Marsh Harrier	marsh, swarig, open grassland	rare nonbreeding Palaerctic migrant, straggler to South Africa	2, 1	frogs, bird's eggs, small vertebrates		Straggler			4	1	5	3	1	13
Falconiformes	ACCIPITRIDAE	*Circus macrourus*	Pallid Harrier	open grassland, cultivated fields	formerly common, now uncommon to rare	1, 3, 5	small mammals, birds, reptiles, insects					4	1	4	2	1	12
Falconiformes	ACCIPITRIDAE	*Circus maurus*	Black Harrier	grassveld, karoo shrub, cultivated land	uncommon	1, 3, 5	birds, small rodents, insects	Endemic to southern Africa			Endemic to southern Africa.	3	3	4	2	5	18
Falconiformes	ACCIPITRIDAE	*Circus pygargus*	Montagu's Harrier	open grassland, vleis	scarce	1, 2	small mammals, birds, reptiles, insects					4	1	5	2	1	13
Falconiformes	ACCIPITRIDAE	*Circus ranivorus*	African Marsh Harrier	grassland near water, vlei, marsh	common	1, 2, 3	small rodents, birds, reptiles, frogs, insects					4	2	1	1	5	13
Falconiformes	ACCIPITRIDAE	*Elanus caeruleus*	Blackshouldered Kite	mainly grassland & farmland, savanna, woodland	very common	1, 3, 5	rodents, small invertebrates, insects					3	2	1	1	5	12
Falconiformes	ACCIPITRIDAE	*Gypaetus barbatus*	Bearded Vulture	Drakensberg massif and foothills	rare and endangered	1, 4	carrion and bones		Rare	Stable	Poisoning, direct persecution.	4	2	5	3	5	19
Falconiformes	ACCIPITRIDAE	*Gyps africanus*	Whitebacked Vulture	savanna & bushveld	common in game reserves	3	carrion, bone					2	2	3	3	5	18
Falconiformes	ACCIPITRIDAE	*Gyps coprotheres*	Cape Vulture	mountainous country, less common in savanna, grassland	carrion, bone	4, 3	carrion, bone	Endemic to southern Africa.	Vulnerable	Down	Endemic to southern Africa, threatened by poisoning, shooting etc.	2	3	3	4	5	17
Falconiformes	ACCIPITRIDAE	*Haliaeetus vocifer*	African Fish Eagle	large rivers, pans, dams	Locally common, vulnerable	2, 3	fish, waterbirds, dassies etc.					2	2	2	1	5	12
Falconiformes	ACCIPITRIDAE	*Hieraaetus ayresii*	Ayres' Eagle	dense woodland, forest edge, *Eucalyptus* in towns	common in north & east, uncommon elsewhere	3, 5	mainly birds					2	2	5	2	5	16
Falconiformes	ACCIPITRIDAE	*Hieraaetus pennatus*	Booted Eagle	edge of Karoo, wide variety habitats	scarce	3, Karoo	mostly birds, lizards, insects, rodents					2	1	1	1	1	6
Falconiformes	ACCIPITRIDAE	*Hieraaetus spilogaster*	African Hawk Eagle	woodland, open savanna at forest edge	common	3	mostly birds, mammals, reptiles					2	2	3	2	5	14
Falconiformes	ACCIPITRIDAE	*Kaupifalco monogrammicus*	Lizard Buzzard	savanna & woodland	uncommon to fairly common	3	insects, lizards, small mammals					2	2	2	2	5	13
Falconiformes	ACCIPITRIDAE	*Lophaetus occipitalis*	Longcrested Eagle	woodland, forest edge, grassland, cultivated land	fairly common	1, 3, 5	mainly rodents, reptiles, rarely fruit				Recorded in sour grassland.	3	2	2	2	5	14
Falconiformes	ACCIPITRIDAE	*Melierax canorus*	Pale Chanting Goshawk	savanna, watercourse	common to very common	3	lizards, small birds, mammals, snakes	Near-endemic to South Africa.			Near-endemic to South Africa.	2	3	1	1	5	12
Falconiformes	ACCIPITRIDAE	*Micronisus gabar*	Gabar Goshawk	woodland to savanna	common	3	small birds, mammals, reptiles, insects					2	2	1	1	5	11
Falconiformes	ACCIPITRIDAE	*Milvus migrans lineatus*	Black Kite	woodland, semi-arid savanna	uncommon	3	any animal material, carrion					2	2	1	1	5	11
Falconiformes	ACCIPITRIDAE	*Milvus migrans migrans*	Black Kite	woodland, semi-arid savanna	common	3	any animal material, carrion					2	1	4	2	1	10
Falconiformes	ACCIPITRIDAE	*Milvus migrans parasitus*	Yellowbilled Kite	woodland, semi-arid savanna	very common	3	any animal material, carrion					2	1	1	1	1	6
Falconiformes	ACCIPITRIDAE	*Pernis apivorus*	Honey Buzzard	woodland, forest edge	scarce	3	any animal material, carrion					2	1	1	1	3	8
Falconiformes	ACCIPITRIDAE	*Polemaetus bellicosus*	Martial Eagle	grassland, savanna with trees, woodland	fairly common in reserves, uncommon to rare else	3	larvae, pupae, small vertebrates, berries					2	1	5	2	1	11
Falconiformes	ACCIPITRIDAE	*Polyboroides typus*	Gymnogene	open savanna, dense woodland, kloofs	locally common	1, 3	birds, small mammals, reptiles		Vulnerable	Down	Shooting, poisoning, electrocution on power lines.	3	2	3	4	5	17
						3, 4	reptiles, amphibians, insects, mammals					2	2	3	2	5	14

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 1. continue...

Falconiformes	ACCIPITRIDAE	*Stephanoaetus coronatus*	Crowned Eagle	forest, riverine forest	common resident	mammals, lizards, birds	3: forest				Numbers declining through afforestation.	2	2	1	1	5	11
Falconiformes	ACCIPITRIDAE	*Torgos tracheliotus*	Lappetfaced Vulture	savanna, bushveld, sometimes grassland, desert	uncommon except in Namib and South Zimbabwe	carrion, small mammals	3, 1		Vulnerable	Down	Poisoning, habitat destruction, pied crows competing for food. Marginal sp.?	3	2	4	4	5	18
Falconiformes	FALCONIDAE	*Falco amurensis*	Eastern Redfooted Kestrel	open grassland, cultivated land, grassy foothills	very common	insects	1, 5					3	1	1	1	1	7
Falconiformes	FALCONIDAE	*Falco biarmicus*	Lanner Falcon	mountains, open country, agricultural land, cities	fairly common	birds, small mammals, reptiles, insects	trees in 1, 5					3	2	2	2	5	14
Falconiformes	FALCONIDAE	*Falco chiquera*	Rednecked Falcon	savanna, riverine woodland	uncommon to rare	birds, small mammals, reptiles, insects	3		Indeterminate, probably rare	Stable	No decrease.	2	2	4	3	5	16
Falconiformes	FALCONIDAE	*Falco concolor*	Sooty Falcon	large trees near water	uncommon nonbreeding migrant	insects, birds, bats	3: trees		Vagrant			2	1	4	2	1	10
Falconiformes	FALCONIDAE	*Falco naumanni*	Lesser Kestrel	highveld, grassland near towns	abundant migrant, numbers declining	insects, rarely birds, reptiles, rodents	1, 5					4	1	1	1	1	8
Falconiformes	FALCONIDAE	*Falco peregrinus calidus*	Peregrine Falcon	cliffs, hunt over grassland, farmland	rare migrant, rare resident ?	birds, termites	3, 5		Rare	Stable	Pesticides leading to thinning of egg shells.	2	2	1	1	5	16
Falconiformes	FALCONIDAE	*Falco peregrinus minor*	Peregrine Falcon	cliffs, hunt over grassland, farmland	rare migrant, rare resident ?	birds, termites	3, 5		Rare	Stable	Pesticides leading to thinning of egg shells.	2	2	5	3	5	17
Falconiformes	FALCONIDAE	*Falco rupicoloides*	Greater Kestrel	drier grassland, cultivated land, savanna	common, confined to highveld in summer	arthropods, small mammals, birds, reptiles	1, 3, desert					2	2	5	3	5	12
Falconiformes	FALCONIDAE	*Falco subbuteo*	Hobby Falcon	wooded country	uncommon, commoner in some parts	insects, small birds, bats	3					3	2	1	1	5	12
Falconiformes	FALCONIDAE	*Falco tinnunculus*	Rock Kestrel	montane grassland with outgrops, variable	generally common, local migrations to Highveld	small mammals, reptiles, insects, birds	1, 3, desert					2	1	3	1	5	12
Falconiformes	FALCONIDAE	*Falco vespertinus*	Western Redfooted Kestrel	open grassland, cultivated land	uncommon to rare	insects	1, 5					3	1	1	1	5	11
Falconiformes	PANDIONIDAE	*Pandion haliaetus*	Osprey	inland waters	mostly uncommon Palearctic migrant	fish	2					2	1	4	2	1	10
Falconiformes	SAGITTARIIDAE	*Sagittarius serpentarius*	Secretarybird	grassland, savanna, open woodland	uncommon to fairly common	insects, small vertebrates	1, 3					2	2	3	2	5	14
Falconiformes	FALCONIDAE	*Polihierax semitorquatus*	Pygmy Falcon	arid to semi-arid savanna and scrub, grassy Karoo, Kalahari	fairly common, somewhat nomadic	insects, lizards, small rodents, birds	3				Marginal species. Kalahari species.	2	2	2	2	5	13
Galliformes	NUMIDIDAE	*Numida meleagris*	Helmeted Guineafowl	open grassland, karoo shrubs, cultivated land	very common	seeds, insects, bulbs, grain	1, 3, 5					3	2	1	1	5	12
Galliformes	PHASIANIDAE	*Coturnix adansonii*	Blue Quail	moist grassland, vleis, cultivated fields	rare breeding migrant	seeds, snails, insects	1, 2, 5		Indeterminate, probably rare	Down	Overgrazing, excessive burning, cultivated fields	4	2	5	3	5	19
Galliformes	PHASIANIDAE	*Coturnix coturnix*	Common Quail	open grassland, savanna, karoo	common	seeds, bulbs, athropods, snails	1, 3					3	2	1	1	5	12
Galliformes	PHASIANIDAE	*Coturnix delegorguei*	Harlequin Quail	rank grass in grassland, fallow lands	locally common	seeds, shoots, insects, snails	1, 5					4	2	3	2	5	16
Galliformes	PHASIANIDAE	*Francolinus africanus*	Greywing Francolin	montane grassland & shrub, karoo	common	bulbs, grain, potatoes	1, 3, fynbos	Endemic to South Africa.			Endemic to South Africa.	3	4	1	1	5	13
Galliformes	PHASIANIDAE	*Francolinus coqui*	Coqui Francolin	savanna, woodland with grass, grassland with trees	common	seeds, shoots, insects, ticks	3, 1					3	2	1	1	5	12
Galliformes	PHASIANIDAE	*Francolinus levaillanti*	Redwing Francolin	montane grassland, low-lying grassland	fairly common	bulbs, grains, seeds, molluscs	1					5	2	2	2	5	16
Galliformes	PHASIANIDAE	*Francolinus levaillantoides*	Orange River Francolin	open grassland, croplands, edges of pans	fairly common	bulbs, corms, seeds, insects	1, 3, 5					3	2	2	2	5	15
Galliformes	PHASIANIDAE	*Francolinus natalensis*	Natal Francolin	dense thickets, rocky terrain	common	insects, molluscs, seed, fruit	3, 4	Near-endemic to southern Africa.			Near-endemic to southern Africa.	3	3	1	1	5	13
Galliformes	PHASIANIDAE	*Francolinus sephaena*	Crested Francolin	bushveld, cultivated land near woodland	very common resident	bulbs, seeds, berries, insects	3, 5				Marginal species. eastern Tvl., Swaziland and KwaZulu-Natal & eastern Africa.	2	2	1	1	5	11
Galliformes	PHASIANIDAE	*Francolinus shelleyi*	Shelley's Francolin	*Acacia* savanna with grass, cultivated land	fairly common	seeds, grains, insects, bulbs	3, 5					2	2	2	2	5	13
Galliformes	PHASIANIDAE	*Francolinus swainsonii*	Swainson's Francolin	grassland with trees, cultivated land, bushveld, vleis	very common, expand through agriculture	seeds, berries, shoots, insects	3, 2, 1, 5	Near-endemic to southern Africa.			Near-endemic to southern Africa.	4	3	1	1	5	14
Gruiformes	GRUIDAE	*Anthropoides paradiseas*	Blue Crane	highland & midland grassland, karoo edge, cultivated land	common	fish, reptiles, frogs, grass seeds	1, 3, 5	Endemic to southern Africa.			Endemic to southern Africa.	3	3	1	1	5	13
Gruiformes	GRUIDAE	*Balearica regulorum*	Crowned Crane	marshes, moist grassland, cultivated land, vleis	common	reptiles, frogs, insects, grain	1, 2, 5					4	2	1	1	5	13
Gruiformes	GRUIDAE	*Grus carunculata*	Wattled Crane	open grassland, floodplains, swamps, vleis	uncommon	reptiles, frogs, insects, small mammals	1, 2		Endangered	Down	Human activity, degredation of grassland to False Karoo, poisoned grain.	4	2	4	5	5	20
Gruiformes	HELIORNITHIDAE	*Podica senegalensis*	African Finfoot	streams, pans, lakes	uncommon	insects, spiders, fish, snakes	2		Indeterminate, probably rare	Down	Habitat destruction	2	2	4	3	5	16
Gruiformes	OTIDIDAE	*Ardeotis kori kori*	Kori Bustard	open plains, highveld grassland, karoo	rare to uncommon, common in reserves	insects, small vertebrates, seeds, carrion	1, 3	Endemic subspecies to southern Africa.	Vulnerable	Down	Hunting, agricultural practices, endemic subspecies to southern Africa.	3	3	4	4	5	19
Gruiformes	OTIDIDAE	*Eupodotis afraoides*	Whitewinged Black Korhaan	Karoo, grassland, open bushveld with grass	very common	insects, plant material	1, karoo, 3	Endemic to southern Africa.			Endemic to southern Africa.	3	3	1	1	5	13
Gruiformes	OTIDIDAE	*Eupodotis afra*	Black Korhaan	grassland, karoo, shrub	very common	insects, plant material	1, karoo	Endemic to South Africa.			Endemic to South Africa.	3	4	1	1	5	13
Gruiformes	OTIDIDAE	*Eupodotis caerulescent*	Blue Korhaan	open grassland, karoo scrub, cultivated land	fairly common to uncommon resident	insects, small lizards, seeds, plant material	1, 3, 5	Endemic to Grassland Biome.			Endemic to Grassland, South Africa.	3	5	3	2	5	18
Gruiformes	OTIDIDAE	*Eupodotis cafra barrowii*	Whitebellied Korhaan	open grassland	uncommon	insects, invertebrates, plants	1	Endemic to southern Africa.			Endemic to southern Africa.	5	3	4	2	5	18
Gruiformes	OTIDIDAE	*Eupodotis melanogaster*	Blackbellied Korhaan	grassland, vleis, bushveld, cultivated land	uncommon resident; some local southward movement	insects and plant material	1, 2, 3, 5				Found more towards the eastern Tvl. Drakensberg escarpment & Natal escarpment.	3	2	4	2	5	16
Gruiformes	OTIDIDAE	*Eupodotis ruficrista rufiersta*	Redcrested Korhaan	savanna, semi desert, grassland	common	seeds, arthropods, fruit	3, 1, desert	Endemic to South Africa.			Endemic to South Africa	3	4	1	1	5	13
Gruiformes	OTIDIDAE	*Eupodotis vigorsii*	Karoo Korhaan	karoo, semi desert, grass stuble	fairly common	insects, invertebrates, reptiles, seeds	3	Endemic to South Africa.			Endemic to South Africa	2	4	2	2	5	15
Gruiformes	OTIDIDAE	*Neotis denhami*	Stanley's Bustard	montane and highveld grassland, karoo, savanna	uncommon, vulnerable	insects, grass, seeds, reptiles	1, 3	Endemic subspecies to South Africa. .	Vulnerable	Down	Hunting and growing human population, endemic subspecies to South Africa	3	4	5	4	5	20
Gruiformes	OTIDIDAE	*Neotis ludwigii*	Ludwig's Bustard	grassland, open plains	uncommon resident	insects, seeds, small vertebrates, plant material	1, desert	Endemic to southern Africa.	Vulnerable	Down	Hunting, changed land use, endemic to southern Africa.	3	3	4	4	5	19
Gruiformes	RALLIDAE	**Crex crex*	Corncrake	rank grassland, fallow fields, crops, vleis	uncommon to fairly common	insects, frogs, seeds, leaves	1, 2, 5	migrant			migrant	4	1	3	2	1	11
Gruiformes	RALLIDAE	*Amaurornis flavirostris*	Black Crake	marshes, weedy ponds, river backwaters	common	insects, small invertebrates, fish, seed, plants	2					2	2	1	1	5	11
Gruiformes	RALLIDAE	*Crex egregia*	African Crake	flooded grassland, marshes, vleis	uncommon	insects, frogs, leaves, seeds	1, 2	Endemic to sub-Saharan Africa.			Endemic to sub-Saharan Africa.	4	3	4	2	5	16
Gruiformes	RALLIDAE	*Fulica cristata*	Redknobbed Coot	inland waters, floating water plants	abundant	water plants, grass, insects, molluscs	2					2	2	1	1	5	11
Gruiformes	RALLIDAE	*Gallinula angulata*	Lesser Moorhen	vleis, flooded grassland, reedbeds	uncommon to locally common	seeds, reed flowers, insects	1, 2					4	1	3	2	1	11
Gruiformes	RALLIDAE	*Gallinula chloropus*	Moorhen	reedbeds, pans, marshes	common	water plants, seeds, insects, molluscs	2					2	2	1	1	5	11
Gruiformes	RALLIDAE	*Porphyrio porphyrio*	Purple Gallinule	reedy swamps & marshes, sedges	fairly common	roots, tubers, insects, nestlings, carrion	2					2	2	2	2	5	13
Gruiformes	RALLIDAE	*Porphyrula alleni*	Lesser Gallinule	marshes, pans, floodplains	uncommon breeding migrant	seeds, flowers, bulbs	2					2	1	4	2	5	12
Gruiformes	RALLIDAE	*Porzana porzana*	Spotted Crake	marshes, flooded grassland, vleis	uncommon	aquatic invertebrates, insects, seeds, rarely fish	1, 2					4	1	4	2	1	12
Gruiformes	RALLIDAE	*Porzana pusilla*	Baillon's Crake	flooded grassland, vleis, reedbeds, marshes	fairly common resident	insects, worms, crustaceans, molluscs, seeds	1, 2		Indeterminate, possibly rare	Stable	No satisfactoruy evidence for decrease.	4	2	2	2	5	15
Gruiformes	RALLIDAE	*Rallus caerulescens*	African Rail	reedbeds, marshes, swamps	fairly common	crabs, insects	2				Endemic to sub-Saharan Africa.	2	3	2	2	5	14
Gruiformes	RALLIDAE	*Sarothrura affinis*	Striped Flufftail	submontane grassland, rank vegetation and grass, forest edges	uncommon resident	insects, seeds, green plant material	1, 3	Endemic to South Africa.	Rare	Stable	No evidence for decrease, endemic to South Africa.	3	4	4	3	5	18
Gruiformes	RALLIDAE	*Sarothrura elegans*	Buffspotted Flufftail	evergreen forest, gardens	fairly common resident	insects, seeds, green plant material	3, 5					2	2	2	2	5	13
Gruiformes	RALLIDAE	*Sarothrura rufa*	Redchested Flufftail	swamps, vleis, marshes	fairly common	seeds, insects, snails, spiders	2					2	2	2	2	5	13
Gruiformes	RALLIDAE	*Sarothura ayresi*	Whitewinged Flufftail	large marshes	rarest flufftail, rare	insects	2		Rare	Stable	No decrease	2	2	5	3	5	17
Gruiformes	TURNICIDAE	*Turnix hottentotta*	Blackrumped Buttonquail	open grassland, fallow lands, montane grassland	fairly common locally, uncommon resident	seeds, insects, invertebrates	1, 5		Endangered	Down	Overgrazing and excessive burning	4	2	3	5	5	19
Gruiformes	TURNICIDAE	*Turnix sylvatica*	Kurrichane Buttonquail	drier grassland, fallow land, light savanna	usually uncommon	seeds, insects, invertebrates, seeds	1, 3, 5					3	2	4	2	5	16
Musophagiformes	MUSOPHAGIFORMES	*Corythaixoides concolor*	Grey Lourie	savanna, bushveld, riverine woodland in arid areas	common	fruit, flowers, insects, seeds, nestlings	3					2	2	1	1	5	11
Passeriformes	ALAUDIDAE	*Calandrella cinerea*	Redcapped Lark	open grassland, overgrazed veld, cultivated land	common, numbers fluctuate	seeds, insects	1, 5					4	2	1	1	5	13
Passeriformes	ALAUDIDAE	*Certhilauda albescens*	Karoo Lark	shrubby semi-desert	common (Karoo)	seed, berries, arthropods	3 shrub	Endemic to South Africa.			Endemic to South Africa.	2	4	1	1	5	13
Passeriformes	ALAUDIDAE	*Certhilauda chuana*	Shortclawed Lark	semi-arid scrub, savanna	uncommon resident	insects, grass seeds	3, scrub	Endemic to southern Africa.	Indeterminate, probably rare	Down	Threatened by agricultural removal of *Acacia & Tarchonanthus*.	2	3	4	3	5	16
Passeriformes	ALAUDIDAE	*Certhilauda curvirostris*	Longbilled Lark	open short grassland, karoo shrub, hills, ridges	common	insects, seeds	1, 3, 4	Near-endemic to southern Africa.			Near-endemic to southern Africa.	3	3	1	1	5	13
Passeriformes	ALAUDIDAE	*Chersomanes albofasciata beesleyi*	Spikeheeled Lark	sparse grassland, overgrazed areas, shrubby veld	common, mainly highveld confined	insects, green plant material	1, 3, 5	Near-endemic to southern Africa.			Near-endemic to southern Africa.	3	3	1	1	5	13
Passeriformes	ALAUDIDAE	*Eremopterix australis*	Blackeared Finchlark	shrubby karoo, Kalahari sandveld	locally common	insects, seed	3					2	1	3	2	1	9
Passeriformes	ALAUDIDAE	*Eremopterix leucotis*	Chestnutbacked Finchlark	bare areas in savanna, burned grassland, fallow lands	common	seeds, insects	1, 5					4	1	1	1	5	8
Passeriformes	ALAUDIDAE	*Eremopterix verticalis*	Greybacked Finchlark	arid ground, open short grass plains, bare pans	very common	insects, seeds, green plant material	1, 3, 5	Near-endemic to southern Africa.			Near-endemic to southern Africa.	5	3	1	1	5	15
Passeriformes	ALAUDIDAE	*Galerida magnirostris*	Thickbilled Lark	high montane grassland, cultivated land, semi-karoo	common	insects, seeds, bulbs	1, 3, 5	Virtual endemic to South Africa.			Virtual endemic to South Africa.	3	4	1	1	5	14
Passeriformes	ALAUDIDAE	*Heteromirafra ruddi*	Rudd's Lark	moist, short montane grassland	uncommon resident, highly localised	unrecorded	1	Endemic to Grassland Biome.	Vulnerable, Indeterminate (1986)	Down	Habitat degredation, overgrazing & excessive burning, endemic to South Africa.	5	5	4	4	5	23
Passeriformes	ALAUDIDAE	*Mirafra africana*	Rufousnaped Lark	open grassland, cultivated land, open savanna	common	insects, seed	1, 3, 5					3	2	1	1	5	12
Passeriformes	ALAUDIDAE	*Mirafra africanoides*	Fawncoloured Lark	scrub, savanna	common	insects, seeds, millipedes	3					2	2	1	1	5	11
Passeriformes	ALAUDIDAE	*Mirafra apiata*	Clapper Lark	highveld grassland, semi-arid karoo	common	insects, seeds	1, 3	Near-endemic to southern Africa.			Near-endemic to southern Africa.	3	3	1	1	5	13
Passeriformes	ALAUDIDAE	*Mirafra cheniana*	Melodious Lark	open climax grassland, grassy Karoo	uncommon, reduced by habitat destruction	insects, seeds	1	Endemic to southern Africa.			Endemic to southern Africa.	5	3	4	2	5	20
Passeriformes	ALAUDIDAE	*Mirafra passerina*	Monotonous Lark	savanna, open woodland	common	insects, seeds	3	Virtually endemic to southern Africa.			Virtually endemic to southern Africa.	2	3	1	1	5	12
Passeriformes	ALAUDIDAE	*Mirafra rufocinnamomea*	Flappet Lark	savanna, grassy woodland, coastal grassland	locally fairly common, but generally sparse resident	insects, seeds	3, coastal 1					2	2	3	2	5	14
Passeriformes	ALAUDIDAE	*Mirafra sabota*	Sabota Lark	semi-arid savanna, thorny bushveld	cpmmon	seeds, insects	3	Near-endemic to southern Africa.			Near-endemic to southern Africa.	2	3	1	1	5	12
Passeriformes	ALAUDIDAE	*Spizocorys conirostris*	Pinkbilled Lark	open short grassland in highveld, cultivated lands	common	seeds, insects	1, 5	Near-endemic to southern Africa.			Near-endemic to southern Africa.	4	3	1	1	5	14
Passeriformes	ALAUDIDAE	*Spizocorys fringillaris*	Botha's Lark	heavily grazed grassland (sour), cultivated land	uncommon, rare	insects, seeds	1, 5	Endemic to Grassland Biome.	Indeterminate, probably rare	Stable	No decrease, endemic to Grassland Biome, South Africa	4	5	4	3	5	21
Passeriformes	BUPHAGIDAE	*Buphagus erythrorhynchus*	Redbilled Oxpecker	savanna, bushveld	common resident in game reserves, rare elsewhere	ticks, horseflies	3					2	2	1	1	5	11
Passeriformes	CAMPEPHAGIDAE	*Campephaga flava*	Black Cuckooshrike	woodland, sparse in savanna, forest edge	uncommon to fairly common	insects, fruit	3					2	2	2	2	5	14
Passeriformes	CORVIDAE	*Corvus albicollis*	Whitenecked Raven	mountains, clifs, open country rarely	locally common, generally uncommon	carrion, insects, fruit, eggs, mammals, reptiles	4, 5					2	2	3	2	5	14
Passeriformes	CORVIDAE	*Corvus albus*	Pied Crow	savanna, farmland, urban areas	common to abundant	plant material, fish, mammals, arthropods, carrion	3, 5					2	2	1	1	5	11
Passeriformes	CORVIDAE	*Corvus capensis*	Black Crow	open grassland, *Acacia* savanna, exotic plantations	common to fairly common	fruit, omnivorous, frogs, carrion	1, 3, 5					3	2	1	1	5	12
Passeriformes	DICRURIDAE	*Dicrurus adsimilis*	Forktailed Drongo	woodland, savanna, gardens, forest edge	common	insects, nectar, fish	1, 3, 5					3	3	1	1	5	13
Passeriformes	ESTRILDIDAE	*Amadina erythrocephala*	Redheaded Finch	open grassland, dry savanna, cultivated land	common to very common	seeds, insects	3, 1, 5	Near-endemic to southern Africa.			Near-endemic to southern Africa.	2	2	3	2	5	14
Passeriformes	ESTRILDIDAE	*Amadina fasciata*	Cuthroat Finch	savanna, oodland	uncommon to fairly common	seeds, insects	3					2	2	3	2	5	14
Passeriformes	ESTRILDIDAE	*Estrilda astrild*	Common Waxbill	rank vegetation, gardens, cultivated land, reeds	common	seeds, insects, *Ficus sycomorus* fruit	1, 2, 3, 5					3	2	1	1	5	12
Passeriformes	ESTRILDIDAE	*Estrilda erythronotos*	Blackcheeked Waxbill	*Acacia* savanna, thornbush	locally common	seeds, insects, nectar, green plant material	3					2	2	3	2	5	14
Passeriformes	ESTRILDIDAE	*Estrilda melanotis*	Swee Waxbill	evergreen forest, exotic plantations, gardens, farmyards	common	seeds, insects	3, 5	Endemic to South Africa.			Endemic to South Africa.	2	3	1	1	5	12
Passeriformes	ESTRILDIDAE	*Lagonosticta rhodopareia*	Jameson's Finch	rank grass, thicket edges, cultivated land	common	seeds, insects	3, 5					2	2	1	1	5	11
Passeriformes	ESTRILDIDAE	*Lagonosticta rubricata rubricata*	Bluebilled Firefinch	rank grass, thicket edges, exotic plantations, cultivated land edges	common	seeds, insects	3, 5					2	2	1	1	5	11
Passeriformes	ESTRILDIDAE	*Lagonosticta senegala*	Redbilled Firefinch	rank grass, *Acacia* savanna, gardens	generally common	seeds, insects, crumbs	3, 5					2	2	1	1	5	11
Passeriformes	ESTRILDIDAE	*Ortygospiza atricollis*	Quail Finch	open short grassland, vleis, pans, grassy hillsides	common	seeds, insects, spiders	2, 1					4	2	1	1	5	13
Passeriformes	ESTRILDIDAE	*Pytilia melba*	Melba Finch	thickets with rank grass, grassland, scrub savanna	common to fairly common	seeds, insects	1, 3					3	2	1	1	5	12
Passeriformes	ESTRILDIDAE	*Spermestes bicolor*	Redbacked Mannikin	riverine forest, moist thickets	locally fairly common to common	seeds, nectar, insects	3, forest					2	2	3	2	5	14
Passeriformes	ESTRILDIDAE	*Spermestes cucullatus*	Bronze Mannikin	savanna edges, parks, thicket edges, cultivated land	very common	seeds, insects, nectar, green plant material, algae	3, 5					2	2	1	1	5	11
Passeriformes	ESTRILDIDAE	*Sporaeginthus subflavus*	Orangebreasted Waxbill	tall rank grass in grassland, savanna, reedbeds	locally common	seeds, insects, shoots	1, 2, 3					3	2	3	2	5	15
Passeriformes	ESTRILDIDAE	*Uraeginthus angolensis*	Blue Waxbill	open thornveld with grass, bushes, gardens, cultivated land	locally common	seeds, insects	3, 5					2	2	3	2	5	14
Passeriformes	ESTRILDIDAE	*Uraeginthus granatinus*	Violetbreasted Waxbill	dry savanna, cultivated land edges	locally common	seeds, insects	3, 5	Near-endemic to southern Africa.			Near-endemic to southern Africa.	2	3	3	2	5	15
Passeriformes	FRINGILLIDAE	*Emberiza capensis*	Cape Bunting	rocky places, near water	common to fairly common	seeds, insects, spiders	3, 4	Near-endemic to southern Africa.			Near-endemic to southern Africa.	2	3	1	1	5	12
Passeriformes	FRINGILLIDAE	*Emberiza flaviventris*	Goldenbreasted Bunting	woodland, savanna, gardens, farmyards, exotic plantations	uncommon to fairly common	seeds, insects, buds	3, 5					2	2	3	2	5	14
Passeriformes	FRINGILLIDAE	*Emberiza impetuani*	Larklike Bunting	arid savanna, karoo, koppies	common to very common	seeds, insects	3, 4	Near-endemic to southern Africa.			Near-endemic to southern Africa.	2	3	1	1	5	12
Passeriformes	FRINGILLIDAE	*Emberiza tahapisi*	Rock Bunting	rocky outcrops, donga slopes, savanna, overgrazed savanna	locally common to uncommon	seeds, insects	3, 4, 5					2	2	3	2	5	14
Passeriformes	FRINGILLIDAE	*Pseudochloroptila symonsi*	Drakensberg Siskin	montane scrub, alpine grassland, cultivated lands	locally common resident	seeds, buds, insects	alpine 1, 3, 5	Endemic to the Grassand Biome.			Endemic to South Africa.	3	5	3	2	5	17
Passeriformes	FRINGILLIDAE	*Serinus alario alario*	Blackheaded Canary	arid shrubby hills, rocky slopes, cultivated land	locally common to uncommon	seeds	3, 5	Endemic to southern Africa.			Endemic to southern Africa.	2	3	3	2	5	16
Passeriformes	FRINGILLIDAE	*Serinus albogularis*	Whitethroated Canary	riverine thornbush, grassland	common	seeds, berries, insects, buds	3, arid 1	Near-endemic to southern Africa.			Near-endemic to southern Africa.	3	3	1	1	5	13
Passeriformes	FRINGILLIDAE	*Serinus atrogularis*	Blackthroated Canary	savanna, woodland, grassy highveld farms, gardens	common to fairly common	seeds, insects, flowers	1, 3, 5					3	2	1	1	5	12

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 1. continue...

Passeriformes	STURNIDAE	*Creatophora cinerea*	Wattled Starling	open woodland, savanna, farmland	locally abundant nomad	insects, fruit, nectar	3, 5					2	2	3	2	5	14
Passeriformes	STURNIDAE	*Lamprotornis australis*	Burchell's Starling	savanna, parklike woodland	fairly common to abundant	insects, fruit, invertebrates	3	Endemic to southern Africa.				2	3	2	2	5	14
Passeriformes	STURNIDAE	*Lamprotornis nitens*	Glossy Starling	*Acacia* savanna, forest edges, parks, semi-arid scrub	common to fairly common	insects, fruit, nectar of aloes	3, 5					2	2	1	1	5	12
Passeriformes	STURNIDAE	*Onychognathus morio*	Redwinged Starling	mountains, cliffs, rocky hills, buildings	common to abundant	insects, fruit, lizards, aloe nectar	3, 4, 5					2	2	1	1	5	12
Passeriformes	STURNIDAE	*Onychognathus nabouroup*	Palewinged Starling	arid country, grassy Karoo, woodland	locally common resident	insects, fruit, ticks	3	Endemic to southern Africa.				2	3	3	2	5	15
Passeriformes	STURNIDAE	*Spreo bicolor*	Pied Starling	open grassland, cultivated land, dongas, farms	common	insects, fruit, nectar, lizards	1, 4, 5	Endemic to southern Africa.				Endemic to southern Africa.	4	3	1	1	5	15
Passeriformes	SYLVIIDAE	*Acrocephalus arundinaceus*	Great Reed Warbler	reedbeds, canefields, gardens	locally common	insects, spiders, tiny frogs	3, 2, 5						2	1	3	2	1	9
Passeriformes	SYLVIIDAE	*Acrocephalus baeticatus*	African Marsh Warbler	reedbeds, tall grass, swampy areas, gardens	common	insects	1, 2, 5						3	1	1	1	3	9
Passeriformes	SYLVIIDAE	*Acrocephalus gracilirostris*	Cape Reed Warbler	reedbeds, dams, pans, vleis	locally common	insects, frogs	2						2	2	3	2	5	14
Passeriformes	SYLVIIDAE	*Acrocephalus palustris*	European Marsh Warbler	thickets, reedbeds, gardens	uncommon to fairly common	insects, berries	2, 3, 5						2	1	3	2	1	9
Passeriformes	SYLVIIDAE	*Acrocephalus schoenobaenus*	European Sedge Warbler	swamps, low aquatic vegetation	fairly common, common in Tvl.	insects, spiders, berries	2						2	1	2	2	1	8
Passeriformes	SYLVIIDAE	*Apalis thoracica*	Bartbreasted Apalis	edges of evergreen forest and bush, woodland, gardens	common resident	insects	3, 5						2	2	1	1	5	11
Passeriformes	SYLVIIDAE	*Bradypterus baboecala*	African Sedge Warbler	reeds, sedges, dams, vleis	locally common	insects	3						2	2	3	2	5	14
Passeriformes	SYLVIIDAE	*Bradypterus barratti*	Barratt's Warbler	forest edges, dense vegetation along streams	locally fairly common to very common	insects, small invertebrates	3	Endemic to southern Africa.				Endemic to southern Africa.	2	3	3	2	5	15
Passeriformes	SYLVIIDAE	*Calamonastes fasciolatus*	Barred Warbler	tree savanna, dense bush	common to fairly common	unrecorded, insects ?	3						2	2	1	1	5	11
Passeriformes	SYLVIIDAE	*Camaroptera brachyura*	Bleating Warbler	thickets in woodland, forest edges, parks, gardens	common resident	insects	3, 5						2	2	1	1	5	11
Passeriformes	SYLVIIDAE	*Chloropeta natalensis*	Yellow Warbler	scrub, rank vegetation along streams, forest edge, vleis	locally common	insects	2, 3					Recorded foraging in grassland.	2	2	2	2	5	13
Passeriformes	SYLVIIDAE	*Cisticola aberrans*	Lazy Cisticola	rocky outcrops in woodland, feet of hills	locally common to fairly common	insects	2, 3, 4						2	2	3	2	5	14
Passeriformes	SYLVIIDAE	*Cisticola aridula*	Desert Cisticola	arid short grassland, vleis	locally common to fairly common	insects	1, 2						4	2	3	2	5	16
Passeriformes	SYLVIIDAE	*Cisticola ayresii*	Ayres' Cisticola	short grassland	common	insects	short 1						5	2	1	1	5	14
Passeriformes	SYLVIIDAE	*Cisticola brunnescens*	Palecrowned Cisticola	moist, short grassland	locally fairly common to uncommon	insects	1						5	2	3	2	5	17
Passeriformes	SYLVIIDAE	*Cisticola chiniana*	Rattling Cisticola	*Acacia* savanna, drier woodland	common	insects, nectar of aloes	3						2	2	1	1	5	11
Passeriformes	SYLVIIDAE	*Cisticola fulvicapilla*	Neddicky	understory of woodland, exotic trees with grassy undercover	common	insects	3, 5						2	2	1	1	5	11
Passeriformes	SYLVIIDAE	*Cisticola juncidis*	Fantailed Cisticola	open grassland, vleis, cultivated land edges, fallow lands	very common	small insects	1, 5						4	2	1	1	5	13
Passeriformes	SYLVIIDAE	*Cisticola lais*	Wailing Cisticola	montane grassland, rocky slopes	common	insects	1, 4						4	2	1	1	5	13
Passeriformes	SYLVIIDAE	*Cisticola natalensis*	Croaking Cisticola	rank, open, moist grassland, edges of vleis, forest edges	common resident or local migrant	insects	1, 2, 3						3	2	1	1	5	12
Passeriformes	SYLVIIDAE	*Cisticola rufilata*	Tinkling Cisticola	ecotones, semi-arid savanna, open grassland, cultivated land	local and uncommon	insects	1, 3, ecotone, 5						3	2	4	2	5	16
Passeriformes	SYLVIIDAE	*Cisticola subruficapilla*	Greybacked Cisticola	shrubby plains, Karoo, montane grassland	common	insects	1, 3	Near-endemic to southern Africa.				Near-endemic to southern Africa.	3	3	1	1	5	13
Passeriformes	SYLVIIDAE	*Cisticola textrix*	Cloud Cisticola	very short grassland, grassy Karoo	common	insects	short 1	Near-endemic to southern Africa.				Near-endemic to southern Africa.	3	3	1	1	5	14
Passeriformes	SYLVIIDAE	*Cisticola tinniens*	Levaillant's Cisticola	vleis, marshes, moist grassland	locally common	insects	1, 2						4	2	3	2	5	16
Passeriformes	SYLVIIDAE	*Eremomela icteropygialis*	Yellowbellied Eremomela	woodland, bushveld, riverine scrub	fairly common	insects	3					Mainly absent from the Highveld.	2	2	2	2	5	14
Passeriformes	SYLVIIDAE	*Eremomela scotops*	Greencapped Eremomela	woodland canopy	fairly common resident	insects	3						2	2	2	2	5	13
Passeriformes	SYLVIIDAE	*Hippolais icterina*	Icterine Warbler	*Acacia* savanna, mixed woodland, exotic plantations	sparse to common	insects, spiders, berries	3, 5						2	1	3	2	1	9
Passeriformes	SYLVIIDAE	*Hippolais olivetorum*	Olivetree Warbler	*Acacia* savanna, thorn thickets	uncommon	insects, fruit	3						2	1	4	2	1	10
Passeriformes	SYLVIIDAE	*Malcorus pectoralis*	Rufouseared Warbler	shrubby vegetation, karoo & Kalahari plains	common	insects, ants	3	Endemic to southern Africa.				Endemic to southern Africa.	2	3	1	1	5	12
Passeriformes	SYLVIIDAE	*Parisoma lavardi*	Layard's Titbabbler	high montane, rocky slopes, bushes in ravines	locally fairly common, generally scarce	insects, fruit	3, 4	Endemic to southern Africa.				Endemic to southern Africa.	2	3	2	2	5	14
Passeriformes	SYLVIIDAE	*Parisoma subcaeruleum*	Titbabbler	thornveld, riverine bush, savanna thickets	common	insects, spiders, fruit	3	Near-endemic to southern Africa.				Near-endemic to southern Africa.	2	3	1	1	5	12
Passeriformes	SYLVIIDAE	*Phragmacia substriata*	Namaqua Warbler	thornbush, overgrown gardens in Karoo and grassveld	locally fairly common	insects, fruit of *Lycium* and Atriplex	1, 3, 5	Endemic to South Africa.				Endemic to South Africa.	3	4	3	2	5	14
Passeriformes	SYLVIIDAE	*Phylloscopus trochilus acredula*	Willow Warbler	woodland, savanna, gardens, exotic plantations	very common	insects	3, 5						2	1	1	1	1	6
Passeriformes	SYLVIIDAE	*Phylloscopus trochilus trochilus*	Willow Warbler	woodland, savanna, gardens, parks	very common	insects	3, 5						2	1	1	1	1	6
Passeriformes	SYLVIIDAE	*Phylloscopus trochilus yakutensis*	Willow Warbler	woodland, savanna, gardens, parks	very common	insects	3, 5						2	1	1	1	1	6
Passeriformes	SYLVIIDAE	*Prinia maculosa*	Karoo Prinia	Karoo, rank grass, gardens, exotic plantations	common	insects	3, 1, 5	Endemic to southern Africa.				Endemic to southern Africa.	3	3	1	1	5	12
Passeriformes	SYLVIIDAE	*Prinia flavicans*	Blackchested Prinia	semi-arid scrub, *Acacia* savanna, gardens	common	insects	3, 5	Near-endemic to southern Africa.				Near-endemic to southern Africa.	2	3	1	1	5	12
Passeriformes	SYLVIIDAE	*Prinia hypoxoxantha*	Spotted Prinia	Karoo, rank grass, gardens, exotic plantations	common	insects	3, 1, 5	Endemic to southern Africa.				Endemic to southern Africa.	3	3	1	1	5	12
Passeriformes	SYLVIIDAE	*Prinia subflava*	Tawnyflanked Prinia	rank grass, gardens, cultivated land edges	common	insects, nectar	2, 5						2	2	1	1	5	11
Passeriformes	SYLVIIDAE	*Schoenicola brevirostris*	Broadtailed Warbler	moist grassland, vleis, rank grass	sparse and local	insects	1, 2			Indeterminate	Down	Overgrazing and vlei degredation pose threat.	4	2	4	3	5	18
Passeriformes	SYLVIIDAE	*Sphenoeacus afer*	Grassbird	rank vegetation along streams, high montane grassland	locally common	insects	1, 2						4	2	3	2	5	17
Passeriformes	SYLVIIDAE	*Sylvia borin borin*	Garden Warbler	woodland, montane forest edges, gardens, thickets	common	insects, soft fruit	3, 5						2	1	1	1	1	6
Passeriformes	SYLVIIDAE	*Sylvia borin woodwardi*	Garden Warbler	woodland, thickets, gardens, forest edges	common	insects, fruit	3, 5						2	1	1	1	1	6
Passeriformes	SYLVIIDAE	*Sylvia communis icterops*	Whitethroat	savanna woodland	generally sparse	insects, fruit	3						2	1	4	2	1	10
Passeriformes	SYLVIIDAE	*Sylvia communis volgensis*	Whitethroat	savanna woodland	generally sparse	insects, fruit	3						2	1	4	2	1	10
Passeriformes	SYLVIIDAE	*Sylvietta rufescens*	Longbilled Crombec	drier savanna, woodland, avoids forests	common to fairly common	insects	3						2	2	1	1	5	11
Passeriformes	TIMALIIDAE	*Liopilus nigricapillus*	Bush Blackcap	montane forest, scrub, *Leucosidea*	generally uncommon; locally fairly common	fruit	3	Endemic to South Africa.				Endemic to South Africa, recorded in tree patches in sour grassland.	2	4	3	2	5	16
Passeriformes	TIMALIIDAE	*Turdoides bicolor*	Pied Babbler	semi-arid savanna, woodland, riverine *Acacia*	locally common	insects	3	Near-endemic southern Africa				Near-endemic to southern Africa.	2	3	3	2	5	15
Passeriformes	TIMALIIDAE	*Turdoides jardineii*	Arrowmarked Babbler	thickets with long grass, savanna, exotic plantations	very common	insects, lizards, seed, fruit, snails	3, 5						2	2	1	1	5	11
Passeriformes	TURDIDAE	*Cercomela familiaris*	Familiar Chat	variable, rocky outcrops, farmyards, gardens	common	insects, fruit, animal fat	3, 4, 5						2	2	1	1	5	11
Passeriformes	TURDIDAE	*Cercomela schlegelii*	Karoo Chat	Karoo, stony hillsides	common in Karoo	insects, seeds	3, 4	Endemic to southern Africa.				Endemic to southern Africa.	2	3	2	1	5	13
Passeriformes	TURDIDAE	*Cercomela sinuata*	Sicklewinged Chat	Karoo, montane grassland, cultivated land, grazed pastures	common	insects	1, 3, 5	Endemic to southern Africa.				Endemic to southern Africa.	3	3	1	1	5	14
Passeriformes	TURDIDAE	*Cercomela tractrac*	Tractrac Chat	shrubby plains, karoo & stubbly grassland	fairly common	insects	1, 3	Endemic to southern Africa.				Endemic to southern Africa.	3	3	2	2	5	15
Passeriformes	TURDIDAE	*Chaetops aurantius*	Orangebreasted Rockjumper	rocky slopes, low escarpments with grass, shrubs	fairly common	insects	1, 3, 4	Endemic to southern Africa.				Endemic to southern Africa.	3	3	2	2	5	14
Passeriformes	TURDIDAE	*Cossypha caffra drakensbergi*	Cape Robin	forest edge, montane scrub, gardens, parks, plantation	common inland	insects, spiders, fruit, lizards, frogs	3, 5						2	2	2	1	1	11
Passeriformes	TURDIDAE	*Cossypha dichroa*	Chorister Robin	evergreen forest	locally common resident	insects, spiders, fruit	3	Endemic to southern Africa.				Endemic to southern Africa.	2	2	3	3	5	16
Passeriformes	TURDIDAE	*Cossypha humeralis*	Whitethroated Robin	dense woodland, thorn thickets, gardens	locally common	insects, invertebrates, berries	3, 5	Endemic to South Africa.				Endemic to South Africa.	2	4	3	2	5	15
Passeriformes	TURDIDAE	*Erythropygia coryphaeus*	Karoo Robin	karoo, bushy hillsides, riverine scrub	fairly common to common	insects, worms, *Lycium* fruit	3	Endemic to southern Africa.				Endemic to southern Africa.	2	3	2	2	5	15
Passeriformes	TURDIDAE	*Erythropygia leucophrys*	Whitebrowed Robin	woodland, savanna, trees in grassland	common	insects, berries, *Aloe* nectar	1, 3						3	2	1	1	5	12
Passeriformes	TURDIDAE	*Erythropygia paena*	Kalahari Robin	open scrub & *Acacia* savanna, grassy Karoo	fairly common to common	insects, spiders, fruit	3						2	2	2	2	5	14
Passeriformes	TURDIDAE	*Luscinia luscinia*	Thrush Nightingale	thickets, riverine bush	locally fairly common, mostly uncommon nonbreeding Palaearctic migrant	insects, spiders, worms	3, riverine bush						2	1	3	2	1	9
Passeriformes	TURDIDAE	*Monticola brevipes*	Shortlored Rock Thrush	rocky outcrops, koppies, towns, river valley	fairly common to common	insects, seeds, scorpions	3, 4, 5	Endemic to southern Africa.				Endemic to southern Africa.	2	3	2	2	5	14
Passeriformes	TURDIDAE	*Monticola explorator*	Sentinel Rock Thrush	rolling grassland, burned areas, felled plantations	locally common	insects, fruit, seeds	3, 5	Endemic to southern Africa.				Endemic to southern Africa.	2	3	3	2	5	15
Passeriformes	TURDIDAE	*Monticola rupestris*	Cape Rock Thrush	gorges, cliffs, hillsides	locally fairly common, generally uncommon	insects, spiders, frogs, nectar, fruit	3, 4	Endemic to southern Africa.				Endemic to southern Africa.	2	3	3	2	5	15
Passeriformes	TURDIDAE	*Myrmecocichla formicivora*	Anteating Chat	open grassland, grassy hills, dongas	common	insects, fruit, millipeds	1, 4	Endemic to southern Africa.				Endemic to southern Africa.	4	3	1	1	5	14
Passeriformes	TURDIDAE	*Oenanthe bifasciata*	Buffstreaked Chat	rolling grassland, rocky outcrops	locally fairly common, generally uncommon	insects, fruit	1, 4	Endemic to Grassland Biome.				Endemic to Grassland Biome, South Africa.	4	5	2	2	5	18
Passeriformes	TURDIDAE	*Oenanthe monticola*	Mountain Chat	rocky outcrops, hills, farmyards, gardens	locally common to fairly common	insects, spiders	3, 4, 5	Endemic to southern Africa.				Endemic to southern Africa.	2	3	3	2	5	15
Passeriformes	TURDIDAE	*Oenanthe pileata*	Capped Wheatear	semidesert, burned grassland, grazed & cultivated field	common	insects	1, 3, 5						3	1	1	1	3	9
Passeriformes	TURDIDAE	*Saxicola torquata*	Stonechat	alpine grassland, vleis, fallow lands, pastures	very common in highveld, fairly common elsewhere	insects	1, 2, 5						2	2	2	1	5	14
Passeriformes	TURDIDAE	*Thamnolaea cinnamommeiventris*	Mocking Chat	wooded gorges, cliffs, gorges	locally common	insects, fruit	3, 4						2	2	3	2	5	14
Passeriformes	TURDIDAE	*Turdus libonyana*	Kurrichane Thrush	woodland, exotic plantations, savanna, gardens	common	insects, lizards, fruit, spiders	3, 5						2	2	1	1	5	11
Passeriformes	TURDIDAE	*Turdus litsitsirupa*	Groundscraper Thrush	savanna, exotic plantations, farmyards	fairly common	insects, molluscs, invertebrates	3, 5						2	2	2	2	5	13
Passeriformes	TURDIDAE	*Turdus olivaceus*	Olive Thrush	evergreen forests, exotic plantions, gardens, parks	common	insects, mammals, molluscs, fish, fruit, seed	3, 5						2	2	1	1	5	11
Passeriformes	VIDUIDAE	*Vidua chalybeata*	Steelblue Widowfinch	savanna, thickets with rank grass, cultivated edge growth	common	seeds	3, 5						2	2	1	1	5	11
Passeriformes	VIDUIDAE	*Vidua funerea*	Black Widowfinch	grassy hills, edges of cultivated lands, gardens	locally common to fairly common	seeds, termites	1, 3, 5						3	2	3	2	5	15
Passeriformes	VIDUIDAE	*Vidua macroura*	Pintailed Whydah	open savanna, grassland, gardens, farmyards	common	seeds, insects	1, 3, 5						3	2	1	1	5	12
Passeriformes	VIDUIDAE	*Vidua paradisaea*	Paradise Whydah	*Acacia* savanna, gardens, cultivated land	fairly common	seeds, insects	3, 5						2	2	2	2	5	13
Passeriformes	VIDUIDAE	*Vidua regia*	Shaftailed Whydah	*Acacia* savanna	common	seeds	3	Near-endemic to southern Africa.				Near-endemic to southern Africa.	2	3	1	1	5	12
Passeriformes	ZOSTEROPIDAE	*Zosterops pallidus*	Cape White-eye	forest, woodland, savanna, garden, exotic plantations	very common	insects, spiders, nectar	3, 5	Endemic to southern Africa.				Endemic to southern Africa.	2	3	1	1	5	13
Pelecaniformes	ANHINGIDAE	*Anhinga melanogaster*	Darter	lakes, pans, inland waters	common	aquatic animals	2						2	2	1	1	5	11
Pelecaniformes	PELICANIDAE	*Pelecanus onocrotalus*	White Pelican	dams, pans	common in breeding, rare	aquatic animals	2			Rare	Stable	Unknown	2	2	5	3	5	17
Pelecaniformes	PHALACROCORACIDAE	*Phalacrocorax africanus*	Reed Cormorant	dams, inland waters	common	aquatic animals	2						2	2	1	1	5	11
Pelecaniformes	PHALACROCORACIDAE	*Phalacrocorax carbo*	Whitebreasted Cormorant	dams, pans	common	aquatic animals	2						2	2	1	1	5	11
Pelecaniformes	PELECANIDAE	*Pelecanus rufescens*	Pinbacked Pelican	open waters, dams	uncommon resident in Zululand, vagrant elsewhere	fish	2			Rare	Up	Human disturbance at breeding site.	2	2	1	1	5	13
Phoenicopteriformes	PHOENICOPTERIDAE	*Phoeniconaias minor*	Lesser Flamingo	larger brackish, saline inland waters	locally abundant	microscopic blue-green algae, diatoms	2			Indeterminate	Stable	No decrease, maybe wires.	2	2	3	3	5	15
Phoenicopteriformes	PHOENICOPTERIDAE	*Phoenicopterus ruber*	Greater Flamingo	shallow inland waters	locally abundant	aquatic vertebrates, algae	2			Indeterminate	Stable	No decrease, maybe wires.	2	2	3	3	5	15
Piciformes	CAPITONIDAE	*Lybius torquatus*	Blackcollared Barbet	woodland, parks, gardens	common	fruit, insects	3, 5						2	2	2	1	5	11
Piciformes	CAPITONIDAE	*Pogoniulus chrysoconus*	Yellowfronted Tinker Barbet	woodland, broad-leaved savanna	common	fruit, insects	3						2	2	2	1	5	12
Piciformes	CAPITONIDAE	*Pogoniulus pusillus*	Redfronted Tinker Barbet	riverine woodland, occationally dense thornveld	common, rarely found in south-eastern Tvl.	fruit, insects	3						2	2	2	1	5	11
Piciformes	CAPITONIDAE	*Trachyphonus vaillantii*	Crested Barbet	thornveld, parks, gardens	common	insects, fruit, worms, snails	3, 5						3	3	1	1	5	12
Piciformes	CAPITONIDAE	*Tricholaema leucomelas*	Pied Barbet	*Acacia* savanna, woodland, gardens, farmyards, Karoo, grassland	common	fruit, nectar, seedpods	3, 5	Near-endemic to South Africa.				Near-endemic to South Africa.	3	3	3	2	5	16
Piciformes	INDICATORIDAE	*Indicator indicator*	Greater Honeyguide	woodland, savanna, exotic plantation, forest edge	widespread but sparse	insects, beeswax, rarely eggs	3, 5	Endemic to sub-Saharan Africa.				Endemic to sub-Saharan Africa.	2	3	3	2	5	14
Piciformes	INDICATORIDAE	*Indicator minor minor*	Lesser Honeyguide	woodland, parks, gardens, dry reedbeds	locally common	insects, spiders, honey, beeswax	3, 5						2	2	2	2	5	14
Piciformes	INDICATORIDAE	*Prodotiscus regulus*	Sharpbilled Honeyguide	woodland, exotic plantations, thornveld	uncommon, rarely highveld	insects, possibly scale-insect wax	3, 5						2	2	4	2	5	15
Piciformes	JYNGIDAE	*Jynx ruficollis*	Redthroated Wryneck	open bushveld, gardens, exotic plantations, thornveld	locally fairly common, generally uncommon	ants, termites, caterpillars	3, 5	Endemic to Afrotropical Africa.				Endemic to the Afrotropical region.	2	3	3	2	5	14
Piciformes	PICIDAE	*Campethera abingoni*	Goldentailed Woodpecker	woodland, evergreen thickets, *Acacia* savanna, bushveld	sparse, rarely highveld	insects	3	Endemic to the Afrotropical region.				Endemic to the Afrotropical region.	2	3	3	2	5	14
Piciformes	PICIDAE	*Campethera bennettii*	Bennett's Woodpecker	woodland, bushveld	uncommon to common	insects	3	Afrotropical endemic.				Afrotropical endemic.	2	3	3	2	5	14
Piciformes	PICIDAE	*Dendropicos fuscescens*	Cardinal Woodpecker	woodland, plantations, gardens, parks, riverine bush	common	insects	3, 5	Endemic to the Afrotropical region.				Endemic to the Afrotropical region.	2	3	1	1	5	11
Piciformes	PICIDAE	*Geocolaptes olivaceus*	Ground Woodpecker	mountains, dongas, rocky hillsides, alpine grassland	locally common	ants, pupae	3, 4	Endemic to southern Africa.				Endemic to southern Africa.	2	3	3	2	5	16
Piciformes	PICIDAE	*Thripias namaquus*	Bearded Woodpecker	drier savanna, woodland	fairly common to uncommon, rarely highveld	insects, geckos, spiders	3	Endemic to the Afrotropical region.				Endemic to the Afrotropical region.	2	3	3	2	5	14
Podicipediformes	PODICIPEDIDAE	*Podiceps cristatus*	Great Crested Grebe	vleis, dams	sparse, locally common	carnivore, water plants	2						2	2	4	2	5	15
Podicipediformes	PODICIPEDIDAE	*Podiceps nigricollis*	Blacknecked Grebe	vleis, pans	uncommon	aquatic animals	2						2	2	1	1	5	11
Podicipediformes	PODICIPEDIDAE	*Tachybaptus ruficollis*	Dabchick	dams, aquatic vegetation	common	aquatic animals	2						2	2	1	1	5	11
Psittaciformes	PSITTACIDAE	*Poicephalus meyeri*	Meyer's Parrot	savanna woodland, riverine forest	common and widespread	nuts, kernels, grain	3						2	2	4	2	5	15
Psittaciformes	PSITTACIDAE	*Psittacula krameri*	Roseringed Parakeet	woodland, adjacent cultivated lands	scarce and local	fruit, grain, seeds, flowers,	3, 5			Indeterminate, probably rae	Stable	No decrease, maybe the destruction of habitat sites.	4	2	1	3	5	15
Pteroclidiformes	PTEROCLIDIDAE	*Pterocles gutturalis*	Yellowthroated Sandgrouse	short grassland, recently burnt ground, cultivated field	common intra-African migrant to Zambia & southward	seeds, fallen grain	1, 5					Virtual endemic to southern Africa.	2	3	1	1	5	12
Pteroclidiformes	PTEROCLIDIDAE	*Pterocles bicinctus*	Doublebanded Sandgrouse	savanna, mopane veld, hills with tussocky grass	common	seeds	3	Virtual endemic to southern Africa.				Endemic to southwestern Africa.	2	3	1	1	5	12
Pteroclidiformes	PTEROCLIDIDAE	*Pterocles namaqua*	Namaqua Sandgrouse	open desert and semidesert, arid savanna	common resident	small hard seeds	3, desert	Endemic to southwestern Africa.					2	2	2	2	5	13
Strigiformes	STRIGIDAE	**Otus leucotis*	Whitefaced Owl	woodland, savanna, riverine bush	fairly common	rodents, birds, arthropods	3					Nomadic in the Freestate Highveld.	4	2	1	1	5	13
Strigiformes	STRIGIDAE	*Asio capensis*	Marsh Owl	grassland, vleis, edges of marshes	common	small rodents, frogs, insects, bats, birds	1, 2						2	2	1	1	5	11
Strigiformes	STRIGIDAE	*Bubo africanus*	Spotted Eagle Owl	rocky areas, savanna, woodland, towns	common	arthropods, birds, mammals, frogs, rarely fish	3, 4, 5						2	2	4	2	5	15
Strigiformes	STRIGIDAE	*Bubo capensis*	Cape Eagle Owl	rocky country, dense woodland or bush nearby	uncommon to rare	mammals, small rodents, lizards, arthropods	3, 4					Localised reports in sweet grassland.	2	2	1	1	5	11
Strigiformes	STRIGIDAE	*Bubo lacteus*	Giant Eagle Owl	woodland, savanna, tree-lined watercourses	common in northern Tvl.	various, mammals, birds, fish, frogs, reptiles	3						2	2	1	1	5	11
Strigiformes	STRIGIDAE	*Glaucidium perlatum licua*	Pearlspotted Owl	woodland, bushveld, *Acacia* savanna	common	arthropods, small rodents, bats, snakes, lizards	3						2	2	3	2	5	14
Strigiformes	STRIGIDAE	*Otus senegalensis*	African Scops Owl	woodland, drier savanna	sparse to locally common	insects, scorpions	3						2	2	3	2	5	14
Strigiformes	STRIGIDAE	*Strix woodfordii*	Wood Owl	evergreen and riverine forest, woodland, pine plantations	locally fairly common	insects, rodents, frogs, birds, rarely snakes	3, 5						2	2	3	2	5	14
Strigiformes	TYTONIDAE	*Tyto alba*	Barn Owl	varied, near cliffs, buildings, holes in trees, woodland	locally common	rodents, insects, frogs (rarely), lizards	3, 4, 5						2	2	4	4	5	19
Strigiformes	TYTONIDAE	*Tyto capensis*	Grass Owl	long grass, near water, vleis, marshes	uncommon to rare/local/vulnerable(RDB)	rodents, birds, hares, insects, frogs, bats	1, 2			Indeterminate, probably vulnerable	Down	Overgrazing, excessive burning, False Karoo.	4	2	4	4	5	19
Struthioniformes	STRUTHIONIDAE	*Struthio camelus*	Ostrich	bushveld to desert	common resident	grass, berries, insects, small reptiles	3, desert					Found in Highveld because of farming activities.	2	2	1	1	5	11

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 1. continue...

Passeriformes	STURNIDAE	*Creatophora cinerea*	Wattled Starling	open woodland, savanna, farmland	locally abundant nomad	insects, fruit, nectar	3, 5					2	2	3	2	5	14
Passeriformes	STURNIDAE	*Lamprotornis australis*	Burchell's Starling	savanna, parklike woodland	fairly common to abundant	insects, fruit, invertebrates	3	Endemic to southern Africa.				2	3	2	2	5	14
Passeriformes	STURNIDAE	*Lamprotornis nitens*	Glossy Starling	*Acacia* savanna, forest edges, parks, semi-arid scrub	common to fairly common	insects, fruit, nectar of aloes	3, 5					2	2	1	1	5	12
Passeriformes	STURNIDAE	*Onychognathus morio*	Redwinged Starling	mountains, cliffs, rocky hills, buildings	common to abundant	insects, fruit, lizards, aloe nectar	3, 4, 5					2	2	1	1	5	12
Passeriformes	STURNIDAE	*Onychognathus nabouroup*	Palewinged Starling	arid country, grassy Karoo, woodland	locally common resident	insects, fruit, ticks	3	Endemic to southern Africa.				2	3	3	2	5	15
Passeriformes	STURNIDAE	*Spreo bicolor*	Pied Starling	open grassland, cultivated land, dongas, farms	common	insects, fruit, nectar, lizards	1, 4, 5	Endemic to southern Africa.				Endemic to southern Africa.					
Passeriformes	SYLVIIDAE	*Acrocephalus arundinaceus*	Great Reed Warbler	reedbeds, canefields, gardens	locally common	insects, spiders, tiny frogs	3, 2, 5					2	3	2	2	5	14
Passeriformes	SYLVIIDAE	*Acrocephalus baeticatus*	African Marsh Warbler	reedbeds, tall grass, swampy areas, gardens	common	insects	1, 2, 5					2	2	3	2	5	14
Passeriformes	SYLVIIDAE	*Acrocephalus gracilirostris*	Cape Reed Warbler	reedbeds, dams, pans, vleis	locally common	insects, frogs	2					2	2	3	2	5	14
Passeriformes	SYLVIIDAE	*Acrocephalus palustris*	European Marsh Warbler	thickets, reedbeds, gardens	uncommon to fairly common	insects, berries	2, 3, 5					2	1	3	2	1	9
Passeriformes	SYLVIIDAE	*Acrocephalus schoenobaenus*	European Sedge Warbler	swamps, low aquatic vegetation	fairly common, common in Tvl.	insects, spiders, berries	2					2	1	2	2	1	8
Passeriformes	SYLVIIDAE	*Apalis thoracica*	Bartheaded Apalis	edges of evergreen forest and bush, woodland, gardens	common resident	insects	3, 5					2	2	1	1	5	11
Passeriformes	SYLVIIDAE	*Bradypterus baboecala*	African Sedge Warbler	reeds, sedges, dams, vleis	locally common	insects	3					2	2	3	2	5	14
Passeriformes	SYLVIIDAE	*Bradypterus barratti*	Barratt's Warbler	forest edges, dense vegetation along streams	locally fairly common to very common	insects, small invertebrates	3	Endemic to southern Africa.				Endemic to southern Africa.					
Passeriformes	SYLVIIDAE	*Calamonastes fasciolatus*	Barred Warbler	tree savanna, dense bush	common to fairly common	unrecorded, insects ?	3					2	3	3	2	5	15
Passeriformes	SYLVIIDAE	*Camaroptera brachyura*	Bleating Warbler	thickets in woodland, forest edges, parks, gardens	common resident	insects	3, 5					2	2	1	1	5	11
Passeriformes	SYLVIIDAE	*Chloropeta natalensis*	Yellow Warbler	scrub, rank vegetation along streams, forest edge, vleis	locally common	insects	2, 3					2	2	1	1	5	11
Passeriformes	SYLVIIDAE	*Cisticola aberrans*	Lazy Cisticola	rocky outcrops in woodland, feet of hills	locally common to fairly common	insects	2, 3, 4					Recorded foraging in grassland.					
Passeriformes	SYLVIIDAE	*Cisticola aridula*	Desert Cisticola	arid short grassland, vleis	locally common to fairly common	insects	1, 2					2	2	2	2	5	13
Passeriformes	SYLVIIDAE	*Cisticola ayresii*	Ayres' Cisticola	short grassland	common	insects	short 1					2	2	3	2	5	14
Passeriformes	SYLVIIDAE	*Cisticola brunnescens*	Palecrowned Cisticola	moist, short grassland	locally fairly common to uncommon	insects	1					4	2	3	2	5	16
Passeriformes	SYLVIIDAE	*Cisticola chiniana*	Rattling Cisticola	*Acacia* savanna, drier woodland	common	insects, nectar of aloes	3					5	2	1	1	5	14
Passeriformes	SYLVIIDAE	*Cisticola fulvicapilla*	Neddicky	understory of woodland, exotic trees with grassy undercover	common	insects	3, 5					5	2	3	2	5	17
Passeriformes	SYLVIIDAE	*Cisticola juncidis*	Fantailed Cisticola	open grassland, vleis, cultivated land edges, fallow lands	very common	small insects	1, 5					2	2	1	1	5	11
Passeriformes	SYLVIIDAE	*Cisticola lais*	Wailing Cisticola	montane grassland, rocky slopes	common	insects	1, 4					2	2	1	1	5	11
Passeriformes	SYLVIIDAE	*Cisticola natalensis*	Croaking Cisticola	rank, open, moist grassland, edges of vleis, forest edges	common resident or local migrant	insects	1, 2, 3					4	2	1	1	5	13
Passeriformes	SYLVIIDAE	*Cisticola rufilata*	Tinkling Cisticola	ecotones, semi-arid savanna, open grassland, cultivated land	local and uncommon	insects	1, 3, ecotone, 5					4	2	1	1	5	13
Passeriformes	SYLVIIDAE	*Cisticola subruficapilla*	Greybacked Cisticola	shrubby plains, Karoo, montane grassland	common	insects	1, 3	Near-endemic to southern Africa.				3	2	3	2	5	15
Passeriformes	SYLVIIDAE	*Cisticola textrix*	Cloud Cisticola	very short grassland, grassy Karoo	common	insects	short 1	Near-endemic to southern Africa.				3	3	1	1	5	13
Passeriformes	SYLVIIDAE	*Cisticola tinniens*	Levaillant's Cisticola	vleis, marshes, moist grassland	locally common	insects	1, 2					Near-endemic to southern Africa.					
Passeriformes	SYLVIIDAE	*Eremomela icteropygialis*	Yellowbellied Eremomela	woodland, bushveld, riverine scrub	fairly common	insects	3					3	3	1	1	5	14
Passeriformes	SYLVIIDAE	*Eremomela scotops*	Greencapped Eremomela	woodland canopy	fairly common resident	insects	3					Near-endemic to southern Africa.					
Passeriformes	SYLVIIDAE	*Hippolais icterina*	Icterine Warbler	*Acacia* savanna, mixed woodland, exotic plantations	sparse to common	insects, spiders, berries	3, 5					4	2	3	2	5	14
Passeriformes	SYLVIIDAE	*Hippolais olivetorum*	Olivetree Warbler	*Acacia* savanna, thorn thickets	uncommon	insects, fruit	3					Mainly absent from the Highveld.					
Passeriformes	SYLVIIDAE	*Malcorus pectoralis*	Rufouseared Warbler	shrubby vegetation, karoo & Kalahari plains	common	insects, ants	3	Endemic to southern Africa.				2	2	2	2	5	13
Passeriformes	SYLVIIDAE	*Parisoma lavardi*	Layard's Titbabbler	high montane, rocky slopes, bushes in ravines	locally fairly common, generally scarce	insects, fruit	3, 4	Endemic to southern Africa.				2	1	1	1	5	10
Passeriformes	SYLVIIDAE	*Parisoma subcaeruleum*	Titbabbler	thornveld, riverine bush, savanna thickets	common	insects, spiders, fruit	3	Near-endemic to southern Africa.				Endemic to southern Africa.					
Passeriformes	SYLVIIDAE	*Phragmacia substriata*	Namaqua Warbler	thornbush, overgrown gardens in Karoo and grassveld	locally fairly common	insects, fruit of *Lycium* and Atriplex	1, 3, 5	Endemic to South Africa.				Endemic to southern Africa.					
Passeriformes	SYLVIIDAE	*Phylloscopus trochilus acredula*	Willow Warbler	woodland, savanna, gardens, exotic plantations	very common	insects	3, 5					Endemic to southern Africa.					
Passeriformes	SYLVIIDAE	*Phylloscopus trochilus trochilus*	Willow Warbler	woodland, savanna, gardens, parks	very common	insects	3, 5					Near-endemic to southern Africa.					
Passeriformes	SYLVIIDAE	*Phylloscopus trochilus yakutensis*	Willow Warbler	woodland, savanna, gardens, parks	very common	insects	3, 5					Endemic to southern Africa.					
Passeriformes	SYLVIIDAE	*Prinia maculosa*	Karoo Prinia	Karoo, rank grass, gardens, exotic plantations	common	insects	3, 1, 5	Endemic to southern Africa.				Near-endemic to southern Africa.					
Passeriformes	SYLVIIDAE	*Prinia flavicans*	Blackchested Prinia	semi-arid scrub, *Acacia* savanna, gardens	common	insects	3, 5	Near-endemic to southern Africa.				Endemic to southern Africa.					
Passeriformes	SYLVIIDAE	*Prinia hypoxoxantha*	Spotted Prinia	Karoo, rank grass, gardens, exotic plantations	common	insects	3, 1, 5	Endemic to southern Africa.				Overgrazing and vlei degredation pose threat.					
Passeriformes	SYLVIIDAE	*Prinia subflava*	Tawnyflanked Prinia	rank grass, gardens, cultivated land edges	common	insects, nectar	2, 5					2	2	4	3	5	18
Passeriformes	SYLVIIDAE	*Schoenicola brevirostris*	Broadtailed Warbler	moist grassland, vleis, rank grass	sparse and local	insects	1, 2		Indeterminate	Down		4	2	3	2	5	17
Passeriformes	SYLVIIDAE	*Sphenoeacus afer*	Grassbird	rank vegetation along streams, high montane grassland	locally common	insects	1, 2					2	1	1	1	1	6
Passeriformes	SYLVIIDAE	*Sylvia borin borin*	Garden Warbler	woodland, montane forest edges, gardens, thickets	common	insects, soft fruit	3, 5					2	1	1	1	1	6
Passeriformes	SYLVIIDAE	*Sylvia borin woodwardi*	Garden Warbler	woodland, thickets, gardens, forest edges	common	insects, fruit	3, 5					2	1	4	2	1	10
Passeriformes	SYLVIIDAE	*Sylvia communis icterops*	Whitethroat	savanna woodland	generally sparse	insects, fruit	3					2	1	4	2	1	10
Passeriformes	SYLVIIDAE	*Sylvia communis volgensis*	Whitethroat	savanna woodland	generally sparse	insects, fruit	3					2	2	1	1	5	11
Passeriformes	SYLVIIDAE	*Sylvietta rufescens*	Longbilled Crombec	drier savanna, woodland, avoids forests	common to fairly common	insects	3					Endemic to South Africa, recorded in tree patches in sour grassland.					
Passeriformes	TIMALIIDAE	*Liopilus nigricapillus*	Bush Blackcap	montane forest, scrub, *Leucosidea*	generally uncommon; locally fairly common	fruit	3	Endemic to South Africa.				2	4	3	2	5	16
Passeriformes	TIMALIIDAE	*Turdoides bicolor*	Pied Babbler	semi-arid savanna, woodland, riverine *Acacia*	locally common	insects	3	Near-endemic southern Africa.				Near-endemic to southern Africa.					
Passeriformes	TIMALIIDAE	*Turdoides jardineii*	Arrowmarked Babbler	thickets with long grass, savanna, exotic plantations	very common	insects, lizards, seed, fruit, snails	3, 5					2	3	3	2	5	15
Passeriformes	TURDIDAE	*Cercomela familiaris*	Familiar Chat	variable, rocky outcrops, farmyards, gardens	common	insects, fruit, animal fat	3, 4, 5					2	2	1	1	5	11
Passeriformes	TURDIDAE	*Cercomela schlegelii*	Karoo Chat	Karoo, stony hillsides	common in Karoo	insects, seeds	3, 4	Endemic to southern Africa.				Endemic to southern Africa.					
Passeriformes	TURDIDAE	*Cercomela sinuata*	Sicklewinged Chat	Karoo, montane grassland, cultivated land, grazed pastures	common	insects	1, 3, 5	Endemic to southern Africa.				2	3	2	2	5	14
Passeriformes	TURDIDAE	*Cercomela tractrac*	Tractrac Chat	shrubby plains, karoo & stubbly grassland	fairly common	insects	1, 3	Endemic to southern Africa.				Endemic to southern Africa.					
Passeriformes	TURDIDAE	*Chaetops aurantius*	Orangebreasted Rockjumper	rocky slopes, low escarpments with grass, shrubs	fairly common	insects	1, 3, 4	Endemic to southern Africa.				3	3	2	2	5	15
Passeriformes	TURDIDAE	*Cossypha caffra drakensbergi*	Cape Robin	forest edge, montane scrub, gardens, parks, plantation	common inland	insects, spiders, fruit, lizards, frogs	3, 5					3	3	3	2	5	14
Passeriformes	TURDIDAE	*Cossypha dichroa*	Chorister Robin	evergreen forest	locally common resident	insects, spiders, fruit	3	Endemic to southern Africa.				2	2	2	2	5	14
Passeriformes	TURDIDAE	*Cossypha humeralis*	Whitethroated Robin	dense woodland, thorn thickets, gardens	locally common	insects, invertebrates, berries	3, 5	Endemic to South Africa.				Endemic to southern Africa.					
Passeriformes	TURDIDAE	*Erythropygia coryphaeus*	Karoo Robin	karoo, bushy hillsides, riverine scrub	fairly common to common	insects, worms, *Lycium* fruit	3	Endemic to southern Africa.				2	1	1	1	5	11
Passeriformes	TURDIDAE	*Erythropygia leucophrys*	Whitebrowed Robin	woodland, savanna, trees in grassland	common	insects, berries, *Aloe* nectar	1, 3					2	2	2	2	5	15
Passeriformes	TURDIDAE	*Erythropygia paena*	Kalahari Robin	open scrub & *Acacia* savanna, grassy Karoo	fairly common to common	insects, spiders, fruit	3					3	2	1	1	5	12
Passeriformes	TURDIDAE	*Luscinia luscinia*	Thrush Nightingale	thickets, riverine bush	locally fairly common, mostly uncommon nonbreeding Palaearctic migrant	insects, spiders, worms	3, riverine bush					2	2	2	2	5	15
Passeriformes	TURDIDAE	*Monticola brevipes*	Shortlored Rock Thrush	rocky outcrops, koppies, towns, river valley	fairly common to common	insects, seeds, scorpions	3, 4, 5	Endemic to southern Africa.				2	2	3	2	5	14
Passeriformes	TURDIDAE	*Monticola explorator*	Sentinel Rock Thrush	rolling grassland, burned areas, felled plantations	common	insects, fruit, seeds	1, 3, 5	Endemic to southern Africa.				2	2	3	2	5	14
Passeriformes	TURDIDAE	*Monticola rupestris*	Cape Rock Thrush	gorges, cliffs, hillsides	very common	insects, fruit, nectar, seeds	3, 4, 5					2	2	3	2	5	14
Passeriformes	TURDIDAE	*Myrmecocichla formicivora*	Anteating Chat	open grassland, grassy hills, dongas	common	insects, fruit, seeds	3	Endemic to southern Africa.				2	2	3	2	5	14
Passeriformes	TURDIDAE	*Oenanthe bifasciata*	Buffstreaked Chat	rolling grassland, rocky outcrops	uncommon to fairly common	insects, berries	2, 3, 5					2	1	3	2	1	9
Passeriformes	TURDIDAE	*Oenanthe monticola*	Mountain Chat	rocky outer-ops, hills, farmyards, gardens	fairly common, common in Tvl.	insects, spiders, berries	2					2	1	2	2	1	8
Passeriformes	TURDIDAE	*Oenanthe pileata*	Capped Wheatear	semidesert, burned grassland, grazed & cultivated field	common resident	insects	3, 5					2	2	1	1	5	11
Passeriformes	TURDIDAE	*Saxicola torquata*	Stonechat	alpine grassland, vleis, fallow lands, pastures	locally common	insects	3					2	2	3	2	5	14
Passeriformes	TURDIDAE	*Thamnolaea cinnamommeiventris*	Mocking Chat	wooded gorges, cliffs, gorges	locally fairly common to very common	insects, small invertebrates	3	Endemic to southern Africa.				Endemic to southern Africa.					
Passeriformes	TURDIDAE	*Turdus libonyana*	Kurrichane Thrush	woodland, exotic plantations, savanna, gardens	common to fairly common	unrecorded, insects ?	3					2	3	3	2	5	15
Passeriformes	TURDIDAE	*Turdus litsitsirupa*	Groundscraper Thrush	savanna, exotic plantations, farmyards	common resident	insects	3, 5					2	2	1	1	5	11
Passeriformes	TURDIDAE	*Turdus olivaceus*	Olive Thrush	evergreen forests, exotic plantions, gardens, parks	locally common	insects	2, 3					2	2	1	1	5	11
Passeriformes	VIDUIDAE	*Vidua chalybeata*	Steelblue Widowfinch	savanna, thickets with rank grass, cultivated edge growth	locally common to fairly common	insects	1, 2, 3					2	2	2	2	5	13
Passeriformes	VIDUIDAE	*Vidua funerea*	Black Widowfinch	grassy hills, edges of cultivated lands, gardens	common	insects, fruit	3, 4					2	2	3	2	5	14
Passeriformes	VIDUIDAE	*Vidua macroura*	Pintailed Whydah	open savanna, grassland, gardens, farmyards	common	insects, fruit	3, 4					2	2	3	2	5	14
Passeriformes	VIDUIDAE	*Vidua paradisaea*	Paradise Whydah	*Acacia* savanna, gardens, cultivated land	very common	insects, small invertebrates	3	Endemic to southern Africa.				Endemic to southern Africa.					
Passeriformes	VIDUIDAE	*Vidua regia*	Shaftailed Whydah	*Acacia* savanna	common to fairly common	unrecorded, insects ?	3					2	3	3	2	5	15
Passeriformes	ZOSTEROPIDAE	*Zosterops pallidus*	Cape White-eye	forest, woodland, savanna, garden, exotic plantations	common resident	insects	3, 5					2	2	1	1	5	11
Pelecaniformes	ANHINGIDAE	*Anhinga melanogaster*	Darter	lakes, pans, inland waters	locally common	insects	2, 3					Recorded foraging in grassland.					
Pelecaniformes	PELICANIDAE	*Pelecanus onocrotalus*	White Pelican	dams, pans	fairly common to common	insects	2, 3, 4					2	2	2	2	5	13
Pelecaniformes	PHALACROCORACIDAE	*Phalacrocorax africanus*	Reed Cormorant	dams, inland waters	locally common to fairly common	insects	1, 2					2	2	3	2	5	14
Pelecaniformes	PHALACROCORACIDAE	*Phalacrocorax carbo*	Whitebreasted Cormorant	dams, pans	common	insects	short 1					4	2	3	2	5	16
Pelecaniformes	PELECANIDAE	*Pelecanus rufescens*	Pinbacked Pelican	open waters, dams	locally fairly common to uncommon	insects	1					5	2	1	1	5	14
Phoenicopteriformes	PHOENICOPTERIDAE	*Phoeniconaias minor*	Lesser Flamingo	larger brackish, saline inland waters	common	insects, nectar of aloes	3					5	2	3	2	5	17
Phoenicopteriformes	PHOENICOPTERIDAE	*Phoenicopterus ruber*	Greater Flamingo	shallow inland waters	common	insects	3, 5					2	2	1	1	5	11
Piciformes	CAPITONIDAE	*Lybius torquatus*	Blackcollared Barbet	woodland, parks, gardens	common	insects, fruit	3					4	2	1	1	5	13
Piciformes	CAPITONIDAE	*Pogoniulus chrysoconus*	Yellowfronted Tinker Barbet	woodland, broad-leaved savanna	common	insects, fruit	3					4	2	1	1	5	13
Piciformes	CAPITONIDAE	*Pogoniulus pusillus*	Redfronted Tinker Barbet	riverine woodland, occationally dense thornveld	common, rarely found in south-eastern Tvl.	fruit, insects	3					3	2	1	1	5	12
Piciformes	CAPITONIDAE	*Trachyphonus vaillantii*	Crested Barbet	thornveld, parks, gardens	common	insects, fruit, worms, snails	3, 5					2	2	1	1	5	11
Piciformes	CAPITONIDAE	*Tricholaema leucomelas*	Pied Barbet	*Acacia* savanna, woodland, gardens, farmyards, Karoo, grassland	common	fruit, nectar, seedpods	3, 5	Near-endemic to South Africa.				Near-endemic to South Africa.					
Piciformes	INDICATORIDAE	*Indicator indicator*	Greater Honeyguide	woodland, savanna, exotic plantation, forest edge	widespread but sparse	insects, beeswax, rarely eggs	3, 5	Endemic to sub-Saharan Africa.				3	3	3	2	5	16
Piciformes	INDICATORIDAE	*Indicator minor minor*	Lesser Honeyguide	woodland, parks, gardens, dry reedbeds	locally common	insects, spiders, honey, beeswax	3, 5					Endemic to sub-Saharan Africa.					
Piciformes	INDICATORIDAE	*Prodotiscus regulus*	Sharpbilled Honeyguide	woodland, exotic plantations, thornveld	uncommon, rarely highveld	insects, possibly scale-insect wax	3, 5					2	2	3	2	5	14
Piciformes	JYNGIDAE	*Jynx ruficollis*	Redthroated Wryneck	open bushveld, gardens, exotic plantations, thornveld	locally fairly common, generally uncommon	ants, termites, caterpillars	3, 5	Endemic to Afrotropical Africa.				2	3	3	2	5	15
Piciformes	PICIDAE	*Campethera abingoni*	Goldentailed Woodpecker	woodland, evergreen thickets, *Acacia* savanna, bushveld	sparse, rarely highveld	insects	3	Endemic to the Afrotropical region.				Endemic to the Afrotropical region.					
Piciformes	PICIDAE	*Campethera bennettii*	Bennett's Woodpecker	woodland, bushveld	uncommon to common	insects	3	Afrotropical endemic.				2	3	3	2	5	14
Piciformes	PICIDAE	*Dendropicos fuscescens*	Cardinal Woodpecker	woodland, plantations, gardens, parks, riverine bush	common	insects	3, 5	Endemic to the Afrotropical region.				Afrotropical endemic.					
Piciformes	PICIDAE	*Geocolaptes olivaceus*	Ground Woodpecker	mountains, dongas, rocky hillsides, alpine grassland	locally common	ants, pupae	3, 4	Endemic to southern Africa.				2	3	3	2	5	15
Piciformes	PICIDAE	*Thripias namaquus*	Bearded Woodpecker	drier savanna, woodland	fairly common to uncommon, rarely highveld	insects, geckos, spiders	3	Endemic to the Afrotropical region.				2	3	3	2	5	16
Podicipediformes	PODICIPEDIDAE	*Podiceps cristatus*	Great Crested Grebe	vleis, dams	sparse, locally common	carnivore, water plants	2					2	3	3	2	5	14
Podicipediformes	PODICIPEDIDAE	*Podiceps nigricollis*	Blacknecked Grebe	vleis, pans	uncommon	aquatic animals	2					2	2	4	2	5	15
Podicipediformes	PODICIPEDIDAE	*Tachybaptus ruficollis*	Dabchick	dams, aquatic vegetation	common	aquatic animals	2					2	2	1	1	5	11
Psittaciformes	PSITTACIDAE	*Poicephalus meyeri*	Meyer's Parrot	savanna woodland, riverine forest	common and widespread	nuts, kernels, grain	3					2	2	1	1	5	11
Psittaciformes	PSITTACIDAE	*Psittacula krameri*	Roseringed Parakeet	woodland, adjacent cultivated lands	scarce and local	fruit, grain, seeds, flowers,	3, 5					2	2	4	2	5	15
Pteroclidiformes	PTEROCLIDIDAE	*Pterocles gutturalis*	Yellowthroated Sandgrouse	short grassland, recently burnt ground, cultivated field	common intra-African migrant to Zambia & southward	seeds, fallen grain	1, 5		Indeterminate, probably rae	Stable	No decrease, maybe the destruction of habitat sites.	4	2	1	1	5	13
Pteroclidiformes	PTEROCLIDAE	*Pterocles bicinctus*	Doublebanded Sandgrouse	savanna, mopane veld, hills with tussocky grass	common	seeds	3	Virtual endemic to southern Africa.			Virtual endemic to southern Africa.	2	3	3	2	5	15
Pteroclidiformes	PTEROCLIDAE	*Pterocles namaqua*	Namaqua Sandgrouse	open desert and semidesert, arid savanna	common resident	small hard seeds	3, desert	Endemic to southwestern Africa.			Endemic to southwestern Africa.	2	3	1	1	5	12
Strigiformes	STRIGIDAE	**Otus leucotis*	Whitefaced Owl	woodland, savanna, riverine bush	fairly common	rodents, birds, arthropods	3				Nomadic in the Freestate Highveld.	2	2	2	2	5	13
Strigiformes	STRIGIDAE	*Asio capensis*	Marsh Owl	grassland, vleis, edges of marshes	common	small rodents, frogs, insects, bats, birds	1, 2					4	2	1	1	5	13
Strigiformes	STRIGIDAE	*Bubo africanus*	Spotted Eagle Owl	rocky areas, savanna, woodland, towns	common	arthropods, birds, mammals, frogs, rarely fish	3, 4, 5					2	2	1	1	5	11
Strigiformes	STRIGIDAE	*Bubo capensis*	Cape Eagle Owl	rocky country, dense woodland or bush nearby	uncommon to rare	mammals, small rodents, lizards, arthropods	3, 4					2	2	4	2	5	15
Strigiformes	STRIGIDAE	*Bubo lacteus*	Giant Eagle Owl	woodland, savanna, tree-lined watercourses	common in northern Tvl.	various, mammals, birds, fish, frogs, reptiles	3					2	2	1	1	5	11
Strigiformes	STRIGIDAE	*Glaucidium perlatum licua*	Pearlspotted Owl	woodland, bushveld, *Acacia* savanna	common	arthropods, small rodents, bats, snakes, lizards	3					2	2	1	1	5	11
Strigiformes	STRIGIDAE	*Otus senegalensis*	African Scops Owl	woodland, drier savanna	sparse to locally common	insects, scorpions	3					2	2	3	2	5	14
Strigiformes	STRIGIDAE	*Strix woodfordii*	Wood Owl	evergreen and riverine forest, woodland, pine plantations	locally fairly common	insects, rodents, frogs, birds, rarely snakes	3, 5					2	2	3	2	5	14
Strigiformes	TYTONIDAE	*Tyto alba*	Barn Owl	varied, near cliffs, buildings, holes in trees, woodland	locally common	rodents, birds, frogs (rarely), lizards	3, 4, 5					2	2	4	2	5	15
Strigiformes	TYTONIDAE	*Tyto capensis*	Grass Owl	long grass, near water, vleis, marshes	uncommon to rare/local/vulnerable(RDB)	rodents, birds, hares, insects, frogs, bats	1, 2		Indeterminate, probably vulnerable	Down	Overgrazing, excessive burning, False Karoo.	4	2	4	4	5	19
Struthioniformes	STRUTHIONIDAE	*Struthio camelus*	Ostrich	bushveld to desert	common resident	grass, berries, insects, small reptiles	3, desert				Found in Highveld because of farming activities.	2	2	1	1	5	11

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 2. continue...

Order	Family	Species name	Habitat	Food	Abundance	Conservation status	International status	South African status	Remarks	Endemic score	RDB status	Habitat type
Squamata	CHAMAELEONIDAE	*Bradypodion sp. (Ngotswane Forest)* in prep. Jacobsen	grassland, riverine habitat	?	endemic to the biome	Unknown ?	not listed	Vulnerable?	Endemic to Biome	1	3	4
Squamata	CHAMAELEONIDAE	*Bradypodion sp.(Zastron)* in prep. Jacobsen	grassland rocky habitat	?	endemic to the biome	Unknown ?	not listed	Unknown?	Endemic to Biome	1	4	4
Squamata	CHAMAELEONIDAE	*Bradypodion transvaalensis* FitzSimons, 1930)	aboreal, forest species, shrubs	?	restricted to north-eastern Tvl	Protected	not listed	vulnerable	Status vulnerable based on limited range & development taking place	0	3	6
Squamata	CHAMAELEONIDAE	*Bradypodion transvaalensis complex* in prep. Jacobsen	unknown ?	?	Unknown ?	Unknown	Unknown	Unknown	Unknown ?	1	4	2
Squamata	CHAMAELEONIDAE	*Chamaeleo dilepis dilepis* Leach, 1819	bushveld savanna, recorded in grassland	insects	common in Northern Tvl., except in the Highveld	Protected	not listed	secure	Widespread. Under predation pressure of cats, habitat destruction spraying of orchards	0	0	2
Squamata	COLUBRIDAE	**Amblyodipsas concolor* (Smith, 1849)	wooded or forested areas, rocks, Acocks veld types, 8, 9, 10	?	Natal to northern Tvl	Partially protected	not listed	secure	Widespread	1	3	6
Squamata	COLUBRIDAE	**Amblyodipsas polylepis polylepis* (Bocage, 1873)	savanna, arid forest, woodland	small mammals, reptiles, frogs	northern and central Tvl	Partially protected	not listed	vulnerable	Rare and threatened by afforestation.	0	0	6
Squamata	COLUBRIDAE	**Dispholidus typus typus* (Smith, 1829)	open bushveld, savanna, bushes, trees	small invertebrates	bush and savanna country, most habitats of the Tvl., except the proper Highveld	Partially protected	not listed	secure	Widespread in many provinces	0	0	6
Squamata	COLUBRIDAE	**Lycophidion variegatum* Broadley, 1969	rocky outcrops, under rocks in lowveld	?	northern and eastern Tvl	Partially protected	not listed	unknown	A rare peripheral species	0	4	6
Squamata	COLUBRIDAE	**Mehelya capensis capensis* (Smith, 1847)	savanna, bushveld, human dwellings	snakes, small vertebrates	northern and eastern Tvl.	Partially protected	not listed	vulnerable	Rare and in need of greater conservation effort	0	3	6
Squamata	COLUBRIDAE	**Philothamnus angolensis* Bocage, 1882	variable, moist savanna, arid savanna, reedbeds, riverine habitat	small vertebrates	Zululand	Partially protected	not listed	Uncommon	Found in eastern part of the country. Near-endemic	1	4	6
Squamata	COLUBRIDAE	**Philothamnus semivariegatus semivariegatus* (Smith, 1840)	open bush, savanna, arid areas	small vertebrates	widespread in Tvl., except southern and southern-eastern Highveld	Partially protected	not listed	secure	Widespread	0	0	6
Squamata	COLUBRIDAE	**Prosymna ambigua stuhlmanni* (Pfeffer, 1893)	rotting logs and stones, lowveld	?	western Tvl.	Partially protected	not listed	secure	Secure, but threatened by habitat destruction.	0	0	6
Squamata	COLUBRIDAE	**Psammophis subtaeniatus subtaeniatus* Peters, 1882	termitaria, rodent burrows, bushveld & lowveld	?	northern Tvl.	Partially protected	not listed	secure	Common and habitat largely secure	0	0	6
Squamata	COLUBRIDAE	**Telescopus semiannulatus semiannulatus* Smith, 1849	savanna, sandveld, rocks, crevices	birds, lizards, bats	Tvl. except highveld	Partially protected	not listed	secure	Uncommon and not viable populations in any reserve, but extensively in the Kruger National Park.	0	0	6
Squamata	COLUBRIDAE	**Thelotornis capensis capensis* Smith, 1849	*Burkea africana* savanna, lowveld, aboreal	?	widespread	Partially protected	not listed	secure	Large scale habitat destruction is main threat.	1	1	6
Squamata	COLUBRIDAE	**Venocalamus bicolor australis* FitzSimons, 1946	Kalahari-sand, *Burkea africana* woodland	amphibians	endemic to the Waterberg	Partially protected	not listed	indeterminate	Endemic to South Africa (Waterberg). Species is very low in numbers.	0	3	1
Squamata	COLUBRIDAE	*Amplorhinus multimaculatus* Smith, 1847	montane and Highveld grassland in moist locations	frogs	southern and eastern Tvl.	Partially protected	not listed	vulnerable	Very uncommon and species has been reduce by afforestation and fire.	0	0	2
Squamata	COLUBRIDAE	*Aparallactus capensis* Smith, 1849	variable, Highveld grassland, mountain grassland, savanna, termitaria in Highveld	small vertebrates	Tvl. and Free State, most frequent in the Highveld and south-western Tvl.	Partially protected	not listed	secure	Continued existence of termitaria on the highveld is essential for this species	0	0	2
Squamata	COLUBRIDAE	*Atractaspis bibronii* Smith, 1849	variable, Highveld grassland, semi-desert, termitaria on the Highveld, crevices, rotting logs	small vertebrates	Tvl., except south-western Tvl.	Partially protected	not listed	secure	Occures in several reserves, affected by habitat destruction.	0	0	2
Squamata	COLUBRIDAE	*Atractaspis duerdeni* Gough, 1917	sandy soil and broadleaved savanna, grass	?	western Tvl.	Partially protected	not listed	indeterminate	Very rare and unknown.	1	1	2
Squamata	COLUBRIDAE	*Crotaphopeltis hotamboia hotamboia* (Laurenti, 1768)	various, debris, moribund termitaria	frogs	widespread in Tvl. and Free State	Partially protected	not listed	secure	Occurs widely in many reserves.	0	0	2
Squamata	COLUBRIDAE	*Dasypeltis inornata* Smith, 1849	montane grassland, mixed woodland, grassland, Acocks veld types 8, 62, 63, 64	?	south-eastern Tvl., eastern Cape	Partially protected	not listed	vulnerable	Afforestation poses threat.	1	3	2
Squamata	COLUBRIDAE	*Dasypeltis scabra* (Linnaeus, 1758)	various, crevices, debris, moribund termitaria	fresh eggs	widespread in all veld types	Partially protected	not listed	secure	Common, but future on highveld determined by availability of moribund termitaria	0	0	2
Squamata	COLUBRIDAE	*Duberria lutrix lutrix* (Linnaeus, 1758)	Highveld & montane grassland at forest edges, moribund termitaria	slugs	eastern Free State, southern and eastern Tvl.	Partially protected	not listed	secure	Endemic to South Africa. Threatened by afforestation and should be monitored in the Tvl.	1	0	2
Squamata	COLUBRIDAE	*Homoroselaps dorsalis* (Smith, 1849)	Highveld and montane grassland, termitaria	?	Occurs in Free State, KwaZulu-Natal and Tvl., Swaziland	Partially protected	not listed	vulnerable	Endemic to South Africa. Threatened by continued urban expansion in the PWV area.	1	3	1
Squamata	COLUBRIDAE	*Homoroselaps lacteus* (Linnaeus, 1754)	variable, grassland, semi-desert, savanna	burrowing reptiles	eastern and south-eastern Tvl. and Free State Highveld grassland	Partially protected	not listed	secure	Endemic to South Africa. Vulnerable to habitat destruction and uncommon over most of its range.	1	0	2
Squamata	COLUBRIDAE	*Lamprophis aurora* (Linnaeus, 1754)	savanna, Highveld grassland	rodents, reptiles	Free State and south and central Tvl.	Partially protected	not listed	secure	Endemic to South Africa.	1	0	2
Squamata	COLUBRIDAE	*Lamprophis fuliginosus* (Boie, 1827)	Highveld grassland, karoo, cities	rodents, reptiles	widespread	Partially protected	not listed	secure	Under no threat.	0	0	2
Squamata	COLUBRIDAE	*Lamprophis fuscus* Boulenger, 1893	open grassland, Acocks veld types 8, 57, savanna	?	Free State and south-eastern Tvl.	Partially protected	not listed	rare, vulnerable	Not known to occur in any nature reserve. Destruction of termitaria poses a threat.	1	3	2
Squamata	COLUBRIDAE	*Lamprophis guttatus* (Smith, 1843)	mountain areas, Acocks veld types 8, 52, 54, 57, 62, 63, 67	lizards	eastern and northern Tvl.	Partially protected	not listed	secure	Uncommon but can be considered secure.	1	0	2
Squamata	COLUBRIDAE	*Lamprophis inornatus* Duméril & Bibron, 1854	grassland under rocks & debris	rodents, reptiles	common	Partially protected	not listed	not secure	Endemic to South Africa. A rare snake in Transvaal.	1	4	2
Squamata	COLUBRIDAE	*Lamprophis swazicus* Schaefer, 1970	rocky hillsides, mountains, montane grassland, Acocks veld types 9, 57	?	eastern Tvl.	Partially protected	not listed	secure	Rare along the Drakensberg.	1	0	2
Squamata	COLUBRIDAE	*Lycodonomorphus laevissimus* Kaw, 1973	alongside streams in Highveld and montane grassland	amphibians	eastern and southern northern Tvl.	Partially protected	not listed	secure	Uncommon with a wide distribution.	1	0	2
Squamata	COLUBRIDAE	*Lycodonomorphus rufulus* (Lichtenstein, 1823)	flowing streams, riverine bush	frogs, fish, tadpoles	widespread	Partially protected	not listed	secure	Common on highveld and escarpment. Status secure.	0	0	2
Squamata	COLUBRIDAE	*Lycophidion capense capense* (Smith, 1831)	grassland, savanna	lizards	widespread, most common in south-western Tvl.	Partially protected	not listed	secure	Widespread and occurs in several reserves.	0	0	2
Squamata	COLUBRIDAE	*Mehelya nyassae* (Günther, 1888)	bushveld, Acocks vled types 8, 63	?	northern and eastern Tvl.	Partially protected	not listed	secure	Uncommon, but widespread and secure.	0	0	2
Squamata	COLUBRIDAE	*Philothamnus hoplogaster* (Günther, 1863)	marshy habitats	toads, fish, lizards	most of the Tvl.	Partially protected	not listed	widespread, uncommon in Tvl.	Not common anywhere, although widespread.	0	0	2
Squamata	COLUBRIDAE	*Philothamnus natalensis occidentalis* Broadley, 1966	variable, moist mountain, miombo-bushveld	frogs	isolated records from Free State, Tvl	Partially protected	not listed	secure	Endemic to South Africa. Uncommon and local, and afforestation poses a threat.	1	0	6
Squamata	COLUBRIDAE	*Prosymna bivittata* Werner, 1901	*Acacia* savanna under rocks and logs, grass	lizard eggs	north-western Free State and Tvl., except the central and southern Tvl.	Partially protected	not listed	secure	A rare species.	0	0	2
Squamata	COLUBRIDAE	*Prosymna sundevallii sundevallii* (Smith, 1849)	savanna, Highveld grassland, arid areas, various	reptile eggs	Free State and Highveld of Tvl.	Partially protected	not listed	vulnerable	Endemic to South Africa. Rare and threatened by mining, agriculture and urbanisation.	1	3	2
Squamata	COLUBRIDAE	*Psammophis crucifer* (Daudin, 1803)	Highveld, mountain grassland, moribund termitaria, rocks	small vertebrates	Free State, Lesotho, southern and eastern Tvl.	Partially protected	not listed	secure	Endemic to South Africa. Uncommon over most of range in Tvl.	1	0	1
Squamata	COLUBRIDAE	*Psammophis leightoni trinasalis* Werner, 1902	desert, semi-desert, savanna, moribund termitaria	small vertebrates	Free State and south to north-east of Tvl.	Partially protected	not listed	vulnerable, not listed	Endemic to South Africa. Uncommon over most of its range.	1	3	2
Squamata	COLUBRIDAE	*Psammophis notostictus* Peters, 1867	arid scrub, Karoo, hard stony ground, Nama Karoo, grass	small vertebrates	southern Free State and Eastern Cape	Unknown ?	not listed	Unknown, secure	Endemic to Southern Africa.	1	0	2
Squamata	COLUBRIDAE	*Psammophis phillipsi* (Hallowell, 1844)	tall grass & reeds alongside water, Acocks veld types 9, 10, 11	?	northern and eastern Tvl.	Partially protected	not listed	secure	Uncommon in Tvl. and habitat destructed by agriculture and overgrazing.	0	0	2
Squamata	COLUBRIDAE	*Psammophis sibilans brevirostris* Peters, 1881	Highveld, mountain grassland, bushveld	small vertebrates	Highveld grassland and bushveld, except the south-eastern and southern Highveld	Partially protected	not listed	secure	Common and occurs in several nature reserves.	0	0	2
Squamata	COLUBRIDAE	*Psammophylax rhombeatus rhombeatus* (Linnaeus, 1754)	Highveld grassland, Karoo	small vertebrates	Free State and eastern and southern Tvl.	Partially protected	not listed	secure	Endemic to South Africa. Widespread and not uncommon on the highveld.	1	0	2
Squamata	COLUBRIDAE	*Psammophylax tritaeniatus* (Günther, 1868)	open grassland, woodland, moribund termitaria	small vertebrates	Tvl. and Free State	Partially protected	not listed	secure	Widespread but sporadic in the Tvl. Locally common in certain areas.	0	0	2
Squamata	COLUBRIDAE	*Pseudaspis cana cana* (Linnaeus, 1754)	Highveld grassland, arid areas, mountain areas	moles, lizards, small vertebrate, eggs	widespread in the Tvl., especially in the south-west	Partially protected	not listed	vulnerable	Uncommon in Tvl. and threatened by habitat destruction and because of its aggressive behaviour.	0	3	2
Squamata	COLUBRIDAE	*Xenocalamus bicolor bicolor* Guenther, 1868	Kalahari-sand	amphibians	north western Tvl. and Free State	Partially protected	not listed	indeterminate	Endemic to South Africa. Very rare and secretive.	1	1	6
Squamata	CORDYLIDAE	**Cordylus tropidosternum jonesi* (Boulenger, 1891)	rotting logs, holes in trees, Acocks veld types 8, 10, aboreal	?	northern Tvl.	Protected	not listed	secure	Widespread, but mass extinction possible if dead wood keeps on being removed.	0	0	2
Squamata	CORDYLIDAE	**Cordylus vandami* (FitzSimons, 1930)	rocky outcrops in lowveld, mountain slopes, Acocks veld types 8, 57, 61	invertebrates	endemic to Tvl.	Protected	not listed	secure	Status secure, widespread. Endemic to Tvl.	1	0	2
Squamata	CORDYLIDAE	**Gerrhosaurus major major* Duméril, 1851	rocky outcrops, lowveld, Acocks veld types 9, 10, 11	?	eastern Tvl	Protected	not listed	rare	A rare, dispersed species.	0	2	6
Squamata	CORDYLIDAE	**Gerrhosaurus validus validus* Smith, 1849	rocky outcrops, dry & moist savanna	invertebrates, beetles	widespread in northern and eastern Tvl.	Protected	not listed	secure	Status considered secure. Widespread.	0	0	6
Squamata	CORDYLIDAE	**Platysaurus intermedius intermedius* Matschie, 1890	hillsides, rocky outcrops, Acocks veld types 8, 67	?	endemic Tvl.	Protected	not listed	secure	Provided that commercial exploitation is curtailed. Endemic to Tvl.	1	0	2
Squamata	CORDYLIDAE	**Platysaurus intermedius wilhelmi* Hewitt, 1909	granite outcrops in lowveld	?	endemic to eastern Tvl. Lowveld	Protected	not listed	secure	Limited distribution. Endemic to eastern Tvl.	1	0	6
Squamata	CORDYLIDAE	*Chamaesaura aenea* (Wiegmann, 1843)	grassland of Highveld and Drakensburg Escarpment	grasshoppers	Highveld, Eastern Cape and Drakensberg Escarpment	Protected	not listed	Unknown	Restricted to highveld and Drakensberg escarpment. Endemic to the Grassland Biome	1	4	1
Squamata	CORDYLIDAE	*Chamaesaura anguina anguina* (Linnaeus, 1758)	grass covered mountain slopes, rocky hillsides in grassland	small invertebrates	eastern Tvl., Natal, southern Cape	Protected	not listed	secure	Endemic to South Africa. Much of the habitat has been destroyed by afforestation and annual fires.	1	0	1
Squamata	CORDYLIDAE	*Chamaesaura macrolepis* (Cope, 1862)	rocky hillsides covered with grass	?	south-eastern Tvl., Natal and a relict population on Chimanimani mountains	Protected	not listed	rare	This species could be endangered and its habitat is destroyed by afforestation and fire. Endemic to Biome.	0	2	2
Squamata	CORDYLIDAE	*Cordylus giganteus* Smith 1844	*Themeda*-grassland or transitional zones	invertebrates or small vertebrates	endemic to South Africa occuring in the north-eastern Free State, south-eastern Tvl. & KwaZulu-Natal	Protected	not listed	vulnerable	Endemic to South Africa. May move into endangered category. Has a very restricted range.	1	3	1
Squamata	CORDYLIDAE	*Cordylus polyzonus polyzonus* Smith, 1838	Karoo-areas, Kalahari thornveld, rocky areas	beetles, grasshoppers	south-western Tvl. and southern Free State	Protected	not listed	secure	Peripheral in Tvl.	1	0	6
Squamata	CORDYLIDAE	*Cordylus vittifer vittifer* (Reichenow, 1887)	various, rocky outcrops, Drakensberg escarpment	beetles, grasshoppers, other insects	Tvl., northern and eastern Free State and KwaZulu-Natal	Protected	not listed	secure	Considered secure. Endemic to South Africa	1	0	5
Squamata	CORDYLIDAE	*Cordylus warreni barbertonensis* Van Dam, 1921)	rocky outcrops, hillsides, Acocks veld types 9, 10, 63	?	Very limited, form eastern Tvl. to northern KwaZulu-Natal and Swaziland	Protected	not listed	secure	Restricted, but secure.	1	0	5
Squamata	CORDYLIDAE	*Cordylus warreni depressus* (FitzSimons, 1930)	rocky outcrops, hillsides, Acocks veld types 8, 9	?	endemic to Tvl.	Protected	not listed	secure	This species is in no danger, but is included of CITES. Endemic to Tvl.	1	0	5
Squamata	CORDYLIDAE	*Gerrhosaurus flavigularis* Wiegmann, 1828	grasslands of Highveld, bushveld, rocky hillsides	grasshoppers, beetles, crickets	Tvl. and Free State	Protected	not listed	secure	Status is secure.	0	0	2
Squamata	CORDYLIDAE	*Platysaurus orientalis orientalis* FitzSimons, 1941	Tvl. Drakensberg and ranges fringing the eastern part of the bushveld/Acocks veld types 57, 61	Lepidoptera larvae	endemic to east-central Tvl.	Protected	not listed	secure	Localised, but considered secure. Endemic to east-central Tvl.	1	0	2
Squamata	CORDYLIDAE	*Pseudocordylus langi* Loveridge, 1944	rock fissures at high altitudes	smal invertebrates, plant matter	summit of Natal Drakensberg, recorded in the Free State	Protected	not listed	restricted, not listed	Inhabits an inaccesible and well-protected region. Threatened by illegal collecting.	1	0	4
Squamata	CORDYLIDAE	*Pseudocordylus melanotus melanotus* (Smith, 1838)	rocky outcrops, Acocks veld types 8, 52, 54, 57, 61, 62, 63, 64	Coleoptera, Neuroptera, Hymenoptera larvae	south-eastern and eastern Tvl. and north-eastern Free State	Protected	not listed	secure	Habitat can be considered secure.	1	0	4
Squamata	CORDYLIDAE	*Pseudocordylus melanotus subviridis* Smith, 1838	rocky outcrops, mountain grassland	?	Drakensberg, Lesotho, recorded in the Free State	Unknown ?	Unknown?	Unknown, secure	Endemic to Biome in South Africa.	1	4	2
Squamata	CORDYLIDAE	*Pseudocordylus melanotus transvaalensis* FitzSimons, 1943	rocky outcrops, crest in grassland, Acocks veld type 67	?	endemic to Tvl.	Protected	not listed	secure	Secure if commercial exploitation is prevented. Endemic to Tvl.	1	0	4
Squamata	CORDYLIDAE	*Pseudocordylus spinosus* FitzSimons, 1947	rocky areas in grassland	?	endemic to the Grassland Biome	Unknown ?	Unknown?	Unknown ?	Endemic to Biome in South Africa	1	4	4
Squamata	CORDYLIDAE	*Tetradactylus africanus africanus* Gray, 1838)	grassland	?	Unknown ?	Unknown ?	Unknown ?	Unknown ?	Unknown ?	1	4	1
Squamata	CORDYLIDAE	*Tetradactylus africanus fitzsimonsi* Hewitt, 1915	grassland	?	Unknown ?	Unknown ?	Unknown ?	Unknown ?	Unknown ?	1	4	1

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 2. continue...

Order	Family	Species name	Habitat	Food	Abundance	Conservation status	International status	South African status	Remarks	Endemic score	RDB status	Habitat type
Squamata	SCINCIDAE	*Mabuya quinquetaeniata margaritifer* (Peters, 1854)	rocky outcrops in bushveld areas, Acocks veld types 57, 63, 67	?	northern & eastern half of Tvl.	Protected	not listed	secure	Widespread. Status is secure and under no threat.	0	0	6
Squamata	SCINCIDAE	*Mabuya striata punctatissimus* (Smith, 1849)	variable, dry savanna, marshes, human dwellings, various veldtypes	insects	Free State & southern and south-western Tvl.	Protected	not listed	secure	Found in many reserves.	0	0	2
Squamata	SCINCIDAE	*Mabuya sulcata* (Peters, 1867)	karooveld, arid savanna, desert	insects	Karoo & Free State	Protected	not listed	secure	Widespread. Status is secure. Near-endemic to Southern Africa.	1	0	6
Squamata	SCINCIDAE	*Mabuya varia* (Peters, 1867)	variable, grassland, arid savanna, mountain tips	insects	widespread	Protected	not listed	secure	Widespread. Status secure.	0	0	2
Squamata	SCINCIDAE	*Panaspis wahlbergii* (Smith, 1849)	tropical to dry savanna , Highveld grassland, rocky outcrops	insects	various habitat types in Tvl., especially Highveld and rocky outcrops	Protected	not listed	secure	Widespread. Species is secure.	0	0	2
Squamata	SCINCIDAE	*Scelotes mirus* (Roux, 1907)	montane grassland and scrub, rocky outcrops	insects	eastern & south-eastern Tvl. montane grassland	Protected ?	not listed	not secure	Endemic to South Africa. Endemic to eastern and south-eastern Tvl, Swaziland and Northern KwaZulu-Natal.	1	4	1
Squamata	SCINCIDAE	*Typhlosaurus cregoi cregoi* Boulenger, 1903	rocky terrain, Acocks veld types 8, 67	?	endemic to the Tvl.	Protected	not listed	secure	Secure. Afforestation poses a threat. Endemic to the Tvl.	1	0	2
Squamata	TYPHLOPIDAE	**Typhlops schlegelii schlegelii* Bianconi, 1850	lowveld, Acocks veld types 10, 11, 67	?	northern and eastern Tvl.	Semi-protected	not listed	secure	Uncommon over most of its range, large scale habitat destruction affects its distribution.	0	0	2
Squamata	TYPHLOPIDAE	*Typhlops bibronii* (Smith, 1846)	various, moribund termitaria, rock, debris	termites, invertebrates	Eastern Cape, Natal, Tvl. and Free State	Partially protected	not listed	secure	Endemic to South Africa. Affected by habitat destruction in the highveld, but out of danger.	1	0	2
Squamata	TYPHLOPIDAE	*Typhlops lalandei* Schlegel, 1844	semi-desert, savanna, moribund termitaria, various	termites, invertebrates	Tvl. and Free State	Partially protected	not listed	secure	Habitat destruction is affecting its distribution.	0	0	2
Squamata	VARANIDAE	*Varanus albigularis* (Dauding, 1802)	widespread over southern Africa, bushveld, rocky terrain	beetles, millipedes, eggs, young birds, young tortoises	widespread in Tvl. & Free State	Partially protected	not listed	secure	Status currently secure, killed while crossing roads. Found more in the bushveld of Tvl.	0	0	2
Squamata	VARANIDAE	*Varanus niloticus niloticus* (Linnaeus, 1762)	rivers, pans, lakes	frogs, birds, eggs, fish	Freestate and Tvl. river edges	Partially protected	not listed	secure	Widespread in the Tvl. Status is considered secure.	0	0	6
Squamata	VIPERIDAE	**Bitis caudalis* (Smith, 1839)	Kalahari sands, tops of the Magaliesberg, human debris, overhanging rocks	rodents and lizards	north-western Tvl.	Partially protected	not listed	secure	Locally common. Secure if exploitation is contained.	0	0	6
Squamata	VIPERIDAE	**Causus defilippii* (Jan, 1862)	rotting logs, Acocks veld types 8, 9, 10, 11, drier areas	?	northern and eastern Tvl. and northern Tvl.	Partially protected	not listed	secure	Rare, although widespread in northern Tvl. Elsewhere densities appear low.	0	0	6
Squamata	VIPERIDAE	*Bitis arietans arietans* (Merrem, 1820)	true desert, high mountain tips, grassland to rocky hillsides	rodents, birds, snakes	Tvl. and Free State, lacking from south-eastern Tvl. Highveld	Partially protected	not listed	secure	Widespread, however threatened by habitat destruction and persecution.	0	0	2
Squamata	VIPERIDAE	*Bitis atropos* (Linnaeus, 1754)	montane and rocky hillsides, Acocks veld types 8, 9, 57, 63, grass tussocks	?	eastern Tvl., north-eastern Free State and Natal Drakensberg	Partially protected	not listed	vulnerable	Rare, but locally common in the Wolkberg range. Threatened by afforestation, development and fires. Conservation action must be established in suitable	0	3	1
Squamata	VIPERIDAE	*Causus rhombeatus* (Lichtenstein, 1823)	moist savanna, rocks, soil, montane grassland, moribund termitaria	frogs, bullfrogs	damp localities, montane grassland and even forest	Partially protected	not listed	secure	Widely distributed in Tvl., but uncommon over most of its range. Locally common along eastern Tvl. escapment.	0	0	2
Testudines	EMYDIDAE	**Chrysemys scripta elegans* (Wied, 1839)	freshwater habitat, vleis, ponds	tadpoles, insects, snails, water plants, fish	freshwater habitats in the Highveld	Introduced	not listed	introduced	Poses threat to indigenous species.	0	0	6
Testudines	PELOMEDUSIDAE	**Pelomedusa subrufa subrufa* (Lacépède, 1788)	fresh, stagnant water-bodies, pans, dams, bogs	tadpoles, frogs, carrion, aquatic life, birds	Tvl. and Free State, except most of the Highveld in Tvl.	Protected	not listed	secure	Widespread in most nature reserves.	0	0	6
Testudines	PELOMEDUSIDAE	**Pelusios sinuatus* (Smith, 1838)	along major streams, dams and pools	?	Tvl. in lowveld and bushveld	Protected	not listed	secure	Occurs in a few nature reserves and major rivers of the Kruger National Park.	0	0	6
Testudines	TESTUDINIDAE	**Geochelone pardalis* (Bell, 1828)	various, Karoo, grassland, bushveld, savanna, not Tvl. Highveld	plants, fruit, man-made food	excluded from of Free State and central and south-western Highveld	Protected	not listed	secure, but appears vulnerable	Widespread in several reserves. A reserve of 3000 ha in not likely to have a viable population.	0	0	2
Testudines	TESTUDINIDAE	**Psammobates oculifer* (Kuhl, 1820)	grassland, bushveld, thornveld	Unknown	western Free State and western and north-western Tvl.	Protected	not listed	vulnerable	Low densities due to limited habitat.	0	3	2
Testudines	TESTUDINIDAE	*Homopus femoralis* Boulenger, 1888	high altitudes, mountain grassland, pure grassland, savanna	Unknown	restricted to western Free State, south-western Tvl. and Cape Province	Protected	not listed	indeterminate	Endemic to South Africa. Occurs in Tvl. and the Free State.	1	1	2
Testudines	TESTUDINIDAE	*Kinixys lobatsiana* Power	grassland, savanna,various	?	southern Africa	Unknown	not listed	Unknown ?	Occurs in Southern Africa	1	4	2
Testudines	TESTUDINIDAE	*Kinixys natalensis* Hewitt, 1935	rocky outcrops, Acocks veld types 6, 10, 11	?	south-eastern Tvl. and Natal midlands	Protected	not listed	rare but indeterminate	Rare and more surveys needed to establish its presence in reserves and the Kruger National Park.	1	1	6
Testudines	TESTUDINIDAE	*Kinixys spekii* Gray, 1863	savanna, Highveld rocky areas, tropical bushveld	plants, insects, snails, flying ants	northern Tvl. in bushveld an lowveld, Free State	Protected	not listed	indeterminate	Suffers from habitat destruction, translocation and road kills.	0	1	2

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 2. continue...

Order	Family	Species name	Habitat	Food	Abundance	Conservation status	International status	South African status	Remarks	Endemic score	RDB status	Habitat type
Squamata	CORDYLIDAE	*Tetradactylus breyeri* Roux, 1907	montane grassland, Highveld grassland	?	eastern Tvl.	Protected	not listed	Rare	Threatened by afforestation. Conservation priority species.	1	2	1
Squamata	CORDYLIDAE	*Tetradactylus eastwoodae* Methuen & Hewitt, 1913	montane grassland	?	montane grassland	Protected	not listed	Possibly extinct ?	Conservation priority species. Endemic to Biome.	1	3	1
Squamata	CORDYLIDAE	*Tetradactylus sepsi* (Linneus, 1758)	coastal forests and high mountains	?	south-eastern Free State, Drakensberg	Unknown ?	not listed	Unknown ?	Endemic to Biome/South Africa	1	4	2
Squamata	CORDYLIDAE	*Tetradactylus tetradactylus* (Laetpede, 1803)	grassy mountain slopes, fynbos	?	south-western Cape, recorded in Free State, eastern Cape	Unknown ?	not listed	Unknown ?	Endemic to Biome.	1	4	2
Squamata	ELAPIDAE	**Aspidelaps scutatus intermedius* Broadley, 1968	stony and sandy areas, Acocks veld types 10, 11	?	endemic to eastern Tvl	Partially protected	not listed	secure	Occurs throughout the Kruger National Park and several reserves. Endemic to eastern Tvl.	1	0	6
Squamata	ELAPIDAE	**Dendroaspis polylepis* (Günther, 1864)	rocky hillsides and outcrops and woodland, Acocks veld types 6, 8, 9, 10, 11	?	northern and central Tvl.	Partially protected	not listed	Unknown ?	Widespread and uncommon to rare, only locally common. Provincial reserves too small for viable populations. In need of greater conservation effort.	0	4	6
Squamata	ELAPIDAE	**Elapsoidea semiannulata boulengeri* Boettger, 1895	logs, stones, Acocks veld type 10	?	eastern Tvl	Partially protected	not listed	indeterminate	Very rare, little known species.	0	1	6
Squamata	ELAPIDAE	**Naja annulifera* Peters, 1854	excluded from most of the highveld, take refuge in rocky outcrops and major river valleys	small vertebrates	Tvl., but excluded from most of the Highveld	Partially protected	not listed	secure	Appear to be more common in Acacia savanna, but are becoming more rare	0	0	6
Squamata	ELAPIDAE	**Naja mossambica* Peters, 1854	rocky, well vegetated hillsides and around human habitation	rodents, chickens	Tvl., except southern Tvl.	Partially protected	not listed	secure	Widespread and fairly common.	0	0	6
Squamata	ELAPIDAE	*Aspidelaps lubricus lubricus* (Laurenti,1768)	Karoo, sandveld areas, grassland	small vertebrates	southern Free State, Eastern Cape	Unknown ?	not listed	Unknown ?, secure	Widespread. Near-endemic to Southern Africa.	1	4	2
Squamata	ELAPIDAE	*Elapsoidea sundevalli media* Broadley, 1971	variable, Highveld grassland, Kalahari desert	reptiles, frogs, small vertebrates	Highveld of Tvl. and Free State	Partially protected	not listed	indeterminate	Endemic to South Africa. Restricted to highveld and uncommon and widespread.	1	1	2
Squamata	ELAPIDAE	*Elapsoidea sundevallii sundevallii* (Smith, 1848)	moribund termitaria in Highveld grassland, Acocks veld types 57, 63	?	south-eastern Tvl.	Partially protected	not listed	indeterminate	Very rare	0	1	3
Squamata	ELAPIDAE	*Hemachatus haemachatus* (Laetpede, 1788)	grassland	small vertebrates	endemic to South Africa, Free State and the southern Tvl. and KwaZulu-Natal	Partially protected	not listed	indeterminate	Endemic to South Africa. Originally common in highveld, but numbers has declined due to habitat destruction.	1	1	1
Squamata	ELAPIDAE	*Naja nivea* (Linnaeus, 1758)	arid karoo, bushveld, thornveld, grassland	small vertebrates	south-western Tvl. and south-western Free State and Lesotho	Partially protected	not listed	endangered	Rare in Tvl. and threatened by habitat destruction in south-western Tvl. and persecution.	1	3	2
Squamata	GEKKONIDAE	**Afroedura langi "Leolo"* in prep. Jacobsen	granite formations above the Steelpoort, bushveld	?	endemic to eastern Tvl.	Protected	not listed	secure	habitat secure, endemic to eastern Tvl.	1	0	6
Squamata	GEKKONIDAE	**Afroedura pondolia "Godlwayo"* in prep. Jacobsen	crevices, Acocks veld types 10, 63	?	endemic to south-eastern Tvl., but likely to be found in northern KwaZulu-Natal & southern Swaziland	Protected	not listed	secure	Non-threatened, endemic to south-eastern Tvl.	1	0	1
Squamata	GEKKONIDAE	**Hemidactylus mabouia mabouia* (Moreau de Jonnes, 1818)	various, boababs, rubble	insects	widespread north of Pretoria	Protected	not listed	secure	Highly variable and widespread	0	0	6
Squamata	GEKKONIDAE	**Homopholis wahlbergii* (Smith, 1849)	rocky outcrops, cliffs, tree trunks	insects	northern and eastern Tvl.	Protected	not listed	secure	Threatened only by trade in this species	0	0	6
Squamata	GEKKONIDAE	**Lygodactylus capensis capensis* (Smith, 1849)	dry savanna bushveld, trees, shrubs	termites	widespread in Tvl., except southern Tvl.	Protected	not listed	secure	Considered abundant and not under threat. Widespread except in in southern and south-eastern highveld.	0	0	6
Squamata	GEKKONIDAE	**Lygodactylus methueni* FitzSimons, 1937	crevices, trees	?	endemic to the Tvl.	Protected	not listed	secure	Status is secure. Common in northern and eastern Tvl., endemic to the Tvl.	1	0	6
Squamata	GEKKONIDAE	**Lygodactylus nigropunctatus montiscaeruli* Jacobsen, 1995	various, thickets, rocky areas	?	known from the Blueberg and the Makgabeng, endemic to the Tvl.	Unknown	Unknown	Unknown	endemic to the Tvl.	1	4	6
Squamata	GEKKONIDAE	**Pachydactylus bibronii* Smith, 1846	variable, Karoo, savanna, semi-desert, rocky outcrops, termitaria, debris	invertebrates, small lizards	widespread in Tvl. but absent in parts of the Highveld	Protected	not listed	secure	Wide distribution in the Tvl. Status secure. Threatende by trade in this species.	0	0	6
Squamata	GEKKONIDAE	**Pachydactylus punctatus punctatus* Peters, 1854	rocky outcrops, crevices of bushveld & grassland	?	widespread, northern Tvl.	Protected	not listed	secure	Common in northern and eastern Tvl.	0	0	2
Squamata	GEKKONIDAE	*Afroedoera sp. nov. ("Lebombo")* in prep. Jacobsen	Acocks veld type 10, scree, bushveld	?	Lebombo mountains	Protected	not listed	very rare and difficult to locate	Rare & difficult to locate. Peripheral species. Endemic to Biome.	1	2	6
Squamata	GEKKONIDAE	*Afroedura karroica halli* Hewitt, 1925	dry moutain grassland, rocky outcrops	?	eastern Cape, recorded in the Free State	Unknown ?	not listed	Unknown ?	Endemic to Biome in South Africa.	1	4	1
Squamata	GEKKONIDAE	*Afroedura langi "Soutpansberg"* in prep. Jacobsen	Acocks veld type 8, 19, crevices in lowveld	?	endemic to Soutpansberg and Blouberg, Tvl.	Protected	not listed	secure	Habitat secure. Locally afforestation may create a problem. Endemic to Soutpansberg.	1	0	5
Squamata	GEKKONIDAE	*Afroedura multiporus "Abel Erasmus"* in prep. Jacobsen	Acocks veld type 8, cliff faces, rocky outcrops	?	endemic to eastern Tvl.	Protected	not listed	secure	Habitat renders it secure and under no threat. Endemic to eastern Tvl.	1	0	6
Squamata	GEKKONIDAE	*Afroedura nivaria* Boulenger, 1894	rocks, crevices of high altitudes, grassland	?	Drakensberg (foothills to summit), recorded in the Free State	Unknown ?	not listed	Unknown ?	Endemic to Biome in South Africa.	1	4	4
Squamata	GEKKONIDAE	*Afroedura pondolia "Maripi"* in prep. Jacobsen	crevices between rocks, Acocks veld type 8	?	endemic to eastern Tvl.	Protected	not listed	secure	Species secure, endemic to eastern Tvl.	1	0	6
Squamata	GEKKONIDAE	*Lygodactylus granticolus* Jacobsen, 1995	Potgietersrus granite, crevices, bushveld	?	endemic to Tvl., granite hills of Percy Fyfe Nature Reserve	Unknown	Unknown	Unknown	Endemic to the Tvl.	1	4	5
Squamata	GEKKONIDAE	*Lygodactylus nigropunctatus incognitus* Jacobsen, 1995	rocky areas in grassland, bushveld, Soutpansberg	?	restricted to the Soutpansberg and northern Tvl., endemic to the Tvl.	Unknown	Unknown	Unknown	Endemic to the Tvl.	1	4	2
Squamata	GEKKONIDAE	*Lygodactylus nigropunctatus nigropunctatus* Jacobsen, 1995	grassland, rocky areas	?	widespread in the Tvl., but absent from the Soutpansberg, endemic to the Tvl.	Unknown	Unknown	Unknown	Endemic to the Tvl.	1	4	4
Squamata	GEKKONIDAE	*Lygodactylus ocellatus ocellatus* Roux, 1907	exclusive to highveld, crevices	insects	restricted to Highveld of Tvl. and Swaziland	Protected	not listed	secure	Highveld species. Endemic to highveld. Status and habitat secure. Afforestation is only threat.	1	0	4
Squamata	GEKKONIDAE	*Lygodactylus ocellatus soutpansbergensis* Jacobsen, 1995	exclusive to highveld, crevices	insects	mountain ranges of Tvl.	Protected	not listed	secure, but restricted	Soutpansberg specimens show affinities with Highveld species. Bonsi complex. Status and habitat secure. Afforestation is only threat.	1	0	5
Squamata	GEKKONIDAE	*Lygodactylus waterbergensis* Jacobsen, 1995	rocky areas, western side of the Waterberg, sandstone boulders in grassland or scrub	?	Widespread but endemic to high-lying scarp of the Waterberg	Unknown	Unknown	Unknown	Endemic to Biome	1	4	2
Squamata	GEKKONIDAE	*Pachydactylus affinis* Boulenger, 1896	termitaria, crevices, rocky outcrops	insects	endemic to Tvl.	Protected	not listed	secure	Regarded as secure. Grazing and fire are the main threats. Endemic to Tvl.	1	0	2
Squamata	GEKKONIDAE	*Pachydactylus capensis capensis* Smith, 1846	rocks on soil, termitaria, rotting logs, grasslands of Highveld	insects	calcrete south-western to north-western Tvl.	Protected	not listed	currently secure	Threatened by demolishin of live termitaria. Current status secure, threatened by habitat destruction.	1	0	2
Squamata	GEKKONIDAE	*Pachydactylus maculatus maculatus* Gray, 1845	rocks, logs, bushwood	?	south-eastern Tvl	Protected	not listed	secure	Peripheral in Tvl. Low priority conservation species. Afforestation poses greatest threat.	1	0	6
Squamata	GEKKONIDAE	*Pachydactylus marisquensis marisquensis* Smith, 1849	flat sandy areas with sparse vegetation, Karoo, Nama Karoo	insects	Eastern Cape, southern Free State	Unknown ?	not listed	Unknown, secure	Endemic to South Africa	1	4	6
Squamata	GEKKONIDAE	*Pachydactylus tigrinus* Van Dam, 1921	crevices, soil, rocks in bushveld countries	?	northern Tvl.	Protected	not listed	secure	Uncommon. Currently secure	0	0	6
Squamata	GEKKONIDAE	*Pachydactylus vansoni* FitzSimons, 1933	Highveld, Soutpansberg, rocky outcrops in grasslands	insects	north-eastern and eastern Tvl.	Protected	not listed	secure	Current status is considered secure. Threatened by afforestation.	1	0	2
Squamata	LACERTIDAE	**Heliobolus lugubris* (Smith, 1838)	shrubs, grass tussocks	?	northern and north-eastern Tvl.	Protected	not listed	secure	Status is secure.	0	0	6
Squamata	LACERTIDAE	**Ichnotropis squamulosa* Peters, 1854	dry to moist savanna, sandy habitats	termites, beetles, grasshoppers	Tvl. sandy habitats, western Free State	Protected	not listed	secure	Widespread in Tvl. Status secure. Found more in the bushveld and to north of Tvl.	0	0	6
Squamata	LACERTIDAE	**Nucras intertesta intertexta* Smith, 1838	dry savanna on Kalahari sand, rocks on soil, shrubs	spiders, scorpions	northern and eastern Tvl. and central and southern Free State	Protected	not listed	secure	Widespread. Occurs in numerous reserves.	0	0	6
Squamata	LACERTIDAE	*Ichnotropis capensis* (Smith, 1838)	sandy habitats and bushveld, grass tussocks	lsoptera, Coleoptera, Araneae, Orthoptera	central and north-west Tvl. bushveld	Protected	not listed	secure	Restricted to ranching areas. Considered secure, although population fluctuations occur on a regular basis.	0	0	2
Squamata	LACERTIDAE	*Nucras lalandii* (Milne-Edwards, 1829)	highveld to montane grassland, under stones	beetles, insect larvae	south-eastern and north-eastern Free State and eastern Cape	Protected	not listed	tentatively secure	Uncommon lizard restricted to parts of the highveld and escarpment. Threatened by veld fires and afforestation.	1	0	1
Squamata	LACERTIDAE	*Nucras ornata* (Gray, 1864)	grass tussocks, montane grassland, rocky hillsides	centipede	montane species	Protected	not listed	secure	Status appears secure. More restricted to escarpment.	0	0	2
Squamata	LACERTIDAE	*Nucras taemiolata holubi* (Steindacher), 1882	wide habitat tolerance, grass tussocks at bush edges	lsoptera, Coleoptera, Curculionidae	Free State and Tvl., especially western Tvl.	Protected	not listed	secure	Widespread. Current status secure	0	0	2
Squamata	LACERTIDAE	*Pedioplanis burchelli* (Dumeril & Bibron, 1839)	slopes of mountains, bedrocks, montane grassland	beetles	south-eastern Tvl.,north and south-eastern Free State and eastern Cape	Protected	not listed	secure	Peripheral in the Tvl. and exhibits a restricted range. Considered secure, bi-annual fires influence abundance.	1	0	4
Squamata	LACERTIDAE	*Pedioplanis lineoocellata lineoocellata* (Dumeril & Bibron, 1839)	variable, karoo, dry to moist savanna	beetles, grasshopper, spiders	Free State, north and north-western Tvl.	Protected	not listed	secure	Possibly endemic to South Africa. Considered secure. Threatened by agricultural development.	1	0	2
Squamata	LACERTIDAE	*Pedioplanis lineoocellata pulchella* (Gray, 1845)	stony hillsides, wooded savanna, open scrub areas	termites, ants, grasshoppers, beetles	Tvl. in wooded savanna	Protected	not listed	secure	Status secure. Fires unlikely to affect its survival seriously.	1	0	6
Squamata	LACERTIDAE	*Tropidosaura cottrelli* Hewitt, 1925	mountain grassland	?	Cape and Natal Drakensberg, recorded in the Free State	Unknown?	not listed	Unknown ?	Endemic to Biome in South Africa.	1	4	4
Squamata	LACERTIDAE	*Tropidosaura essexi* Hewitt, 1927	rocky mountain grassland	?	mountains of Natal Drakensberg and Free State	Unknown?	not listed	Unknown ?	Endemic to Biome/South Africa.	1	4	1
Squamata	LACERTIDAE	*Tropidosaura montana rangeri* Hewitt, 1926	montane grassland & fynbos	?	Eastern Cape to Natal Drakensberg	Unknown?	not listed	Unknown ?	Endemic to Biome in South Africa.	1	4	2
Squamata	LEPTOTYPHLOPIDAE	**Leptotyphlops conjunctus incognitus* Broadley & Watson, 1976	rocks, grass roots, Acocks veld types 8, 10 , 63, 67	invertebrates	northern and eastern Tvl.	Partially protected	not listed	secure	Widespread and status considered secure.	0	0	2
Squamata	LEPTOTYPHLOPIDAE	**Leptotyphlops longicaudus* (Peters, 1854)	under rocks, Acocks veld types 10, 11, 67	?	northern and eastern Tvl.	Partially protected	not listed	secure	Uncommon but its habitat renders this species secure.	0	0	2
Squamata	LEPTOTYPHLOPIDAE	*Leptotyphlops conjunctus conjunctus* Jan, 1861	grass tussocks, termitaria, Acocks veld types 8, 52, 54, 55, 57, 61, 63, 64	?	Eastern Cape & southern Tvl.	Partially protected	not listed	secure	Widespread on the Highveld. Habitat subjected to destruction.	0	0	2
Squamata	LEPTOTYPHLOPIDAE	*Leptotyphlops distanti* (Boulenger, 1892)	grassland, savanna	termites, invertebrates	central, northern and eastern Tvl	Partially protected	not listed	secure	Under no threat.	0	0	2
Squamata	LEPTOTYPHLOPIDAE	*Leptotyphlops scutifrons scutifrons* (Peters, 1854)	grassland, moist and dry savanna	termites, invertebrates	widespread	Partially protected	not listed	secure	Largest diversity in South Africa.	0	0	2
Squamata	SCINCIDAE	**Lygosoma sundevalli sundevalli* (Smith, 1849)	bushveld, stones, debris, rocks	insects	mountain ranges, central and northern Tvl.	Protected	not listed	secure	Widespread, under no immediate threat.	0	0	6
Squamata	SCINCIDAE	**Mabuya sp.nov.*	rocky outcrops, mountains, crevices, savanna	insects	widespread in Tvl. only and south-east Botswana	Unknown?	Unknown ?	Unknown ?	Only known from Tvl. and south-east Botswana. Endemic to Southern Africa.	1	4	5
Squamata	SCINCIDAE	**Mabuya striata striata* (Peters, 1844)	aboreal, human habitation, bridges	?	widespread in the northern and eastern Tvl.	Protected	not listed	secure	Considered secure.	0	0	6
Squamata	SCINCIDAE	**Mabuya variegata punctulata* (Boulage, 1872)	variable, desert, Karoo, savanna, mountain grassland	insects	north-west and western Tvl. and central and western Free State	Protected	not listed	secure	Widespread peripheral species. Status secure. Kalahari thornveld & savanna.	0	0	2
Squamata	SCINCIDAE	**Panaspis sp. nov. "maculicolla"*	various, rocky outcrops, grass covered flats	?	Tvl., Zimbabwe, Botswana	Protected	not listed	secure	Currently secure. Near-endemic.	1	0	6
Squamata	SCINCIDAE	**Scelotes bidigittata* FitzSimons, 1930	rock, rotting logs, grass tussocks, Acocks veld types 8, 11	?	north-eastern Tvl.	Protected	not listed	secure	Currently secure. Habitat destruction has impact on species.	0	0	2
Squamata	SCINCIDAE	**Scelotes mossambicus* Hewitt, 1925	rocks, rotting logs, mixed bushveld, montane grassland	?	eastern Tvl.	Protected	not listed	secure	Widespread. Status secure.	0	0	2
Squamata	SCINCIDAE	*Acontias breviceps* Essex, 1925	montane and Highveld grassland	invertebrates	eastern and south-eastern Tvl., Eastern Cape	Rare/vulnerable	not listed	vulnerable	Rare lizard restricted to highveld grassland. Considered vulnerable	1	3	1
Squamata	SCINCIDAE	*Acontias gracilicauda gracilicauda* Essex, 1925	grassland, sandy areas, valley bushveld	invertebrates, lizards, snakes	Free State highveld, southern Tvl. and Eastern Cape	Unknown	not listed	Unknown	Endemic to South Africa.	1	4	2
Squamata	SCINCIDAE	*Acontias percivali occidentalis* FitzSimons, 1941	dead logs, western half of Tvl. excluding the Highveld	invertebrates	western and north-western Tvl.	Unknown ?	not listed	indeterminate	Uncommon species restricted to western half of Tvl.	0	1	6
Squamata	SCINCIDAE	*Acontias plumbeus* Biacoru, 1849	woodland, south-eastern Highveld grassland	?	eastern Tvl., also a relict population in Eastern Cape	Protected	not listed	secure	Considered secure. Afforestation has a large impact on species.	0	0	2
Squamata	SCINCIDAE	*Acontiophiops lineatus* Sternfeld, 1911	montane grassland with rocky outcrops	?	endemic to Tvl.	Unknown ?	not listed	vulnerable	Considered secure. Afforestation has a large impact on species. Endemic to the Tvl.	1	3	2
Squamata	SCINCIDAE	*Mabuya capensis* (Gray, 1830)	rocks, debris, Highveld grassland, south western Tvl. & Escarpment	insects	widespread	Protected	not listed	secure	Well represented in many reserves especially on the Highvel. Secure, but threatened by habitat destruction.	0	0	2
Squamata	SCINCIDAE	*Mabuya homalocephala smithi* (Gray, 1845)	rocky hillsides, Acocks veld type 57	?	Eastern Cape, Free State and Tvl.	Protected	not listed	vulnerable	Afforestation poses threat.	1	3	4

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 3. Inventory of butterflies recorded in the Grassland Biome

Family	Subfamily	Species name	Habitat	Distribution	Distribution range	Conservation status	Remarks	Edge species	Larval food	Habitat code	Lar... fo...
HESPERIIDAE		*Abantis tettensis* Hopffer, 1855	woodland, bushveld	Northern Cape, Free State, Transvaal, KwaZulu-Natal	widespread	common	No threat	No	*Grewia flava & G. monticola*	3	
HESPERIIDAE		*Borbo fallax* (Gaede, 1916)	coastal bush, savanna, woodland	Gauteng, KwaZulu-Natal, Northern Province, North-West Province	widespread	common	No threat	No	*Ehrharta erecta, Saccharum* sp., grasses	3	5
HESPERIIDAE		*Caprona pillaana* Wallengren, 1857	bushveld, riverine bush	Transvaal, KwaZulu-Natal, Swaziland, Northern Cape, Free State	local but widespread	local	No threat	No	*Diombeya rotundifolia, Grewia flava, Grewia monticola* etc.	3	
HESPERIIDAE		*Coeliades anchises* (Gerstaecker, 1871)	bushveld to riverine and coastal forest	Natal midlands to eastern and northern Tvl.	wide	Rare	No known threats	Yes	*Triaspis glaucophylla, Mardenia angolensis*	3	
HESPERIIDAE		*Coeliades forestan forestan* (Stoll, 1782)	rainforest, coastal bush	Eastern Cape, Free State, Tvl., Transkei, KwaZulu-Natal	widespread	common		No	*Combretum* spp., *Millettia sutherlandii, Solanum mauritianum* etc.	3	
HESPERIIDAE		*Eretis umbra umbra* (Trimen, 1862)	open grassland	Tvl., Free State, KwaZulu-Natal, Eastern Cape, Northern Cape	widespread	common	No threat	No	*Chaetocanthus setiger*	5	
HESPERIIDAE		*Gegenes hottentota hottentota* (Latreille, 1823)	grassland, bushveld, marshes	Widespread in southern Africa, except the Karoo, Namakwaland, western Northern Cape	widespread	common		No	various grass species	4	5
HESPERIIDAE		*Gegenes niso niso* (Linnaeus, 1764)	bushveld, savanna, woodland, grassy slopes	Transvaal, KwaZulu-Natal, Eastern Cape	widespread	common	No threat	No	*Ehrharta erecta, Themeda triandra*	4	5
HESPERIIDAE		*Gegenes pumilio gambica* (Mabille, 1878)	bushveld, grassy slopes	Free State, Transvaal, KwaZulu-Natal, Eastern Cape	widespread	common	No threat	No	*Ehrharta* sp., *Cymodon* sp.	4	5
HESPERIIDAE		*Gomalia elma* (Trimen, 1862)	bush, woodland, forest	most of southern Africa, except west coast and Cape Point	widespread	uncommon	No threat	No	*Abutilon guineense, A. grantii, A. intermedium* etc.	3	5
HESPERIIDAE		*Kedestes callicles* (Hewitson, 1868)	bushveld	Tvl., except the southern parts, KwaZulu-Natal, Swaziland	widespread	common		No	one or more grass species	3	5
HESPERIIDAE		*Kedestes lenis* Riley, 1932	grassy areas, marshy areas	Golden Gate Highlands, Eastern Cape mountains, KwaZulu-Natal Drakensberg	widely distributed	local		No	*Imperata cylindrica*	5	5
HESPERIIDAE		*Kedestes lepenula* (Wallengren, 1857)	grassland and bushveld	Eastern and Northern Cape, Free State, North-West Province	widespread	common	No threat	No	*Imperata cylindrica*	4	0
HESPERIIDAE		*Kedestes macomo* (Trimen, 1862)	bushveld, coastal bush	Tvl., except southern parts, KwaZulu-Natal, Eastern Cape, Transkei	widespread	common		No	*Imperata cylindrica*	3	0
HESPERIIDAE		*Kedestes mohozutza* (Wallengren, 1857)	grassy slopes, montane grassland, forest edge	Eastern Cape, hills of the Drakensberg, Mpumalanga, Gauteng	widespread	common	No threat	No	Unrecorded	4	0
HESPERIIDAE		*Kedestes nerva* (Fabricius, 1793)	bush, woodland, grassland	Gauteng, Mpumalanga, North-West Province, Northern Province	fairly widespread	local & uncommon	No threat	No	Unrecorded	4	0
HESPERIIDAE		*Kedestes wallengrenii* (Trimen, 1883)	grasslands and woodland	KwaZulu-Natal, grassy Highveld of Gauteng, Mpumalanga	fairly widely spread	scarce and local	No threat	No	Unrecorded	4	0
HESPERIIDAE		*Leucochitonea levubu* Wallengren, 1857	koppies, shrubs	Tvl. except the southern & central part, Zululand, Swaziland	relatively widespread	common		Yes	*Grewia flava*	3	0
HESPERIIDAE		*Metisella aegipan* (Trimen, 1868)	marshes, damp patches on hills and mountains	Eastern Cape, on the Drakensberg, KwaZulu-Natal, Lesotho, Northern Province	widespread	common	No threat	No	unrecorded	4	0
HESPERIIDAE		*Metisella malgacha* (Boisduval, 1833)	gardens, grassland, vleis	Western Cape, southern Karoo, Eastern Cape, North-West Province, Gauteng, KwaZulu-Natal	widespread	fairly common	No threat	No	*Ehrharta erecta*	4	0
HESPERIIDAE		*Metisella malgacha orina* Van, 1976	gardens, grassland, vleis	Drakensberg in Lesotho and KwaZulu-Natal	widespread	fairly common	No threat	No	*Ehrharta erecta*	4	0
HESPERIIDAE		*Metisella meninx* (Trimen, 1873)	marshy habitats	southern and eastern Tvl., northern Free State and KwaZulu-Natal	wide	Rare	Habitats destroyed	No	flowers, grass blades	4	5
HESPERIIDAE		*Metisella metis metis* (Linnaeus, 1764)	bushveld, forests	Tvl. escarpment, KwaZulu-Natal, south Cape coastal areas	relatively widespread	common		Possibly: Grassland	various grass species	3	5
HESPERIIDAE		*Metisella syrinx* (Trimen, 1868)	mountain bamboo on high mountains	endemic to SA and found in Eastern Cape and Lesotho	limited	Rare	No known threats	Possibly: Grassland	*Thamnocalamus tessallatus*	3	0
HESPERIIDAE		*Metisella willemi* (Wallengren, 1857)	grassy areas, deciduous woodland, bushveld	North-West Province, Gauteng, Mpumalanga	widespread	relatively common	No threat	No	various grasses, Setaria sp.	4	5
HESPERIIDAE		*Parosmodes morantii morantii* (Trimen, 1873)	woodland, savanna	Gauteng, KwaZulu-Natal, Northern Province, Mpumalanga	widespread	common	No threat	No	*Termunalia* sp., *Combretum molle, Brildelia micrantha* etc.	4	0
HESPERIIDAE		*Pelopidas mathias* (Fabricius, 1798)	grassy woodlands and forest	Eastern Cape, KwaZulu-Natal, Gauteng, Mpumalanga, Northern Province	widespread	common	No threat	No	Ehrharta erecta, Panicum sp., *Andropogon* sp, Zea sp.	4	5
HESPERIIDAE		*Pelopidas thrax* (Hubner, 1821)	woodland, forest margins	Free State, Gauteng, Eastern Cape, Northern Province, Mpumalanga, KwaZulu-Natal	widespread	common	No threat	No	*Imperata cylindrica, Ehrharta erecta*	3	5
HESPERIIDAE		*Platylesches ayresii* (Trimen & Bowker, 1889)	grassland, bushveld	KwaZulu-Natal, Gauteng, Mpumalanga, Northern Province	widespread	common	No threat	No	*Parinari capensis*	3	0
HESPERIIDAE		*Platylesches neba* (Hewitson, 1877)	forest, coastal bush	Gauteng, KwaZulu-Natal, Mpumalanga, Northern Province	fairly wide spread	common	No threat	No	*Parinari capensis*	3	0
HESPERIIDAE		*Sarangesa motozi* (Wallengren, 1857)	savanna, forests	north-, west- & eastern Tvl., Eastern Cape, KwaZulu-Natal, Transkei	widespread	common		No	*Peristrophe hensii*	3	0
HESPERIIDAE		*Spialia agylla agylla* (Trimen, 1889)	grassland	Western, Eastern, Northern Cape, Free State, Gauteng, Lesotho, Mpumalanga, North-west Province	widespread	common	No threat	No	*Hermannia* sp., *Pavonia burchellii*	5	0
HESPERIIDAE		*Spialia asterodia* (Trimen, 1864)	grassy hillsides	western,northern, Eastern Cape, Free State, KwaZulu-Natal, Lesotho, Northern Province, Gauteng	widespread	common	No threat	No	*Hermannia diffusa, H. incana, Hibiscus* sp. etc.	5	0
HESPERIIDAE		*Spialia delagoae* (Trimen ,1898)	bushveld	North-West Province, Northern Province, Mpumalanga, KwaZulu-Natal	widely spread	fairly common	No threat	Possibly: Grassland	Unrecorded	3	0
HESPERIIDAE		*Spialia dismus* (Hopffer, 1855)	woodland, savanna, open montane areas	southern Africa	widespread	common	No threat	No	*Hermannia diffusa, H. incana, H. comosa, Sida* sp. etc.	4	0
HESPERIIDAE		*Spialia dromus* (Plotz, 1884)	woodland, forest, open clearings in forest	Eastern Cape, KwaZulu-Natal, Gauten, North-West Province, Mpumalanga	widespread	common	No threat	No	*Triumfetta tomentosa , Melhania* sp., *Waltheria* sp.	3	0
HESPERIIDAE		*Spialia mafa mafa mafa* (Trimen, 1870)	savanna, mountain areas	southern Africa, except east coast	widespread	local	No threat	No	*Hermannia depressa, Hibiscus aethopicus, Pavonia* sp.	4	0
HESPERIIDAE		*Spialia nanus* (Trimen, 1889)	karoid vegetation	Western Cape, western Eastern Province, Karoo, Free State, Northern Cape	widespread	common	No threat	No	*Hermannia diffusa, H. incana, H. comosa* etc.	3	0
HESPERIIDAE		*Spialia paula* (Higgins, 1925)	savanna	A marginal species found in Tvl. and northern Free State	wide	Indeterminate	Threatened by agriculture, urbanisation	No	flowers	3	0
HESPERIIDAE		*Spialia spio* (Linnaeus, 1767)	various	Widespread in southern Africa	widespread	very common		No	*Hermannia* spp., *Pavonia* spp., *Hibiscus* spp.	4	0
HESPERIIDAE		*Tsitana tsita* (Trimen, 1870)	grassy hillsides	Eastern Cape, northern Free State, Gauteng, Northern Province, Mpumalanga	widely distributed	common	No threat	No	Stipa dregeana	5	0
LYCAENIDAE		*Actizera lucida* (Trimen, 1883)	Karoo fringes, grassy slopes	southern Africa except Karoo, southwestern Cape	widespread	common	No threat	No	*Oxalis* sp., *Rhyncosia* sp., *Argyrolobium* sp. etc.	4	0
LYCAENIDAE		*Alaena amazoula amazoula* (Boisduval, 1847)	rocky outcrops in grassland, various	Eastern Cape, Transvaal, KwaZulu-Natal	widespread in habitat	common		Possibly: Grassland	lichen	4	0
LYCAENIDAE		*Alaena margaritacea* Eltringham, 1929	steep grassy slopes	endemic to the north eastern Tvl.	limited	Vulnerable	Threatened by afforestation	Yes	rock lichen	5	0
LYCAENIDAE		*Aloeides dentatis dentatis* (Swierstra, 1909)	highveld grassland	Highveld of the Tvl.	limited	Rare	The reserve at Ruimsig & Suikerbosrand. spp. safe	No	*Lotononis erianthe* (Fabaceae)	5	0
LYCAENIDAE		*Aloeides dentatis maseruna* (Riley, 1938)	flat grassland on sandy gravel soil	through the Free State and western Tvl.	limited	Indeterminate	Threatened by agriculture and human activities	No	*Hermannia jacobifolia* (Sterculiaceae)	5	0
LYCAENIDAE		*Aloeides macmasteri* Tite & Dickson, 1973	grassland, karoo	Eastern Cape, Karoo, Little Namaqualand	?	common	No threat	No	Unrecorded	5	0
LYCAENIDAE		*Aloeides mercera* Henning & Henning, 1987	rocky edge of Drakensberg mountain	southeastern Tvl. above Wakkerstroom and KwaZulu-Natal	limited	Rare	No known threats	Possibly: Grassland	Unknown ?	5	0
LYCAENIDAE		*Aloeides nubilus* Henning & Henning, 1982	moist highland areas of the eastern Tvl. and found on rocky outcrops in grasslands near forested areas	eastern Tvl.	limited	Rare	No immediate threats, but afforestation	No	flowers	5	0
LYCAENIDAE		*Aloeides penningtoni* Tite & Dickson, 1968	grassy hillsides	Eastern Cape, KwaZulu-Natal	limited	common		Possibly: Grassland	Unknown	5	0
LYCAENIDAE		*Aloeides pierus* (Cramer, 1779)	Western Cape, Eastern Cape, Lesotho, southern Free State	open sandy areas	relatively widespread	common		No	*Aspalathus* spp.	5	0
LYCAENIDAE		*Aloeides pringlei* Tite & Dickson, 1976	coarse grass and shrub on sandy loam	endemic to the Cape and found on the Great Winterberg mountains in the Eastern Cape	limited	Indeterminate	No known threats	Possibly: Grassland	*Merxmuellera* grass	5	5
LYCAENIDAE		*Aloeides rossouwi* Henning & Henning, 1982	rocky gullies below the summit of grassy escarpment of south-west Stofberg	near Stofberg in the Tvl.	limited	Rare	Threatened by agriculture	No	Unknown	5	0
LYCAENIDAE		*Aloeides taikosama* (Wallengren, 1857)	Unknown ?	Tvl., KwaZulu-Natal, Swaziland	relatively widespread	common		No	Unknown	2	0
LYCAENIDAE		*Aloeides trimeni trimeni* Tite & Dickson, 1973	grassland, karroid areas	All the provinces	widespread	common		No	*Asplathus* sp.	4	0
LYCAENIDAE		*Anthene amarah amarah* (Guerin-Meneville, 1849)	various, bushveld	Tvl., Free State, Karoo, KwaZulu-Natal, Eastern Cape	widespread	common		No	various Acacia spp.	3	0
LYCAENIDAE		*Anthene butleri lividu* (Trimen, 1881)	mountainous areas, gardens, savanna	eastern southern Africa	widespread	common		No	*Convledon* spp., *Kalanchoe crenata*	3	5
LYCAENIDAE		*Anthene definita definita* (Butler, 1899)	gardens, coastal bush, bushveld, forest edge, karoo	Transvaal, Swaziland, KwaZulu-Natal	widespread	common	No threat	No	*Schmidelia africana, Acacia karroo, Albizia distachya, Schotia* sp., *Pappea* sp. etc.	3	0
LYCAENIDAE		*Anthene minima* (Trimen, 1893)	thornveld	Marginal species from northern- KwaZulu-Natal and north eastern Tvl.	limited	Rare	Threatened by agriculture	Yes	flowers	3	0
LYCAENIDAE		*Aphnaeus hutchinsonii* Trimen & Bowker, 1887	bushveld, rocky outcrops	Tvl. bushveld, KwaZulu-Natal	limited	relatively common		No	*Acacia* spp.	3	0
LYCAENIDAE		*Axiocerses tjoane* (Wallengren, 1857)	bushveld	Tvl. bushveld, Eastern Cape, Transkei, KwaZulu-Natal	widespread	common		No	Unknown ?	3	0
LYCAENIDAE		*Azanus jesous jesous* (Guerin-Meneville, 1849)	various, near host	eastern southern Africa	widespread	common		No	flowers of *Acacia* spp., *Entada spicata*	4	0
LYCAENIDAE		*Cacyreus marshalli* Butler, 1897	various, but not in drier habitats	Widespread in Southern Africa, except Karoo, Namakwaland, Boesmanland	scattered through region	common		No	*Ceranium* spp., *Pelargonium* spp.	4	0
LYCAENIDAE		*Capys alphus* (Cramer, 1777)	fynbos, grassy fynbos	Western Cape, Transkei, eastern & central Tvl.	relatively widespread	common		Yes	*Protea* spp.	4	0
LYCAENIDAE		*Cnodontes pennington* Bennett, 1954	bushveld, coastal bush	Eastern, Northern Tv. & Gauteng, Zululand	limited	more common than		No	Unknown: lichen ?	3	0
LYCAENIDAE		*Cupidopsis cissus cissus* (Godart, 1824)	grassland	eastern southern Africa	widespread	relatively common		No	*Vigna* spp., *Eriosema* spp.	5	0
LYCAENIDAE		*Cyclyrius babaulti* (Stempffer, 1935)	wooded moist habitats	A marginal species and found in eastern Tvl.	wide	Indeterminate	No known threats	Possibly: Grassland	flowers	3	0
LYCAENIDAE		*Cyclyrius pirithous* (Linnaeus, 1767)	various	Widespread in southern Africa	widespwidesp	common		No	*Plumbago auriculata, Indigofera* spp., *Vigna* spp.	4	0
LYCAENIDAE		*Durbania amakosa amakosa* Trimen, 1862	rocky grassland	eastern Cape	local	common	No threat	No	Lichen	5	0
LYCAENIDAE		*Eicochrysops messapus mahallakoaena* (Godart, 1823)	bushveld, fynbos	Tvl., KwaZulu-Natal	relatively widespread	common		No	*Thesium* spp.	3	0
LYCAENIDAE		*Eicochrysops messapus messapus* (Godart, 1823)	bushveld, fynbos	Eastern Cape, Free State, Lesotho, southwestern Cape	relatively widespread	common		No	*Thesium* spp.	3	0
LYCAENIDAE		*Freyeria trochylus* (Freyer, 1845)	bushveld, grassland, marshes	eastern southern Africa	widespread	common		No	*Indigofera cryptantha, Heliotropium* spp.	4	0
LYCAENIDAE		*Gonatonyrina gorgias gorgias* (Stoll, 1790)	gardens, various	Transkei, KwaZulu-Natal, Tvl.	widespread	common		No	succulents	4	0

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 3. continue...

Family	Subfamily	Species name	Habitat	Distribution	Distribution range	Conservation status	Remarks	Edge species	Larval food	Habitat code	Larv.
LYCAENIDAE	-	*Gonatomyrina lara* (Linnaeus, 1764)	gardens, various	Cape Province, Free State, Lesotho	widespread	common		No	succulents	4	
LYCAENIDAE		*Harpendyreus noquasa* (Trimen & Bowker), 1887)	stream beds, marshy areas	eastern Transvaal, Wakkerstroom, Natal Drakensberg	widespread	common	No threat	No	*Alchemilla capensis*	4	
LYCAENIDAE		*Iolaus alienus alienus* (Trimen, 1898)	rocky areas	Tvl , northern Zululand	limited	common, females are rare		No	*Actinanthella wyliei*	3	
LYCAENIDAE		*Iolaus mimosae mimosae* Trimen, 1874	nearby larval host	Tvl , Eastern Cape, Eastern Karoo, KwaZulu-Natal	widespread	common		No		3	
LYCAENIDAE		*Iolaus pallene* (Wallengren, 1857)	nearby larval host	Tvl , Natal	widespread in habitat	relatively common		Yes	*Ximenia caffra*	3	
LYCAENIDAE		*Lachnocnema bibulus* (Fabricius, 1793)	coastal & inland bushveld	northern & eastern Tvl , Eastern Cape, KwaZulu-Natal	widespread	abundant		Yes	plant lice	3	
LYCAENIDAE		*Lampides boeticus* (Linnaeus, 1767)	various	Widespread in Southern Africa	widespread & scattered	common		No	flowers, seed of various spp.	4	
LYCAENIDAE		*Lepidochrysops asteris* (Godart, 1819)	grassy slopes of elevated hills	eastern Cape, Transkei, KwaZulu-Natal	widespread	common	No threat	No	*Selago* spp., *Becium burchellianum, Plectranthus grandidentatus*	5	
LYCAENIDAE		*Lepidochrysops hypopolia* (Trimen, 1887)	grassland	Natal and Tvl Highveld	limited	Extinct	Possibly already extinct	No	Unknown	5	
LYCAENIDAE		*Lepidochrysops ignota* (Trimen & Bowker, 1887)	grassland	KwaZulu-Natal, Tvl	limited	common		No	*Becium* spp.	5	
LYCAENIDAE		*Lepidochrysops jefferyi* (Swierstra, 1907)	grassy hilltops and slopes with scattered trees	Baberton in eastern Tvl	limited	Rare	No known threats	Possibly: Grassland	*Becium obovatum*	5	
LYCAENIDAE		*Lepidochrysops letsea* (Trimen, 1870)	Highveld grassland	Free State, Tvl highveld, Western Lesotho	limited	common		No	*Hemizygia pretoriae*	5	
LYCAENIDAE		*Lepidochrysops loewenstemi* (Swanepoel, 1951)	grassy mountain slopes	Lesotho	limited	Rare	No known threats	Possibly: Grassland	flowers	3	
LYCAENIDAE		*Lepidochrysops lotana* Swanepoel, 1962	grassy slopes	endemic to the Tvl	limited	Vulnerable	Threatened by agriculture	Yes	*Becium obovatum*	5	
LYCAENIDAE		*Lepidochrysops oosthuizeni* Swanepoel & Vari, 1983	rocks or low bushes	north-eastern Cape and Lesotho	limited	Rare	No known threats	No	*Selago galpinii* .	3	
LYCAENIDAE		*Lepidochrysops orrygia* (Trimen, 1887)	grassland	relatively widespread	relatively widespread	common		No	*Selago* spp., *Becium* spp.	5	
LYCAENIDAE		*Lepidochrysops patricia* (Trimen, 1887)	open grassland, bushveld, forest edge	Free State, Tvl , Natal, Eastern Cape, southern Cape	widespread	common		No	*Lantana* spp.	4	0
LYCAENIDAE		*Lepidochrysops pephredo* (Trimen, 1889)	grassy slopes	KwaZulu-Natal	limited	Rare	No known threats	Possibly: Grassland	*Becium obovatum*	5	0
LYCAENIDAE		*Lepidochrysops plebeia plebeia* (Butler, 1898)	bushveld, grassy areas	Tvl , KwaZulu-Natal, North-western Free State	widespread	common		No	*Lantana rugosa*	4	0
LYCAENIDAE		*Lepidochrysops swanepoeli* Pennington, 1948	grassy summits	eastern Tvl at Baberton and in northern KwaZulu-Natal	limited	Rare	No known theats	Possibly: Grassland	*Becium* sp.	5	
LYCAENIDAE		*Lepidochrysops tantalus* (Trimen & Bowker, 1887)	grassland	Transkei, KwaZulu-Natal, eastern Tvl	limited	common		Possibly: Grassland	*Becium obovatum*	5	
LYCAENIDAE		*Lepidochrysops variabilis* Cottrell, 1965	grassland	south-west Cape, Eastern Cape, KwaZulu-Natal, Tvl , Lesotho	relatively widespread	common		No	*Selago* spp.	5	0
LYCAENIDAE		*Lepidochrysops victori* Pringle, 1984	high altitude on the foothills of the Great Winterberg	foothills of the Great Winterberg, eastern Cape	limited	Rare	No known threats	Possibly: Grassland	*Selago* spp.	5	0
LYCAENIDAE		*Leptotes pirithous* (Linnaeus, 1767)	various habitats	southern Africa	widespread	common	No threat	No	*Plumbago auriculata, Indigofora, Vigna* etc.	4	0
LYCAENIDAE		*Lycaena clarki* Dickson, 1971	grassland, marshes	Free State, Tvl Highveld, Eastern Cape, KwaZulu-Natal	widespread	common		No	*Rumex* spp.	5	0
LYCAENIDAE		*Myrina silenus ficedula* (Fabricius, 1775)	thornveld ?	Transkei, Tvl bushveld, KwaZulu-Natal	widespread	common		No		3	0
LYCAENIDAE		*Orachrysops subravus* (Henning & Henning, 1994)	montane grassland, near streams	Eastern Cape, Natal Drakensberg, Transkei	widespread	common		No	*Indigofera* sp.	4	0
LYCAENIDAE		*Oraidium barberae* (Trimen, 1868)	various, near host	Widespread in southern Africa	widespread	common	No threat	No	*Exomis microphylla*	4	0
LYCAENIDAE		*Poecilmitis chrysaor* (Trimen, 1864)	hilly grassland	Free State, Lesotho, eastern Cape	widespread	common	No threat	No	*Cotelydon orbiculata , Rhus* sp., *Zygophyllum sessilifolium*	5	0
LYCAENIDAE		*Poecilmitis aureus* Van Son, 1966	slopes of hills on grassy, damp patches	endemic to the Tvl , Heidelberg and Suikerbosrand Nature Reserve	limited	Rare	No threats	No	*Clutia pulchella* (Euphorbiaceae)	5	
LYCAENIDAE		*Poecilmitis lycegenes* (Trimen, 1874)	grassy highveld	eastern Free State, KwaZulu-Natal & adjoining Tvl	localised	common		No	*Myrsine africana, Diospyros austro-africana* ,	5	
LYCAENIDAE		*Spindasis ella* (Hewitson, 1865)	bushveld, thornveld, savanna	northern & western Free State, Tvl , KwaZulu-Natal, north-east Cape	widespread	common		No	*Acacia* spp. in association with ants	3	0
LYCAENIDAE		*Spindasis mozambica* (Bertolini, 1850)	grassland, bushveld	KwaZulu-Natal, Eastern & Northern Tvl	relatively widespread	common		Possibly: Grassland	*Sphenostylis angustifolia*	4	0
LYCAENIDAE		*Spindasis natalensis* (Westwood, 1852)	bushveld, coastal bush, rocky hilltops	Eastern Cape, KwaZulu-Natal, Free State, Tvl	widespread	fairly common		No	*Canthium inerme, Mundulea* spp., *Clerodendrum glabrum*	3	0
LYCAENIDAE		*Stugeta bowkeri bowkeri* (Trimen, 1864)	bushveld	Northern Cape, Eastern Cape, Karoo, KwaZulu-Natal, Transkei	widespread in habitat	common		No	*Ximenia caffra, Viscum* spp.	3	0
LYCAENIDAE		*Stugeta bowkeri henningi* (Trimen, 1864)	Unknown ?	southern Tvl & Free State	widespread in habitat	common		No	*Ximenia caffra, Viscum* spp.	2	0
LYCAENIDAE		*Stugeta bowkeri tearei* (Trimen, 1864)	Unknown ?	Tvl	widespread in habitat	common		No	*Ximenia caffra, Viscum* spp.	2	0
LYCAENIDAE		*Tarucus sybaris sybaris* (Hopffer, 1855)	near host plant	Free State, Tvl , Eastern Cape, KwaZulu-Natal	widespread	common		No	*Ziziphus* spp.	3	0
LYCAENIDAE		*Thestor basutus basutus* (Wallengren, 1857)	various	eastern southern Africa	widespread	common	No threat	No	Psyllids (Homoptera)	4	0
LYCAENIDAE		*Thestor compassbergae* Quickelberge & McMaster, 1970	low bushes and tufts of grass	endemic to the Cape, found in eastern Cape	limited	Indeterminate	No known threats	Possibly: Grassland	grass species	4	5
LYCAENIDAE		*Tuxentius melaena melaena* (Trimen, 1887)	Unknown ?	Eastern Cape, Free State, Tvl , KwaZulu-Natal	widespread	common		No	*Ziziphus mucronata*	2	0
LYCAENIDAE		*Virachola antalus* (Hopffer, 1855)	various, except central Karoo & Northern Cape	Widespread in Southern Africa, except central Karoo & Northern Cape	widespread	very common		Possibly: Grassland	fruit & seed of *Acacia-, Schotia-, Cassia* spp.	4	0
LYCAENIDAE		*Virachola dinochares* (Grose-Smith, 1887)	thornveld	Transvaal, KwaZulu-Natal	widespread	common		No	fruit of *Syzygium* spp., *Acacia* spp., *Combretum* spp.	3	0
LYCAENIDAE		*Zizeeria knysna* (Trimen, 1862)	grassland, woodland, forest edge	southern Africa	widespread	common	No threat	No	*Tribulus terrestris, Amaranthus deflexus, A. viridis, Zornia, Euphorbia*	4	0
LYCAENIDAE		*Zizula hylax hylax* (Fabricius, 1775)	grassy areas, various	Widespread in southern Africa, except north-west Cape, Namakwaland, Great Karoo	widespread	common		No	*Phaulopsis imbricata, Ruellia* spp., *Justicia* spp.	4	0
NYMPHALIDAE		*Hyalites anacreon* (Trimen, 1868)	high-rainfall mountains, streams	eastern Cape, KwaZulu-Natal, eastern Transvaal	widespread	common	No threat	No	*Adenia* spp., *Clytfortia linearifolia, Adenia* spp.	4	0
NYMPHALIDAE	ACRAEINAE	*Acraea eponina eponina* (Cramer, 1780)	long grass next to forests	Eastern Cape, KwaZulu-Natal, eastern & northern Tvl , Swaziland	widespread	common		Possibly: Grassland	*Triumfetta* spp.	4	0
NYMPHALIDAE	ACRAEINAE	*Acraea horta* (Linnaeus, 1764)	gardens, thickets	eastern southern Africa	widespread	very common		No	*Kigelia africana, Passiflora* species	3	0
NYMPHALIDAE	ACRAEINAE	*Acraea machequena* Grose-Smith, 1887	bushveld areas but may be found in intervening habitats	A marginal species migrating periodically into South Africa, isolated records in Tvl	marginal	Indeterminate	No threats	Yes	flowers	3	0
NYMPHALIDAE	ACRAEINAE	*Acraea natalica natalica* Boisduval, 1847	thickets, dry grassland of Northwest Tvl	Transkei, KwaZulu-Natal, Northwest Tvl , Eastern Cape	widespread	very common		No	*Adenia gummifera, Passiflora* spp., *Trichiceras* spp.	4	0
NYMPHALIDAE	ACRAEINAE	*Acraea neobule neobule* (Doubleday, 1848)	grassland, bushveld	central & eastern southern Africa	widespread	very common		No	*Passiflora edulis, Adenia gummifera*	4	
NYMPHALIDAE	ACRAEINAE	*Acraea rahira rahira* Boisduval, 1833	swamps, dams, rivers, streams	moister areas of southern Africa, but not in the Karoo & Northern Cape	widespread	common		No	*Comyza canadensis, Polygonum pulchrum*	4	
NYMPHALIDAE	ACRAEINAE	*Acraea zetes* (Linnaeus, 1758)	thornveld	Northern & Western Tvl , Western Free State, Zululand	widespread	common		No	*Passiflora* spp., *Adenia glauca*	3	
NYMPHALIDAE	ACRAEINAE	*Acrea anemosa* Hewitson, 1865	bushveld	drier areas of Tvl bushveld, Northern KwaZulu-Natal	widespread in habitat	very common		No	*Adenia venenata*	3	
NYMPHALIDAE	ACRAEINAE	*Pardopsis punctatissima* (Boisduval, 1833)	rocky habitats	Transkei, KwaZulu-Natal, eastern Tvl , Eastern Cape	widespread in limited	recorded in many localities		Possibly: Grassland	*Hybanthus capensis*	5	
NYMPHALIDAE	CHARAXINAE	*Charaxes achaemenes achaemenes* C & R. Felder, 1867	bushveld	Tvl bushveld, Swaziland, KwaZulu-Natal, Transkei	widespread in habitat	common, Protected in Tvl		Yes	*Pterocarpus rotundifolius, Dalbergia boehmii* etc.	3	
NYMPHALIDAE	CHARAXINAE	*Charaxes candiope candiope* (Godart, 1819)	thickets	esterm& central Tvl , KwaZulu-Natal	widespread in habitat	very general, Protected in		Yes	*Croton* spp.	3	
NYMPHALIDAE	CHARAXINAE	*Charaxes jahlusa jahlusa* (Trimen, 1862)	bushveld	Eastern Cape, KwaZulu-Natal, Tvl , Swaziland	widespread	common, Protected in Tvl		No	*Pappea capensis*	3	0
NYMPHALIDAE	CHARAXINAE	*Charaxes jahlusa rex* (Trimen, 1862)	bushveld	Eastern Cape, KwaZulu-Natal, Tvl , Swaziland	widespread	common, Protected in Tvl		Yes	*Pappea capensis*	3	0
NYMPHALIDAE	CHARAXINAE	*Charaxes jasius saturnus* Butler, 1865	hilltops, bushveld	Northern KwaZulu-Natal, Tvl bushveld	widespread in habitat	common, Protected in Tvl		Yes	*Hibiscus* spp., *Croton* spp., *Afzelia quanzensis* etc.	3	0
NYMPHALIDAE	DANAINAE	*Bicyclus safitza safitza* (Hewitson, 1851)	forests & thickets	eastern forests of South Africa, Eastern Cape, KwaZulu-Natal, eastern Tvl , northern Tvl	wide	common	Most common brown butterfly in Africa	Possibly: Grassland	various grass species.	3	
NYMPHALIDAE	DANAINAE	*Danaus chrysippus aegyptus* (Schreber, 1759)	various Larves use various species of *Ceropegia, Stapelia, Huernia*, family Asclepiadaceae	Widespread in southern Africa	wide	common	Widespread in Europe	No	melkbos	4	
NYMPHALIDAE	DANAINAE	*Hamotesia perspicua* (Trimen, 1873)	wet forest, thickets, alongside rivers & dams	Natal coast, Northern Tvl , Mozambique	limited	common		Possibly: Grassland	various grass species.	3	
NYMPHALIDAE	DANAINAE	*Melanitis leda helena* (Westwood, 1851)	southern African rain forests	South African forests, Free State, KwaZulu-Natal, Tvl , Eastern Cape	wide	common		No	*Cynodon* spp.	3	
NYMPHALIDAE	NYMPHALINAE	*Byblia ilithyia* (Drury, 1773)	Eastern Cape, Free State, various	Free State, eastern Karoo	widespread	common		No	Unknown ?	4	0
NYMPHALIDAE	NYMPHALINAE	*Catacroptera cloanthe cloanthe* (Stoll, 1781)	wet grassland	Eastern Cape, Tvl , Zululand, Natal, Eastern Cape	widespread in habitat	common		No	*Justicia rottracta, Asclepias* spp. etc.	5	0
NYMPHALIDAE	NYMPHALINAE	*Hypolimnas misippus* (Linnaeus, 1764)	various, except drier habitats	Throughout southern Africa, except Karoo, Namakwaland, Northwest Cape	widespread	common		No	*Asystasia* spp., *Talinum* spp., *Portulaca* spp.	4	0
NYMPHALIDAE	NYMPHALINAE	*Junonia hierta cebrene* Trimen, 1870	various, except the drier Karoo, Namakwaland, north-east Cape	Widespread in southern Africa, except the drier Karoo, Namakwaland, North-east Cape	widespread	common		No	*Adhatoda natalensis, Ruellia cordata*	3	0
NYMPHALIDAE	NYMPHALINAE	*Junonia octavia sesamus* (Trimen, 1883)	gardens, bushveld, rocky areas, thickets	Eastern Cape,eastern & northern Tvl , KwaZulu-Natal	widespread in habitat	common		Yes	*Coleus* spp., *Plectranthus* spp.	3	
NYMPHALIDAE	NYMPHALINAE	*Junonia oenone oenone* (Linnaeus, 1758)	hilltops	Eastern Cape, Transkei, KwaZulu-Natal, Tvl , Free State	widespread	common		No	*Asystasia gangetica, Barleria stuhlmannii* etc.	5	0
NYMPHALIDAE	NYMPHALINAE	*Junonia orithya madagascariensis* (Guenee, 1865)	thornveld	Free State, Tvl , KwaZulu-Natal	widespread	common, occurs		No	*Hygrophila* spp., *Plectranthus* spp. etc.	3	0
NYMPHALIDAE	NYMPHALINAE	*Phalantha phalantha aethiopica* (Rothschild & Jordan, 1903)	wetter eastern southern Africa	Eastern Cape, Free State, Tvl , KwaZulu-Natal, Transkei	widespread	common		No	*Populus alba, Maytenus* spp., *Trimeria grandifolia*	4	0
NYMPHALIDAE	NYMPHALINAE	*Precis octavia sesamus* Trimen, 1883	grassland, hills, gardens	Eastern Cape, KwaZulu-Natal, Transvaal, Swaziland	widespread	common	No threat	No	*Coleus* sp., *Plectranthus floribundus* etc.	4	0
NYMPHALIDAE	NYMPHALINAE	*Precis oenone oenone* (Linnaeus, 1788)	bushveld, grassland, woodland	Eastern Cape upwards through southern Africa	widespread	common	No threat	No	*Asystasia gangetica, Mackaya bella, Adhatoda densiflora*	4	0
NYMPHALIDAE	NYMPHALINAE	*Vanessa Cynthia cardui* (Linnaeus, 1758)	various	Widespread in southern Africa	widespread	common		No	*Asteraceae, Boraginaceae, Malvaceae* etc.	4	0

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 3. continue...

Family	Subfamily	Species name	Habitat	Distribution	Distribution range	Conservation status	Remarks	Edge species	Larval food	Habitat code	Larval grass food
NYMPHALIDAE	SATYRIDAE	*Aeropetes tulbaghia* C18	rocky areas	Drakensberg mountains down to southern Cape mountains	wide in limited habitat	common		No	various grass species	3	5
NYMPHALIDAE	SATYRIDAE	*Cassnympha cassius* (Godart, 1823)	coastal bush, rainforest	Eastern Cape, Transvaal, KwaZulu-Natal, Cape Peninsula	widespread	common	No threat	No	*Juncus capensis, Afrachneria capensis*	3	0
NYMPHALIDAE	SATYRIDAE	*Coenyra hebe* (Trimen, 1862)	shrubs, next to footpaths	Transvaal Lowveld to Zululand	limited	common		Yes	various grass species	3	5
NYMPHALIDAE	SATYRIDAE	*Dingana dingana* Henning & Henning, 1984	high elevation grassy ridges on the eastern Tvl. Drakensberg escarpment (Wakkerstroom region)	endemic to Tvl. inhabiting the escarpment above Wakkerstroom, south eastern Tvl.	limited	Rare	No known threats.	No	grass species	5	5
NYMPHALIDAE	SATYRIDAE	*Dingana dingana bella* Van Son, 1955	steep grassy hillsides	Found near Cradock and Cambedoo Mountains in the Eastern Cape	limited	Indeterminate	No known threats.	Possibly: Grassland	*Merxmuellera* grass	5	5
NYMPHALIDAE	SATYRIDAE	*Dingana bowkeri bowkeri* (Trimen, 1870)	hilly & mountainous country	KwaZulu-Natal, Tvl., Eastern Cape, Free State	widespread	common		No	*Danthonia* sp.	4	0
NYMPHALIDAE	SATYRIDAE	*Dingana dingana* (Trimen, 1873)	montane grassland, Transvaal Drakensberg	Transvaal Drakensberg, Natal, Drakensberg, Wolkberg, endemic to Biome?	limited	common		No	various grass species	5	5
NYMPHALIDAE	SATYRIDAE	*Dira jansei* Swierstra, 1911	wooded grassland on south facing slopes	endemic to Tvl. occurring from Makapans Caves to Marieskop	limited	Indeterminate	Veld fires are a threat	Yes	grass species	5	5
NYMPHALIDAE	SATYRIDAE	*Dira oxylus* (Trimen, 1881)	mountainous- rocky grassland areas	Kokstad, endemic?	limited	common	endemic to Kokstad ?	Yes	various grass species	5	5
NYMPHALIDAE	SATYRIDAE	*Paralethe dendrophilus* (Trimen, 1862)	rain forests	Eastern Cape, Transkei, KwaZulu-Natal, Northern Tvl.	wide in habitat preferred	common		Possibly: Grassland	various grass species	3	5
NYMPHALIDAE	SATYRIDAE	*Pseuss hierta cebrene* (Trimen, 1870)	grassy spots, open ground, gardens, bushveld	southern Africa, except western Cape and Karoo	widespread	common	No threat	No	*Adhatoda densiflora, Ruellia cadata* etc	4	0
NYMPHALIDAE	SATYRIDAE	*Pseudonympha camdeboo* Dickson, 1982	open grassland on the edges of thick bush	Camdeboo Mountains	limited	Indeterminate	No threats	Possibly: Grassland	grass ?	4	5
NYMPHALIDAE	SATYRIDAE	*Pseudonympha machacha* Riley, 1938	montane & alpine grasslands	Drakensberg, Lesotho, Eastern Cape	limited	common		No	various grass species	5	5
NYMPHALIDAE	SATYRIDAE	*Pseudonympha magoides* Van Son, 1955	grassy slopes of hills	eastern Cape, to the Wolkberg in Tvl.	widespread	common	No threat	No	Various grasses	5	5
NYMPHALIDAE	SATYRIDAE	*Pseudonympha paragaika* Vári, 1971	high elevation grassland on the southern aspects of mountains	endemic to the Free State and was discovered in the Golden Gate Higlands National Park	limited	Rare	No threats	No	grass ?	5	5
NYMPHALIDAE	SATYRIDAE	*Pseudonympha swanepoeli* Van Son, 1955	marshy valley high up in the mountains	endemic to the Tvl. between Houtbosdorp and Woodbush	limited	Rare	Threatened by afforestation	Yes	grass ?	4	5
NYMPHALIDAE	SATYRIDAE	*Pseudonympha varii* Van Son, 1955	grassy slopes of hills, stream banks, fynbos	eastern Cape, Amatola Mountains, KwaZulu-Natal midlands	widespread	relatively common	No threat	No	grasses, further unrecorded	4	5
NYMPHALIDAE	SATYRIDAE	*Stygionympha scotina scotina* Quickelberge,1977	summits of mountains	eastern Cape, Natal Drakensberg, Lesotho, Free State	widespread	common	No threat	No	Unrecorded	5	0
NYMPHALIDAE	SATYRIDAE	*Stygionympha vigilans* (Trimen, 1887)	rocky areas in open grasslands in mountainous country	mountains of Lesotho, KwaZulu-Natal, Eastern and Western Cape	widespread in limited	common		No	various grass species & *Resino cancinnatus*	5	5
NYMPHALIDAE	SATYRIDAE	*Stygiommpha wichgrafi wichgrafi* Van Son, 1955	grassland	eastern Cape, Lesotho, KwaZulu-Natal lower altitudes	widespread	common	No threat	No	grass	5	5
NYMPHALIDAE	SATYRIDAE	*Torynessa orangiea* Vári, 1971	high elevation grassland of Golden Gate	Found in the Free State in the Golden Gate and in the intervening mountains of Lesotho	limited	Rare	No known threats	No	*Merxmuellera* grass	5	5
NYMPHALIDAE	SATYRIDAE	*Torynessa pringlei* Dickson, 1979	grassy slopes	Found in Lesotho	limited	Rare	Threatened by overgrazing and soil erosion.	Possibly: Grassland	grass ?	5	5
PAPILIONIDAE	PAPILIONIDAE	*Papilio demodocus demodocus* Esper, 1798	most habitats	southern Africa	widespread	common	No threat	No	*Clausena anisata, Citrus* sp. etc	4	0
PAPILIONIDAE	PAPILIONIDAE	*Papilio nireus lyaeus* Doubleday, 1845	wooded areas	KwaZulu-Natal, Transvaal, Swaziland, Eastern Cape, Free State	widespread	common	No threat	No	*Calodendron capense, Clausena inaequalis, Calodendron capense, Fagara capensis*, cultivated citrus	3	0
PIERIDAE		*Belenois aurota aurota* (Fabricius, 1793)	various	Widespread insouthern Africa	widespread	very common		No	*Boscia oleoides, Capparis fascicularis, Maerua cafra*	4	0
PIERIDAE		*Belenois creona severina* (Stoll, 1781)	thickets, savanna, edge of forests	Eastern Cape, Tvl., KwaZulu-Natal, Transkei	widespread	common		No	*Boscia oleoides, Capparis fascicularis, Maerua cafra*	3	0
PIERIDAE		*Belenois gidica* (Godart, 1819)	woodland, coastal bush	eastern Tvl., Eastern Cape, Natal, Swaziland	widespread	common	No threat	No	*Boscia oleoides, Maerua cafra, Capparis fascicularis*	3	0
PIERIDAE		*Belenois zochalia zochalia* (Boisduval, 1836)	coastal bush, thickets, forests	Tvl. Highveld, KwaZulu-Natal, Transkei, eastern Cape	widespread	common		No	*Capparis citrifolia*	3	0
PIERIDAE		*Catopsilia florella* (Fabricius, 1775)	various	Widespread in southern Africa	widespread	common		No	*Maerua* spp.	3	0
PIERIDAE		*Colias electo electo* (Linnaeus, 1763)	various	Widespread in southern Africa	widespread	common		No	*Cassia* spp., possibly other plant spp.	4	0
PIERIDAE		*Colotis agove agove* (Wallengren, 1857)	bushveld, drier areas	Namakwaland, western Tvl., western Free State, Northern Karoo	localised	common		No	*Medicago sativa, Trifolium* spp., *Vicia* spp. etc.	4	0
PIERIDAE		*Colotis antevippe gavisa* C39	bushveld, coastal bush, savanna	eastern & northern Tvl., north-east Cape, KwaZulu-Natal, Transkei	widespread	very common		Yes	*Boscia* spp., *Cadaba* spp.	3	0
PIERIDAE		*Colotis celimene amina* (Hewitson, 1866)	bushveld	northern & western Tvl.	relatively widespread	common		Yes	*Capparis* spp., *Boscia* spp.	3	0
PIERIDAE		*Colotis eris eris* (Klug, 1829)	bushveld, Karoo	western Free State, Namakwaland, Tvl., KwaZulu-Natal, north-east Cape	widespread	common		No	*Boscia oleoides*	3	0
PIERIDAE		*Colotis euippe omphale* (Godart, 1819)	savanna, coastal bush, woodland	southern Africa except south-western Western Cape and high-altitude grassland	widespread	common	No threat	No	*Boscia albitrunca, Maerua cafra, Moringa*	3	0
PIERIDAE		*Colotis evagore antigone* (Boisduval, 1836)	open bushlveld	Tvl, western Free State, Eastern Cape, Transkei, KwaZulu-Natal	widespread	common		No	*Capparis sepiaria, Cadaba aphylla, Maerua cafra*	3	0
PIERIDAE		*Colotis evenina evenina* (Wallengren, 1857)	bushveld	Free State, north-, west- & eastern Tvl., KwaZulu-Natal, Swaziland	widespread	common		No	*Capparis* spp.	3	0
PIERIDAE		*Colotis ione* (Godart, 1819)	thornveld, bushveld	Northern & eastern Tvl.	relatively widespread	common		No	Maerua racemulosa spp.	3	0
PIERIDAE		*Colotis regina* (Trimen, 1863)	bushveld	Tvl., Zululand, Swaziland, north-east Cape	widespread	common		No	*Capparis* spp., *Boscia* spp.	3	0
PIERIDAE		*Colotis subfasciatus subfasciatus* (Swainson, 1823)	bushveld, grassland, savanna	Tvl., Western Free State, Northern Cape	widespread	common		No	*Boscia albitrunca*	4	0
PIERIDAE		*Colotis vesta argillaceus* (Reiche, 1849)	thornveld, bushveld	Tvl. bushveld, KwaZulu-Natal, eastern Tvl., Swaziland	relatively widespread	common		Yes	*Maerua angolensis*	3	0
PIERIDAE		*Colotis vesta mutans* (Reiche, 1849)	thornveld, bushveld	Western Tvl., Botswana, Zimbabwe, Namibia	relatively widespread	common		Yes	*Maerua angolensis*	3	0
PIERIDAE		*Eurema brigitta brigitta* (Stoll, 1780)	various	Widespread in southern Africa, except in the drier Karoo, Namakwaland, south-west Cape	widespread	very common		No	*Cassia mimosoides, Hypericum aethiopicum*	4	0
PIERIDAE		*Mylothris agathina agathina* (Cramer, 1779)	wooded habitats	Transvaal, east coast	widespread	common	No threat	No	*Tapinanthus kraussianus* etc	3	0
PIERIDAE		*Mylothris rueppellii haemus* (Trimen, 1879)	drier thickets, forests	Eastern Cape, Tvl., KwaZulu-Natal, Transkei	widespread	common		No	Viscum spp.	3	0
PIERIDAE		*Pinacopteryx eriphia eriphia* (Godart, 1819)	various	Widespread in southern Africa, except parts of Namakwaland, Gordonia, Skiereiland	widespread	very common		No	*Boscia oleoides, Maerua cafra*	4	0
PIERIDAE		*Pontia helice helice* (Linnaeus, 1764)	various, especially grassland or open country	Widespread in southern Africa	widespread	very common		No	*Heliophila* spp., *Reseda odorata*	4	0

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 27. Red Data Book butterfly species that occur in the Grassland Biome

Family	Subfamily	Species name	Habitat	Distribution	Conservation status	Edge species	Habitat type	Larval grass food
NYMPHALIDAE	SATYRIDAE	*Dira jansei* Swierstra, 1911	wooded grassland on south facing slopes	endemic to Tvl. occurring from Makapans Caves to Marieskop	Indeterminate	Yes	1	5
NYMPHALIDAE	SATYRIDAE	*Dingana bowkeri bella* Van Son, 1955	steep grassy hillsides	Found near Cradock and Cambedoo Mountains in the eastern Cape	Indeterminate	Possibly: Grassland	1	5
NYMPHALIDAE	SATYRIDAE	*Dingana alaedeus* Henning & Henning, 1984	high elevation grassy ridges on the eastern Tvl. Drakensberg escarpment (Wakkerstroom region)	endemic to Tvl. inhabiting the escarpment above Wakkerstroom, south eastern Tvl.	Rare	No	1	5
NYMPHALIDAE	SATYRIDAE	*Torynesis orangica* Vári, 1971	high elevation grassland of Golden Gate	Found in the Free State in the Golden Gate and in the intervening mountains of Lesotho.	Rare	No	1	5
NYMPHALIDAE	SATYRIDAE	*Torynesis pringlei* Dickson, 1979	grassy slopes	Found in Lesotho	Rare	Possibly: Grassland	1	5
NYMPHALIDAE	SATYRIDAE	*Pseudonympha paragaika* Vári, 1971	high elevation grassland on the southern aspects of mountains	endemic to the Free State and was discovered in the Golden Gate Higlands National Park	Rare	No	1	5
NYMPHALIDAE	SATYRIDAE	*Pseudonympha swanepoeli* Van Son, 1955	marshy valley high up in the mountains	endemic to the Tvl. between Houtbosdorp and Woodbush.	Rare	Yes	2	5
NYMPHALIDAE	SATYRIDAE	*Pseudonympha camdeboo* Dickson, 1982	open grassland on the edges of thick bush	Camdeboo Mountains	Indeterminate	Possibly: Grassland	2	5
NYMPHALIDAE	ACRAEINAE	*Acraea machequena* Grose-Smith, 1887	bushveld areas but may be found in intervening habitats	(From KNP to Brits and Pietersburg) and Natal	Indeterminate	Yes	0	0
LYCAENIDAE		*Alaena margaritacea* Eltringham, 1929	steep grassy slopes	endemic to the north eastern Tvl.	Vulnerable	Yes	1	0
LYCAENIDAE		*Thestor compassbergae* Quickelbergae & McMaster, 1970	low bushes and tufts of grass	endemic to the Cape; found in eastern Cape	Indeterminate	Possibly: Grassland	2	5
LYCAENIDAE		*Aloeides pringlei* Tite & Dickson, 1976	coarse grass and shrub on sandy loam	endemic to the Cape and found on the Great Winterberg mountains in the Eastern Cape.	Indeterminate	Possibly: Grassland	1	5
LYCAENIDAE		*Aloeides dentatis dentatis* (Swierstra, 1909)	highveld grassland	highveld of the Tvl.	Rare	No	1	0
LYCAENIDAE		*Aloeides dentatis maseruna* (Riley, 1938)	flat grassland on sandy gravel soil	throughout the Free State and western Tvl.	Indeterminate	No	1	0
LYCAENIDAE		*Aloeides rossouwi* Henning & Henning, 1982	rocky gullies below the summit of grassy escarpment of south-west Stofberg	near Stofberg in the Tvl.	Rare	No	1	0
LYCAENIDAE		*Aloeides mubilus* Henning & Henning, 1982	moist highland areas of the eastern Tvl. and found on rocky outcrops in grasslands near forested areas	eastern Tvl.	Rare	No	1	0
LYCAENIDAE		*Aloeides merces* Henning & Henning, 1987	rocky edge of Drakensberg mountain	south eastern Tvl. above Wakkerstroom and Natal	Rare	Possibly: Grassland	1	0
LYCAENIDAE		*Poecilmitis aureus* Van Son, 1966	slopes of hills on grassy, damp patches	endemic to the Tvl., Heidelberg and Suikerbosrand Nature Reserve	Rare	No	1	0
LYCAENIDAE		*Anthene minima* (Trimen, 1893)	thornveld	Marginal species from northern-Natal and north-eastern Tvl.	Rare	Yes	0	0
LYCAENIDAE		*Cyclyrius babaulti* (Stempffer, 1935)	wooded moist habitats	A marginal species and found in eastern Tvl.	Indeterminate	Possibly: Grassland	0	0
LYCAENIDAE		*Lepidochrysops loewensteini* (Swanepoel, 1951)	grassy mountain slopes	Lesotho	Rare	Possibly: Grassland	0	0
LYCAENIDAE		*Lepidochrysops victori* Pringle, 1984	high altitude on the foothills of the Great Winterberg	foothills of the Great Winterberg, Eastern Cape	Rare	Possibly: Grassland	1	0
LYCAENIDAE		*Lepidochrysops pephredo* (Trimen, 1889)	grassy slopes	Natal	Rare	Possibly: Grassland	1	0
LYCAENIDAE		*Lepidochrysops swanepoeli* Pennington, 1948	grassy summits	eastern Tvl. at Baberton and in northern Natal	Rare	Possibly: Grassland	1	0
LYCAENIDAE		*Lepidochrysops jefferyi* (Swierstra, 1907)	grassy hilltops and slopes with scattered trees	Baberton in eastern Tvl.	Rare	Possibly: Grassland	1	0
LYCAENIDAE		*Lepidochrysops hypopolia* (Trimen, 1887)	grassland	Natal and Tvl. highveld	Extinct	No	1	0
LYCAENIDAE		*Lepidochrysops lotana* Swanepoel, 1962	grassy slopes	endemic to the Tvl.	Vulnerable	Yes	1	0
LYCAENIDAE		*Lepidochrysops oosthuizeni* Swanepoel & Vári, 1983	rocks or low bushes	north-eastern Cape and Lesotho	Rare	No	0	0
HESPERIIDAE	HESPERIIDAE	*Coeliades anchises* (Gerstaecker, 1871)	bushveld to riverine and coastal forest	Natal midlands to eastern and northern Tvl.	Rare	Yes	0	0
HESPERIIDAE	HESPERIIDAE	*Spialia paula* (Higgins, 1925)	savanna	A marginal species found in Tvl. and northern Free State	Indeterminate	No	0	0
HESPERIIDAE	HESPERIIDAE	*Metisella meninx* (Trimen, 1873)	marshy habitats	southern and eastern Tvl., northern Free State and Natal	Rare	No	2	5
HESPERIIDAE	HESPERIIDAE	*Metisella syrinx* (Trimen, 1868)	Mountain Bamboo on high mountains	endemic to SA and found in Eastern Cape and Lesotho	Rare	Possibly: Grassland	0	0

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 4. continue...

Order	Family	Species name	Common name	Habitat	Food	Conservation status	RDB Mark	Endemic mark	Food mark	Habitat preference	Habitat type
Rodentia	MURIDAE	*Dendromus mystacalis jamesoni*	Chestnut Climbing Mouse	grassland	seeds, insects, termites			3	6	1	1
Rodentia	MURIDAE	*Desmodillus auricularis*	Short-tailed Gerbil	grass cover, karroid bush, pan fringes with grass, bush	granivorous			3	4	3, 1	3
Rodentia	MURIDAE	*Lemniscomys rosalia spinalis*	Single-Striped Mouse	various, savanna, especially grassland areas, farms, short grass, vleis	seeds, herbage, insects			3	6	1, 3, 5, 2	2
Rodentia	MURIDAE	*Malacothrix typica fryi*	Large-eared Mouse	short grass, pan fringes, karroid bush	grass seed, green vegetable matter			3	3	1, 3	3
Rodentia	MURIDAE	*Mastomys coucha*	Multimammate Mouse	various, human settlements, agricultural land	omnivorous			3	6	3, 5	4
Rodentia	MURIDAE	*Mastomys natalensis*	Natal multimammate Mouse	various, human settlements, agricultural land	omnivorous			3	6	3, 5	4
Rodentia	MURIDAE	*Mus indutus pretoriae*	Desert Pygmy Mouse	scrub savanna	grass seeds, pods, fruit of buffalo thorn			3	3	3	4
Rodentia	MURIDAE	*Mus indutus valschensis*	Desert Pygmy Mouse	scrub savanna	grass seeds, dry pods, fruit, insects			3	3	3	4
Rodentia	MURIDAE	*Mus minutoides orangiae*	Pygmy Mouse	savanna grassland, woodland	grass seeds, termites, insects			3	6	3	4
Rodentia	MURIDAE	*Mus musculus*	House Mouse	houses, buildings, stores	omnivorous			3	6	5	5
Rodentia	MURIDAE	*Mystromys albicaudatus*	White-tailed Mouse	savanna grassland, karoo	omnivorous	Rare	4	1	6	3	4
Rodentia	MURIDAE	*Otomys angoniensis tugelensis*	Angoni Vlei Rat	vleis, swamps, grasslands, savannas	stems, fine reeds, rhizomes of grass			3	3	1, 2, 3	3
Rodentia	MURIDAE	*Otomys irroratus auratus*	Vlei Rat	grassland, moist habitat	grass, reed shoots, forbs			3	3	1, 2	2
Rodentia	MURIDAE	*Otomys irroratus randensis*	Vlei Rat	grassland, moist habitat	grass, reed shoots, forbs			3	3	1, 2	2
Rodentia	MURIDAE	*Otomys laminatus fannini*	Laminate Vlei Rat	grassland	shoots and stems of grasses, small shrubs			1	3	1	1
Rodentia	MURIDAE	*Otomys laminatus mariepsi*	Laminate Vlei Rat	grassland	shoots and stems of grasses, small shrubs			1	3	1	1
Rodentia	MURIDAE	*Otomys laminatus pondoensis*	Laminate Vlei Rat	grassland	shoots and stems of grasses, small shrubs			1	3	1	1
Rodentia	MURIDAE	*Otomys saundersiae*	Saunders' Vlei Rat	mountainous habitat	no information available			3	7	4	4
Rodentia	MURIDAE	*Otomys sloggetti basuticus*	Sloggett's Rat	high altitudes amongst rocks and forbs	leaves, stems and flowers of *Helichrysum* spp.			3	3	3, 4	4
Rodentia	MURIDAE	*Otomys sloggetti jeppei*	Sloggett's Rat	high altitudes amongst rocks and forbs	leaves, stems and flowers of *Helichrysum* spp.			3	3	3, 4	4
Rodentia	MURIDAE	*Otomys sloggetti robertsi*	Sloggett's Rat	high altitudes amongst rocks and forbs	leaves, stems and flowers of *Helichrysum* spp.			3	3	3, 4	4
Rodentia	MURIDAE	*Otomys sloggetti sloggetti*	Sloggett's Rat	high altitudes amongst rocks and forbs	leaves, stems and flowers of *Helichrysum* spp.			3	3	3, 4	4
Rodentia	MURIDAE	*Otomys sloggetti turneri*	Sloggett's Rat	high altitudes amongst rocks and forbs	leaves, stems and flowers of *Helichrysum* spp.			3	3	3, 4	4
Rodentia	MURIDAE	*Rattus rattus*	House Rat	rocks, thickets, human settlements	omnivorous			3	6	3, 4, 5	4
Rodentia	MURIDAE	*Rhabdomys pumilio dilectus*	Striped Mouse	grassland, agricultural land	omnivorous			3	6	1, 5	2
Rodentia	MURIDAE	*Rhabdomys pumilio griquae*	Striped Mouse	grassland, agricultural land	omnivorous			3	6	1, 5	2
Rodentia	MURIDAE	*Rhabdomys pumilio intermedius*	Striped Mouse	grassland, agricultural land	omnivorous			3	6	1, 5	2
Rodentia	MURIDAE	*Rhabdomys pumilio pumilio*	Striped Mouse	grassland, agricultural land	omnivorous			3	6	1, 5	2
Rodentia	MURIDAE	*Saccostomus campestris*	Pouched Mouse	grass fringes of pans, bushveld, rocky koppies, scrub bush	insectivorous granivore			3	6	3, 4, 1	3
Rodentia	MURIDAE	*Steatomys krebsii orangiae*	Kreb's Fat Mouse	sandy grassland	insects, seeds			3	6	1	1
Rodentia	MURIDAE	*Steatomys pratensis natalensis*	Fat Mouse	river fringes, swamps, cultivated land	seeds, insects, herbage			3	6	2, 3, 5	4
Rodentia	MURIDAE	*Tatera brantsii brantsii*	Highveld Gerbil	sandy soils with grass, scrub, woodland	omnivorous			3	6	3, 1	3
Rodentia	MURIDAE	*Tatera leucogaster*	Bushveld Gerbil	sandy soils, open grassland, savanna, termitaria	omnivorous			3	6	1, 3	3
Rodentia	MURIDAE	*Thallomys paedulcus*	Tree Rat	savanna woodland, riparian association	seed, leaflets			3	3	3	4
Rodentia	PEDETIDAE	*Pedetes capensis*	Springhaas	sandy soil substrate, overgrazed grassland, floodplain grassland, farmland	grass			3	3	1, 3, 5	3
Rodentia	SCUIRIDAE	*Xerus inauris*	Cape Ground Squirrel	open arid areas, open grassland, karroid areas, overgrazed areas	grasses, seed, insects, leaves			3	6	1, 3	3
Rodentia	THRYONOMYIDAE	*Thryonomys swinderianus*	Greater Canerat	reedbeds, tall grass, near lakes, agricultural land	roots, shoots, grass stems			3	3	2, 1, 5	3
Tubilentata	ORYCTEROPODIDAE	*Orycteropus afer*	Aardvark	grassland, various except desert & forest	ants, termites	Vulnerable	5	3	1	1, 2, 3	3

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 4. continue...

Order	Family	Species name	Common name	Habitat	Food	Conservation status	RDB Mark	Endemic mark	Food mark	Habitat preference	Habitat type
Chiroptera	RHINOLOPHIDAE	*Rhinolophus clivosus zulensis*	Geoffrey's Horseshoe Bat	woodland, forest edges	insects			3	1	3	4
Chiroptera	RHINOLOPHIDAE	*Rhinolophus darlingi darlingi*	Darling's Horseshoe Bat	savanna woodland, caves, mines, rocky outcrops	insects			3	1	3, 4, 5	4
Chiroptera	RHINOLOPHIDAE	*Rhinolophus hildebrandtii*	Hildebrandt's Horsehoe Bat	savanna woodland, absent from grassland	insects			3	1	3	4
Chiroptera	RHINOLOPHIDAE	*Rhinolophus simulator*	Bushveld Horseshoe Bat	caves, mines	insects			3	1	4, 5	4
Chiroptera	VESPERTILIONIDAE	*Eptesicus capensis*	Cape Serotine Bat	forest, savanna	insects			3	1	3	4
Chiroptera	VESPERTILIONIDAE	*Eptesicus somalicus*	Somali Serotine Bat	savanna, drier areas with water available	insects			3	1	3	4
Chiroptera	VESPERTILIONIDAE	*Miniopterus schreibersii natalensis*	Schreiber's Long-fingered Bat	cave dweller, mines	insects			3	1	3, 4, 5	4
Chiroptera	VESPERTILIONIDAE	*Myotis tricolor*	Temminck's hairy Bat	savanna woodland, drier open terrain, caves, mines	insects			3	1	3, 4, 5	4
Chiroptera	VESPERTILIONIDAE	*Myotis welwitschii*	Welwitsch's hairy Bat	savanna woodland	insects	Indeterminate	3	4	1	3	4
Chiroptera	VESPERTILIONIDAE	*Pipistrellus kuhlii subtilis*	Kuhl's Bat	various, near water, suitable roosting places	insects	Indeterminate	3	1	1	3, 2	4
Chiroptera	VESPERTILIONIDAE	*Pipistrellus nanus*	Banana Bat	woodland savanna, forest, banana plantations	insects			3	1	3, 5	4
Chiroptera	VESPERTILIONIDAE	*Pipistrellus rusticus rusticus*	Rusty Bat	savanna woodland with riverine conditions	insects	Indeterminate	3	4	1	3	4
Chiroptera	VESPERTILIONIDAE	*Scotophilus borbonicus viridis*	Lesser Yellow house Bat	savanna woodland with riverine conditions	insects			3	1	3	4
Chiroptera	VESPERTILIONIDAE	*Scotophilus dinganii*	Yellow House-Bat	rock walls, barns	insects			3	1	4, 5	4
Haplorhini	CERCOPITHECIDAE	*Cercopithecus aethiops pygerythrus*	Vervet Monkey	riparian, savanna, absent from grassland, except margins	omnivorous			3	6	3, 2, 4, 5	4
Hyracoidea	PROCAVIIDAE	*Procavia capensis capensis*	Rock Dassie	rock outcrops, rocky hills	grasses, forbs, shrubs			3	3	4	4
Insectivora	CHRYSOCHLORIDAE	*Amblysomus gunningi*	Gunning's Golden Mole	montane forest, montane grassland, cultivated land	insects			3	1	1, 3, 5	3
Insectivora	CHRYSOCHLORIDAE	*Amblysomus hottentotus hottentotus*	Hottentot Golden Mole	grassland, soft sandy ground, golf courses, sometimes forest	insects, earthworms			1	1	1, 3, 5	3
Insectivora	CHRYSOCHLORIDAE	*Amblysomus iris*	Zulu Golden Mole	sandy areas, further unknown	no information	indeterminate		1	7	3	4
Insectivora	CHRYSOCHLORIDAE	*Amblysomus julianae*	Juliana's Golden Mole	savanna , rocky outcrops, grassland	insectivorous	Indeterminate	3	1	1	1, 3, 4	3
Insectivora	CHRYSOCHLORIDAE	*Chlorotalpa sclateri montana*	Sclater's Golden Mole	high altitiudes of moist kloofs, rocky hillsides	not described	Indeterminate	3	1	7	4	4
Insectivora	CHRYSOCHLORIDAE	*Chlorotalpa sclateri sclateri*	Sclater's Golden Mole	high altitiudes of moist kloofs, rocky hillsides	not described	Indeterminate	3	1	7	4	4
Insectivora	CHRYSOCHLORIDAE	*Chrysopalax villosus rufopallidus*	Rough-haired Golden Mole	grassland, fringes of vleis	insects, earthworms	Vulnerable	5	1	1	1, 2	2
Insectivora	CHRYSOCHLORIDAE	*Chrysopalax villosus transvaalensis*	Rough-haired Golden Mole	grassland, ringes of vleis	insects, earthworms	Vulnerable	5	1	1	1, 2	2
Insectivora	CHRYSOCHLORIDAE	*Chrysospalax villosus rufus*	Rough-haired Golden Mole	grassland, fringes of vleis	insects, earthworms	Vulnerable	5	1	1	1, 2	2
Insectivora	ERINACEIDAE	*Atelerix frontalis frontalis*	South African hedgehog	various, grassland in Tvl., scrub bush, dry cover, gardens	omniviorous	Rare	3	3	6	3, 2, 1, 5	3
Insectivora	SORICIDAE	*Crocidura cyanea cyanea*	Reddish-grey Musk Shrew	dry terrain, rocks, dense grass, hedges, vlei, grassland	insectivorous			3	1	1, 2, 4, 3, 5	3
Insectivora	SORICIDAE	*Crocidura cyanea infumata*	Reddish-grey Musk Shrew	moister terrain, vleis, grassland with scrub, hedges	insectivorous			3	1	2, 1, 3, 5	3
Insectivora	SORICIDAE	*Crocidura flavescens*	Greater Musk Shrew	shrub, mountain country, vleis	insectivorous			1	1	2, 3	4
Insectivora	SORICIDAE	*Crocidura fuscomurina bicolor*	Tiny Musk Shrew	grassland, reeds near water, sandy soil near water	insectivorous			3	1	2, 1, 3	3
Insectivora	SORICIDAE	*Crocidura fuscomurina woosnami*	Tiny Musk Shrew	drier sandy areas, grass areas near water	insectivorous			3	1	2, 1, 3	3
Insectivora	SORICIDAE	*Crocidura hirta hirta*	Lesser red Musk Shrew	low bushes, damp vegetation along streams	insectivorous, cannibalistic			3	1	3, 2	4
Insectivora	SORICIDAE	*Crocidura maquassiensis*	Maquassie Musk Shrew	rocks among grass, montane grassland	insectivorous ?	Rare	3	2	1	1, 4	2
Insectivora	SORICIDAE	*Crocidura mariquensis mariquensis*	Swamp Musk Shrew	reedbeds, swamps, grassland near water's edge	insectivorous			3	1	2, 1	2
Insectivora	SORICIDAE	*Crocidura silacea silacea*	Peter's Musk Shrew	savanna woodland, grassland, rocks	insectivorous			3	1	3, 2, 4	4
Insectivora	SORICIDAE	*Myosorex cafer*	Dark-footed forest Shrew	moist, dense habitat, streams, montane grassland	insects, termites, beetles, grasshoppers			3	1	1, 2	2
Insectivora	SORICIDAE	*Myosorex varius*	Forest Shrew	dense habitat, dense grass in highveld	insects, termites, beetles, grasshoppers			1	1	1, 3	3
Insectivora	SORICIDAE	*Suncus infinitesimus chriseos*	Least Dwarf Shrew	termite mounds	insectivorous	Indeterminate	3	1	1	1, 3	3
Insectivora	SORICIDAE	*Suncus lixus*	Greater Dwarf Shrew	savanna woodland, riverine forest	insects			3	1	3	4
Insectivora	SORICIDAE	*Suncus varilla orangiae*	Lesser Dwarf Shrew	termite mounds in grassland	insectivorous			3	1	1	1
Lagomorpha	LEPORIDAE	*Lepus capensis*	Cape Hare	various, dry grassland	browse, grass, bush			3	3	3, 1	3
Lagomorpha	LEPORIDAE	*Lepus saxatilis*	Scrub Hare	ecotones, savanna woodland and scrub, absent from open grassland, agricultural land	leaves, stems, grass			3	3	3, 5	4
Lagomorpha	LEPORIDAE	*Pronolagus crassicaudatus*	Natal Red Rock Rabbit	steep hillsides with grass cover	grass			1	3	1, 4	2
Lagomorpha	LEPORIDAE	*Pronolagus randensis randensis*	Jameson's Red Rock Rabbit	rocky koppies, kloofs	grass			3	3	4	4
Lagomorpha	LEPORIDAE	*Pronolagus rupestris barretti*	Smith's Red Rock Rabbit	rocky hillsides, koppies, shrub	grass, sprouts after burn			3	3	3, 4	4
Lagomorpha	LEPORIDAE	*Pronolagus rupestris curryi*	Smith's Red Rock Rabbit	rocky hillsides, koppies, shrub	grass, sprouts after burn			3	3	3, 4	4
Macroscelidea	MACROSCELIDIDAE	*Elephantulus brachyrhynchus*	Short-snouted Elephant-shrew	well-watered, open grassland, shrub	insects, ants, termites			3	1	1, 3	3
Macroscelidea	MACROSCELIDIDAE	*Elephantulus myurus*	Rock Elephant-shrew	rocky koppies, boulders, not in grassland	insects, ants, termites			3	1	3, 4	4
Perissodactyla	EQUIDAE	*Equus burchelli*	Burchell's Zebra	savanna, grassland	grass, herbs			3	3	3, 1	3
Perissodactyla	EQUIDAE	*Equus quagga*	Quagga	Historically	grass		0	0	0	0	0
Perissodactyla	RHINOCEROTIDAE	*Ceratotherium simum*	White Rhinoceros	wooded grasslands	grass	Pleistocene frequently on grassland.	8	8	8	3	8
Pholidota	MANIDAE	*Manis temminckii*	Pangolin	savanna, savanna woodland, floodplain grassland, rocky outcrops	formicid ants	Vulnerable	5	2	1	3, 1, 4	3
Primates	CERCOPITHECIDAE	*Cercopithecus aethiops cloetei*	Vervet Monkey	riparian, savanna, absent from grassland, except margins	omnivorous			3	6	3, 2, 4, 5	4
Primates	CERCOPITHECIDAE	*Papio ursinus occidentalis*	Chacma Baboon	various	omnivorous			3	6	2, 3, 4, 5	4
Primates	CERCOPITHECIDAE	*Papio ursinus orientalis*	Chacma Baboon	various	omnivorous			3	6	2, 3, 4, 5	4
Primates	LORISIDAE	*Galago moholi moholi*	South African Lesser Bushbaby	savanna woodland, forest fringes	insects, gum, spiders			3	1	3	4
Proboscidea	ELEPHANTIDAE	*Loxodonta africana*	African Elephant	various, riverine valleys, desert, savanna	browse, grass			8	8	Historically	8
Rodentia	BATHYERGIDAE	*Cryptomys hottentotus hottentotus*	Common Mole-rat	various substrates, mesic to semi-mesic	roots, bulbs, tubers			3	3	1, 2, 3, 5	3
Rodentia	BATHYERGIDAE	*Cryptomys hottentotus natalensis*	Natal Mole-rat	various substrates, mesic to semi-mesic	roots, bulbs, tubers			3	3	1, 3, 5	3
Rodentia	BATHYERGIDAE	*Cryptomys hottentotus Pretoriae*	Highveld Mole-rat	various substrates, mesic to semi-mesic	roots, bulbs, tubers			3	3	1, 2, 3, 5	3
Rodentia	BATHYERGIDAE	*Georychus capensis*	Cape Molerat	sandy soils	bulbs, tubers, roots, aerial plants 6%			3	3	3: sandy soils	4
Rodentia	GLIRIDAE	*Graphiurus murinus microtis*	Woodland Dormouse	woodland, rocks, houses	moths, grass seeds, fruit			3	6	3, 4, 5	4
Rodentia	GLIRIDAE	*Graphiurus murinus murinus*	Woodland Dormouse	woodland, rocks, houses	fruit, moths, grass seeds			3	6	3, 4, 5	4
Rodentia	GLIRIDAE	*Graphiurus platyops platyops*	Rock Dormouse	rocky terrain, crevices, boulders, buildings	seeds, insects, moths			3	1	4, 5	4
Rodentia	HYSTRICIDAE	*Hystrix africaeaustralis*	Cape Porcupine	various, rocky hills, caves, agricultural land	bulbs, tubers, roots, crops			3	3	3, 4, 5	4
Rodentia	MURIDAE	*Acomys spinossismus*	Spiny Mouse	rocky environments, mountains	seeds, insects			3	6	4	4
Rodentia	MURIDAE	*Aethomys chrysophilus chrysophilus*	Red Veld Rat	grassland, savanna woodland, rocky crevices, cultivated areas	omnivorous			3	6	1, 3, 4, 5	3
Rodentia	MURIDAE	*Aethomys namaquensis namaquensis*	Namaqua Rock Mouse	rocky koppies, outcrops, scrub, open woodland, pan fringes	omnivorous			3	6	3, 4	4
Rodentia	MURIDAE	*Dasymys incomtus incomtus*	Water Rat	wet habitat, reeds, semi-aquatic grass	succulent stems, reeds, other vegetation			3	3	2	4
Rodentia	MURIDAE	*Dendromus melanotis melanotis*	Grey Climbing Mouse	tall grass, bushes, grassland after fire	insects, seeds			3	6	1, 3	3
Rodentia	MURIDAE	*Dendromus melanotis vulturnus*	Grey Climbing Mouse	tall grass, bushes, grassland after fire	insects, seeds			3	6	1, 3	3
Rodentia	MURIDAE	*Dendromus mesomelas mesomelas*	Brant's Climbing Mouse	tall grass with scrub, tussock grass in flood water	insects, grass seed			3	6	1, 2, 3	3

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 4. Inventory of mammals recorded in the Grassland Biome

Order	Family	Species name	Common name	Habitat	Food	Conservation status	RDB Mark	Endemic mark	Food mark	Habitat preference	Habitat type
Artiodactyla	BOVIDAE	*Aepyceros melampus*	Impala	woodland savanna, bush	grass, leaves			3	3	3	4
Artiodactyla	BOVIDAE	*Alcephalus buselaphus*	Cape Hartebeest	open grassy plains of open woodland, floodplain grassland	grass	Protected only on farms, reserves.		3	3	1, 3	3
Artiodactyla	BOVIDAE	*Antidorcas bondi*	Extinct Springbok species	Historically at Florisbad	grass, scrub	Historically at Florisbad.	0	0	0	Florisbad	0
Artiodactyla	BOVIDAE	*Antidorcas marsupialis*	Springbok	open plains, karroid shrub, Highveld grassland	grass, leaves			3	3	1, 3	3
Artiodactyla	BOVIDAE	*Connachaetus gnou*	Black Wildebeest	open grassland	grass, karroid bushes			1	3	1	1
Artiodactyla	BOVIDAE	*Connachaetus taurinus taurinus*	Blue Wildebeest	savanna woodland	short grass			3	3	3	4
Artiodactyla	BOVIDAE	*Damaliscus dorcas phillipsi*	Blesbok	grassland	grass			1	3	1	1
Artiodactyla	BOVIDAE	*Kobus ellipsoprymnus*	Waterbuck	permanent water with good grass cover	grass	More abundant in historical times.		3	3	2, 3	4
Artiodactyla	BOVIDAE	*Kobus leche subsp.*	Extinct Waterbuck species	Historically	herbivore	Historically at Florisbad.	0	0	0	Florisbad	0
Artiodactyla	BOVIDAE	*Oreotragus oreotragus oreotragus*	Klipspringer	rocky habitat, krantzes	leaves, rarely grass, fruit, seed, berries			3	3	4	4
Artiodactyla	BOVIDAE	*Oreotragus oreotragus transvaalensis*	Klipspringer	rocky habitat, krantzes	leaves, rarely grass, fruit, seed, berries			3	3	4	4
Artiodactyla	BOVIDAE	*Ourebia ourebi ourebi*	Oribi	open habitat, open grassland, floodplains, burned areas, vleis	grass, rarely forbs	Vulnerable	5	2	3	1, 2	3
Artiodactyla	BOVIDAE	*Pelea capreolus*	Grey Rhebok	rocky hills, rocky mountains, good grass cover, grassy slopes	leaves, roots, seeds, grass, flowers			1	3	3, 4, 1	3
Artiodactyla	BOVIDAE	*Raphicerus campestris*	Steenbok	open country, absent desert & forest, open grassland, scrub woodland	forbs, grasses, pods, bulbs			3	3	1, 3	3
Artiodactyla	BOVIDAE	*Redunca arundinum arundinum*	Reedbuck	tall grass, reedbeds, avoid open veld	grass, herbs			3	3	1, 2	2
Artiodactyla	BOVIDAE	*Redunca fulvorufula fulvorufula*	MountainReedbuck	dry grass-covered slopes of hills, mountains	grass, or leaves			3	3	1, 4	2
Artiodactyla	BOVIDAE	*Sylvicapra grimmia burcelli*	Common Duiker	bush, not short, but medium tall grassland, woodlands, farmland	shrubs, cultivated crops, leaves, fruit			3	3	3, 1, 5	3
Artiodactyla	BOVIDAE	*Sylvicapra grimmia caffra*	Common Duiker	bush, not short, but medium tall grassland, woodlands, farmland	shrubs, cultivated crops, leaves, fruit			3	3	3, 1, 5	3
Artiodactyla	BOVIDAE	*Taurotragus oryx*	Eland	various	leaves, grass			3	3	1, 3	3
Artiodactyla	BOVIDAE	*Tragelaphus strepsiceros strepsiceros*	Kudu	savanna woodland, not open grassland	leaves, shoots, forbs			3	3	3	4
Artiodactyla	CERVIDAE	*Cervus dama dama*	European Fallow Deer	various, scrub, vleis, highveld grassland, riverine bush	leaves, herbs, berries			3	3	3, 2, 1	3
Artiodactyla	HIPPOPOTAMIDAE	*Hippopotamus amphibius capensis*	Hippopotamus	open water	grass	Historically abundant	8	8	8	2	8
Artiodactyla	SUIDAE	*Phacochoerus aethiopicus sundevalli*	Warthog	grassland, open ground, vleis, pans, woodland	grass, herbs, rhizomes			3	3	1, 2, 3	3
Artiodactyla	SUIDAE	*Phacochoerus africanus*	Extinct Warthog species	Historically	omnivorous	Historically at Florisbad	0	0	0	Florisbad	0
Carnivora	CANIDAE	*Canis mesomales mesomales*	Black-backed Jackal	various, absent from forest, human settlements	carrion, carnivorous, insects			3	5	1, 2, 3, 5	3
Carnivora	CANIDAE	*Lycaon pictus*	Cape Hunting Dog	scrub savanna	carnivorous	Historically at Florisbad	8	8	8	3	8
Carnivora	CANIDAE	*Otocyon megalotis megalotis*	Bat-eared Fox	open country, open grassland, open woodland, Karoo scrub	insects, wild fruit, mice, scorpions			3	6	1, 3	3
Carnivora	CANIDAE	*Vulpes chama*	Cape Fox	grassland, semi-desert scrub, dry woodland	mice, insects			3	5	1, 3	3
Carnivora	FELIDAE	*Felis caracal caracal*	Caracal	karroid areas, open savanna, open grassland, vleis	carrion, medium sized prey			3	2	3, 2, 1	3
Carnivora	FELIDAE	*Felis catus*	Domestic Cat	human settlement	carnivorous			3	2	5	5
Carnivora	FELIDAE	*Felis lybica cafra*	African Wild Cat	various, rocky hillsides, scrub, agricultural land, reedbeds, tall grass	murids, spiders, birds	Vulnerable	5	3	5	3, 1, 2, 5	3
Carnivora	FELIDAE	*Felis lybica griselda*	African Wild Cat	various, rocky hillsides, scrub, agricultural land, reedbeds, tall grass	murids, spiders, birds	Vulnerable	5	3	5	3, 1, 2, 5	3
Carnivora	FELIDAE	*Felis nigripes nigripes*	Black-footed Cat	arid and semi-arid open country, cultivated land	insects, grass			3	6	1, 3, 5	3
Carnivora	FELIDAE	*Felis nigripes thomasi*	Small spotted Cat	arid country, tall grass, scrub bush	murids, spiders, insects	Rare	4	1	5	1, 3	3
Carnivora	FELIDAE	*Felis serval serval*	Serval	near permanent water, tall grass, reed beds, underbush	murids	Rare	4	2	2	1, 2, 3	3
Carnivora	FELIDAE	*Panthera leo*	Lion	highveld, bushveld, plains, semi-desert	carnivorous	Historically at Florisbad.	8	8	8	1, 3	8
Carnivora	FELIDAE	*Panthera pardus melanotica*	Leopard	wide but generally in mountains, kloofs & dense grass stands	carnivorous	Rare	4	2	2	1, 3, 4	3
Carnivora	HYAENIDAE	*Hyaena brunnea*	Brown Hyaena	woodland savanna, rocky areas, semi-desert scrub	carrion, small mammals, insects, fruit	Rare	4	2	5	3, 4	4
Carnivora	HYENIDAE	*Crocuta crocuta*	Spotted Hyaena	various, semi-desert to mountains	carnivorous, carrion	Historically at Florisbad.	8	8	8	1, 2, 3, 4	8
Carnivora	MUSTELIDAE	*Aonyx capensis capensis*	Cape Clawless Otter	aquatichabitats, dams, swamps, streams	crabs, frogs, fish, water birds			3	2	2	4
Carnivora	MUSTELIDAE	*Ictonyx striatus*	Striped Polecat	various, grassland, savanna, exotic plantations, rocky areas	insects, mice, birds, reptiles			3	2	1, 3, 4	3
Carnivora	MUSTELIDAE	*Lutra maculicollis maculicollis*	Spotted-necked Otter	aquatic habitats, lakes, rivers, swamps	fish, crabs, frogs, molluscs, birds			3	5	2	4
Carnivora	MUSTELIDAE	*Mellivora capensis capensis*	Honey Badger	various, rocky areas, swamps, arid areas	carnivorous, fruit, berries, honey			3	6	1, 2, 3, 4	3
Carnivora	MUSTELIDAE	*Poecilogale albinucha transvaalensis*	African Weasel	moist grassland, savanna	rodents, birds, small insectivores	Rare	4	1	5	1, 3	3
Carnivora	PROTELIDAE	*Proteles cristatus cristatus*	Aardwolf	grassland, savanna, karroid scrub, woodland	termites	Rare	4	3	1	1, 3	3
Carnivora	VIVERRIDAE	*Atilax paludinosus paludinosus*	Water Mongoose	well-watered terrain, reeds, swamps, dams, vleis	insects, small mammals, birds, eggs, fruit			3	6	2	4
Carnivora	VIVERRIDAE	*Civettictis civetta*	African Civet	forest, well-watered savanna, underbush	omnivorous	Rare	4	2	6	3	4
Carnivora	VIVERRIDAE	*Cynictis penicillata*	Yellow Mongoose	open country, savanna, grassland, scrub, vleis	insects, mice, reptiles, scorpions			3	5	1, 2, 3	3
Carnivora	VIVERRIDAE	*Galerella pulverulenta pulverulenta*	Small Grey Mongoose	various, open country, outbuildings, fynbos, rocky areas	insects, mice, reptiles, eggs			1	5	3, 4, 5	4
Carnivora	VIVERRIDAE	*Galerella sanguina cauni*	Slender Mongoose	various, woodland, forest edge, open country	insects, murids, fruit, frogs			3	6	3	4
Carnivora	VIVERRIDAE	*Galerella sanguinea ratlamuchi*	Slender Mongoose	various, woodland, forest edge, open country	insects, murids, fruit, frogs			3	6	3	4
Carnivora	VIVERRIDAE	*Genetta genetta pulchra matschie*	Small-spotted Genet	arid areas, grassland, vleis, woodland	birds, mice			3	2	1, 2, 3	3
Carnivora	VIVERRIDAE	*Genetta tigrina rubiginosa*	Large-spotted Genet	savanna woodland, riverine associations, open grassland, vleis	insects, murids			3	5	3, 1, 2	3
Carnivora	VIVERRIDAE	*Helogale parvula parvula*	Dwarf Mongoose	savanna, open grassland, scrub, termitaria	termites, locusts, reptiles, eggs			3	5	3, 1	3
Carnivora	VIVERRIDAE	*Ichneumia albicauda grandis*	White-tailed Mongoose	savanna, not in forest	insects, rodents, birds			3	5	3	4
Carnivora	VIVERRIDAE	*Mungos mungo taemonotus*	Banded Mongoose	riverine forest, *Acacia* woodland, termitaria essential for habitat requirements	insects, grubs, snails, small reptiles			3	5	3	4
Carnivora	VIVERRIDAE	*Rhynchogale melleri langi*	Meller's Mongoose	woodland or grassland with termitaria	termites, grasshoppers, centipedes			3	1	1, 3	3
Carnivora	VIVERRIDAE	*Suricata suricatta suricatta*	Suricate	open arid country, savanna, scrub woodland	reptiles, insects, spiders, scorpions			3	5	3	4
Chiroptera	EMBALLONURIDAE	*Taphozous mauritianus*	Tomb Bat	savanna woodland, rocks, buildings	insects			3	1	3, 4, 5	4
Chiroptera	HIPPOSIDERIDAE	*Cloeotis percivali australis*	Short-eared Trident Bat	mines, caves, unknown	insects			3	1	4, 5, unknown	4
Chiroptera	HIPPOSIDERIDAE	*Hipposideros caffer caffer*	Sundevall's Leaf-nose Bat	savanna woodland, near water	insects			3	1	3, 4	4
Chiroptera	MOLOSSIDAE	*Sauromys petrophilus petrophilus*	Flat-headed Free-tailed Bat	rocky areas, crevices	insects			3	1	3, 4	4
Chiroptera	MOLOSSIDAE	*Tadarida aegyptiaca aegyptiaca*	Egyptian Free-tailed Bat	various, except forest, in grassland, scrub savanna, temporay pools	insects			3	1	3, 2, 1	3
Chiroptera	MOLOSSIDAE	*Tadarida aegyptiaca bocagei*	Egyptian Free-tailed Bat	various, except forest, in grassland, scrub savanna, tempory pools	insects			3	1	3, 2, 1	3
Chiroptera	MOLOSSIDAE	*Tadarida condylura*	Angola Free-tailed Bat	savanna woodland, riverine vegetation	insects			3	1	3	4
Chiroptera	MOLOSSIDAE	*Tadarida ventralis*	Transvaal Free-tailed Bat	unknown	unknown	Indeterminate	3	4	7	unknown	3
Chiroptera	NYCTERIDAE	*Nycteris thebaica capnesis*	Common Slit-faced Bat	open savanna woodland, not Tvl. Highveld grassland	insects			3	1	3	4
Chiroptera	PTEROPODIDAE	*Eidolon helvum helvum*	Straw-Coloured fruit Bat	various, tropical forests, food determine occurrence	fruit, flower buds			3	3	3	4

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 4. continue...

Order	Family	Species name	Common name	Habitat	Food	Conservation status	RDB Mark	Endemic mark	Food mark	Habitat preference	Habitat type
Rodentia	MURIDAE	*Dendromus mystacalis jamesoni*	Chestnut Climbing Mouse	grassland	seeds, insects, termites			3	6	1	1
Rodentia	MURIDAE	*Desmodillus auricularis*	Short-tailed Gerbil	grass cover, karroid bush, pan fringes with grass, bush	granivorous			3	4	3, 1	3
Rodentia	MURIDAE	*Lemniscomys rosalia spinalis*	Single-Striped Mouse	various, savanna, especially grassland areas, farms, short grass, vleis	seeds, herbage, insects			3	6	1, 3, 5, 2	2
Rodentia	MURIDAE	*Malacothrix typica fryi*	Large-eared Mouse	short grass, pan fringes, karroid bush	grass seed, green vegetable matter			3	3	1, 3	3
Rodentia	MURIDAE	*Mastomys coucha*	Multimammate Mouse	various, human settlements, agricultural land	omnivorous			3	6	3, 5	4
Rodentia	MURIDAE	*Mastomys natalensis*	Natal multimammate Mouse	various, human settlements, agricultural land	omnivorous			3	6	3, 5	4
Rodentia	MURIDAE	*Mus indutus pretoriae*	Desert Pygmy Mouse	scrub savanna	grass seeds, pods, fruit of buffalo thorn			3	3	3	4
Rodentia	MURIDAE	*Mus indutus valschensis*	Desert Pygmy Mouse	scrub savanna	grass seeds, dry pods, fruit, insects			3	3	3	4
Rodentia	MURIDAE	*Mus minutoides orangiae*	Pygmy Mouse	savanna grassland, woodland	grass seeds, termites, insects			3	6	3	4
Rodentia	MURIDAE	*Mus musculus*	House Mouse	houses, buildings, stores	omnivorous			3	6	5	5
Rodentia	MURIDAE	*Mystromys albicaudatus*	White-tailed Mouse	savanna grassland, karoo	omnivorous	Rare	4	1	6	3	4
Rodentia	MURIDAE	*Otomys angoniensis tugelensis*	Angoni Vlei Rat	vleis, swamps, grasslands, savannas	stems, fine reeds, rhizomes of grass			3	3	1, 2, 3	3
Rodentia	MURIDAE	*Otomys irroratus auratus*	Vlei Rat	grassland, moist habitat	grass, reed shoots, forbs			3	3	1, 2	2
Rodentia	MURIDAE	*Otomys irroratus randensis*	Vlei Rat	grassland, moist habitat	grass, reed shoots, forbs			3	3	1, 2	2
Rodentia	MURIDAE	*Otomys laminatus fannini*	Laminate Vlei Rat	grassland	shoots and stems of grasses, small shrubs			1	3	1	1
Rodentia	MURIDAE	*Otomys laminatus mariepsi*	Laminate Vlei Rat	grassland	shoots and stems of grasses, small shrubs			1	3	1	1
Rodentia	MURIDAE	*Otomys laminatus pondoensis*	Laminate Vlei Rat	grassland	shoots and stems of grasses, small shrubs			1	3	1	1
Rodentia	MURIDAE	*Otomys saundersiae*	Saunders' Vlei Rat	mountainous habitat	no information available			3	7	4	4
Rodentia	MURIDAE	*Otomys sloggetti basuticus*	Sloggett's Rat	high altitudes amongst rocks and forbs	leaves, stems and flowers of *Helichrysum* spp.			3	3	3, 4	4
Rodentia	MURIDAE	*Otomys sloggetti jeppei*	Sloggett's Rat	high altitudes amongst rocks and forbs	leaves, stems and flowers of *Helichrysum* spp.			3	3	3, 4	4
Rodentia	MURIDAE	*Otomys sloggetti robertsi*	Sloggett's Rat	high altitudes amongst rocks and forbs	leaves, stems and flowers of *Helichrysum* spp.			3	3	3, 4	4
Rodentia	MURIDAE	*Otomys sloggetti sloggetti*	Sloggett's Rat	high altitudes amongst rocks and forbs	leaves, stems and flowers of *Helichrysum* spp.			3	3	3, 4	4
Rodentia	MURIDAE	*Otomys sloggetti turneri*	Sloggett's Rat	high altitudes amongst rocks and forbs	leaves, stems and flowers of *Helichrysum* spp.			3	3	3, 4	4
Rodentia	MURIDAE	*Rattus rattus*	House Rat	rocks, thickets, human settlements	omnivorous			3	6	3, 4, 5	4
Rodentia	MURIDAE	*Rhabdomys pumilio dilectus*	Striped Mouse	grassland, agricultural land	omnivorous			3	6	1, 5	2
Rodentia	MURIDAE	*Rhabdomys pumilio griquae*	Striped Mouse	grassland, agricultural land	omnivorous			3	6	1, 5	2
Rodentia	MURIDAE	*Rhabdomys pumilio intermedius*	Striped Mouse	grassland, agricultural land	omnivorous			3	6	1, 5	2
Rodentia	MURIDAE	*Rhabdomys pumilio pumilio*	Striped Mouse	grassland, agricultural land	omnivorous			3	6	1, 5	2
Rodentia	MURIDAE	*Saccostomus campestris*	Pouched Mouse	grass fringes of pans, bushveld, rocky koppies, scrub bush	insectivorous granivore			3	6	3, 4, 1	3
Rodentia	MURIDAE	*Steatomys krebsii orangiae*	Kreb's Fat Mouse	sandy grassland	insects, seeds			3	6	1	1
Rodentia	MURIDAE	*Steatomys pratensis natalensis*	Fat Mouse	river fringes, swamps, cultivated land	seeds, insects, herbage			3	6	2, 3, 5	4
Rodentia	MURIDAE	*Tatera brantsii brantsii*	Highveld Gerbil	sandy soils with grass, scrub, woodland	omnivorous			3	6	3, 1	3
Rodentia	MURIDAE	*Tatera leucogaster*	Bushveld Gerbil	sandy soils, open grassland, savanna, termitaria	omnivorous			3	6	1, 3	3
Rodentia	MURIDAE	*Thallomys paedulcus*	Tree Rat	savanna woodland, riparian association	seed, leaflets			3	3	3	4
Rodentia	PEDETIDAE	*Pedetes capensis*	Springhaas	sandy soil substrate, overgrazed grassland, floodplain grassland, farmland	grass			3	3	1, 3, 5	3
Rodentia	SCUIRIDAE	*Xerus inauris*	Cape Ground Squirrel	open arid areas, open grassland, karroid areas, overgrazed areas	grasses, seed, insects, leaves			3	6	1, 3	3
Rodentia	THRYONOMYIDAE	*Thryonomys swinderianus*	Greater Canerat	reedbeds, tall grass, near lakes, agricultural land	roots, shoots, grass stems			3	3	2, 1, 5	3
Tubilentata	ORYCTEROPODIDAE	*Orycteropus afer*	Aardvark	grassland, various except desert & forest	ants, termites	Vulnerable	5	3	1	1, 2, 3	3

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 5. Birds categorised as grassland specialists (Habitat type 1)

Species name	Common name	Habitat	Endemicity score
Anthus brachyurus	Shorttailed Pipit	grassy hillsides or flats	2
Anthus hoeschi	Mountain Pipit	short, montane grassland on eastern slopes of Escarpment	3
Cisticola ayresii	Ayres' Cisticola	short grassland	2
Cisticola brunnescens	Palecrowned Cisticola	moist, short grassland	2
Eremopterix verticalis	Greybacked Finchlark	arid ground, open short grass plains, bare pans	3
Eupodotis cafra barrowii	Whitebellied Korhaan	open grassland	3
Francolinus levaillantii	Redwing Francolin	montane grassland, low-lying grassland	2
Glareola normanni	Blackwinged Prantincole	open grassland	1
Heteromirafra ruddi	Rudd's Lark	moist, short montane grassland	5
Hirundo atrocaerulea	Blue Swallow	moist montane grassland	1
Hirundo cucullata	Greater Striped Swallow	open country, grassy Highveld	3
Mirafra cheniana	Melodious Lark	open climax grassland, grassy Karoo	3

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 6. Birds endemic to the Grassland Biome

Species name	Common name	Habitat	Habitat score	Threatened status
Eupodotis caerulescens	Blue Korhaan	open grassland, Karoo scrub, cultivated land	3	2
Hemimacronyx chloris	Yellowbreasted Pipit	dense, open grassland to bushveld in summer	3	4
Heteromirafra ruddi	Rudd's Lark	moist, short montane grassland	5	4
Oenanthe bifasciata	Buffstreaked Chat	rolling grasslands, rocky outcrops	4	2
Pseudochloroptila symonsi	Drakensberg Siskin	montane scrub, alpine grassland, cultivated lands	3	2
Spizocorys fringillaris	Botha's Lark	heavily grazed grassland (sour), cultivated land	4	3

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 7. Birds recorded in the Grassland Biome, endemic to South Africa (non-cumulative)

Species name	Common name	Habitat	Endemicity score	Habitat score	Threatened status
Buteo trizonatus	Forest Buzzard	indigenous or alien forest	4	2	2
Certhilauda albescens	Karoo Lark	shrubby semi-desert	4	2	1
Cossypha humeralis	Whitethroated Robin	dense woodland, thorn thickets, gardens	4	2	2
Eupodotis afra	Black Korhaan	grassland, Karoo, shrub	4	3	1
Eupodotis ruficrista ruficrista	Redcrested Korhaan	savanna, semi-desert, grassland	4	3	1
Eupodotis vigorsii	Karoo Korhaan	Karoo, semi-desert, grass stuble	4	2	2
Francolinus africanus	Greywing Francolin	montane grassland & shrub, Karoo	4	3	1
Galerida magnirostris	Thickbilled Lark	high montane grassland, cultivated land, semi-Karoo	4	3	1
Lioptilus nigricapillus	Bush Blackcap	montane forest, scrub, *Leucosidea*	4	2	2
Neotis denhami	Stanley's Bustard	montane and Highveld grassland, Karoo, savanna	4	3	4
Parus afer	Southern Grey Tit	karoid scrub	4	2	2
Phragmacia substriata	Namaqua Warbler	thornbush, overgrown gardens in Karoo and grassland	4	3	2
Ploceus capensis	Cape Weaver	open woodland, wooded rivers, gardens, farmland	4	2	1
Sarothrura affinis	Striped Flufftail	submontane grassland, rank vegetation and grass, forest edges	4	3	3
Serinus scotops	Forest Canary	forest, gardens, plantations, forage in sour grassland, maize fields	4	2	2

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 8. Birds recorded in the Grassland Biome, endemic to the sub-Region (non-cumulative)

Species	Common name	Habitat	Habitat score	Threatened
**Anatomus lamelligerus*	Openbilled Stork	inland waters, marshes	2	2
Actophilornis africanus	African Jacana	lakes, pans, vleis	2	1
Amadina erythrocephala	Redheaded Finch	open grassland, dry savanna, cultivated land	3	1
Anas smithii	Cape Shoveller	shallow tempory pans, vleis	2	1
Anthoscopus minutus	Cape Penduline Tit	*Acacia* savanna, semi-aric scrub	2	2
Anthropoides paradiseas	Blue Crane	highland & midland grassland, Karoo edge, cultivated land	3	1
Anthus crenatus	Rock Pipit	rocky hills, rocky outcrops	2	2
Anthus hoeschi	Mountain Pipit	short, montane grassland on eastern slopes of Escarpment	5	3
Ardea melanocephala	Blackheaded Heron	open grasslands, inland waters	4	1
Ardeotis kori kori	Kori Bustard	open plains, highveld grassland, Karoo	3	4
Batis capensis	Cape Batis	lower levels of evergreen forest, savanna, woodland	2	1
Batis pririt	Pririt Batis	*Acacia* savanna, thickets	2	1
Bradypterus barratti	Barratt's Warbler	forest edges, dense vegetation along streams	2	2
Buteo rufofuscus	Jackal Buzzard	mountainous, hilly grassland terrain, savanna	3	2
Butorides rufiventris	Rufousbellied Heron	marshy shallows, floodplains	2	3
Campethera abingoni	Goldentailed Woodpecker	woodland, evergreen thickets, *Acacia* savanna, bushveld	2	2
Campethera bennettii	Bennett's Woodpecker	woodland, bushveld	2	2
Cercomela schlegelii	Karoo Chat	Karoo, stony hillsides	2	1

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 8. continue…

Cercomela sinuata	Sicklewinged Chat	Karoo, montane grassland, cultivated land, grazed pastures	3	1
Cercomela tractrac	Tractrac Chat	shrubby plains, Karoo & stubbly grassland	3	2
Certhilauda chuana	Shortclawed Lark	semi-arid scrub, savanna	2	3
Certhilauda curvirostris	Longbilled Lark	open short grassland, Karoo shrub, hills, ridges	3	1
Chaetops aurantius	Orangebreasted Rockjumper	rocky slopes, low escarpments with grass, shrubs	3	2
Charadrius pallidus	Chestnutbanded Plover	brackish pans	2	3
Chersomanes albofasciata beesleyi	Spikeheeled Lark	sparse grassland, overgrazed areas, shrubby veld	3	1
Circus maurus	Black Harrier	grassland, Karoo shrub, cultivated land	3	2
Cisticola subruficapilla	Greybacked Cisticola	shrubby plains, Karoo, montane grassland	3	1
Cisticola textrix	Cloud Cisticola	very short grassland, grassy Karoo	3	1
Colius colius	Whitebacked Mousebird	arid shrub, gardens, farmyards	2	1
Columba arquatrix	Rameron Pigeon	canopy of lowland, evergreen forest, alien plantations	2	2
Cossypha dichroa	Chorister Robin	evergreen forest	2	2
Crex egregia	African Crake	flooded grassland, marshes, vleis	4	2
Cursorius rufus	Burchell's Courser	open or burned grassland, overgrazed veld, Karoo	3	2
Dendropicos fuscescens	Cardinal Woodpecker	woodland, plantations, gardens, parks, riverine bush	2	1
Emberiza capensis	Cape Bunting	rocky places, near water	2	1
Emberiza impetuani	Larklike Bunting	arid savanna, karoo, koppies	2	1
Eremopterix verticalis	Greybacked Finchlark	arid ground, open short grass plains, bare pans	5	1
Erythropygia coryphaeus	Karoo Robin	Karoo, bushy hillsides, riverine scrub	2	2

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 8. continue…

Estrilda melanotis	Swee Waxbill	evergreen forest, alien plantations, gardens, farmyards	2	1
Eupodotis affraoides	Whitewinged Black Korhaan	Karoo, grassland, open bushveld with grass	3	1
Eupodotis cafra barrowii	Whitebellied Korhaan	open grassland	5	2
Francolinus natalensis	Natal Francolin	dense thickets, rocky terrain	2	1
Francolinus swainsonii	Swainson's Francolin	grassland with trees, cultivated land, bushveld, vleis	4	1
Geocolaptes olivaceus	Ground Woodpecker	mountains, dongas, rocky hillsides, alpine grassland	2	2
Geronticus calvus	Bald Ibis	high grassland, burned & cultivated lands, mountains	4	2
Gorsachius leuconotus natalensis	Whitebacked Night Heron	streams, marshes	2	3
Gyps coprotheres	Cape Vulture	mountainous country, less common in savanna, grassland	2	4
Hirundo cucullata	Greater Striped Swallow	open country, grassy highveld	5	1
Hirundo spilodera	South African Cliff Swallow	open grassland, sparse savanna, bridges	3	2
Indicator indicator	Greater Honeyguide	woodland, savanna, alien plantations, forest edge	2	2
Jynx ruficollis	Redthroated Wryneck	open bushveld, gardens, alien plantations, thornveld	2	2
Lamprotornis australis	Burchell's Starling	savanna, parklike woodland	2	2
Laniarius atroccoccineus	Crimsonbreasted Shrike	*Acacia* savanna, semi-arid scrub, thornbush	2	1
Laniarius ferrugineus	Southern Boubou	dense bush, gardens, thickets	2	1
Macronyx capensis	Orangethroated Longclaw	moist short grassland, vleis	4	1
Malcorus pectoralis	Rufouseared Warbler	shrubby vegetation, Karoo & Kalahari plains	2	1
Melaenornis mariquensis	Marico Flycatcher	*Acacia* savanna	2	2
Melierax canorus	Pale Chanting Goshawk	savanna, watercourse	2	1

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 8. continue…

Mirafra apiata	Clapper Lark
Mirafra cheniana	Melodious Lark
Mirafra passerina	Monotonous Lark
Mirafra sabota	Sabota Lark
Monticola brevipes	Shorttoed Rock Thrush
Monticola explorator	Sentinel Rock Thrush
Monticola rupestris	Cape Rock Thrush
Myrmecocichla formicivora	Anteating Chat
Nectarinia afra	Greater Doublecollared
Nectarinia fusca	Dusky Sunbird
Neotis ludwigii	Ludwig's Bustard
Oenanthe monticola	Mountain Chat
Onychognathus nabouroup	Palewinged Starling
Parisoma layardi	Layard's Titbabbler
Parisoma subcaeruleum	Titbabbler
Parus cinerascens	Ashy Tit
Passer melanurus	Cape Sparrow
Philetairus socius	Sociable Weaver
Phoeniculus purpureus	Redbilled Woodhoopoe
Platalea alba	African Spoonbill

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 8. continue…

Prina maculosa	Karoo Prinia	Highveld grassland, semi-arid Karoo	3	1
Prinia flavilcans	Blackchested Prinia	open climax grassland, grassy Karoo	5	2
Prinia hypoxoxantha	Spotted Prinia	savanna, open woodland	2	1
Promerops gurneyi	Gurney's Sugarbird	semi-arid savanna, thorny bushveld	2	1
Psalidoprocne holomelas	Black Sawwing Swallow	rocky outcrops, koppies, towns, river valley	2	2
Pterocles bicinctus	Doublebanded Sandgrouse	rolling grassland, burned areas, felled plantations	3	1
Pterocles namaqua	Namaqua Sandgrouse	gorges, cliffs, hillsides	2	2
Pycnonotus nigricans	Redeyed Bulbul	open grassland, grassy hills, dongas	4	1
Rallus caurulescens	African Rail	riverine bush, *Protea* savanna, parks, gardens	2	1
Serinus alario alario	Blackheaded Canary	desert to semi-desert with shrubs, trees along water	2	1
Serinus albogularis	Whitethroated Canary	grassland, open plains	3	4
Serinus flaviventris	Yellow Canary	rocky outcrops, hills, farmyards, gardens	2	2
Sigelus silens	Fiscal Flycatcher	arid country, grassy Karoo, woodland	2	2
Spizocorys conirostris	Pinkbilled Lark	high montane, rocky slopes, bushes in ravines	2	2
Sporopipes squamifrons	Scalyfeathered Finch	thornveld, riverine bush, savanna thickets	2	1
Spreo bicolor	Pied Starling	*Acacia* savanna, Kalahari scrub, thornbush	2	2
Stenostira scita	Fairy Flycatcher	arid, semi-arid savanna, gardens, thornbush, Highveld farm	2	1
Tadorna cana	South African Shelduck	arid *Acacia* savanna, semi-desert	2	1
Telophorus zeylonus	Bokmakierie	*Acacia* thornveld, gardens, parks	2	1
Thripias namaquus	Bearded Woodpecker	shallow inland waters, alpine and sour grassland	2	1

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 8. continue…

Prina maculosa	Karoo Prinia	Karoo, rank grass, gardens, exotic plantations	3	1
Prinia flavilcans	Blackchested Prinia	semi-arid scrub, *Acacia* savanna, gardens	2	1
Prinia hypoxoxantha	Spotted Prinia	Karoo, rank grass, gardens, alien plantations	3	1
Promerops gurneyi	Gurney's Sugarbird	montane scrub with *Protea* and *Aloe*	2	2
Psalidoprocne holomelas	Black Sawwing Swallow	forest edge, plantations, road edge	2	2
Pterocles bicinctus	Doublebanded Sandgrouse	savanna, mopane veld, hills with tussocky grass	2	1
Pterocles namaqua	Namaqua Sandgrouse	open desert and semi-desert, arid savanna	2	1
Pycnonotus nigricans	Redeyed Bulbul	savanna, gardens, farmyards	2	1
Rallus caurulescens	African Rail	reedbeds, marshes, swamps	2	2
Serinus alario alario	Blackheaded Canary	arid shrubby hills, rocky slopes, cultivated land	2	2
Serinus albogularis	Whitethroated Canary	riverine thornbush, grassland	3	1
Serinus flaviventris	Yellow Canary	montane shrub & grassland, Karoo, gardens, farmyards	3	1
Sigelus silens	Fiscal Flycatcher	thornveld, Karoo, bushes in grassland, gardens	3	1
Spizocorys conirostris	Pinkbilled Lark	open short grassland in highveld, cultivated lands	4	1
Sporopipes squamifrons	Scalyfeathered Finch	*Acacia* savanna, arid scrub, farmyards	2	1
Spreo bicolor	Pied Starling	open grassland, cultivated land, dongas, farms	4	1
Stenostira scita	Fairy Flycatcher	Karoo scrub, *Acacia* savanna, gardens, bushy hills.	2	1
Tadorna cana	South African Shelduck	inland waters, dams, pans, vleis, temporay waters	2	1
Telophorus zeylonus	Bokmakierie	variable, bushy hillsides, thickets in grassland, gardens	3	1
Thripias namaquus	Bearded Woodpecker	drier savanna, woodland	2	2

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 8. continue...

Tockus leucomelas	Southern Yellowbilled Hornbill	bushveld, woodland, savanna	2	1
Tricholaema leucomelas	Pied Barbet	*Acacia* savanna, woodland, gardens, farmyards, Karoo, grassland	3	1
Turdoides bicolor	Pied Babbler	semi-arid savanna, woodland, riverine *Acacia*	2	2
Uraeginthus granatinus	Violeteared Waxbill	dry savanna, cultivated land edges	2	2
Vanellus melanopterus minor	Blackwinged Plover	open short grassland, fallow lands, pastures	4	2
Vidua regia	Shafttailed Whydah	*Acacia* savanna	2	1
Zosterops pallidus	Cape White-eye	forest, woodland, savanna, garden, alien plantations	2	1

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 9. Grassland Biome and sub-Region endemic birds of Habitat type 1

Species name	Common name	Habitat	Endemicity mark
Heteromirafra ruddi	Rudd's Lark	moist, short montane grassland	5
Anthus hoeschi	Mountain Pipit	short, montane grassland on eastern slopes of Escarpment	3
Eremopterix verticalis	Greybacked Finchlark	arid ground, open short grass plains, bare pans	3
Eupodotis cafra barrowii	Whitebellied Korhaan	open grassland	3
Hirundo cucullata	Greater Striped Swallow	open country, grassy Highveld	3
Mirafra cheniana	Melodious Lark	open climax grassland, grassy Karoo	3

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 10. Grassland Biome and sub-Region endemic birds of Habitat type 2

Species name	Common name	Habitat	Endemicity mark
Oenanthe bifasciata	Buffstreaked Chat	rolling grassland, rocky outcrops	5
Spizocorys fringillaris	Botha's Lark	heavily grazed grassland (sour), cultivated land	5
Ardea melanocephala	Blackheaded Heron	open grassland, inland waters	3
Crex egregia	African Crake	flooded grassland, marshes, vleis	3
Francolinus swainsonii	Swainson's Francolin	grassland with trees, cultivated land, bushveld, vleis	3
Geronticus calvus	Bald Ibis	high grassland, burned & cultivated lands, mountains	3
Macronyx capensis	Orangethroated Longclaw	moist short grassland, vleis	3
Myrmecocichla formicivora	Anteating Chat	open grassland, grassy hills, dongas	3
Spizocorys conirostris	Pinkbilled Lark	open short grassland in highveld, cultivated lands	3
Spreo bicolor	Pied Starling	open grassland, cultivated land, dongas, farms	3
Vanellus melanopterus minor	Blackwinged Plover	open short grassland, fallow lands, pastures	3

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 11. Endemic birds of Habitat type 3

Species	Common name	Habitat	Endemicity score
Eupodotis caerulescens	Blue Korhaan	open grassland, Karoo scrub, cultivated land	5
Hemimacronyx chloris	Yellowbreasted Pipit	dense, open grassland to bushveld in summer	5
Pseudochloroptila symonsi	Drakensberg Siskin	montane scrub, alpine grassland, cultivated lands	5
Eupodotis afra	Black Korhaan	grassland, Karoo, shrub	4
Eupodotis ruficrista ruficrista	Redcrested Korhaan	savanna, semi desert, grassland	4
Francolinus africanus	Greywing Francolin	montane grassland & shrub, Karoo	4
Galerida magnirostris	Thickbilled Lark	high montane grassland, cultivated land, semi-Karoo	4
Neotis denhami	Stanley's Bustard	montane and highveld grassland, Karoo, savanna	4
Phragmacia substriata	Namaqua Warbler	thornbush, overgrown gardens in Karoo and grassland	4
Sarothrura affinis	Striped Flufftail	submontane grassland, rank vegetation and grass, forest edges	4
Amadina erythrocephala	Redheaded Finch	open grassland, dry savanna, cultivated land	3
Anthropoides paradiseas	Blue Crane	highland & midland grassland, Karoo edge, cultivated land	3
Ardeotis kori kori	Kori Bustard	open plains, Highveld grassland, Karoo	3
Buteo rufofuscus	Jackal Buzzard	mountainous, hilly grassland terrain, savanna	3
Cercomela sinuata	Sicklewinged Chat	Karoo, montane grassland, cultivated land, grazed pastures	3

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 11. continue...

Cercomela tractrac	Tractrac Chat	shrubby plains, Karoo & stubbly grassland	3
Certhilauda curvirostris	Longbilled Lark	open short grassland, Karoo shrub, hills, ridges	3
Chaetops aurantius	Orangebreasted Rockjumper	rocky slopes, low escarpments with grass, shrubs	3
Chersomanes albofasciata beesleyi	Spikeheeled Lark	sparse grassland, overgrazed areas, shrubby veld	3
Circus maurus	Black Harrier	grassland, Karoo shrub, cultivated land	3
Cisticola subruficapilla	Greybacked Cisticola	shrubby plains, Karoo, montane grassland	3
Cisticola textrix	Cloud Cisticola	very short grassland, grassy Karoo	3
Cursorius rufus	Burchell's Courser	open or burned grassland, overgrazed veld, Karoo	3
Eupodotis affraoides	Whitewinged Black Korhaan	Karoo, grassland, open bushveld with grass	3
Hirundo spilodera	South African Cliff Swallow	open grassland, sparse savanna, bridges	3
Mirafra apiata	Clapper Lark	Highveld grassland, semi-arid Karoo	3
Monticola explorator	Sentinel Rock Thrush	rolling grassland, burned areas, felled plantations	3

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 12. Grassland Biome and sub-region endemic birds of Habitat type 4, that occur within the Grassland Biome

Species name	Common name	Habitat	Endemicity score
Buteo trizonatus	Forest Buzzard	indigenous or alien forest	4
Certhilauda albescens	Karoo Lark	shrubby semi-desert	4
Cossypha humeralis	Whitethroated Robin	dense woodland, thorn thickets, gardens	4
Eupodotis vigorsii	Karoo Korhaan	Karoo, semi desert, grass stuble	4
Lioptilus nigricapillus	Bush Blackcap	montane forest, scrub, *Leucosidea*	4
Parus afer	Southern Grey Tit	karoid scrub	4
Ploceus capensis	Cape Weaver	open woodland, wooded rivers, gardens, farmland	4
Serinus scotops	Forest Canary	forest, gardens, plantations, forage in sour grassland, maize fields	4
**Anatomus lamelligerus*	Openbilled Stork	inland waters, marshes	3
Actophilornis africanus	African Jacana	lakes, pans, vleis	3
Anas smithii	Cape Shoveller	shallow tempory pans, vleis	3
Anthoscopus minutus	Cape Penduline Tit	*Acacia* savanna, semi-aric scrub	3
Anthus crenatus	Rock Pipit	rocky hills, rocky outcrops	3
Batis capensis	Cape Batis	lower levels of evergreen forest, savanna, woodland	3
Batis pririt	Pririt Batis	*Acacia* savanna, thickets	3
Bradypterus barratti	Barratt's Warbler	forest edges, dense vegetation along streams	3
Butorides rufiventris	Rufousbellied Heron	marshy shallows, floodplains	3
Campethera abingoni	Goldentailed Woodpecker	woodland, evergreen thickets, *Acacia* savanna, bushveld	3

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 12. Grassland Biome and sub-region endemic birds of Habitat type 4, that occur within the Grassland Biome

Species name	Common name	Habitat	Endemicity score
Buteo trizonatus	Forest Buzzard	indigenous or alien forest	4
Certhilauda albescens	Karoo Lark	shrubby semi-desert	4
Cossypha humeralis	Whitethroated Robin	dense woodland, thorn thickets, gardens	4
Eupodotis vigorsii	Karoo Korhaan	Karoo, semi desert, grass stuble	4
Lioptilus nigricapillus	Bush Blackcap	montane forest, scrub, *Leucosidea*	4
Parus afer	Southern Grey Tit	karoid scrub	4
Ploceus capensis	Cape Weaver	open woodland, wooded rivers, gardens, farmland	4
Serinus scotops	Forest Canary	forest, gardens, plantations, forage in sour grassland, maize fields	4
**Anatomus lamelligerus*	Openbilled Stork	inland waters, marshes	3
Actophilornis africanus	African Jacana	lakes, pans, vleis	3
Anas smithii	Cape Shoveller	shallow tempory pans, vleis	3
Anthoscopus minutus	Cape Penduline Tit	*Acacia* savanna, semi-aric scrub	3
Anthus crenatus	Rock Pipit	rocky hills, rocky outcrops	3
Batis capensis	Cape Batis	lower levels of evergreen forest, savanna, woodland	3
Batis pririt	Pririt Batis	*Acacia* savanna, thickets	3
Bradypterus barratti	Barratt's Warbler	forest edges, dense vegetation along streams	3
Butorides rufiventris	Rufousbellied Heron	marshy shallows, floodplains	3
Campethera abingoni	Goldentailed Woodpecker	woodland, evergreen thickets, *Acacia* savanna, bushveld	3

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 12. continue...

Campethera bennettii	Bennett's Woodpecker	woodland, bushveld	3
Cercomela schlegelii	Karoo Chat	Karoo, stony hillsides	3
Certhilauda chuana	Shortclawed Lark	semi-arid scrub, savanna	3
Charadrius pallidus	Chestnutbanded Plover	brackish pans	3
Colius colius	Whitebacked Mousebird	arid shrub, gardens, farmyards	3
Columba arquatrix	Rameron Pigeon	canopy of lowland, evergreen forest, alien plantations	3
Cossypha dichroa	Chorister Robin	evergreen forest	3
Dendropicos fuscescens	Cardinal Woodpecker	woodland, plantations, gardens, parks, riverine bush	3
Emberiza capensis	Cape Bunting	rocky places, near water	3
Emberiza impetuani	Larklike Bunting	arid savanna, Karoo, koppies	3
Erythropygia coryphaeus	Karoo Robin	Karoo, bushy hillsides, riverine scrub	3
Estrilda melanotis	Swee Waxbill	evergreen forest, alien plantations, gardens, farmyards	3
Francolinus natalensis	Natal Francolin	dense thickets, rocky terrain	3
Geocolaptes olivaceus	Ground Woodpecker	mountains, dongas, rocky hillsides, alpine grassland	3
Gorsachius leuconotus	Whitebacked Night Heron	streams, marshes	3
Gyps coprotheres	Cape Vulture	mountainous country, less common in savanna, grassland	3
Indicator indicator	Greater Honeyguide	woodland, savanna, alien plantation, forest edge	3
Jynx ruficollis	Redthroated Wryneck	open bushveld, gardens, alien plantations, thornveld	3
Lamprotornis australis	Burchell's Starling	savanna, parklike woodland	3
Laniarius atroccoccineus	Crimsonbreasted Shrike	*Acacia* savanna, semi-arid scrub, thornbush	3

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 12. continue...

Laniarius ferrugineus	Southern Boubou	woodland, bushveld	3
Malcorus pectoralis	Rufouseared Warbler	Karoo, stony hillsides	3
Melaenornis mariquensis	Marico Flycatcher	semi-arid scrub, savanna	3
Melierax canorus	Pale Chanting Goshawk	brackish pans	3
Mirafra passerina	Monotonous Lark	arid shrub, gardens, farmyards	3
Mirafra sabota	Sabota Lark	canopy of lowland, evergreen forest, alien plantations	3
Monticola brevipes	Shorttoed Rock Thrush	evergreen forest	3
Monticola rupestris	Cape Rock Thrush	woodland, plantations, gardens, parks, riverine bush	3
Nectarinia afra	Greater Doublecollared	rocky places, near water	3
Nectarinia fusca	Dusky Sunbird	arid savanna, Karoo, koppies	3
Oenanthe monticola	Mountain Chat	Karoo, bushy hillsides, riverine scrub	3
Onychognathus	Palewinged Starling	evergreen forest, alien plantations, gardens, farmyards	3
Parisoma layardi	Layard's Titbabbler	dense thickets, rocky terrain	3
Parisoma subcaeruleum	Titbabbler	mountains, dongas, rocky hillsides, alpine grassland	3
Parus cinerascens	Ashy Tit	streams, marshes	3
Passer melanurus	Cape Sparrow	mountainous country, less common in savanna, grassland	3
Philetairus socius	Sociable Weaver	woodland, savanna, alien plantation, forest edge	3
Phoeniculus purpureus	Redbilled Woodhoopoe	open bushveld, gardens, alien plantations, thornveld	3
Platalea alba	African Spoonbill	savanna, parklike woodland	3
Prinia flavilcans	Blackchested Prinia	*Acacia* savanna, semi-arid scrub, thornbush	3

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 12. continue...

Laniarius ferrugineus	Southern Boubou	dense bush, gardens, thickets	3
Malcorus pectoralis	Rufouseared Warbler	shrubby vegetation, Karoo & Kalahari plains	3
Melaenornis mariquensis	Marico Flycatcher	*Acacia* savanna	3
Melierax canorus	Pale Chanting Goshawk	savanna, watercourse	3
Mirafra passerina	Monotonous Lark	savanna, open woodland	3
Mirafra sabota	Sabota Lark	semi-arid savanna, thorny bushveld	3
Monticola brevipes	Shorttoed Rock Thrush	rocky outcrops, koppies, towns, river valley	3
Monticola rupestris	Cape Rock Thrush	gorges, cliffs, hillsides	3
Nectarinia afra	Greater Doublecollared	riverine bush, *Protea* savanna, parks, gardens	3
Nectarinia fusca	Dusky Sunbird	desert to semidesert with shrubs, trees along water	3
Oenanthe monticola	Mountain Chat	rocky outcrops, hills, farmyards, gardens	3
Onychognathus	Palewinged Starling	arid country, grassy Karoo, woodland	3
Parisoma layardi	Layard's Titbabbler	high montane, rocky slopes, bushes in ravines	3
Parisoma subcaeruleum	Titbabbler	thornveld, riverine bush, savanna thickets	3
Parus cinerascens	Ashy Tit	*Acacia* savanna, Kalahari scrub, thornbush	3
Passer melanurus	Cape Sparrow	arid, semi-arid savanna, gardens, thornbush, Highveld farm	3
Philetairus socius	Sociable Weaver	arid *Acacia* savanna, semi-desert	3
Phoeniculus purpureus	Redbilled Woodhoopoe	*Acacia* thornveld, gardens, parks	3
Platalea alba	African Spoonbill	shallow inland waters, alpine and sour grassland	3
Prinia flavilcans	Blackchested Prinia	semi-arid scrub, *Acacia* savanna, gardens	3

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 12. continue...

Promerops gurneyi	Gurney's Sugarbird	montane scrub with *Protea* and *Aloe*	3
Psalidoprocne holomelas	Black Sawwing Swallow	forest edge, plantations, road edge	3
Pterocles bicinctus	Doublebanded Sandgrouse	savanna, mopane veld, hills with tussocky grass	3
Pterocles namaqua	Namaqua Sandgrouse	open desert and semi-desert, arid savanna	3
Pycnonotus nigricans	Redeyed Bulbul	savanna, gardens, farmyards	3
Rallus caurulescens	African Rail	reedbeds, marshes, swamps	3
Serinus alario alario	Blackheaded Canary	arid shrubby hills, rocky slopes, cultivated land	3
Sporopipes squamifrons	Scalyfeathered Finch	*Acacia* savanna, arid scrub, farmyards	3
Stenostira scita	Fairy Flycatcher	karoo scrub, *Acacia* savanna, gardens, bushy hills.	3
Tadorna cana	South African Shelduck	inland waters, dams, pans, vleis, temporay waters	3
Thripias namaquus	Bearded Woodpecker	drier savanna, woodland	3
Tockus leucomelas	Southern Yellowbilled	bushveld, woodland, savanna	3
Turdoides bicolor	Pied Babbler	semi-arid savanna, woodland, riverine *Acacia*	3
Uraeginthus granatinus	Violeteared Waxbill	dry savanna, cultivated land edges	3
Vidua regia	Shafttailed Whydah	*Acacia* savanna	3
Zosterops pallidus	Cape White-eye	forest, woodland, savanna, garden, alien plantations	3

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 13. Red Data Book birds recorded in the Grassland Biome

Species name	Common name	Habitat	Habitat type	Threatened status score
**Anas clypeata*	European Shoveller	shallow inland waters	4	3
**Ephiippiorhynchus*	Saddlebilled Stork	floodplains, flooded grassland, inland water	2	3
**Macheiramphus alcinus*	Bat Hawk	dense woodland, riverine forest	4	3
Anas querquedula	Garganey	inland waters and sewage ponds	4	3
Anthus brachyurus	Shorttailed Pipit	grassy hillsides or flats	1	3
Anthus hoeschi	Mountain Pipit	short, montane grassland on eastern slopes of Escarpment	1	3
Ardeola ralloides	Squacco Heron	inland waters, dense vegetation	4	3
Ardeotis kori kori	Kori Bustard	open plains, Highveld grassland, Karoo	3	4
Aviceda cuculoides	Cuckoo Hawk	woodland, forest	4	3
Botaurus stellaris	Bittern	reedbeds, marshes	4	4
Butorides rufiventris	Rufousbellied Heron	marshy shallows, floodplains	4	3
Butorides striatus	Greenbacked Heron	dense vegetated rivers, ponds, waters	4	3
Centropus bengalensis	Black Coucal	rank grass in vleis	2	3
Certhilauda chuana	Shortclawed Lark	semi-arid scrub, savanna	4	3
Charadrius pallidus	Chestnutbanded Plover	brackish pans	4	3
Ciconia episscopus	Woollynecked Stork	grassland, wetland, breeds in trees	2	3
Coturnix adansonii	Blue Quail	moist grassland, vleis, cultivated fields	2	3
Delichon urbica	House Martin	steep hillsides, open grassland, man-made structures, cultivated land	3	3

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 13. continue...

Falco chiquera	Rednecked Falcon	savanna, riverine woodland	4	3
Falco peregrinus calidus	Peregrine Falcon	cliffs, hunt over grassland, farmland	4	3
Falco peregrinus minor	Peregrine Falcon	cliffs, hunt over grassland, farmland	4	3
Glareola pratincola	Redwinged Prantincole	open ground, burned grass, overgrazed veld, pans	3	3
Gorsachius leuconotus	Whitebacked Night	streams, marshes	4	3
Grus carunculata	Wattled Crane	open grassland, floodplains, swamps, vleis	2	5
Gypaetus barbatus	Bearded Vulture	Drakensberg massif and foothills	2	3
Gyps coprotheres	Cape Vulture	mountainous country, less common in savanna, grassland	4	4
Hemimacronyx chloris	Yellowbreasted Pipit	dense, open grassland to bushveld in summer	3	4
Heteromirafra ruddi	Rudd's Lark	moist, short montane grassland	1	4
Hydroprogne caspia	Caspian Tern	larger inland pans and dams	4	3
Ixobrychus minutus minutus	Little Bittern	reedbeds	4	3
Ixobrychus sturmii	Dwarf Bittern	reedbeds, trees in floodplains, marshes	4	3
Leptoptilos crumeniferus	Marabou Stork	open woodland, rubbish dumps	4	3
Macrodipteryx vexillaria	Pennantwinged Nightjar	stony hillsides, sandy grounds in woodland	4	3
Microparra capensis	Lesser Jacana	vleis, dams with lilies	4	3
Mycteria ibis	Yellowbilled Stork	inland waters, pans, marshes	4	3
Neotis denhami	Stanley's Bustard	montane and Highveld grassland, Karoo, savanna	3	4
Neotis ludwigii	Ludwig's Bustard	grassland, open plains	3	4

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 13. continue...

Pachycoccyx audeberti	Thickbilled Cuckoo	woodland, savanna, bushveld	4	3
Pelecanus onocrotalus	White Pelican	dams, pans	4	3
Pelecanus rufescens	Pinbacked Pelican	open waters, dams	4	3
Phoeniconaias minor	Lesser Flamingo	larger brackish, saline inland waters	4	3
Phoenicopterus truber	Greater Flamingo	shallow inland waters	4	3
Podica senegalensis	African Finfoot	streams, pans, lakes	4	3
Polemaetus bellicosus	Martial Eagle	grassland, savanna with trees, woodland	3	4
Pterocles gutturalis	Yellowthroated	short grassland, recently burned ground, cultivated field	2	3
Rostratula benhalensis	Painted Snipe	swamps, marshes, lakes	4	3
Sarothrura affinis	Striped Flufftail	submontane grassland, rank vegetation and grass, forest edges	3	3
Sarothura ayresi	Whitewinged Flufftail	large marshes	4	3
Schoenicola brevirostris	Broadtailed Warbler	moist grassland, vleis, rank grass	2	3
Spizocorys fringillaris	Botha's Lark	heavily grazed grassland (sour), cultivated land	2	3
Torgos tracheliotus	Lappetfaced Vulture	savanna, bushveld, sometimes grassland, desert	3	4
Turnix hottentotta	Blackrumped	open grassland, fallow lands, montane grassland	2	5
Tyto capensis	Grass Owl	long grass, near water, vleis, marshes	2	4

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 14. Grassland Biome birds of Habitat type 1 that are South African breeders

Species	Common name	Habitat	Endemicity
Heteromirafra ruddi	Rudd's Lark	moist, short montane grassland	5
Mirafra cheniana	Melodious Lark	open climax grassland, grassy Karoo	3
Eremopterix verticalis	Greybacked Finchlark	arid ground, open short grass plains, bare pans	3
Anthus hoeschi	Mountain Pipit	short, montane grassland on eastern slopes of escarpment	3
Anthus brachyurus	Shorttailed Pipit	grassy hillsides or flats	2
Eupodotis cafra barrowii	Whitebellied Korhaan	open grassland	3
Francolinus levaillantii	Redwing Francolin	montane grassland, low-lying grassland	2
Cisticola brunnescens	Palecrowned Cisticola	moist, short grassland	2
Cisticola ayresii	Ayres' Cisticola	short grassland	2

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 15. Omnivorous Grassland Biome birds

Species name	Common name	Food
**Crex crex*	Corncrake	insects, frogs, seeds, leaves
**Nectarinia talatala*	Whitebellied Sunbird	nectar, insects, spiders
Acridotheres tristis	Indian Myna	insects, fruit, birds, mice
Acrocephalus palustris	European Marsh Warbler	insects, berries
Acrocephalus schoenobaenus	European Sedge Warbler	insects, spiders, berries
Actophilornis africanus	African Jacana	insects, invertebrates, waterlily bulbs
Amadina fasciata	Cutthroat Finch	seeds, insects
Amaurornis flavirostris	Black Crake	insects, small invertebrates, fish, seed, plants
Amblyospiza albifrons	Thickbilled Weaver	insects, fruit, small molluscs
Anas capensis	Cape Teal	99 % insect material & 1 % plants
Anas erythrorhyncha	Redbilled Teal	water plants, aquatic invertebrates
Anas hottentota	Hottentot Teal	seed, fruit, insects, molluscs
Anas smithii	Cape Shoveller	planctonic invertebrates, insects, tadpoles, seed
Anas undulata	Yellowbilled Duck	plants, seed, stems, grain, grass, insects, larvae
Anthoscopus minutus	Cape Penduline Tit	insects, berries
Anthropoides paradiseas	Blue Crane	fish, reptiles, frogs, grass seeds
Anthus brachyurus	Shorttailed Pipit	insects, grass seeds
Anthus crenatus	Rock Pipit	insects, seeds, spiders
Anthus leucophrys	Plainbacked Pipit	insects, seeds
Anthus novaeseelandiae	Richard's Pipit	insects, seeds, arthropods
Anthus vaalensis	Buffy Pipit	insects, seeds
Ardea cinerea	Grey Heron	aquatic animals, small mammals, rarely plants
Ardeotis kori kori	Kori Bustard	insects, small vertebrates, seeds, carrion
Balearica regulorum	Crowned Crane	reptiles, frogs, insects, grain
Burhinus capensis	Spotted Dikkop	insects, worms, crustaceans, seeds
Calandrella cinerea	Redcapped Lark	seeds, insects
Calidris alpina	Dunlin	molluscs, crustaceans, insects, seeds
Campephaga flava	Black Cuckooshrike	insects, fruit
Centropus bengalensis	Black Coucal	insects, spiders, reptiles, seeds
Cercomela familiaris	Familiar Chat	insects, fruit, animal fat
Cercomela schlegelii	Karoo Chat	insects, seeds
Certhilauda albescens	Karoo Lark	seed, berries, arthropods
Certhilauda chuana	Shortclawed Lark	insects, grass seeds
Certhilauda curvirostris	Longbilled Lark	insects, seeds
Charadrius asiaticus	Caspian Plover	insects, grass seeds
Chersomanes albofasciata beesleyi	Spikeheeled Lark	insects, green plant material
Cinnyricinclus leucogaster	Plumcoloured Starling	insects, fruit
Cisticola chiniana	Rattling Cisticola	insects, nectar of aloes
Colius striatus	Speckled Mousebird	fruit, leaves, seed, nectar, insects(rarely)
Corvus albicollis	Whitenecked Raven	carrion, insects, fruit, eggs, mammals, reptiles
Corvus albus	Pied Crow	plant material, fish, mammals, arthropods, carrion
Corvus capensis	Black Crow	fruit, omnivorous, frogs, carrion
Corythaixoides concolor	Grey Lourie	fruit, flowers, insects, seeds, nestlings
Cossypha caffra drakensbergi	Cape Robin	insects, spiders, fruit, lizards, frogs
Cossypha dichroa	Chorister Robin	insects, spiders, fruit
Cossypha humeralis	Whitethroated Robin	insects, invertebrates, berries
Coturnix adansonii	Blue Quail	seeds, snails, insects
Coturnix coturnix	Common Quail	seeds, bulbs, athropods, snails
Coturnix delegorguei	Harlequin Quail	seeds, shoots, insects, snails
Creatophora cinerea	Wattled Starling	insects, fruit, nectar
Crex egregia	African Crake	insects, frogs, leaves, seeds
Cuculus solitarius	Redchested Cuckoo	insects, seeds
Cursorius rufus	Burchell's Courser	insects, seeds
Cursorius temminckii	Temminck's Courser	insects, seeds, molluscs
Dendrocygna bicolor	Fulvous Duck	seed, fruit of aquatic material, sometimes insects
Dendrocygna viduata	Whitefaced Duck	seeds, buds, insects, fruit, grass, grain
Dicrurus adsimilis	Forktailed Drongo	insects, nectar, fish
Emberiza capensis	Cape Bunting	seeds, insects, spiders
Emberiza flaviventris	Goldenbreasted Bunting	seeds, insects, buds

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Species name	Common name	Food
Emberiza impetuani	Larklike Bunting	seeds, insects
Emberiza tahapisi	Rock Bunting	seeds, insects
Eremopterix australis	Blackeared Finchlark	insects, seed
Eremopterix leucotis	Chestnutbacked Finchlark	seeds, insects
Eremopterix verticalis	Greybacked Finchlark	seeds, insects, green plant material
Erythropygia coryphaeus	Karoo Robin	insects, worms, *Lycium* fruit
Erythropygia leucophrys	Whitebrowed Robin	insects, berries, *Aloe* nectar
Erythropygia paena	Kalahari Robin	insects, spiders, fruit
Estrilda astrild	Common Waxbill	seeds, insects, *Ficus sycomorus* fruit
Estrilda erythronotos	Blackcheeked Waxbill	seeds, insects, nectar, green plant material
Estrilda melanotis	Swee Waxbill	seeds, insects
Euplectes afer	Golden Bishop	seeds, insects
Euplectes albonotatus	Whitewinged Widow	seeds, insects, grain, nectar
Euplectes ardens	Redcollared Widow	seeds, insects
Euplectes capensis	Yellowrumped Widow	seeds, insects
Euplectes progne	Longtailed Widow	seeds, insects
Euplectus orix	Red Bishop	seeds, grain, insects for young
Eupodotis affraoides	Whitewinged Black Korhaan	insects, plant material
Eupodotis afra	Black Korhaan	insects, plant material
Eupodotis caerulescens	Blue Korhaan	insects, small lizards, seeds, plant material
Eupodotis cafra barrowii	Whitebellied Korhaan	insects, invertebrates, plants
Eupodotis melanogaster	Blackbellied Korhaan	insects and plant material
Eupodotis ruficrista ruficrista	Redcrested Korhaan	seeds, arthropoda, fruit
Eupodotis vigorsii	Karoo Korhaan	insects, invertebrates, reptiles, seeds
Francolinus coqui	Coqui Francolin	seeds, shoots, insects, ticks
Francolinus levaillantii	Redwing Francolin	bulbs, grains, seeds, molluscs
Francolinus levaillantoides	Orange River Francolin	bulbs, corms, seeds, insects
Francolinus natalensis	Natal Francolin	insects, molluscs, seed, fruit
Francolinus sephaena	Crested Francolin	bulbs, seeds, berries, insects
Francolinus shelleyi	Shelley's Francolin	seeds, grains, insects, bulbs
Francolinus swainsonii	Swainson's Francolin	seeds, berries, shoots, insects
Fulica cristata	Redknobbed Coot	water plants, grass, insects, molluscs
Galerida magnirostris	Thickbilled Lark	insects, seeds, bulbs
Gallinula angulata	Lesser Moorhen	seeds, reed flowers, insects
Gallinula chloropus	Moorhen	water plants, seeds, insects, molluscs
Grus carunculata	Wattled Crane	reptiles, frogs, insects, small mammals
Himantopus himantopus	Blackwinged Stilt	insects, worms, crustaceans, seeds
Hippolais icterina	Icterine Warbler	insects, spiders, berries
Hippolais olivetorum	Olivetree Warbler	insects, fruit
Hirundo abyssinica	Lesser Striped Swallow	aerial arthropods, arils of *Acacia* seeds
Hirundo cucullata	Greater Striped Swallow	aerial arthropods, arils of *Acacia* seeds
Indicator minor minor	Lesser Honeyguide	insects, spiders, honey, beeswax
Lagonosticta rubricata rubricata	Bluebilled Firefinch	seeds, insects
Lagonosticta senegala	Redbilled Firefinch	seeds, insects, crumbs
Lamprotornis australis	Burchell's Starling	insects, fruit, invertebrates
Lamprotornis nitens	Glossy Starling	insects, fruit, nectar of aloes
Laniarius ferrugineus	Southern Boubou	insects, birds, grain, fruit
Limosa limosa	Blacktailed Godwit	molluscs, crustaceans, worms, seeds
Lophaetus occipitalis	Longcrested Eagle	mainly rodents, reptiles, rarely fruit
Lybius torquatus	Blackcollared Barbet	fruit, insects
Macronyx capensis	Orangethroated Longclaw	insects, grass seed
Melaenornis mariquensis	Marico Flycatcher	insects, rarely fruit
Melaenornis pallidus	Pallid Flycather	insects, small fruits
Melaenornis pammelaina	Black Flycatcher	insects, nectar of aloes, fruit
Mirafra africana	Rufousnaped Lark	insects, seed
Mirafra africanoides	Fawncoloured Lark	insects, seeds, millipedes
Mirafra apiata	Clapper Lark	insects, seeds
Mirafra cheniana	Melodious Lark	insects, seeds
Mirafra passerina	Monotonous Lark	insects, seeds
Mirafra rufocinnamomea	Flappet Lark	insects, seeds
Mirafra sabota	Sabota Lark	seeds, insects

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Species name	Common name	Food
Monticola explorator	Sentinel Rock Thrush	insects, fruit, seeds
Monticola rupestris	Cape Rock Thrush	insects, spiders, frogs, nectar, fruit
Muscicapa striata	Spotted Flycatcher	insects, fruit of *Ochna pretoriensis* & *Trema orient*
Myrmecocichla formicivora	Anteating Chat	insects, fruit, millipeds
Nectarinia afra	Greater Doublecollared Sunbird	nectar, insects, spiders
Nectarinia amethystina	Black Sunbird	nectar, insects, spiders
Nectarinia famosa	Malachite Sunbird	nectar, insects, spiders
Nectarinia fusca	Dusky Sunbird	nectar, insects
Nectarinia mariquensis	Marico Sunbird	nectar, insects, spiders
Neotis denhami	Stanley's Bustard	insects, grass, seeds, reptiles
Neotis ludwigii	Ludwig's Bustard	insects, seeds, small vertebrates, plant material
Netta erythrophthalma	Southern Pochard	seed, aquatic vegetation, crustacea
Nettapus auritus	Pygmy Goose	seeds, insects, fish
Numenius arquata arquata	Curlew	molluscs, crustaceans, insects, berries
Numenius arquata orientalis	Curlew	molluscs, crustaceans, insects, berries
Numida meleagris	Helmeted Guineafowl	seeds, insects, bulbs, grain
Oenanthe bifasciata	Buffstreaked Chat	insects, fruit
Onychognathus morio	Redwinged Starling	insects, fruit, lizards, aloe nectar
Onychognathus nabouroup	Palewinged Starling	insects, fruit, ticks
Oriolus larvatus	Blackheaded Oriole	insects, fruit, nectar
Oriolus oriolus	European Golden Oriole	insects, fruit
Ortygospiza atricollis	Quail Finch	seeds, insects, spiders
Oxyura maccoa	Maccoa Duck	larvae, pupae, seeds, insects, algae
Parisoma layardi	Layard's Titbabbler	insects, fruit
Parisoma subcaeruleum	Titbabbler	insects, spiders, fruit
Passer diffusus	Greyheaded Sparrow	seeds, insects
Passer domesticus	House Sparrow	seeds, fruit, insects, scrabs
Passer melanurus	Cape Sparrow	seeds, insects, fruit
Passer motitensis	Great Sparrow	seeds, insects
Pernis apivorus	Honey Buzzard	larvae, pupae, small vertebrates, berries
Petronia superciliaris	Yellowthroated Sparrow	insects, seeds, nectar of *Aloe*
Phalaropus fulicarius	Grey Phalarope	plankton, insects, worms, molluscs
Phalaropus lobatus	Rednecked Phalarope	plankton, insects, worms
Philetairus socius	Sociable Weaver	insects, seeds
Philomachus pugnax	Ruff/Reeve	molluscs, berries, grain, seeds
Phoenicopterus truber	Greater Flamingo	aquatic vertebrates, algae
Phoeniculus cyanomelas	Scimitarbilled Woodhoopoe	insects, seeds, buds, nectar
Phoeniculus purpureus	Redbilled Woodhoopoe	insects, millipeds, lizards, nectar
Phragmacia substriata	Namaqua Warbler	insects, fruit of *Lycium* and *Atriplex*
Phyllastrephus terrestris	Terrestrial Bulbul	insects, snails, fruit
Plocepasser mahali	Whitebrowed Sparrowweaver	insects, seed
Ploceus cucullatus	Spottedbacked Weaver	small insects, seeds
Ploceus intermedius	Lesser Masked Weaver	insects, seeds
Ploceus velatus	Masked Weaver	insects, seeds, nectar
Pluvialis squatarola	Grey Plover	worms, molluscs, crustaceans, rarely seeds
Podiceps cristatus	Great Crested Grebe	carnivore, water plants
Pogoniulus chrysoconus	Yellowfronted Tinker Barbet	fruit, insects
Pogoniulus pusillus	Redfronted Tinker Barbet	fruit, insects
Porphyrio porphyrio	Purple Gallinule	roots, tubers, insects, nestlings, carrion
Porphyrula alleni	Lesser Gallinule	seeds, flowers, bulbs
Porzana porzana	Spotted Crake	aquatic invertebrates, insects, seeds, rarely fish
Porzana pusilla	Baillon's Crake	insects, worms, crustaceans, molluscs, seeds
Prinia subflava	Tawnyflanked Prinia	insects, nectar
Promerops gurneyi	Gurney's Sugarbird	insects, nectar
Pseudochloroptila symonsi	Drakensberg Siskin	seeds, buds, insects
Pterocles gutturalis	Yellowthroated Sandgrouse	seeds, fallen grain
Pycnonotus barbatus	Blackeyed Bulbul	fruit, nectar, insects, lizards
Pycnonotus nigricans	Redeyed Bulbul	fruit, nectar, insects
Pytilia melba	Melba Finch	seeds, insects
Quelea quelea	Redbilled Quelea	seeds, grain, insects
Recurvirostra avosetta	Avocet	insects, crustaceans, worms, seeds, plants

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

Species name	Common name	Food
Sarkidiornis melanotos	Knobbilled Duck	seed of grass, lilies, insect larvae
Sarothrura affinis	Striped Flufftail	insects, seeds, green plant material
Sarothrura elegans	Buffspotted Flufftail	insects, seeds, green plant material
Sarothrura rufa	Redchested Flufftail	seeds, insects, snails, spiders
Serinus albogularis	Whitethroated Canary	seeds, berries, insects, buds
Serinus atrogularis	Blackthroated Canary	seeds, insects, flowers
Serinus flaviventris	Yellow Canary	seeds, nectar, insects
Serinus mozambicus	Yelloweyed Canary	seeds, insects, *Hibiscus* flowers
Serinus sulphuratus	Bully Canary	seeds, fruit, leaves
Sigelus silens	Fiscal Flycatcher	incects, fruit, nectar of aloes
Smutsornis africanus	Doublebanded Courser	insects, seeds, molluscs
Spermestes bicolor	Redbacked Mannikin	seeds, nectar, insects
Spermestes cucullatus	Bronze Mannikin	seeds, insects, nectar, green plant material, algae
Spizocorys conirostris	Pinkbilled Lark	seeds, insects
Spizocorys fringillaris	Botha's Lark	insects, seeds
Sporopipes squamifrons	Scalyfeathered Finch	seeds
Spraeginthus subflavus	Orangebreasted Waxbill	seeds, insects, shoots
Spreo bicolor	Pied Starling	insects, fruit, nectar, lizards
Streptopelia capicola	Cape Turtle Dove	seeds, insects, grain, termite alates
Streptopelia semitorquata	Redeyed Dove	seeds, bulbs, termite alates
Streptopelia senegalensis	Laughing Dove	seeds, insects, termite alates, snails
Struthio camelus	Ostrich	grass, berries, insects, small reptiles
Sylvia borin borin	Garden Wabler	insects, soft fruit
Sylvia borin woodwardi	Garden Warbler	insects, fruit
Sylvia communis icterops	Whitethroat	insects, fruit
Sylvia communis volgensis	Whitethroat	insedts, fruit
Tadorna cana	South African Shelduck	seeds, algae, insects, crustaceans
Tchagra tchagra	Southern Tchagra	insects, small fruit
Telophorus olivaceus	Olive Bush Shrike	insects, figs
Thalassornis leuconotus	Whitebacked Duck	waterlilly seeds,water plant parts, larvae,seed
Thamnolaea cinnamommeiventris	Mocking Chat	insects, fruit
Threskiornis aethiopicus	Sacred Ibis	various, insects, small vertebrates, seed, carrion
Tockus nasutus	Grey Hornbill	insects, frogs, fruit, rodents
Trachyphonus vaillantii	Crested Barbet	insects, fruit, worms, snails
Tryngites subruficollis	Buffbreasted Sandpiper	insects, spiders, seeds
Turdoides jardineii	Arrowmarked Babbler	insects, lizards, seed, fruit, snails
Turdus libonyana	Kurrichane Thrush	insects, lizards, fruit, spiders
Turdus olivaceus	Olive Thrush	insects, mammals, molluscs, fish, fruit, seed
Turnix hottentotta	Blackrumped Buttonquail	seeds, insects, invertebrates
Turnix sylvatica	Kurrichane Buttonquail	seeds, insects, invertebrates, seeds
Turtus chalcospilos	Greenspotted Dove	seeds, berries, termite alates
Uraeginthus angolensis	Blue Waxbill	seeds, insects
Uraeginthus granatinus	Violeteared Waxbill	seeds, insects
Vidua funerea	Black Widowfinch	seeds, termites
Vidua macroura	Pintailed Whydah	seeds, insects
Vidua paradisaea	Paradise Whydah	seeds, insects
Xenus cinereus	Terek Sandpiper	crustaceans, molluscs, worms, insects
Zosterops pallidus	Cape White-eye	insects, spiders, nectar

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 16. Reptiles (lizards and snakes) of the Grassland Biome

Species name	Habitat	Conservation status	Habitat type
Python sebae natalensis	moist habitats,rocky areas, well-wooded areas	Partially protected	6
Lycodonomorphus rufulus	flowing streams, riverine bush	Partially protected	2
Lamprophis fuliginosus	Higveld grassland, Karoo, cities	Partially protected	2
Lamprophis inornatus	grassland under rocks & debris	Partially protected	2
Lamprophis aurora	savanna, Highveld grassland	Partially protected	2
Lycophidion capense capense	grassland, savanna	Partially protected	2
**Mehelya capensis capensis*	savanna, bushveld, human dwellings	Partially protected	6
Duberria lutrix lutrix	Highveld & montane grassland at forest edges, moribund termitaria	Partially protected	2
Pseudaspis cana cana	Highveld grassland, arid areas, mountain areas	Partially protected	2
Prosymna sundevallii sundevallii	savanna, Highveld grassland, arid areas, various	Partially protected	2
Typhlops bibronii	various, moribund termitaria, rock, debris	Partially protected	2
Typhlops lalandei	semi-desert, savanna, moribund termitaria, various	Partially protected	2
Leptotyphlops scutifrons scutifrons	grassland, moist and dry savanna	Partially protected	2
Leptotyphlops distanti	grassland, savanna	Partially protected	2

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 16. continue...

Psammophylax rhombeatus rhombeatus	Highveld grassland, Karoo	Partially protected	2
Psammophylax tritaenatus	open grassland, woodland, moribund termitaria	Partially protected	2
Psammophis notostictus	arid scrub, Karoo, hard stony ground, Nama Karoo, grass	Unknown?	2
Psammophis leightoni trinasalis	desert, semi-desert, savanna, moribund termitaria	Partially protected	2
Psammophis sibilans brevirostris	Highveld, mountain grassland, bushveld	Partially protected	2
Psammophis crucifer	Highveld, mountain grassland, moribund termitaria, rocks	Partially protected	1
Atractaspis bibronii	variable, Highveld grassland, semi-desert, termitaria, crevices, rotting logs	Partially protected	2
Aparallactus capensis	variable, Highveld grassland, mountain grassland, savanna, termitaria	Partially protected	2
**Amblyodispas polylepis polylepis*	savanna, arid forest, woodland	Partially protected	6
Homoroselaps lacteus	variable, grassland, semi-desert, savanna	Partially protected	2
**Xenocalamus bicolor australis*	Kalahari-sand, *Burkea africana* woodland	Partially protected	6
**Philothamnus semivariegatus semivariegatus*	open bush, savanna, arid areas	Partially protected	6
**Philothamnus angolensis*	variable, moist savanna, arid savanna, reedbeds, riverine habitat	Unknown?	6
Philothamnus natalensis occidentalis	variable, moist mountain, miombo-bushveld	Partially protected	6
Dasypeltis scabra	various, crevices, debris, moribund termitaria	Partially protected	2

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 16. continue...

Crotaphopeltis hotamboeia hotamboeia	various, debris, moribund termitaria	Partially protected	2
**Telescopus semiannulatus semiannulatus*	savanna, sandveld, rocks, crevices	Partially protected	6
**Dispholidus typus typus*	open bushveld, savanna, bushes, trees	Partially protected	6
Aspidelaps lubricus lubricus	Karoo, sandveld areas, grassland	Unknown?	2
Elapsoidea sundevallii media	variable, Highveld grassland, Kalahari desert	Partially protected	2
Naja nivea	arid Karoo, bushveld, thornveld, grassland	Partially protected	2
Hemachatus haemachatus	grassland	Partially protected	1
Causus rhombeatus	moist savanna, rocks, soil, montane grassland, moribund termitaria	Partially protected	2
Bitis arietans arietans	true desert, high mountain tips, grassland to rocky hillsides	Partially protected	2
Monopeltis capensis capensis	Kalahari-sandveld	Protected	6
Acontias gracilicauda gracilicauda	grassland, sandy areas, valley bushveld	Unknown	2
Mabuya capensis	rocks, debris, Highveld grassland, south-western Tvl. & Escarpment	Protected	2
Mabuya striata punctatissimus	variable, dry savanna, marshes, human dwellings, various veldtypes	Protected	2
Mabuya sulcata	Karoo, arid savanna, desert	Protected	6
Mabuya varia	variable, grassland, arid savanna, mountain tips	Protected	2

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 16. continue…

**Mabuya variegata punctulata*	variable, desert, Karoo, savanna, mountain grassland	Protected	2
Panaspis wahlbergii	tropical to dry savanna , Highveld grassland, rocky outcrops	Protected	2
**Ichnotropis squamulosa*	dry to moist savanna, sandy habitats	Protected	6
**Nucras intertexta intertexta*	dry savanna on Kalahari sand, rocks on soil, shrubs	Protected	6
Pedioplanis lineoocellata lineoocellata	variable, Karoo, dry to moist savanna	Protected	2
Chamaesaura anguina anguina	grass covered mountain slopes, rocky hillsides in grassland	Protected	1
Cordylus giganteus	*Themeda*-grassland or transitional zones	Protected	1
Cordylus polyzonus polyzonus	Karoo-areas, Kalahari thornveld, rocky areas	Protected	6
Cordylus vittifer vittifer	various, rocky outcrops, Drakensberg escarpment	Protected	5
Varanus niloticus niloticus	rivers, pans, lakes	Partially protected	6
Agama aculeata distanti	shrubs, grass tussocks, moribund termitaria, savanna, debris	Protected	2
Agama aculeata aculeata	semi-desert, savanna, grass tussocks	Unknown?	2
Agama atra atra	semi-desert to fynbos, rocky outcrops	Protected	4
Agama atricollis	open savanna, bushveld	not protected	6
Chamaeleo dilepis dilepis	bushveld savanna, recorded in grassland	Protected	2

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 16. continue...

**Lygodactylus capensis capensis*	dry savanna bushveld, trees, shrubs	Protected	6
**Pachydactylus bibronii*	variable, Karoo, savanna, semi-desert, rocky outcrops, termitaria, debris	Protected	6
Pachydactylus mariquensis mariquensis	flat sandy areas with sparse vegetation, Karoo, Nama Karoo	Unknown?	6
**Hemidactylus mabouia mabouia*	various, boababs, rubble	Protected	6
**Homopholis wahlbergii*	rocky outcrops, cliffs, tree trunks	Protected	6
Lygodactylus ocellatus ocellatus	exclusive to Highveld, crevices	Protected	4
Pachydactylus capensis capensis	rocks on soil, termitaria, rotting logs, grasslands of Highveld	Protected..	2
Pachydactylus vansoni	Highveld, Soutpansberg, rocky outcrops in grasslands	Protected	2
Pachydactylus affinis	termitaria, crevices, rocky outcrops	Protected	2
Scelotes mirus	montane grassland and scrub, rocky outcrops	Protected??	1
**Mabuya sp.nov.*	rocky outcrops, mountains, crevices, savanna	Unknown?	5
**Lygosoma sundevalli sundevalli*	bushveld, stones, debris, rocks	Protected	6
Acontias percivali occidentalis	dead logs, western half of Tvl. excluding the Highveld	Uncommon	6
Acontias breviceps	montane and Highveld grassland	Rare/vulnerable	1
Nucras lalandii	Highveld to montane grassland, under stones	Protected	1

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 16. continue…

Nucras taeniolota holubi	wide habitat tolerance, grass tussocks at bush edges	Protected	2
Nucras ornata	grass tussocks, montane grassland, rocky hillsides	Protected	2
Pedioplanis lineoocellata pulchella	stony hillsides, wooded savanna, open scrub areas	Protected	6
Pedioplanis burchelli	slopes of mountains, bedrocks, montane grassland	Protected	5
Ichnotropis capensis	sandy habitats and bushveld, grass tussocks	Protected	2
Varanus albigularis	widespread over South Africa, bushveld, rocky terrain	Partially protected	2
Bradypodion cf.karrooicum	gardens, karroid country	Unknown?	6
Bradypodion dracomontanum	forest and high altitude mountains, grassland	Unknown?	2
Bradypodion sp.(Zastron)	grassland	Unknown?	4
Bradypodion sp. (Ngotswane Gorge)	grassland, riverine habitat	Unknown?	4
Lycodonomorphus laevissimus	alongside streams in Highveld and montane grassland	Partially protected	2
Tetradactylus seps	coastal forests and high mountains	Unknown?	2
Tetradactylus tetradactylus	grassy mountain slopes, fynbos	Unknown?	2
Tropidosaura essexi	rocky mountain grassland	Unknown?	1
Leptotyphlops conjunctus conjunctus	grass tussocks, termitaria, Acocks veld types 8, 52, 54, 55, 57, 61, 63, 64	Partially protected	2

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 16. continue...

Afroedura karroica halli	dry moutain grassland, rocky outcrops	Unknown?	1
Afroedura nivaria	rocks, crevices of high altitudes, grassland	Unknown?	4
Pseudocordylus melanotus melanotus	rocky outcrops, Acocks veld types 8, 52, 54, 57, 61, 62, 63, 64	Protected	4
Pseudocordylus melanotus subviridis	rocky outcrops, mountain grassland	Unknown?	2
Xenocalamus bicolor bicolor	Kalahari-sand	Partially protected	6
Prosymna bivittata Werner	*Acacia* savanna under rocks and logs, grass	Partially protected.	2
**Agama aculeata armata*	deep sand areas, calcrete flats, savanna & bushveld	Protected	6
Pseudocordylus langi	rock fissures at high altitudes	Protected	4
Tropidosaura cottrelli	mountain grassland	Unknown?	4
Amplorhinus multimaculatus	montane and Highveld grassland in moist locations	Partially protected	1
Philothamnus hoplogaster	marshy habitats	Partially protected	2
**Gerrhosaurus validus validus*	rocky outcrops, dry & moist savanna	Protected	6
Gerrhosuarus flavigularis	grasslands of Highveld, bushveld, rocky hillsides	Protected	2
Chamaesaura aenea	grassland of Highveld and Drakensburg Escarpment	Protected	1
**Cordylus vandami*	rocky outcrops in lowveld, mountain slopes, Acocks veld types 8, 57, 61	Protected	2

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 16. continue...

Platysaurus orientalis orientalis	ranges fringing the eastern part of the bushveld, Acocks veld types 57, 61	Protected	2
**Leptotyphlops conjunctus incognitus*	rocks, grass roots, Acocks veld types 8, 10 , 63, 67	Partially protected	2
Lamprophis guttatus	mountain areas, Acocks veld types 8, 52, 54, 57, 62, 63, 67	Partially protected	2
Homoroselaps dorsalis	Highveld and montane grassland, termitaria	Partially protected	1
Atractaspis duerdeni	sandy soil and broadleaved savanna, grass	Partially protected	2
**Naja annulifera*	excluded from most of the Highveld, rocky outcrops and major river valleys	Partially protected	6
**Naja mossambica*	rocky, well vegetated hillsides and around human habitation	Partially protected	6
**Bitis caudalis*	Kalahari sands, tops of the Magaliesberg, human debris, overhanging rocks	Partially protected	6
Tropidosaura montana rangeri	montane grassland & fynbos	Unknown?	2
Pseudocordylus spinosus	rocky areas in grassland	Unknown?	4
Agama hispida distanti	Highveld, shrubs, dry terrain, Nama Karoo, sandy thornbush	Unknown?	2
**Mabuya striata striata*	aboreal, human habitation, bridges	Protected	6
Mabuya quinquetaeniata margaritifer	rocky outcrops in bushveld areas, Acocks veld types 57, 63, 67	Protected	6
Acontophiops lineatus	montane grassland with rocky outcrops	Protected	2
Acontias plumbeus	woodland, south-eastern Highveld grassland	Protected	2

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 16. continue...

**Panapsis sp. nov. "maculicollis"*	various, rocky outcrops, grass covered flats	Protected	6
Tetradactylus breyeri	montane grassland, Highveld grassland	Protected	1
Tetradactylus eastwoodae	montane grassland	Protected	1
**Heliobolus lugubris*	shrubs, grass tussocks	Protected	6
Typhlosaurus cregoi cregoi	rocky terrain, Acocks veld types 8, 67	Protected	2
Mabuya homalocephala smithi	rocky hillsides, Acocks veld type 57	Protected	4
**Scelotes mossambicus*	rocks, rotting logs, mixed bushveld, montane grassland	Protected	2
**Scelotes bidigittata*	rock, rotting logs, grass tussocks, Acocks veld types 8, 11	Protected	2
Bradypodion transvaalensis	aboreal, forest species, shrubs	Protected	6
Pachydactylus maculatus maculatus	rocks, logs, brushwood	Protected	6
Pachydactylus tigrinus	crevices, soil, rocks in bushveld countries	Protected	6
**Afroedura langi "Leolo" in prep.*	granite formations above the Steelpoort, bushveld	Protected	6
**Lygodactylus methueni*	crevices, trees	Protected	6
**Pachydactylus punctatus punctatus*	rocky outcrops, crevices of bushveld & grassland	Protectec	2
**Afroedura pondolia "Godlwayo" in prep.*	crevices, Acocks veld types 10, 63	Protected	1

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 16. contiue...

Afroedoera sp. nov. ("Lebombo") in prep.	Acocks veld type 10, scree, bushveld	Protected	6
Afroedura langi "Soutpansberg" in prep.	Acocks veld type 8, 19, crevices in lowveld	Protected	5
Afroedura multiporus "Abel Erasmus" in prep.	Acocks veld type 8, cliff faces, rocky outcrops	Protected	6
Afroedura pondolia "Maripi" in prep.	crevices between rocks, Acocks veld type 8	Protected	6
**Gerrhosaurus major major*	rocky outcrops, lowveld, Acocks veld types 9, 10, 11	Protected	6
Chamaesaura macrolepis	rocky hillsides covered with grass	Protected	2
Cordylus warreni depressuss	rocky outcrops, hillsides, Acocks veld types 8, 9	Protected	5
Cordylus warreni barbertonensis	rocky outcrops, hillsides, Acocks veld types 9, 10, 63	Protected	5
**Cordylus tropidosternum jonesi*	rotting logs, holes in trees, Acocks veld types 8, 10, aboreal	Protected	2
**Platysaurus intermedius intermedius*	hillsides, rocky outcrops, Acocks veld types 8, 67	Protected	2
**Platysaurus intermedius wilhelmi*	granite outcrops in lowveld	Protected	6
**Zygaspis violacea vandami*	rocks or logs in shadowed areas, lowveld	Protected	6
**Typhlops schlegelii schlegelii*	lowveld, Acocks veld types 10, 11, 67	Semi protected	2
**Leptotyphlops longicaudus*	under rocks, Acocks veld types 10, 11, 67	Partially protected	2
Lamprophis fuscus	open grassland, Acocks veld types 8, 57, savanna	Partially protected	2

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 16. continue…

Lamprophis swazicus	rocky hillsides, mountains, montane grassland, Acocks veld types 9, 57	Partially protected	2
**Lycophidion variegatum*	rocky outcrops, under rocks in lowveld	Partially protected	6
Mehelya nyassae	bushveld, Acocks vled types 8, 63	Partially protected	2
**Psammophis subtaeniatus subtaeniatus*	termitaria, rodent burrows, bushveld & lowveld	Partially protected	6
Psammophis phillipsii	tall grass & reeds alongside water, Acocks veld types 9, 10, 11	Partially protected	2
**Amblyodipsas concolor*	wooded or forested areas, rocks, Acocks veld types, 8, 9, 10	Partially protected	6
**Prosymna ambigua stuhlmanni*	rotting logs and stones, lowveld	Partially protected	6
**Theloptornis capensis capensis*	*Burkea africana* savanna, lowveld, aboreal	Partially protected	6
Dasypeltis inornata	montane grassland, mixed woodland, Acocks veld types 8, 62, 63, 64	Partially protected	2
Pseudocordylus melanotus transvaalensis	rocky outcrops, crest in grassland, Acocks veld type 67	Protected	4
Lygodactylus nigropunctatus nigropunctatus	grassland, rocky areas	Unknown	4
Lygodactylus nigropunctatus incognitus	rocky areas in grassland, bushveld, Soutpansberg	Unknown	2
**Lygodactylus nigropunctatus montiscaeruli*	various, thickets, rocky areas	Unknown	6
Lygodactylus graniticolus	Potgietersrus granite, crevices, bushveld	Unknown	5
Lygodactylus waterbergensis	rocky areas, western side of the Waterberg, sandstone boulders in grassland	Unknown	2

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Bradypodion transvaalensis complex	unknown ?	Unknown	2
Tetradactylus africanus africanus	grassland		1
Tetradactylus africanus fitzsimonsi	grassland		1

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 17. Turtles and tortoises of the Grassland Biome

Species name	Habitat	Conservation status	Habitat type
**Pelomedusa subrufa subrufa*	fresh, stagnant water-bodies, pans, dams, bogs	Protected	6
**Geochelone pardalis*	various, Karoo, grassland, bushveld, savanna, not Tvl. Highveld	Protected	2
**Psammobates oculifer y*	grassland, bushveld, thornveld	Protected	2
Homopus femoralis boulengery	high altitudes, mountain grassland, pure grassland, savanna	Protected	2
Kinixys spekii	savanna, Highveld rocky areas, tropical bushveld	Protected	2
**Chrysemys scripta elegans*	freshwater habitat, vleis, ponds	Introduced	6
**Pelusios sinuatus*	along major streams, dams and pools	Protected	6
Kinixys natalensis	rocky outcrops, Acocks veld types 6, 10, 11	Protected	6
Kinixys lobatsiana	grassland, savanna,various	Unknown	2

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 18. Amphibians recorded in the Grassland Biome

Species name	Habitat	Conservation status	Habitat type
Bufo gariepensis gariepensis	grassland	Unknown?	1
Bufo gariepensis nubicolus	montane grassland, under rocks & soil	Unprotected	1
Bufo gutturalis	bushveld, Highveld and lowveld, mesic climates	Unprotected	2
**Leptopelis mossambicus*	savanna woodland and lowveld close to streams or swamps	Unprotected	6
Pyxicephalus adspersus adspersus	central highveld pans, bushveld	Protected	2
Tomopterna cryptotis	throughout Tvl. except along the Drakensberg and low lying areas	Unprotected	2
Tomopterna natalensis	along streams and wet grass	Unprotected	2
Xenopus laevis laevis	aquatic, grassland	Unprotected	2
Heleophryne natalensis	montane forest zones, with dense vegetation and dark ravines and kloofs	Unprotected	6
**Bufo poweri*	savanna	Unknown?	6
Bufo rangeri	Highveld following northwards and westwards the mountain chains	Unprotected	2
Bufo vertebralis	open grassland with scattered tree clumps	Unprotected	2
Schismaderma carens	rocky areas in the bushveld, largely excluded from the Highveld	Unprotected	6
Rana angolensis	along permanent water,dams, rivers	Unprotected	2
Rana fuscigula	along larger streams, rivers in grassland and wooded savanna	Unprotected	2

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 18. continue...

Strongylopus grayii grayii	montane grassland to forest areas	Unprotected	2
Strongylopus fasciata fasciata	marshy grassland	Unprotected	1
Strongylopus hymenopus	open grassy slopes near water & rocky areas of 2000-3000 m	Unknown	1
Phrynobatrachus natalensis	permanent or temporary water	Unprotected	2
Cacosternum boettgeri	various near water bodies, especially on the highveld and south-western Tvl.	Unprotected	2
Cacosternum nanum nanum	marshy vegetation of montane and highveld grassland	Unprotected	1
Arthroleptella hewitti	riverine habitat	Unknown	6
Kassina senegalensis	rotting vegetation in all habitat types	Unprotected	2
Semnodactylus wealii	open grassland, vleis, marshes	Unknown?	1
**Phrynomerus bifasciatus bifasciatus*	wooded savannas of Tvl.	Unprotected	6
**Tomopterna krugerensis*	shallow pans in open woodland with sandy soils	Unprotected	6
**Ptychadena oxyrhynchus*	pools in open wooded savanna or at shallow depressions where water gathers	Unprotected	6
Strongylopus wageri	streams, rivers flowing through grassland or scrubby bush, forest	Unknown?	4
**Phrynobatrachus mababiensis*	permanent or temporary pans, along riversto eastern Cape	Unprotected	6
Cacosternum nanum parvum	open grassy swamps at high altitudes, grassland	Unknown?	1
Bufo maculatus	various veld types, alongside water amongst grass tussocks or rocks	Unprotected	2

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 18. continue…

Bufo garmani	savanna areas with exclusion of highveld	Unprotected	6
**Bufo fenoulheti fenoulheti*	bushveld areas and rocky outcrops	Unprotected	6
Breviceps adspersus adspersus	bushveld and lowveld of Tvl., but most common in sandveld	Unprotected	6
Pyxicephalus adspersus edulis	pans in open woodland	Protected	6
Ptychadena porosissima	highveld, montane and wooded grassland	Unprotected	2
**Chiromantis xerampelina xerampelina*	crevices, drier habitats, Acocks veld types 6, 8, 9, 10, 11	Unprotected	6
Hemisus guttatus	wooded grassland or grassy areas, Acocks veld type 63	Unprotected	2
**Leptopelis bocagii*	shrubs, Acocks veld types 9, 11	Unprotected	6
**Hemisus marmoratus marmoratus*	mesic bushveld, Acocks veld types 6, 10, 11	Unprotected	6
**Afrixalus aureus*	wooded savanna, Acocks veld types 6, 10, 11	Unprotected	6
Hyperolius semidiscus	reeds, dams, Acocks veld types 57, 63, 64	Unprotected	2
Hyperolius marmoratus taeniatus	dams, canals, Acocks veld types 6, 8, 9, 10, 11, 63	Unprotected	2
**Elapsoidea semiannulata boulengeri*	logs, stones, Acocks veld type 10	Partially protected	6
Elapsoidea sundevallii sundevallii	moribund termitaria in highveld grassland, Acocks veld types 57, 63	Partially protected	3
**Aspidelaps scutatus intermedius*	stony and sandy areas, Acocks veld types 10, 11	Partially protected	6
**Dendroaspis polylepis*	rocky hillsides and outcrops and woodland, Acocks veld types 6, 8, 9, 10, 11	Partially protected	6

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 18. continue...

**Causus defilippii*	rotting logs, Acocks veld types 8, 9, 10, 11, drier areas	Partially protected	6
Bitis atropos	montane and rocky hillsides, Acocks veld types 8, 9, 57, 63, grass tussocks	Partially protected	1
**Xenopus muelleri*	pans, dams, Acocks veld types 8, 9, 10, 11	Unprotected	6
Breviceps verrucosus verrucosus	montane grassland, Acocks veld types 8, 57	Unprotected	2
Breviceps sylvestris sylvestris	grassland, montane forest, Acocks veld types 8, 9	Unprotected	2
Breviceps sylvestris taenitus	grassland, montane forest, wooded savanna, Acocks veld types 8, 9	Unprotected	2
Breviceps adspersus pentheri	montane and highveld grassland, Acocks veld types 8, 54, 57, 63	Unprotected	2
**Breviceps mossambicus*	mixed wooded savanna, Acocks veld types 6, 9, 11	Unprotected	6
**Tomopterna marmorata*	shallow pools in woodland, Acocks veld types 8, 11, 67	Unprotected	6
**Hildebrandtia ornata ornata*	grass near water, Acocks veld types 10, 11	Widespread but localised	2
**Ptychadena anchietae*	pans, dams, vleis, Acocks veld types 6, 9, 10 ,11, 63	Unprotected	6
Ptychadena uzungewensis	montane grassland, Acocks veld type 8, bushveld	Unprotected	2
**Ptychadena mossambica*	savanna woodland, Acocks veld types 6, 9, 10, 11	Unprotected	6
**Ptychadena mascareniensis mascareniensis*	grassland, bushveld, Acocks veld type 10, swamps	Unprotected	2
Rana dracomontana	grassland		1
Arthroleptella ngongoniensis	grassland		1

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 19. Endemic herpetofauna recorded in the Grassland Biome

Order	Family	Species name	Red Data Book code
Anura	BUFONIDAE	*Bufo gariepensis gariepensis* Smith, 1848	4
Anura	BUFONIDAE	*Bufo gariepensis nubicolus* Hewitt, 1927	0
Anura	BUFONIDAE	*Bufo rangeri* Hewitt, 1935	0
Anura	BUFONIDAE	*Bufo vertebralis* Smith, 1848	1
Anura	HELEOPHRYNIDAE	*Heleophryne natalensis* Hewitt, 1931	3
Anura	HYPEROLIDAE	*Semnodactylus wealii* (Boulenger, 1882)	4
Anura	MICROHYLIDAE	**Breviceps mossambicus* Peters, 1854	4
Anura	MICROHYLIDAE	*Breviceps adspersus pentheri* Werner, 1899	0
Anura	MICROHYLIDAE	*Breviceps sylvestris sylvestris* FitzSimons, 1930	3
Anura	MICROHYLIDAE	*Breviceps sylvestris taenitus* Poynton, 1963	0
Anura	MICROHYLIDAE	*Breviceps verrucosus verrucosus* Rapp, 1842	1
Anura	RANIDAE	*Arthroleptella hewitti* (FitzSimons, 1947)	4
Anura	RANIDAE	*Arthroleptella ngongoniensis* Bishop & Passmore, 1993	4
Anura	RANIDAE	*Cacosternum nanum nanum* (Boulenger, 1887)	1
Anura	RANIDAE	*Cacosternum nanum parvum* Poynton, 1963	4
Anura	RANIDAE	*Rana dracomontana* Channing, 1978	4
Anura	RANIDAE	*Rana fuscigula* Duméril & Bibron, 1841	0
Anura	RANIDAE	*Rana vertebralis* Hewitt, 1927	0
Anura	RANIDAE	*Strongylopus fasciata fasciata* (Smith, 1849)	0
Anura	RANIDAE	*Strongylopus hymenopus* (Boulenger, 1920)	4
Anura	RANIDAE	*Strongylopus wageri* Wager, 1961	4
Squamata		*Montaspis gihomaculatu* s Bourquin, 1991	4
Squamata	AGAMIDAE	*Agama aculeata aculeata* Merrem, 1820	0
Squamata	AGAMIDAE	*Agama aculeata distanti* Boulenger, 1902	0
Squamata	AGAMIDAE	*Agama atra atra* Daudin, 1802	4
Squamata	AGAMIDAE	*Agama hispida distanti* Boulenger, 1892	4
Squamata	AMPHISBAENIDAE	**Zygaspis violacea vandami* (Peters, 1854)	0
Squamata	CHAMAELEONIDAE	*Bradypodion* cf. *karrooicum* (Methuen & Hewitt, 1915)	4
Squamata	CHAMAELEONIDAE	*Bradypodion dracomontanum* Raw, 1976	4
Squamata	CHAMAELEONIDAE	*Bradypodion* sp. *(Ngotswane Gorge)* Jacobsen, ms.	3
Squamata	CHAMAELEONIDAE	*Bradypodion* sp.*(Zastron)* Jacobsen, ms.	4
Squamata	CHAMAELEONIDAE	*Bradypodion transvaalensis complex* Jacobsen, ms.	4
Squamata	COLUBRIDAE	**Amblyodipsas concolor* (Smith, 1849)	3
Squamata	COLUBRIDAE	**Philothamnus angolensis* Bocage, 1882	4
Squamata	COLUBRIDAE	**Xenocalamus bicolor australis* FitzSimons, 1946	1
Squamata	COLUBRIDAE	*Atractaspis duerdeni* Gough, 1907	1
Squamata	COLUBRIDAE	*Dasypeltis inornata* Smith, 1849	3
Squamata	COLUBRIDAE	*Duberria lutrix lutrix* (Linnaeus, 1758)	0
Squamata	COLUBRIDAE	*Homoroselaps dorsalis* (Smith, 1849)	3
Squamata	COLUBRIDAE	*Homoroselaps lacteus* (Linnaeus, 1754)	0
Squamata	COLUBRIDAE	*Lamprophis aurora* (Linnaeus, 1754)	0
Squamata	COLUBRIDAE	*Lamprophis fuscus* Boulenger, 1893	3
Squamata	COLUBRIDAE	*Lamprophis guttatus* (Smith, 1843)	0
Squamata	COLUBRIDAE	*Lamprophis inornatus* Duméril & Bibron, 1854	4
Squamata	COLUBRIDAE	*Lamprophis swazicus* Schaefer, 1970	0
Squamata	COLUBRIDAE	*Lycodonomorphus laevissimus* Raw, 1973	0
Squamata	COLUBRIDAE	*Philothamnus natalensis occidentalis* Broadley, 1966	0
Squamata	COLUBRIDAE	*Prosymna sundevallii sundevallii* (Smith, 1849)	3
Squamata	COLUBRIDAE	*Psammophis crucifer* (Daudin, 1803)	0
Squamata	COLUBRIDAE	*Psammophis leightoni trinasalis* Werner, 1902	3
Squamata	COLUBRIDAE	*Psammophis notostictus* Peters, 1867	0
Squamata	COLUBRIDAE	*Psammophylax rhombeatus rhombeatus* (Linnaeus, 1754)	0
Squamata	COLUBRIDAE	*Xenocalamus bicolor bicolor* Günther, 1868	1
Squamata	CORDYLIDAE	**Cordylus vandami* (FitzSimons, 1930)	0
Squamata	CORDYLIDAE	**Platysaurus intermedius intermedius* Matschie, 1890	0

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Order	Family	Species name	Red Data Book code
Squamata	CORDYLIDAE	**Platysaurus intermedius wilhelmi* Hewitt, 1909	0
Squamata	CORDYLIDAE	*Chamaesaura aenea* (Wiegmann, 1843)	4
Squamata	CORDYLIDAE	*Chamaesaura anguina anguina* (Linnaeus, 1758)	0
Squamata	CORDYLIDAE	*Cordylus giganteus* Smith 1844	3
Squamata	CORDYLIDAE	*Cordylus polyzonus polyzonus* Smith, 1838	0
Squamata	CORDYLIDAE	*Cordylus vittifer vittifer* (Reichenow, 1887)	0
Squamata	CORDYLIDAE	*Cordylus warreni barbertonensis* (Van Dam, 1921)	0
Squamata	CORDYLIDAE	*Cordylus warreni depressuss* (FitzSimons, 1930)	0
Squamata	CORDYLIDAE	*Platysaurus orientalis orientalis* FitzSimons, 1941	0
Squamata	CORDYLIDAE	*Pseudocordylus langi* Loveridge, 1944	0
Squamata	CORDYLIDAE	*Pseudocordylus melanotus melanotus* (Smith, 1838)	0
Squamata	CORDYLIDAE	*Pseudocordylus melanotus subviridis* Smith, 1838	4
Squamata	CORDYLIDAE	*Pseudocordylus melanotus transvaalensis* FitzSimons, 1943	0
Squamata	CORDYLIDAE	*Pseudocordylus spinosus* FitzSimons, 1947	4
Squamata	CORDYLIDAE	*Tetradactylus africanus africanus* (Gray, 1838)	4
Squamata	CORDYLIDAE	*Tetradactylus africanus fitzsimonsi* Hewitt, 1915	4
Squamata	CORDYLIDAE	*Tetradactylus breyeri* Roux, 1907	2
Squamata	CORDYLIDAE	*Tetradactylus eastwoodae* Methuen & Hewitt, 1913	3
Squamata	CORDYLIDAE	*Tetradactylus seps* (Linnaeus, 1758)	4
Squamata	CORDYLIDAE	*Tetradactylus tetradactylus* (Lacépède, 1803)	4
Squamata	ELAPIDAE	**Aspidelaps scutatus intermedius* Broadley, 1968	0
Squamata	ELAPIDAE	*Aspidelaps lubricus lubricus* (Laurenti,1768)	4
Squamata	ELAPIDAE	*Elapsoidea sundevallii media* Broadley, 1971	1
Squamata	ELAPIDAE	*Hemachatus haemachatus* (Lacépède, 1788)	1
Squamata	ELAPIDAE	*Naja nivea* (Linnaeus, 1758)	3
Squamata	GEKKONIDAE	**Afroedura langi "Leolo"* Jacobsen, in prep.	0
Squamata	GEKKONIDAE	**Afroedura pondolia "Godlwayo"* Jacobsen, ms.	0
Squamata	GEKKONIDAE	**Lygodactylus methueni* FitzSimons, 1937	0
Squamata	GEKKONIDAE	**Lygodactylus nigropunctatus montiscaeruli* Jacobsen, 1995	4
Squamata	GEKKONIDAE	*Afroedoera* sp. nov. *("Lebombo")* Jacobsen, ms.	2
Squamata	GEKKONIDAE	*Afroedura karroica halli* Hewitt, 1925	4
Squamata	GEKKONIDAE	*Afroedura langi "Soutpansberg"* Jacobsen, ms.	0
Squamata	GEKKONIDAE	*Afroedura multiporus "Abel Erasmus"* Jacobsen, ms.	0
Squamata	GEKKONIDAE	*Afroedura nivaria* Boulenger, 1894	4
Squamata	GEKKONIDAE	*Afroedura pondolia "Maripi"* Jacbosen, ms.	0
Squamata	GEKKONIDAE	*Lygodactylus graniticolus* Jacobsen, 1995	4
Squamata	GEKKONIDAE	*Lygodactylus nigropunctatus incognitus* Jacobsen, 1995	4
Squamata	GEKKONIDAE	*Lygodactylus nigropunctatus nigropunctatus* Jacobsen, 1995	4
Squamata	GEKKONIDAE	*Lygodactylus ocellatus ocellatus* Roux, 1907	0
Squamata	GEKKONIDAE	*Lygodactylus ocellatus soutpansbergensis* Jacobsen, 1995	0
Squamata	GEKKONIDAE	*Lygodactylus waterbergensis* Jacobsen, 1995	4
Squamata	GEKKONIDAE	*Pachydactylus affinis* Boulenger, 1896	0
Squamata	GEKKONIDAE	*Pachydactylus capensis capensis* Smith, 1846	0
Squamata	GEKKONIDAE	*Pachydactylus maculatus maculatus* Gray, 1845	0
Squamata	GEKKONIDAE	*Pachydactylus mariquensis mariquensis* Smith, 1849	4
Squamata	GEKKONIDAE	*Pachydactylus vansoni* FitzSimons, 1933	0
Squamata	LACERTIDAE	*Nucras lalandii* (Milne-Edwards, 1829)	0
Squamata	LACERTIDAE	*Pedioplanis burchelli* (Duméril & Bibron, 1839)	0
Squamata	LACERTIDAE	*Pedioplanis lineoocellata lineoocellata* (Duméril & Bibron, 1839)	0
Squamata	LACERTIDAE	*Pedioplanis lineoocellata pulchella* (Gray, 1845)	0
Squamata	LACERTIDAE	*Tropidosaura cottrelli* Hewitt, 1925	4
Squamata	LACERTIDAE	*Tropidosaura essexi* Hewitt, 1927	4
Squamata	LACERTIDAE	*Tropidosaura montana rangeri* Hewitt, 1926	4
Squamata	SCINCIDAE	**Mabuya* sp.nov.	4
Squamata	SCINCIDAE	**Panapsis* sp. nov. *"maculicollis"*	0
Squamata	SCINCIDAE	*Acontias breviceps* Essex, 1925	3
Squamata	SCINCIDAE	*Acontias gracilicauda gracilicauda* Essex, 1925	4

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Order	Family	Species name	Red Data Book code
Squamata	SCINCIDAE	*Acontophiops lineatus* Sternfeld, 1911	3
Squamata	SCINCIDAE	*Mabuya homalocephala smithi* (Gray, 1845)	3
Squamata	SCINCIDAE	*Mabuya sulcata* (Peters, 1867)	0
Squamata	SCINCIDAE	*Scelotes mirus* (Roux, 1907)	4
Squamata	SCINCIDAE	*Typhlosaurus cregoi cregoi* Boulenger, 1903	0
Squamata	TYPHLOPIDAE	*Typhlops bibronii* (Smith, 1846)	0
Testudines	TESTUDINIDAE	*Homopus femoralis* Boulenger, 1888	1
Testudines	TESTUDINIDAE	*Kinixys lobatsiana* Power	4
Testudines	TESTUDINIDAE	*Kinixys natalensis* Hewitt, 1935	1

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 20. Herpetofauna of the Grassland Biome listed in the Red Data Book (1988), or with unknown conservation status

Order	Family	Species name	Habitat	Endemicity code	Red Data Book code
Anura	BUFONIDAE	*Bufo vertebralis* Smith, 1848	open grassland with scattered tree clumps	1	1
Anura	HEMISIDAE	*Hemisus guttatus* (Rapp, 1842)	wooded grassland or grassy areas, Acocks veld type 63	0	1
Anura	HYPEROLIIDAE	**Leptopelis bocagii* (Günther, 1864)	shrubs, Acocks veld types 9, 11	0	1
Anura	MICROHYLIDAE	*Breviceps verrucosus verrucosus* Rapp, 1842	montane and hillside grassland, Acocks veld types 8 & 57	1	1
Anura	RANIDAE	**Ptychadena mascareniensis mascareniensis* (Duméril & Bibron, 1841)	grassland, bushveld, Acocks veld type 10, swamps	0	1
Anura	RANIDAE	*Cacosternum nanum nanum* (Boulenger, 1887)	marshy vegetation of montane and Highveld grassland	1	1
Anura	RANIDAE	*Ptychadena porosissima* (Steindacher, 1867)	Highveld, montane and wooded grassland	0	1
Squamata	COLUBRIDAE	**Xenocalamus bicolor australis* FitzSimons, 1946	Kalahari-sand, *Burkea africana* woodland	1	1
Squamata	COLUBRIDAE	*Atractaspis duerdeni* Gough, 1907	sandy soil and broadleaved savanna, grass	1	1
Squamata	COLUBRIDAE	*Xenocalamus bicolor bicolor* Günther, 1868	Kalahari-sand	1	1
Squamata	ELAPIDAE	**Elapsoidea semiannulata boulengeri* Boettger, 1895	logs, stones, Acocks veld type 10	0	1
Squamata	ELAPIDAE	*Elapsoidea sundevallii media* Broadley, 1971	variable, Highveld grassland, Kalahari desert	1	1
Squamata	ELAPIDAE	*Elapsoidea sundevallii sundevallii* (Smith, 1848)	moribund termitaria in Highveld grassland, Acocks veld types 57, 63	0	1
Squamata	ELAPIDAE	*Hemachatus haemachatus* (Lacépède, 1788)	grassland	1	1
Squamata	SCINCIDAE	*Acontias percivali occidentalis* FitzSimons, 1941	dead logs, western half of Tvl. excluding the Highveld	0	1
Testudines	TESTUDINIDAE	*Homopus femoralis* Boulenger, 1888	high altitudes, mountain grassland, pure grassland, savanna	1	1
Testudines	TESTUDINIDAE	*Kinixys natalensis* Hewitt, 1935	rocky outcrops, Acocks veld types 6, 10, 11	1	1
Testudines	TESTUDINIDAE	*Kinixys spekii* Gray, 1863	savanna, Highveld rocky areas, tropical bushveld	0	1
Squamata	CORDYLIDAE	**Gerrhosaurus major major* Duméril, 1851	rocky outcrops, lowveld, Acocks veld types 9, 10, 11	0	2
Squamata	CORDYLIDAE	*Chamaesaura macrolepis* (Cope, 1862)	rocky hillsides covered with grass	0	2
Squamata	CORDYLIDAE	*Tetradactylus breyeri* Roux, 1907	montane grassland, highveld grassland	1	2
Squamata	GEKKONIDAE	*Afroedoera sp. nov. ("Lebombo")* Jacobsen, in prep.	Acocks veld type 10, scree, bushveld	1	2
Anura	HELEOPHRYNIDAE	*Heleophryne natalensis* Hewitt, 1931	montane forest zones confined to mountain streams with dense vegetation and dark ravines and kloofs	1	3
Anura	MICROHYLIDAE	*Breviceps sylvestris sylvestris* FitzSimons, 1930	grassland, montane forest, Acocks veld types 8, 9	1	3
Anura	RANIDAE	**Ptychadena oxyrhynchus* (Smith, 1849)	pools in open wooded savanna or at shallow depressions where water gathers	0	3
Anura	RANIDAE	*Pyxicephalus adspersus adspersus* Tscudi, 1838	central Highveld pans, bushveld	0	3
Crocodylia	CROCYDYLIDAE	**Crocodylus niloticus* Laurenti, 1768	major streams amd dams	0	3
Squamata	BOIDAE	*Python sebae natalensis* Smith, 1840	moist habitats,rocky areas, well-wooded areas	0	3
Squamata	CHAMAELEONIDAE	*Bradypodion sp. (Ngotswane Gorge)* Jacobsen, in prep.	grassland, riverine habitat	1	3
Squamata	CHAMAELEONIDAE	*Bradypodion transvaalensis* (FitzSimons, 1930)	aboreal, forest species, shrubs	0	3
Squamata	COLUBRIDAE	**Amblyodipsas concolor* (Smith, 1849)	wooded or forested areas, rocks, Acocks veld types, 8, 9, 10	1	3
Squamata	COLUBRIDAE	**Mehelya capensis capensis* (Smith, 1847)	savanna, bushveld, human dwellings	0	3
Squamata	COLUBRIDAE	*Amplorhinus multimaculatus* Smith, 1847	montane and Highveld grassland in moist locations	0	3
Squamata	COLUBRIDAE	*Dasypeltis inornata* Smith, 1849	montane grassland, mixed woodland, grassland, Acocks veld types 8, 62, 63, 64	1	3
Squamata	COLUBRIDAE	*Homoroselaps dorsalis* (Smith, 1849)	Highveld and montane grassland, termitaria	1	3
Squamata	COLUBRIDAE	*Lamprophis fuscus* Boulenger, 1893	open grassland, Acocks veld types 8, 57, savanna	1	3
Squamata	COLUBRIDAE	*Prosymna sundevallii sundevallii* (Smith, 1849)	savanna, Highveld grassland, arid areas, various	1	3
Squamata	COLUBRIDAE	*Psammophis leightoni trinasalis* Werner, 1902	desert, semi-desert, savanna, moribund termitaria	1	3
Squamata	COLUBRIDAE	*Pseudaspis cana cana* (Linnaeus, 1754)	highveld grassland, arid areas, mountain areas	0	3
Squamata	CORDYLIDAE	*Cordylus giganteus* Smith 1844	*Themeda* -grassland or transitional zones	1	3
Squamata	CORDYLIDAE	*Tetradactylus eastwoodae* Methuen & Hewitt, 1913	montane grassland	1	3
Squamata	ELAPIDAE	*Naja nivea* (Linnaeus, 1758)	arid karoo, bushveld, thornveld, grassland	1	3
Squamata	SCINCIDAE	*Acontias breviceps* Essex, 1925	montane and Highveld grasslands	1	3
Squamata	SCINCIDAE	*Acontophiops lineatus* Sternfeld, 1911	montane grassland with rocky outcrops	1	3
Squamata	SCINCIDAE	*Mabuya homalocephala smithi* (Gray, 1845)	rocky hillsides, Acocks veld type 57	1	3
Squamata	VIPERIDAE	*Bitis atropos* (Linnaeus, 1754)	montane and rocky hillsides, Acocks veld types 8, 9, 57, 63, grass tussocks	0	3
Testudines	TESTUDINIDAE	**Psammobates oculifer* (Kuhl, 1820)	grassland, bushveld, thornveld	0	3
Anura	BUFONIDAE	**Bufo poweri* Hewitt, 1935	savanna	0	4
Anura	BUFONIDAE	*Bufo gariepensis gariepensis* Smith, 1848	grassland	1	4
Anura	HYPEROLIDAE	*Semnodactylus wealii* (Boulenger, 1882)	open grassland, vleis, marshes	1	4
Anura	MICROHYLIDAE	**Breviceps mossambicus* Peters, 1854	mixed wooded savanna, Acocks veld types 6, 9, 11	1	4
Anura	RANIDAE	**Hildebrandtia ornata ornata* (Peters, 1878)	grass near water, Acocks veld types 10, 11	0	4
Anura	RANIDAE	*Arthroleptella hewitti* (FitzSimons, 1947)	riverine habitat	1	4

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Order	Family	Species name	Habitat	Endemicity code	Red Data Book code
Anura	RANIDAE	*Arthroleptella ngongoniensis* Bishop & Passmore, 1993	grassland	1	4
Anura	RANIDAE	*Cacosternum nanum parvum* Poynton, 1963	open grassy swamps at high altitudes, grassland	1	4
Anura	RANIDAE	*Rana dracomontana* Channing, 1978	grassland	1	4
Anura	RANIDAE	*Strongylopus hymenopus* (Boulenger, 1920)	open grassy slopes near water & rocky areas of 2000-3000 m	1	4
Anura	RANIDAE	*Strongylopus wageri* Wager, 1961	streams, rivers flowing through grassland or scrubby bush, forest	1	4
Squamata	AGAMIDAE	*Agama atra atra* Daudin, 1802	semi-desert to fynbos, rocky outcrops	1	4
Squamata	AGAMIDAE	*Agama hispida distanti* Boulenger, 1892	Highveld, shrubs, dry terrain, Nama Karoo, sandy thornbush	1	4
Squamata	CHAMAELEONIDAE	*Bradypodion cf.karrooicum* (Methuen & Hewitt, 1915)	gardens, karroid country	1	4
Squamata	CHAMAELEONIDAE	*Bradypodion dracomontanum* Raw, 1976	forest and high altitude mountains, grassland	1	4
Squamata	CHAMAELEONIDAE	*Bradypodion sp.(Zastron)* Jacobsen, in prep.	grassland	1	4
Squamata	CHAMAELEONIDAE	*Bradypodion transvaalensis complex* Jacobsen, in prep.	unknown ?	1	4
Squamata	COLUBRIDAE	**Lycophidion variegatum* Broadley, 1969	rocky outcrops, under rocks in lowveld	0	4
Squamata	COLUBRIDAE	**Philothamnus angolensis* Bocage, 1882	variable, moist savanna, arid savanna, reedbeds, riverine habitat	1	4
Squamata	COLUBRIDAE	*Lamprophis inornatus* Duméril & Bibron, 1854	grassland under rocks & debris	1	4
Squamata	CORDYLIDAE	*Chamaesaura aenea* (Wiegmann, 1843)	grassland of Highveld and Drakensburg Escarpment	1	4
Squamata	CORDYLIDAE	*Pseudocordylus melanotus subviridis* Smith, 1838	rocky outcrops, mountain grassland	1	4
Squamata	CORDYLIDAE	*Pseudocordylus spinosus* FitzSimons, 1947	rocky areas in grassland	1	4
Squamata	CORDYLIDAE	*Tetradactylus africanus africanus* (Gray, 1838)	grassland	1	4
Squamata	CORDYLIDAE	*Tetradactylus africanus fitzsimonsi* Hewitt, 1915	grassland	1	4
Squamata	CORDYLIDAE	*Tetradactylus seps* (Linnaeus, 1758)	coastal forests and high mountains	1	4
Squamata	CORDYLIDAE	*Tetradactylus tetradactylus* (Lacépède, 1803)	grassy mountain slopes, fynbos	1	4
Squamata	ELAPIDAE	**Dendroaspis polylepis* (Günther, 1864)	rocky hillsides and outcrops and woodland, Acocks veld types 6, 8, 9, 10, 11	0	4
Squamata	ELAPIDAE	*Aspidelaps lubricus lubricus* (Laurenti,1768)	Karoo, sandveld areas, grassland	1	4
Squamata	GEKKONIDAE	**Lygodactylus nigropunctatus montiscaeruli* Jacobsen, 1995	various, thickets, rocky areas	1	4
Squamata	GEKKONIDAE	*Afroedura karroica halli* Hewitt, 1925	dry moutain grassland, rocky outcrops	1	4
Squamata	GEKKONIDAE	*Afroedura nivaria* Boulenger, 1894	rocks, crevices of high altitudes, grassland	1	4
Squamata	GEKKONIDAE	*Lygodactylus graniticolus* Jacobsen, 1995	Potgietersrus granite, crevices, bushveld	1	4
Squamata	GEKKONIDAE	*Lygodactylus nigropunctatus incognitu* s Jacobsen, 1995	rocky areas in grassland, bushveld, Soutpansberg	1	4
Squamata	GEKKONIDAE	*Lygodactylus nigropunctatus nigropunctatus* Jacobsen, 1995	grassland, rocky areas	1	4
Squamata	GEKKONIDAE	*Lygodactylus waterbergensis* Jacobsen, 1995	rocky areas, western side of the Waterberg, sandstone boulders in grassland or scrub	1	4
Squamata	GEKKONIDAE	*Pachydactylus mariquensis mariquensis* Smith, 1849	flat sandy areas with sparse vegetation, Karoo, Nama Karoo	1	4
Squamata	LACERTIDAE	*Tropidosaura cottrelli* Hewitt, 1925	mountain grassland	1	4
Squamata	LACERTIDAE	*Tropidosaura essexi* Hewitt, 1927	rocky mountain grassland	1	4
Squamata	LACERTIDAE	*Tropidosaura montana rangeri* Hewitt, 1926	montane grassland & fynbos	1	4
Squamata	SCINCIDAE	**Mabuya sp.nov.*	rocky outcrops, mountains, crevices, savanna	1	4
Squamata	SCINCIDAE	*Acontias gracilicauda gracilicauda* Essex, 1925	grassland, sandy areas, valley bushveld	1	4
Squamata	SCINCIDAE	*Scelotes mirus* (Roux, 1907)	montane grassland and scrub, rocky outcrops	1	4
Testudines	TESTUDINIDAE	*Kinixys lobatsiana* Power	grassland, savanna,various	1	4

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 21. Grassland Biome endemic herpetofauna of Habitat type 1

Order	Family	Species name	Habitat	Distribution
Anura	BUFONIDAE	*Bufo gariepensis gariepensis* Smith, 1848	grassland	endemic to southern Africa.
Anura	BUFONIDAE	*Bufo gariepensis nubicolus* Hewitt, 1927	montane grassland, under rocks & soil	south-eastern Tvl. and southern and eastern Free State
Anura	HYPEROLIDAE	*Semnodactylus wealii* (Boulenger, 1882)	open grassland, vleis, marshes	Natal Drakensberg: Giant's Castle
Anura	RANIDAE	*Arthroleptella ngongoniensis* Bishop & Passmore, 1993	grassland	unknown ?
Anura	RANIDAE	*Cacosternum nanum nanum* (Boulenger, 1887)	marshy vegetation of montane and Highveld grassland	montane and Highveld grassland of Tvl. escarpment and Eastern Cape
Anura	RANIDAE	*Cacosternum nanum parvum* Poynton, 1963	open grassy swamps at high altitudes, grassland	Drakensberg in the south, Giant's Castle
Anura	RANIDAE	*Rana dracomontana* Channing, 1978	grassland	unknown ?
Anura	RANIDAE	*Rana vertebralis* Hewitt, 1927	streams, ponds in Alpine grassland, grassland	Alpine grassland: Drakensberg
Anura	RANIDAE	*Strongylopus fasciata fasciata* (Smith, 1849)	marshy grassland	eastern Free State and central and eastern Tvl.
Anura	RANIDAE	*Strongylopus hymenopus* (Boulenger, 1920)	open grassy slopes near water & rocky areas of 2000-3000 m	Drakensberg (Natal: Sani Pass)
Squamata		*Montaspis gihomaculatus* Bourquin, 1991	grassland	unknown ?
Squamata	COLUBRIDAE	*Homoroselaps dorsalis* (Smith, 1849)	Highveld and montane grassland, termitaria	Occurs in Free State, KwaZulu-Natal and Tvl., Swaziland
Squamata	COLUBRIDAE	*Psammophis crucifer* (Daudin, 1803)	Highveld, mountain grassland, moribund termitaria, rocks	Free State, Lesotho, southern and eastern Tvl.
Squamata	CORDYLIDAE	*Chamaesaura aenea* (Wiegmann, 1843)	grassland of highveld and Drakensburg Escarpment	Highveld, Eastern Cape and Drakensberg Escarpment
Squamata	CORDYLIDAE	*Chamaesaura anguina anguina* (Linnaeus, 1758)	grass covered mountain slopes, rocky hillsides in grassland	eastern Tvl., KwaZulu-Natall, southern Cape
Squamata	CORDYLIDAE	*Cordylus giganteus* Smith 1844	*Themeda* -grassland or transitional zones	endemic to South Africa occuring in the north-eastern Free State, south-eastern Tvl & KwaZulu-Natal
Squamata	CORDYLIDAE	*Tetradactylus africanus africanus* (Gray, 1838)	grassland	unknown ?
Squamata	CORDYLIDAE	*Tetradactylus africanus fitzsimons* i Hewitt, 1915	grassland	unknown ?
Squamata	CORDYLIDAE	*Tetradactylus breyeri* Roux, 1907	montane grassland, Highveld grassland	eastern Tvl.
Squamata	CORDYLIDAE	*Tetradactylus eastwoodae* Methuen & Hewitt, 1913	montane grassland	montane grassland
Squamata	ELAPIDAE	*Hemachatus haemachatus* (Lacépède, 1788)	grassland	endemic to South Africa, Free State and the southern Tvl. and KwaZulu-Natal
Squamata	GEKKONIDAE	**Afroedura pondolia "Godlwayo"* in prep.	crevices, Acocks veld types 10, 63	endemic to south-eastern Tvl., but likely to be found in northern KwaZulu-Natal & southern Swaziland
Squamata	GEKKONIDAE	*Afroedura karroica halli* Hewitt, 1925	dry moutain grassland, rocky outcrops	eastern Cape, recorded in the Free State
Squamata	LACERTIDAE	*Nucras lalandii* (Milne-Edwards, 1829)	Highveld to montane grassland, under stones	south-eastern and north-eastern Free State and Eastern Cape
Squamata	LACERTIDAE	*Tropidosaura essexi* Hewitt, 1927	rocky mountain grassland	mountains of Natal Drakensberg and Free State
Squamata	SCINCIDAE	*Acontias breviceps* Essex, 1925	montane and Highveld grasslands	eastern and south-eastern Tvl., Eastern Cape
Squamata	SCINCIDAE	*Scelotes mirus* (Roux, 1907)	montane grassland and scrub, rocky outcrops	eastern & south-eastern Tvl. montane grassland

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 22. Herpetofauna that utilise Habitat type 1 within the Grassland Biome

Order	Family	Species name	Habitat	Distribution
Anura	BUFONIDAE	*Bufo gariepensis gariepensis* Smith, 1848	grassland	endemic to southern Africa.
Anura	BUFONIDAE	*Bufo gariepensis nubicolus* Hewitt, 1927	montane grassland, under rocks & soil	south-eastern Tvl. and southern and eastern Free State
Anura	HYPEROLIDAE	*Semnodactylus wealii* (Boulenger, 1882)	open grassland, vleis, marshes	Natal Drakensberg: Giant's Castle
Anura	RANIDAE	*Arthroleptella ngongoniensis* Bishop & Passmore, 1993	grassland	unknown ?
Anura	RANIDAE	*Cacosternum nanum nanum* (Boulenger, 1887)	marshy vegetation of montane and Highveld grassland	montane and Highveld grassland of Tvl. escarpment and Eastern Cape
Anura	RANIDAE	*Cacosternum nanum parvum* Poynton, 1963	open grassy swamps at high altitudes, grassland	Drakensberg in the south, Giant's Castle
Anura	RANIDAE	*Rana dracomontana* Channing, 1978	grassland	unknown ?
Anura	RANIDAE	*Rana vertebralis* Hewitt, 1927	streams, ponds in Alpine grassland, grassland	Alpine grassland: Drakensberg
Anura	RANIDAE	*Strongylopus fasciata fasciata* (Smith, 1849)	marshy grassland	eastern Free State and central and eastern Tvl.
Anura	RANIDAE	*Strongylopus hymenopus* (Boulenger, 1920)	open grassy slopes near water & rocky areas of 2000-3000 m	Drakensberg (Natal: Sani Pass)
Squamata		*Montaspis gihomaculatus* Bourquin, 1991	grassland	unknown ?
Squamata	COLUBRIDAE	*Amplorhinus multimaculatus* Smith, 1847	montane and Highveld grassland in moist locations	southern and eastern Tvl.
Squamata	COLUBRIDAE	*Homoroselaps dorsalis* (Smith, 1849)	Highveld and montane grassland, termitaria	Occurs in Free State, KwaZulu-Natal,Tvl., Swaziland
Squamata	COLUBRIDAE	*Psammophis crucifer* (Daudin, 1803)	Highveld, mountain grassland, moribund termitaria, rocks	Freestate, Lesotho, southern and eastern Tvl.
Squamata	CORDYLIDAE	*Chamaesaura aenea* (Wiegmann, 1843)	grassland of Highveld and Drakensberg Escarpment	Highveld, Eastern Cape and Drakensberg Escarpment
Squamata	CORDYLIDAE	*Chamaesaura anguina anguina* (Linnaeus, 1758)	grass covered mountain slopes, rocky hillsides in grassland	eastern Tvl., Natal, southern Cape
Squamata	CORDYLIDAE	*Cordylus giganteus* Smith 1844	*Themeda*-grassland or transitional zones	endemic to South Africa occuring in the north-eastern Free State, south-eastern Tvl & KwaZulu-Natal
Squamata	CORDYLIDAE	*Tetradactylus africanus africanus* (Gray, 1838)	grassland	unknown ?
Squamata	CORDYLIDAE	*Tetradactylus africanus fitzsimonsi* Hewitt, 1915	grassland	unknown ?
Squamata	CORDYLIDAE	*Tetradactylus breyeri* Roux, 1907	montane grassland, Highveld grassland	eastern Tvl.
Squamata	CORDYLIDAE	*Tetradactylus eastwoodae* Methuen & Hewitt, 1913	montane grassland	montane grassland
Squamata	ELAPIDAE	*Hemachatus haemachatus* (Lacépède, 1788)	grassland	endemic to South Africa; Free State and the southern Tvl. and KwaZulu-Natal
Squamata	GEKKONIDAE	**Afroedura pondolia "Godlwayo"* Jacobsen, in prep.	crevices, Acocks veld types 10, 63	endemic to south-eastern Tvl., but likely to be found in northern KwaZulu-Natal & southern Swaziland
Squamata	GEKKONIDAE	*Afroedura karroica halli* Hewitt, 1925	dry moutain grassland, rocky outcrops	eastern Cape, recorded in the Free State
Squamata	LACERTIDAE	*Nucras lalandii* (Milne-Edwards, 1829)	Highveld to montane grassland, under stones	south-eastern and north-eastern Free State and eastern Cape
Squamata	LACERTIDAE	*Tropidosaura essexi* Hewitt, 1927	rocky mountain grassland	mountains of Natal Drakensberg and Free State
Squamata	SCINCIDAE	*Acontias breviceps* Essex, 1925	montane and Highveld grasslands	eastern and south-eastern Tvl., Eastern Cape
Squamata	SCINCIDAE	*Scelotes mirus* (Roux, 1907)	montane grassland and scrub, rocky outcrops	eastern & south-eastern Tvl. montane grassland
Squamata	VIPERIDAE	*Bitis atropos* (Linnaeus, 1754)	montane and rocky hillsides, Acocks veld types 8, 9, 57, 63, grass tussocks	eastern Tvl., north-eastern Free State and Natal Drakensberg

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 23. Herpetofauna predominant in Habitat type 5 within the Grassland Biome

Order	Family	Species name	Habitat	Distribution	Endemicity code
Squamata	CORDYLIDAE	*Cordylus vittifer vittifer* (Reichenow, 1887)	various, rocky outcrops, Drakensberg escarpment	Transvaal, northern and eastern Free State and KwaZulu-Natal	1
Squamata	CORDYLIDAE	*Cordylus warreni barbertonensis* (Van Dam, 1921)	rocky outcrops, hillsides, Acocks veld types 9, 10, 63	Very limited, form eastern Tvl. to northern KwaZulu-Natal and Swaziland	1
Squamata	CORDYLIDAE	*Cordylus warreni depressuss* (FitzSimons, 1930)	rocky outcrops, hillsides, Acocks veld types 8, 9	endemic to Tvl.	1
Squamata	GEKKONIDAE	*Afroedura langi "Soutpansberg"* Jacobsen, in prep.	Acocks veld type 8, 19, crevices in lowveld	endemic to Soutpansberg and Blouberg, Tvl.	1
Squamata	GEKKONIDAE	*Lygodactylus graniticolus* Jacobsen, 1995	Potgietersrus granite, crevices, bushveld	endemic to Tvl., granite hills of Percy Fyfe Nature Reserve	1
Squamata	GEKKONIDAE	*Lygodactylus ocellatus soutpansbergensis* Jacobsen, 1995	exclusive to Highveld, crevices	mountain ranges of Tvl.	1
Squamata	LACERTIDAE	*Pedioplanis burchelli* (Duméril & Bibron, 1839)	slopes of mountains, bedrocks, montane grassland	south-eastern Tvl.,north and south-eastern Free State and Eastern Cape	1
Squamata	SCINCIDAE	**Mabuya sp.* nov.	rocky outcrops, mountains, crevices, savanna	Widespread in Tvl. only and south-east Botswana	1

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 24. Grassland Biome Herpetofauna species of Habitat type 1, and their conservation status

Order	Family	Species name	Habitat	Conservation status
Anura	BUFONIDAE	*Bufo gariepensis gariepensis* Smith, 1848	grassland	Unknown ?
Anura	BUFONIDAE	*Bufo gariepensis nubicolus* Hewitt, 1927	montane grassland, under rocks & soil	Unprotected
Anura	HYPEROLIDAE	*Semnodactylus wealii* (Boulenger, 1882)	open grassland, vleis, marshes	Unknown ?
Anura	RANIDAE	*Arthroleptella ngongoniensis* Bishop & Passmore, 1993	grassland	Unknown ?
Anura	RANIDAE	*Cacosternum nanum nanum* (Boulenger, 1887)	marshy vegetation of montane and Highveld grassland	Unprotected
Anura	RANIDAE	*Cacosternum nanum parvum* Poynton, 1963	open grassy swamps at high altitudes, grassland	Unknown ?
Anura	RANIDAE	*Rana dracomontana* Channing, 1978	grassland	Unknown ?
Anura	RANIDAE	*Rana vertebralis* Hewitt, 1927	streams, ponds in Alpine grassland, grassland	Unknown ?
Anura	RANIDAE	*Strongylopus fasciata fasciata* (Smith, 1849)	marshy grassland	Unprotected
Anura	RANIDAE	*Strongylopus hymenopus* (Boulenger, 1920)	open grassy slopes near water & rocky areas of 2000-3000 m	Unknown
Squamata		*Montaspis gihomaculatus* Bourquin, 1991	grassland	Unknown ?
Squamata	COLUBRIDAE	*Amplorhinus multimaculatus* Smith, 1847	montane and Highveld grassland in moist locations	Partially protected
Squamata	COLUBRIDAE	*Homoroselaps dorsalis* (Smith, 1849)	Highveld and montane grassland, termitaria	Partially protected
Squamata	COLUBRIDAE	*Psammophis crucifer* (Daudin, 1803)	Highveld, mountain grassland, moribund termitaria, rocks	Partially protected
Squamata	CORDYLIDAE	*Chamaesaura aenea* (Wiegmann, 1843)	grassland of Highveld and Drakensburg Escarpment	Protected
Squamata	CORDYLIDAE	*Chamaesaura anguina anguina* (Linnaeus, 1758)	grass covered mountain slopes, rocky hillsides in grassland	Protected
Squamata	CORDYLIDAE	*Cordylus giganteus* Smith 1844	*Themeda* -grassland or transitional zones	Protected
Squamata	CORDYLIDAE	*Tetradactylus africanus africanus* (Gray, 1838)	grassland	Unknown ?
Squamata	CORDYLIDAE	*Tetradactylus africanus fitzsimonsi* Hewitt, 1915	grassland	Unknown ?
Squamata	CORDYLIDAE	*Tetradactylus breyeri* Roux, 1907	montane grassland, Highveld grassland	Protected
Squamata	CORDYLIDAE	*Tetradactylus eastwoodae* Methuen & Hewitt, 1913	montane grassland	Protected
Squamata	ELAPIDAE	*Hemachatus haemachatus* (Lacépède, 1788)	grassland	Partially protected
Squamata	GEKKONIDAE	**Afroedura pondolia "Godlwayo"* Jacobsen, in prep.	crevices, Acocks veld types 10, 63	Protected
Squamata	GEKKONIDAE	*Afroedura karroica halli* Hewitt, 1925	dry moutain grassland, rocky outcrops	Unknown ?
Squamata	LACERTIDAE	*Nucras lalandii* (Milne-Edwards, 1829)	Highveld to montane grassland, under stones	Protected
Squamata	LACERTIDAE	*Tropidosaura essexi* Hewitt, 1927	rocky mountain grassland	Unknown ?
Squamata	SCINCIDAE	*Acontias breviceps* Essex, 1925	montane and Highveld grasslands	Rare/vulnerable
Squamata	SCINCIDAE	*Scelotes mirus* (Roux, 1907)	montane grassland and scrub, rocky outcrops	Protected ?
Squamata	VIPERIDAE	*Bitis atropos* (Linnaeus, 1754)	montane and rocky hillsides, Acocks veld types 8, 9, 57, 63, grass tussocks	Partially protected

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 25 Butterflies that utilise Habitat type 1 within the Grassland Biome

Family	Subfamily	Species name	Habitat	Distribution	Edge species	Larval grass food
HESPERIIDAE		*Eretis umbra umbra (Trimen, 1862)*	open grassland	Tvl., Free State, KwaZulu-Natal, Eastern Cape, Northern Cape	No	0
HESPERIIDAE		*Kedestes lenis Riley, 1932*	grassy areas, marshy areas	Golden Gate Highlands, Eastern Cape mountains, KwaZulu-Natal Drakensberg	No	0
HESPERIIDAE		*Spialia agylla agylla (Trimen, 1889)*	grassland	North-west Province	No	0
HESPERIIDAE		*Spialia asterodia (Trimen, 1864)*	grassy hillsides	Province, Gauteng	No	0
HESPERIIDAE		*Tsitana tsita (Trimen, 1870)*	grassy hillsides	Eastern Cape, northern Free State, Gauteng, Northern Province, Mpumalanga	No	0
LYCAENIDAE		*Alaena margaritacea Eltringham, 1929*	steep grassy slopes	endemic to the north-eastern Tvl.	Yes	0
LYCAENIDAE		*Aloeides dentatis dentatis (Swierstra, 1909)*	Highveld grassland	Highveld of the Tvl.	No	0
LYCAENIDAE		*Aloeides dentatis maseruna (Riley, 1938)*	flat grassland on sandy gravel soil	throughout the Free State and western Tvl.	No	0
LYCAENIDAE		*Aloeides macmasteri Tite & Dickson, 1973*	grassland, Karoo	Eastern Cape, Karoo, Little Namaqualand	No	0
LYCAENIDAE		*Aloeides merces Henning & Henning, 1987*	rocky edge of Drakensberg mountain	south-eastern Tvl. above Wakkerstroom and KwaZulu-Natal	Possibly: Grassland	0
LYCAENIDAE		*Aloeides nubilus Henning & Henning, 1982*	grasslands near forested areas	eastern Tvl.	No	0
LYCAENIDAE		*Aloeides pennington Tite & Dickson, 1968*	grassy hillsides	Eastern Cape, KwaZulu-Natal	Possibly: Grassland	0
LYCAENIDAE		*Aloeides nubilus Henning & Henning, 1982*	Western Cape, Eastern Cape, Lesotho, southern Free State	open sandy areas	No	0
LYCAENIDAE		*Aloeides pringlei Tite & Dickson, 1976*	coarse grass and shrub on sandy loam	Cape	Possibly: Grassland	5
LYCAENIDAE		*Aloeides rossouwi Henning & Henning, 1982*	Stofberg	near Stofberg in the Tvl.	No	0
LYCAENIDAE		*Cupidopsis cissus cissus (Godart, 1824)*	grassland	eastern southern Africa	No	0
LYCAENIDAE		*Durbania amakosa amakosa Trimen, 1862*	rocky grassland	eastern Cape	No	0
LYCAENIDAE		*Lepidochrysops asteris (Godart, 1819)*	grassy slopes of elevated hills	eastern Cape, Transkei, KwaZulu-Natal	No	0
LYCAENIDAE		*Lepidochrysops hypopolia (Trimen, 1887)*	grassland	KwaZulu-Natal and Tvl. Highveld	No	0
LYCAENIDAE		*Lepidochrysops ignota (Trimen & Bowker, 1887)*	grassland	KwaZulu-Natal, Tvl.	No	0
LYCAENIDAE		*Lepidochrysops jefferyi (Swierstra, 1907)*	grassy hilltops and slopes with scattered trees	Baberton in eastern Tvl.	Possibly: Grassland	0
LYCAENIDAE		*Lepidochrysops letsea (Trimen, 1870)*	Highveld grassland	Free State, Tvl. Highveld, western Lesotho	No	0
LYCAENIDAE		*Lepidochrysops lotana Swanepoel, 1962*	grassy slopes	endemic to the Tvl.	Yes	0
LYCAENIDAE		*Lepidochrysops ortygia (Trimen, 1887)*	grassland	relatively widespread	No	0
LYCAENIDAE		*Lepidochrysops pephredo (Trimen, 1889)*	grassy slopes	KwaZulu-Natal	Possibly: Grassland	0
LYCAENIDAE		*Lepidochrysops swanepoeli Pennington, 1948*	grassy summits	eastern Tvl. at Baberton and in northern KwaZulu-Natal	Possibly: Grassland	0
LYCAENIDAE		*Lepidochrysops tantalus (Trimen & Bowker, 1887)*	grassland	Transkei, KwaZulu-Natal, eastern Tvl.	Possibly: Grassland	0
LYCAENIDAE		*Lepidochrysops variabilis Cottrell, 1965*	grassland	south-west Cape, Eastern Cape, KwaZulu-Natal, Tvl., Lesotho	No	0
LYCAENIDAE		*Lepidochrysops victori Pringle, 1984*	high altitude on the foothills of the Great Winterberg	foothills of the Great Winterberg, eastern Cape	Possibly: Grassland	0
LYCAENIDAE		*Lycaena clarki Dickson, 1971*	grassland, marshes	Free State, Tvl. Highveld, Eastern Cape, KwaZulu-Natal	No	0
LYCAENIDAE		*Poecilmitis chrysaor (Trimen,1864)*	hilly grassland	Free State, Lesotho, Eastern Cape	No	0
LYCAENIDAE		*Poecilmitis aureus Van Son, 1966*	slopes of hills on grassy, damp patches	endemic to the Tvl., Heidelberg, Suikerbosrand Nature Reserve	No	0
LYCAENIDAE		*Poecilmitis lycegenes (Trimen, 1874)*	grassy Highveld	eastern Free State, KwaZulu-Natal & adjoining Tvl.	No	0
NYMPHALIDAE	ACRAEINAE	*Pardopsis punctatissima (Boisduval, 1833)*	rocky habitats	Transkei, KwaZulu-Natal, eastern Tvl., Eastern Cape	Possibly: Grassland	0
NYMPHALIDAE	NYMPHALINAE	*Cataeroptera cloanthe cloanthe (Stoll, 1781)*	wet grassland	Eastern Cape, Tvl., KwaZulu-Natal, Eastern Cape	No	0
NYMPHALIDAE	NYMPHALINAE	*Junonia oenone oenone (Linnaeus, 1758)*	hilltops	Eastern Cape, Transkei, KwaZulu-Natal, Tvl., Free State	No	0
NYMPHALIDAE	SATYRIDAE	*Dingana alaedeus Henning & Heming, 1984*	(Wakkerstroom region)	escarpment above Wakkerstroom, south-eastern Tvl.	No	5
NYMPHALIDAE	SATYRIDAE	*Dingana bowkeri bella Van Son, 1955*	steep grassy hillsides	Cradock and Cambedoo Mountains in the Eastern Cape	Possibly: Grassland	5
NYMPHALIDAE	SATYRIDAE	*Dingana dingana (Trimen, 1873)*	montane grassland, Transvaal Drakensberg	Transvaal Drakensberg, Natal, Drakensberg, Wolkberg	No	5
NYMPHALIDAE	SATYRIDAE	*Dira jansei Swierstra, 1911*	wooded grassland on south facing slopes	endemic to Tvl. occurring from Makapans Caves to Marieskop	Yes	5
NYMPHALIDAE	SATYRIDAE	*Dira oxylus (Trimen, 1881)*	mountainous- rocky grassland areas	Kokstad; endemic?	Yes	5
NYMPHALIDAE	SATYRIDAE	*Pseudonympha machacha Riley, 1938*	montane & alpine grassland	Drakensberg, Lesotho, Eastern Cape	No	5
NYMPHALIDAE	SATYRIDAE	*Pseudonympha magoides Van Son, 1955*	grassy slopes of hills	eastern Cape, to the Wolkberg in Transvaal	No	5
NYMPHALIDAE	SATYRIDAE	*Pseudonympha paragaika Vári, 1971*	high elevation grassland on the southern aspects of mountains	National Park	No	5
NYMPHALIDAE	SATYRIDAE	*Stygionympha scotina scotina Quickelberge, 1977*	summits of mountains	Eastern Cape, Natal Drakensberg, Lesotho, Free State	No	0
NYMPHALIDAE	SATYRIDAE	*Stygionympha vigilans (Trimen, 1887)*	rocky areas in open grassland in mountainous country	mountains of Lesotho, KwaZulu-Natal, Eastern and Western Cape	No	5
NYMPHALIDAE	SATYRIDAE	*Stygionympha wichgrafi wichgrafi Van Son, 1955*	grassland	eastern Cape, Lesotho, KwaZulu-Natal: lower altitudes	No	5
NYMPHALIDAE	SATYRIDAE	*Torynesis orangica Vári, 1971*	high elavation grassland of Golden Gate	Lesotho.	No	5
NYMPHALIDAE	SATYRIDAE	*Torynesis pringlei Dickson, 1979*	grassy slopes	Found in Lesotho	Possibly: Grassland	5

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 26. Non-edge butterfly species that occur in the Grassland Biome

Family	Subfamily	*Species name*	Habitat	Distribution	Habitat type	Larval grass food
HESPERIIDAE		*Abantis tettensis Hopffer, 1855*	woodland, bushveld	Northern Cape, Free State, Transvaal, KwaZulu-Natal	0	0
HESPERIIDAE		*Borbo fallax (Gaede, 1916)*	coastal bush, savanna, woodland	Gauteng, KwaZulu-Natal, Northern Province, North-West Province	0	5
HESPERIIDAE		*Caprona pillaana Wallengren, 1857*	bushveld, riverine bush	Tvl., KwaZulu-Natal, Swaziland, Northern Cape, Free State	0	0
HESPERIIDAE		*Coeliades forestan forestan (Stoll, 1782)*	rainforest, coastal bush	Eastern Cape, Free State, Tvl., Transkei, KwaZulu-Natal	0	0
HESPERIIDAE		*Eretis umbra umbra (Trimen, 1862)*	open grassland	Tvl., Free State, KwaZulu-Natal, Eastern Cape, Northern Cape	1	0
HESPERIIDAE		*Gegenes hottentota hottentota (Latreille, 1823)*	grassland, bushveld, marshes	southern Africa, except the Karoo, Namakwaland, western Northern Cape	2	5
HESPERIIDAE		*Gegenes niso niso (Linnaeus, 1764)*	bushveld, savanna, woodland, grassy slopes	Transvaal, KwaZulu-Natal, Eastern Cape	2	5
HESPERIIDAE		*Gegenes pumilio gambica (Mabille, 1878)*	bushveld, grassy slopes	Free State, Transvaal, KwaZulu-Natal, Eastern Cape	2	5
HESPERIIDAE		*Gomalia elma (Trimen, 1862)*	bush, woodland, forest	most of southern Africa, except west coast and Cape Point	0	0
HESPERIIDAE		*Kedestes callicles (Hewitson, 1868)*	bushveld	Tvl., except the southern parts, Natal, Swaziland	0	5
HESPERIIDAE		*Kedestes lenis Riley, 1932*	grassy areas, marshy areas	Golden Gate Highlands, Eastern Cape mountains, KwaZulu-Natal Drakensberg	1	0
HESPERIIDAE		*Kedestes lepenula (Wallengren, 1857)*	grassland and bushveld	Eastern and Northern Cape, Free State, North-West Province	2	0
HESPERIIDAE		*Kedestes macomo (Trimen, 1862)*	bushveld, coastal bush	Tvl., except southern parts, KwaZulu-Natal, Eastern Cape, Transkei	0	0
HESPERIIDAE		*Kedestes mohozutza (Wallengren, 1857)*	grassy slopes, montane grassland, forest edge	Eastern Cape, hills of the Drakensberg, Mpumalanga, Gauteng	2	0
HESPERIIDAE		*Kedestes nerva (Fabricius, 1793)*	bush, woodland, grassland	Gauteng, Mpumalanga, North-West Province, Northern Province	2	0
HESPERIIDAE		*Kedestes wallengrenii (Trimen, 1883)*	grassland and woodland	KwaZulu-Natal, grassy Highveld of Gauteng, Mpumalanga	2	0
HESPERIIDAE		*Metisella aegipan (Trimen, 1868)*	marshes, damp patches on hills and mountains	Eastern Cape, on the Drakensberg, KwaZulu-Natal, Lesotho, Northern Province	2	0
HESPERIIDAE		*Metisella malgacha (Boisduval, 1833)*	gardens, grassland, vleis	Western Cape, southern Karoo, Eastern Cape, North-West Province, Gauteng, KwaZulu-Natal	2	0
HESPERIIDAE		*Metisella malgacha orina Vari, 1976*	gardens, grassland, vleis	Drakensberg in Lesotho and KwaZulu-Natal	2	0
HESPERIIDAE		*Metisella meninx (Trimen, 1873)*	marshy habitats	southern and eastern Tvl., northern Freestate and Natal	2	5
HESPERIIDAE		*Metisella willemi (Wallengren, 1857)*	grassy areas, deciduous woodland, bushveld	North-West Province, Gauteng, Mpumalanga	2	5
HESPERIIDAE		*Parosmodes morantii morantii (Trimen, 1873)*	woodland, savanna	Gauteng, KawZulu-Natal, Northern Province, Mpumalanga	2	0
HESPERIIDAE		*Pelopidas mathias (Fabricius, 1798)*	grassy woodlands and forest	Eastern Cape, KwaZulu-Natal, Gauteng, Mpumalanga, Northern Province	2	5
HESPERIIDAE		*Pelopidas thrax(Hubner, 1821)*	woodland, forest margins	Free State, Gauteng, Eastern Cape, Northern Province, Mpumalanga, KwaZulu-Natal	0	5
HESPERIIDAE		*Platylesches ayresii (Trimen & Bowker, 1889)*	grassland, bushveld	KwaZulu-Natal, Gauteng, Mpumalanga, Northern Province	0	0
HESPERIIDAE		*Platylesches neba (Hewitson, 1877)*	forest, coastal bush	Gauteng, KwaZulu-Natal, Mpumalanga, Northern Province	0	0
HESPERIIDAE		*Sarangesa motozi (Wallengren, 1857)*	savanna, forests	north-, west- & eastern Tvl., Eastern Cape, KwaZulu-Natal, Transkei	0	0
HESPERIIDAE		*Spialia agylla agylla (Trimen, 1889)*	grassland	Province	1	0
HESPERIIDAE		*Spialia asterodia (Trimen, 1864)*	grassy hillsides	Gauteng	1	0
HESPERIIDAE		*Spialia diomus (Hopffer, 1855)*	woodland, savanna, open montane areas	southern Africa	2	0
HESPERIIDAE		*Spialia dromus (Plotz, 1884)*	woodland, forest, open clearings in forest	Eastern Cape, KwaZulu-Natal, GautenG, North-West Province, Mpumalanga	0	0
HESPERIIDAE		*Spialia mafa mafa (Trimen, 1870)*	savanna, mountain areas	southern Africa, except east coast	2	0
HESPERIIDAE		*Spialia nanus (Trimen, 1889)*	karoid vegetation	Western Cape, western Eastern Province, Karoo, Free State, Northern Cape	0	0
HESPERIIDAE		*Spialia paula (Higgins, 1925)*	savanna	A marginal species found in Tvl. and northern Free State	0	0
HESPERIIDAE		*Spialia spio (Linnaeus, 1767)*	various	Widespread in southern Africa	2	0
HESPERIIDAE		*Tsitana tsita (Trimen, 1870)*	grassy hillsides	Eastern Cape, northern Free State, Gauteng, Northern Province, Mpumalanga	1	0
LYCAENIDAE		*Actizera lucida (Trimen, 1883)*	karoo fringes, grassy slopes	southern Africa except Karoo, south-western Cape	2	0
LYCAENIDAE		*Aloeides dentatis dentatis (Swierstra, 1909)*	Highveld grassland	Highveld of the Tvl.	1	0
LYCAENIDAE		*Aloeides dentatis maseruna (Riley, 1938)*	flat grassland on sandy gravel soil	through the Free State and western Tvl.	1	0
LYCAENIDAE		*Aloeides macmasteri Tite & Dickson, 1973*	grassland, Karoo	Eastern Cape, Karoo, Little Namaqualand	1	0
LYCAENIDAE		*Aloeides nubilus Henning & Henning, 1982*	grasslands near forested areas	eastern Tvl.	1	0
LYCAENIDAE		*Aloeides pierus (Cramer, 1779)*	Western Cape, Eastern Cape, Lesotho, southern Free State	open sandy areas	1	0
LYCAENIDAE		*Aloeides rossouwi Henning & Henning, 1982*	Stofberg	near Stofberg in the Tvl.	1	0
LYCAENIDAE		*Aloeides taikosama (Wallengren, 1857)*	Unknown ?	Tvl., KwaZulu-Natal, Swaziland	3	0
LYCAENIDAE		*Aloeides trimeni trimeni Tite & Dickson, 1973*	grassland, karroid areas	All the provinces	2	0
LYCAENIDAE		*Anthene amarah amarah (Guerin-Meneville, 1849)*	various, bushveld	Tvl., Free State, Karoo, Natal, Eastern Cape	0	0
LYCAENIDAE		*Anthene butleri livida (Trimen, 1881)*	mountainous areas, gardens, savanna	Eastern southern Africa	0	5
LYCAENIDAE		*Anthene definita definita (Butler, 1899)*	gardens, coastal bush, bushveld, forest edge, Karoo	Transvaal, Swaziland, KwaZulu-Natal	0	0
LYCAENIDAE		*Aphnaeus hutchinsonii Trimen & Bowker, 1887*	bushveld, rocky outcrops	Tvl. bushveld, KwaZulu-Natal	0	0
LYCAENIDAE		*Axiocerses tjoane (Wallengren, 1857)*	bushveld	Tvl. bushveld, Eastern Cape, Transkei, KwaZulu-Natal	0	0
LYCAENIDAE		*Azanus jesous jesous (Guérin-Méneville, 1849)*	various, near host	Eastern southern Africa	2	0
LYCAENIDAE		*Cacyreus marshalli Butler, 1897*	various, but not in drier habitats	Widespread in southern Africa, except Karoo, Namakwaland, Boesmanland	2	0
LYCAENIDAE		*Cnodontes pennington Bennett, 1954*	bushveld, coastal bush	Eastern, Northern & Central Tvl., Zululand	0	0

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

LYCAENIDAE		*Cupidopsis cissus cissus (Godart, 1824)*	grassland	Eastern Southern Africa	1	0
LYCAENIDAE		*Cyclyrius pirithous (Linnaeus, 1767)*	various	Widespread in southern Africa	2	0
LYCAENIDAE		*Durbania amakosa amakosa Trimen, 1862*	rocky grassland	Eastern Cape	1	0
LYCAENIDAE		*Eicochrysops messapus mahallakoaena (Godart, 1823)*	bushveld, fynbos	Tvl., KwaZulu-Natal	0	0
LYCAENIDAE		*Eicochrysops messapus messapus (Godart, 1823)*	bushveld, fynbos	Eastern Cae, Free State, Lesotho, south-west Cape	0	0
LYCAENIDAE		*Freyeria trochylus (Freyer, 1845)*	bushveld, grassland, marshes	Eastern southern Africa	2	0
LYCAENIDAE		*Gonatomyrina gorgias gorgias (Stoll, 1790)*	gardens, various	Transkei, KwaZulu-Natal, Tvl.	2	0
LYCAENIDAE		*Gonatomyrina lara (Linnaeus, 1764)*	gardens, various	Cape Province, Free State, Lesotho	2	0
LYCAENIDAE		*Harpendyreus noquasa (Trimen & Bowkeri, 1887)*	stream beds, marshy areas	eastern Transvaal, Wakkerstroom, Natal Drakensberg	2	0
LYCAENIDAE		*Iolaus alienus alienus (Trimen, 1898)*	rocky areas	Tvl., northern Zululand	0	0
LYCAENIDAE		*Iolaus mimosae mimosae Trimen, 1874*	nearby larval host	Tvl., Eastern Cape, eastern Karoo, KwaZulu-Natal	0	0
LYCAENIDAE		*Lampides boeticus (Linnaeus, 1767)*	various	Widespread in southern Africa	2	0
LYCAENIDAE		*Lepidochrysops asteris (Godart, 1819)*	grassy slopes of elevated hills	eastern Cape, Transkei, KwaZulu-Natal	1	0
LYCAENIDAE		*Lepidochrysops hypopolia (Trimen, 1887)*	grassland	Natal and Tvl. Highveld	1	0
LYCAENIDAE		*Lepidochrysops ignota (Trimen & Bowker, 1887)*	grassland	Natal, Tvl.	1	0
LYCAENIDAE		*Lepidochrysops letsea (Trimen, 1870)*	highveld grassland	Free State, Tvl. Highveld, western Lesotho	1	0
LYCAENIDAE		*Lepidochrysops oosthuizeni Swanepoel & Vári, 1983*	rocks or low bushes	north-eastern Cape and Lesotho	0	0
LYCAENIDAE		*Lepidochrysops ortygiaTrimen, 1887)*	grassland	relatively widespread	1	0
LYCAENIDAE		*Lepidochrysops patricia (Trimen, 1887)*	open grassland, bushveld, forest edge	Free State, Tvl., KwaZulu-Natal, Eastern Cape, southern Cape	2	0
LYCAENIDAE		*Lepidochrysops plebeia plebeia (Butler, 1898)*	bushveld, grassy areas	Tvl., KwaZulu-Natal, north-western Free State	2	0
LYCAENIDAE		*Lepidochrysops variabilis Cottrell, 1965*	grassland	south-west Cape, Eastern Cape, KwaZulu-Natal, Tvl., Lesotho	1	0
LYCAENIDAE		*Leptotes pirithous (Linnaeus, 1767)*	various habitats	southern Africa	2	0
LYCAENIDAE		*Lycaena clarki Dickson, 1971*	grassland, marshes	Free State, Tvl. Highveld, Eastern Cape, KwaZulu-Natal	1	0
LYCAENIDAE		*Myrina silenus ficedula (Fabricius, 1775)*	thornveld ?	Transkei, Tvl. bushveld, KwaZulu-Natal	0	0
LYCAENIDAE		*Orachrysops subravus (Henning & Henning, 1994)*	montane grassland, near streams	Eastern cape, Natal Drakensberg, Transkei	2	0
LYCAENIDAE		*Oraidium barberae (Trimen, 1868)*	various, near host	Widespread in southern Africa	2	0
LYCAENIDAE		*Poecilimitis chrysaor (Trimen,1864)*	hilly grassland	Free State, Lesotho, Eastern Cape	1	0
LYCAENIDAE		*Poecilmitis aureus Van Son, 1966*	slopes of hills on grassy, damp patches	endemic to the Tvl., Heidelberg and Suikerbosrand Nature Reserve	1	0
LYCAENIDAE		*Poecilmitis lycegenes (Trimen, 1874)*	grassy highveld	eastern Free State, KwaZulu-Natal & adjoining Tvl.	1	0
LYCAENIDAE		*Spindasis ella (Hewitson, 1865)*	bushveld, thornveld, savanna	northern & western Free State, Tvl., KwaZulu-Natal, north-east Cape	0	0
LYCAENIDAE		*Spindasis natalensis (Westwood, 1852)*	bushveld, coastal bush, rocky hilltops	Eastern Cape, KwaZulu-Natal, Free State, Tvl.	0	0
LYCAENIDAE		*Stugeta bowkeri bowkeri (Trimen, 1864)*	bushveld	Northern Cape, Eastern Cape, Karoo, KwaZulu-Natal, Transkei	0	0
LYCAENIDAE		*Stugeta bowkeri henningi (Trimen, 1864)*	Unknown ?	southern Tvl. & Free State	0	0
LYCAENIDAE		*Stugeta bowkeri tearei (Trimen, 1864)*	Unknown ?	Tvl.	0	0
LYCAENIDAE		*Tarucus sybaris sybaris (Hopffer, 1855)*	near host plant	Free State, Tvl., Eastern Cape, KwaZulu-Natal	0	0
LYCAENIDAE		*Thestor basutus basutus (Wallengren ,1857)*	various	eastern southern Africa	2	0
LYCAENIDAE		*Tuxentius melaena melaena (Trimen, 1887)*	Unknown ?	Eastern Cape, Free State, Tvl., KwaZulu-Natal	0	0
LYCAENIDAE		*Virachola dinochares (Grose-Smith, 1887)*	thornveld	Transvaal, KwaZulu-Natal	0	0
LYCAENIDAE		*Zizeeria knysna (Trimen, 1862)*	grassland, woodland, forest edge	southern Africa	2	0
LYCAENIDAE		*Zizula hylax hylax (Fabricius, 1775)*	grassy areas, various	Widespread in Southern Africa, except North-west Cape, Namakwaland, Great Karoo	2	0
NYMPHALIDAE		*Hyalites anacreon (Trimen, 1868)*	high-rainfall mountains, streams	Eastern Cape, KwaZulu-Natal, eastern Transvaal	2	0
NYMPHALIDAE	ACRAEINAE	*Acraea horta (Linnaeus, 1764)*	gardens, thickets	eastern Southern Africa	0	0
NYMPHALIDAE	ACRAEINAE	*Acraea natalica natalica Boisduval, 1847*	thickets, dry grassland of North-west Tvl.	Transkei, KwaZulu-Natal, North-west Tvl., Eastern Cape	2	0
NYMPHALIDAE	ACRAEINAE	*Acraea neobule neobule (Doubleday, 1848)*	grassland, bushveld	central & eastern southern Africa	2	0
NYMPHALIDAE	ACRAEINAE	*Acraea rahira rahira Boisduval, 1833*	swamps, dams, rivers, streams	moister areas of southern Africa, but not in the Karoo & Northern Cape	2	0
NYMPHALIDAE	ACRAEINAE	*Acraea zetes (Linnaeus, 1758)*	thornveld	norhtern & western Tvl., Western Free State, Zululand	0	0
NYMPHALIDAE	ACRAEINAE	*Acrea anemosa Hewitson, 1865*	bushveld	drier areas of Tvl. bushveld, northern KwaZulu-Natal	0	0
NYMPHALIDAE	CHARAXINAE	*Charaxes jahlusa jahlusa (Trimen, 1862)*	bushveld	Eastern Cape, KwaZulu-Natal, Tvl., Swaziland	0	0
NYMPHALIDAE	DANAINAE	*Danaus chrysippus aegyptius (Schreber, 1759)*	widespread, various	Widespread in southern Africa.	2	0
NYMPHALIDAE	DANAINAE	*Melanitis leda helena (Westwood, 1851)*	South African rain forests	South African forests, Free State, KwaZulu-Natal, Tvl., Eastern Cape	0	0
NYMPHALIDAE	NYMPHALINAE	*Byblia ilithyia (Drury, 1773)*	Eastern Cape, Free State, various	Free State, eastern Karoo	2	0
NYMPHALIDAE	NYMPHALINAE	*Catacroptera cloanthe cloanthe (Stoll, 1781)*	wet grassland	Eastern Cape, Tvl., KwaZulu-Natal, Eastern Cape	1	0
NYMPHALIDAE	NYMPHALINAE	*Hypolimnas misippus (Linnaeus, 1764)*	various, except drier habitats	Throughout southern Africa, except Karoo, Namakwaland, Northwest Cape	2	0
NYMPHALIDAE	NYMPHALINAE	*Junonia hierta cebrene Trimen, 1870*	various, except the drier Karoo, Namakwaland, North-east Cape	Namakwaland	0	0
NYMPHALIDAE	NYMPHALINAE	*Junonia oenone oenone (Linnaeus, 1758)*	hilltops	Eastern Cape, Transkei, KwaZulu-Natal, Tvl., Free State	1	0
NYMPHALIDAE	NYMPHALINAE	*Junonia orithya madagascariensis (Guenée, 1865)*	thornveld	Free State, Tvl., KwaZulu-Natal	0	0
NYMPHALIDAE	NYMPHALINAE	*Phalantha phalantha aethiopica (Rothschild & Jordan, 1903)*	wetter eastern southern Africa	Eastern Cape, Free State, Tvl., KwaZulu-Natal, Transkei	2	0
NYMPHALIDAE	NYMPHALINAE	*Precis octavia sesamus Trimen, 1883*	grassland, hills, gardens	Eastern Cape, KwaZulu-Natal, Transvaal, Swaziland	2	0

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

NYMPHALIDAE	NYMPHALINAE	*Precis oenone oenone (Linnaeus, 1788)*	bushveld, grassland, woodland	Eastern Cape upwards through southern Africa	2	0
NYMPHALIDAE	NYMPHALINAE	*Vanessa/Cynthia cardui (Linnaeus, 1758)*	various	Widespread in southern Africa	2	0
NYMPHALIDAE	SATYRIDAE	*Aeropetes tulbaghia (Linnaeus, 1764)*	rocky areas	Drakensberg mountains down to southern Cape mountains.	0	5
NYMPHALIDAE	SATYRIDAE	*Cassionympha cassius (Godart, 1823)*	coastal bush, rainforest	Eastern Cape, Tvl., KwaZulu-Natal, Cape Peninsula	0	0
NYMPHALIDAE	SATYRIDAE	*Dingana alaedeus Henning & Henning, 1984*	(Wakkerstroom region)	endemic to Tvl. inhabiting the escarpment above Wakkerstroom, south-eastern Tvl.	1	5
NYMPHALIDAE	SATYRIDAE	*Dingana bowkeri bowkeri (Trimen, 1870)*	hilly & mountainous country	KwaZulu-Natal, Tvl., Eastern Cape, Free State	2	0
NYMPHALIDAE	SATYRIDAE	*Dingana dingana (Trimen, 1873)*	montane grassland, Transvaal Drakensberg	Tvl. Drakensberg, KwaZulu-Natal, Wolkberg; endemic to Biome?	1	5
NYMPHALIDAE	SATYRIDAE	*Precis hierta cebrene (Trimen, 1870)*	grassy spots, open ground, gardens, bushveld	southern Africa, except Western Cape and Karoo	2	0
NYMPHALIDAE	SATYRIDAE	*Pseudonympha machacha Riley, 1938*	montane & alpine grasslands	Drakensberg, Lesotho, Eastern Cape	1	5
NYMPHALIDAE	SATYRIDAE	*Pseudonympha magoides Van Son, 1955*	grassy slopes of hills	Eastern Cape, to the Wolkberg in Transvaal	1	5
NYMPHALIDAE	SATYRIDAE	*Pseudonympha paragaika Vári, 1971*	high elevation grassland on the southern aspects of mountains	endemic to the Free State, Golden Gate Higlands National Park	1	5
NYMPHALIDAE	SATYRIDAE	*Pseudonympha varii Van Son, 1955*	grassy slopes of hills, stream banks, fynbos	Eastern Cape, Amatola Mountains, Natal midlands	2	5
NYMPHALIDAE	SATYRIDAE	*Stygionympha scotina scotina Quickelberge, 1977*	summits of mountains	Eastern Cape, Natal Drakensberg, Lesotho, Free State	1	0
NYMPHALIDAE	SATYRIDAE	*Stygionympha vigilans (Trimen, 1887)*	rocky areas in open grassland in mountainous country	mountains of Lesotho, KwaZulu-Natal, Eastern and Western Cape	1	5
NYMPHALIDAE	SATYRIDAE	*Stygionympha wichgrafi wichgrafi Van Son, 1959*	grassland	Eastern Cape, Lesotho, KwaZulu-Natal: lower altitudes	1	5
NYMPHALIDAE	SATYRIDAE	*Torynesis orangica Vári, 1971*	high elavation grassland of Golden Gate	Free State in the Golden Gate and in the intervening mountains of Lesotho.	1	5
PAPILIONIDAE	PAPILIONIDAE	*Papilio demodocus demodocus Esper, 1798*	most habitats	southern Africa	2	0
PAPILIONIDAE	PAPILIONIDAE	*Papilio nireus lyaeus Doubleday, 1845*	wooded areas	Natal, Transvaal, Swaziland, Eastern Cape, Free State	0	0
PIERIDAE		*Belenois aurota aurota (Fabricius, 1793)*	various	Widespread in southern Africa	2	0
PIERIDAE		*Belenois creona severina (Stoll, 1781)*	thickets, savanna, edge of forests	Eastern Cape, Tvl., Natal, Transkei	0	0
PIERIDAE		*Belenois gidica (Godart, 1819)*	woodland, coastal bush	eastern Tvl., eastern Cape, Natal, Swaziland	0	0
PIERIDAE		*Belenois zochalia zochalia (Boisduval, 1836)*	coastal bush, thickets, forests	Tvl. Highveld, KwaZulu-Natal, Transkei, eastern Cape	0	0
PIERIDAE		*Catopsilia florella (Fabricius, 1775)*	various	Widespread in southern Africa	2	0
PIERIDAE		*Colias electo electo (Linnaeus, 1763)*	various	Widespread in southern Africa	2	0
PIERIDAE		*Colotis agoye agoye (Wallengren, 1857)*	bushveld, drier areas	Namakwaland, western Tvl., western Free State, northern Karoo	0	0
PIERIDAE		*Colotis eris eris (Klug, 1829)*	bushveld, Karoo	western Free State, Namakwaland, Tvl., KwaZulu-Natal, north-east Cape	0	0
PIERIDAE		*Colotis euippe omphale (Godart, 1819)*	savanna, coastal bush, woodland	southern Africa except south-western Western Cape and high-altitude grassland	0	0
PIERIDAE		*Colotis evagore antigone (Boisduval, 1836)*	open bushveld	Tvl, western Free State, Eastern Cape, Transkei, KwaZulu-Natal	0	0
PIERIDAE		*Colotis evenina evenina (Wallengren, 1857)*	bushveld	Free State, north-, west- & eastern Tvl., Zululand, Swaziland	0	0
PIERIDAE		*Colotis ione(Godart, 1819)*	thornveld, bushveld	northern & eastern Tvl.	0	0
PIERIDAE		*Colotis regina (Trimen, 1863)*	bushveld	Tvl., Zululand, Swaziland, north-east Cape	0	0
PIERIDAE		*Colotis subfasciatus subfasciatus (Swainson, 1823)*	bushveld, grassland, savanna	Tvl., western Free State, Northern Cape	2	0
PIERIDAE		*Eurema brigitta brigitta (Stoll, 1780)*	various	southern Africa, except in the drier Karoo, Namakwaland, south-west Cape	2	0
PIERIDAE		*Mylothris agathina agathina (Cramer, 1779)*	wooded habitats	Transvaal, east coast	0	0
PIERIDAE		*Mylothris ruepellii haemus (Trimen, 1879)*	drier thickets, forests	Eastern Cape, Tvl., KwaZulu-Natal, Transkei	0	0
PIERIDAE		*Pinacopteryx eriphia eriphia (Godart, 1819)*	various	Widespread in southern Africa, except parts of Namakwaland, Gordonia, Skiereiland	2	0
PIERIDAE		*Pontia helice helice (Linnaeus, 1764)*	various, especially grassland or open country	Widespread in southern Africa	2	0

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

Table 27. Red Data Book butterfly species that occur in the Grassland Biome

Family	Subfamily	Species name	Habitat	Distribution	Conservation status	Edge species	Habitat type	Larval grass food
NYMPHALIDAE	SATYRIDAE	*Dira jansei* Swierstra, 1911	wooded grassland on south facing slopes	endemic to Tvl. occurring from Makapans Caves to Marieskop	Indeterminate	Yes	1	5
NYMPHALIDAE	SATYRIDAE	*Dingana bowkeri bella* Van Son, 1955	steep grassy hillsides	Found near Cradock and Cambedoo Mountains in the eastern Cape	Indeterminate	Possibly: Grassland	1	5
NYMPHALIDAE	SATYRIDAE	*Dingana alaedeus* Henning & Henning, 1984	high elevation grassy ridges on the eastern Tvl. Drakensberg escarpment (Wakkerstroom region)	endemic to Tvl. inhabiting the escarpment above Wakkerstroom, south eastern Tvl.	Rare	No	1	5
NYMPHALIDAE	SATYRIDAE	*Torynesis orangica* Vári, 1971	high elevation grassland of Golden Gate	Found in the Free State in the Golden Gate and in the intervening mountains of Lesotho.	Rare	No	1	5
NYMPHALIDAE	SATYRIDAE	*Torynesis pringlei* Dickson, 1979	grassy slopes	Found in Lesotho	Rare	Possibly: Grassland	1	5
NYMPHALIDAE	SATYRIDAE	*Pseudonympha paragaika* Vári, 1971	high elevation grassland on the southern aspects of mountains	endemic to the Free State and was discovered in the Golden Gate Higlands National Park	Rare	No	1	5
NYMPHALIDAE	SATYRIDAE	*Pseudonympha swanepoeli* Van Son, 1955	marshy valley high up in the mountains	endemic to the Tvl. between Houtbosdorp and Woodbush.	Rare	Yes	2	5
NYMPHALIDAE	SATYRIDAE	*Pseudonympha camdeboo* Dickson, 1982	open grassland on the edges of thick bush	Camdeboo Mountains	Indeterminate	Possibly: Grassland	2	5
NYMPHALIDAE	ACRAEINAE	*Acraea machequena* Grose-Smith, 1887	bushveld areas but may be found in intervening habitats	(From KNP to Brits and Pietersburg) and Natal	Indeterminate	Yes	0	0
LYCAENIDAE		*Alaena margaritacea* Eltringham, 1929	steep grassy slopes	endemic to the north eastern Tvl.	Vulnerable	Yes	1	0
LYCAENIDAE		*Thestor compassbergae* Quickelbergae & McMaster, 1970	low bushes and tufts of grass	endemic to the Cape; found in eastern Cape	Indeterminate	Possibly: Grassland	2	5
LYCAENIDAE		*Aloeides pringlei* Tite & Dickson, 1976	coarse grass and shrub on sandy loam	endemic to the Cape and found on the Great Winterberg mountains in the Eastern Cape.	Indeterminate	Possibly: Grassland	1	5
LYCAENIDAE		*Aloeides dentatis dentatis* (Swierstra, 1909)	highveld grassland	highveld of the Tvl.	Rare	No	1	0
LYCAENIDAE		*Aloeides dentatis maseruna* (Riley, 1938)	flat grassland on sandy gravel soil	throughout the Free State and western Tvl.	Indeterminate	No	1	0
LYCAENIDAE		*Aloeides rossouwi* Henning & Henning, 1982	rocky gullies below the summit of grassy escarpment of south-west Stofberg	near Stofberg in the Tvl.	Rare	No	1	0
LYCAENIDAE		*Aloeides nubilus* Henning & Henning, 1982	moist highland areas of the eastern Tvl. and found on rocky outcrops in grasslands near forested areas	eastern Tvl.	Rare	No	1	0
LYCAENIDAE		*Aloeides merces* Henning & Henning, 1987	rocky edge of Drakensberg mountain	south eastern Tvl. above Wakkerstroom and Natal	Rare	Possibly: Grassland	1	0
LYCAENIDAE		*Poecilmitis aureus* Van Son, 1966	slopes of hills on grassy, damp patches	endemic to the Tvl., Heidelberg and Suikerbosrand Nature Reserve	Rare	No	1	0
LYCAENIDAE		*Anthene minima* (Trimen, 1893)	thornveld	Marginal species from northern-Natal and north-eastern Tvl.	Rare	Yes	0	0
LYCAENIDAE		*Cyclyrius babaulti* (Stempffer, 1935)	wooded moist habitats	A marginal species and found in eastern Tvl.	Indeterminate	Possibly: Grassland	0	0
LYCAENIDAE		*Lepidochrysops loewensteini* (Swanepoel, 1951)	grassy mountain slopes	Lesotho	Rare	Possibly: Grassland	0	0
LYCAENIDAE		*Lepidochrysops victori* Pringle, 1984	high altitude on the foothills of the Great Winterberg	foothills of the Great Winterberg, Eastern Cape	Rare	Possibly: Grassland	1	0
LYCAENIDAE		*Lepidochrysops pephredo* (Trimen, 1889)	grassy slopes	Natal	Rare	Possibly: Grassland	1	0
LYCAENIDAE		*Lepidochrysops swanepoeli* Pennington, 1948	grassy summits	eastern Tvl. at Baberton and in northern Natal	Rare	Possibly: Grassland	1	0
LYCAENIDAE		*Lepidochrysops jefferyi* (Swierstra, 1907)	grassy hilltops and slopes with scattered trees	Baberton in eastern Tvl.	Rare	Possibly: Grassland	1	0
LYCAENIDAE		*Lepidochrysops hypopolia* (Trimen, 1887)	grassland	Natal and Tvl. highveld	Extinct	No	1	0
LYCAENIDAE		*Lepidochrysops lotana* Swanepoel, 1962	grassy slopes	endemic to the Tvl.	Vulnerable	Yes	1	0
LYCAENIDAE		*Lepidochrysops oosthuizeni* Swanepoel & Vári, 1983	rocks or low bushes	north-eastern Cape and Lesotho	Rare	No	0	0
HESPERIIDAE	HESPERIIDAE	*Coeliades anchises* (Gerstaecker, 1871)	bushveld to riverine and coastal forest	Natal midlands to eastern and northern Tvl.	Rare	Yes	0	0
HESPERIIDAE	HESPERIIDAE	*Spialia paula* (Higgins, 1925)	savanna	A marginal species found in Tvl. and northern Free State	Indeterminate	No	0	0
HESPERIIDAE	HESPERIIDAE	*Metisella meninx* (Trimen, 1873)	marshy habitats	southern and eastern Tvl., northern Free State and Natal	Rare	No	2	5
HESPERIIDAE	HESPERIIDAE	*Metisella syrinx* (Trimen, 1868)	Mountain Bamboo on high mountains	endemic to SA and found in Eastern Cape and Lesotho	Rare	Possibly: Grassland	0	0

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 28. Butterfly species recorded in the Grassland Biome,of which the larvae feed on grass swards

Family	Subfamily	Species name	Habitat	Distribution	Habitat type	Larval grass food
HESPERIIDAE		*Borbo fallax (Gaede, 1916)*	coastal bush, savanna, woodland	widespread	0	5
HESPERIIDAE		*Gegenes hottentota hottentota (Latreille, 1823)*	grassland, bushveld, marshes	widespread	2	5
HESPERIIDAE		*Gegenes niso niso (Linnaeus, 1764)*	bushveld, savanna, woodland, grassy slopes	widespread	2	5
HESPERIIDAE		*Gegenes pumilio gambica (Mabille, 1878)*	bushveld, grassy slopes	widespread	2	5
HESPERIIDAE		*Kedestes callicles (Hewitson, 1868)*	bushveld	widespread	0	5
HESPERIIDAE		*Metisella meninx (Trimen, 1873)*	marshy habitats	wide	2	5
HESPERIIDAE		*Metisella metis metis (Linnaeus, 1764)*	bushveld, forests	relatively widespread	0	5
HESPERIIDAE		*Metisella willemi (Wallengren, 1857)*	grassy areas, deciduous woodland, bushveld	widespread	2	5
HESPERIIDAE		*Pelopidas mathias (Fabricius, 1798)*	grassy woodlands and forest	widespread	2	5
HESPERIIDAE		*Pelopidas thrax(Hubner, 1821)*	woodland, forest margins	widespread	0	5
LYCAENIDAE		*Aloeides pringlei Tite & Dickson, 1976*	coarse grass and shrub on sandy loam	limited	1	5
LYCAENIDAE		*Anthene butleri livida (Trimen, 1881)*	mountainous areas, gardens, savanna	widespread	0	5
LYCAENIDAE		*Thestor compassbergae Quickelbergae & McMaster, 1970*	low bushes and tufts of grass	limited	2	5
NYMPHALIDAE	DANAINAE	*Bicyclus safitza safitza (Hewitson, 1851)*	forests & thickets	wide	0	5
NYMPHALIDAE	DANAINAE	*Henotesia perspicua (Trimen, 1873)*	wet forest, thickets, alongside rivers & dams	limited	0	5
NYMPHALIDAE	SATYRIDAE	*Aeropetes tulbaghia (Linnaeus, 1764)*	rocky areas	wide in limited habitat	0	5
NYMPHALIDAE	SATYRIDAE	*Coenyra hebe (Trimen, 1862)*	shrubs, next to footpaths	limited	0	5
NYMPHALIDAE	SATYRIDAE	*Dingana alaedeus Henning & Henning, 1984*	(Wakkerstroom region)	limited	1	5
NYMPHALIDAE	SATYRIDAE	*Dingana bowkeri bella Van Son, 1955*	steep grassy hillsides	limited	1	5
NYMPHALIDAE	SATYRIDAE	*Dingana dingana (Trimen, 1873)*	montane grassland, Transvaal Drakensberg	limited	1	5
NYMPHALIDAE	SATYRIDAE	*Dira jansei Swierstra, 1911*	wooded grassland on south facing slopes	limited	1	5
NYMPHALIDAE	SATYRIDAE	*Dira oxylus (Trimen, 1881)*	mountainous- rocky grassland areas	limited	1	5
NYMPHALIDAE	SATYRIDAE	*Paralethe dendrophilus (Trimen, 1862)*	rain forests	wide in habitat preferred	0	5
NYMPHALIDAE	SATYRIDAE	*Pseudonympha camdeboo Dickson, 1982*	open grassveld on the edges of thick bush	limited	2	5
NYMPHALIDAE	SATYRIDAE	*Pseudonympha machacha Riley, 1938*	montane & alpine grasslands	limited	1	5
NYMPHALIDAE	SATYRIDAE	*Pseudonympha magoides Van Son, 1955*	grassy slopes of hills	widespread	1	5
NYMPHALIDAE	SATYRIDAE	*Pseudonympha paragaika Vári, 1971*	high elevation grassland on the southern aspects of mountains	limited	1	5
NYMPHALIDAE	SATYRIDAE	*Pseudonympha swanepoeli Van Son, 1955*	marshy valley high up in the mountains	limited	2	5
NYMPHALIDAE	SATYRIDAE	*Pseudonympha varii Van Son, 1955*	grassy slopes of hills, stream banks, fynbos	widespread	2	5
NYMPHALIDAE	SATYRIDAE	*Stygionympha vigilans (Trimen, 1887)*	rocky areas in open grasslands in mountainous country	widespread in limited habitat	1	5
NYMPHALIDAE	SATYRIDAE	*Stygionympha wichgrafi wichgrafi Van Son, 1955*	grassland	widespread	1	5
NYMPHALIDAE	SATYRIDAE	*Torynesis orangica Vári, 1971*	high elavation grassland of Golden Gate	limited	1	5
NYMPHALIDAE	SATYRIDAE	*Torynesis pringlei Dickson, 1979*	grassy slopes	limited	1	5

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 29. Mammals restricted to the grasslands within the Grassland Biome

Species	Common name	Habitat	Endemicity mark	Habitat preference mark
Suncus varilla orangiae	Lesser dwarf shrew	termite mounds in grassland	3	5
Dendromus mystacalis jamesoni	Chestnut climbing mouse	grassland	3	5
Steatomys krebsii orangiae	Kreb's fat mouse	sandy grassland	3	5
Connachaetus gnou	Black wildebeest	open grassland	1	5
Damaliccus dorcas phillipsi	Blesbok	grassland	1	5
Otomys laminatus mariepsi	Laminate vlei rat	grassland	1	5
Otomys laminatus pondoensis	Laminate vlei rat	grassland	1	5
Otomys laminatus fannini	Laminate vlei rat	grassland	1	5

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 30. Mammals recorded within the Grassland Biome, with contracted distribution ranges due to habitat destruction and fragmentation

Species	Common name	Habitat
Ceratotherium simum	White rhinoceros	wooded grassland
Hippopotamus amphibius capensis	Hippopotamus	open water
Lycaon pictus	Cape hunting dog	scrub savanna
Crocuta crocuta	Spotted hyaena	various, semi-desert to mountains
Panthera leo	Lion	Highveld, bushveld, plains, semi-desert
Loxodonta africana	African elephant	various, riverine valleys, desert, savanna

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

Table 31. Extinct mammals that historically occured in the Grassland Biome

Species name	Common name	Habitat
Phacochoerus africanus	Extinct Warthog species	Historically at Florisbad
Antidorcas bondi	Extinct Springbok species	Historically at Florisbad
Kobus leche subsp.	Extinct waterbuck species	Historically at Florisbad
Equus quagga	Quagga	Historically in Fynbos, Karoo edge and grassland

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 32. Mammals endemic to southern Africa, recorded in the Grassland Biome

Species	Common name	Habitat	Habitat score
Myosorex varius	Forest Shrew	dense habitat, dense grass in Highveld	3
Suncus infinitesimus chriseos	Least dwarf Shrew	termite mounds	3
Chrysopalax villosus rufopallidus	Rough-haired Golden Mole	grassland, fringes of vleis	2
Chrysospalax villosus rufus	Rough-haired Golden Mole	grassland, fringes of vleis	2
Chrysopalax villosus transvaalensis	Rough-haired Golden Mole	grassland, ringes of vleis	2
Chlorotalpa sclateri montana	Sclater's Golden Mole	high altitudes of moist kloofs, rocky hillsides	4
Chlorotalpa sclateri sclateri	Sclater's Golden Mole	high altitudes of moist kloofs, rocky hillsides	4
Amblysomus hottentotus hottentotus	Hottentot Golden Mole	grassland, soft sandy ground, golf courses, sometimes	3
Amblysomus julianae	Juliana's Golden Mole	savanna , rocky outcrops, grassland	3
Pipistrellus kuhlii subtilis	Kuhl's Bat	various, near water, suitable roosting places	4
Mystromys albicaudatus	White-tailed Mouse	savanna grassland, Karoo	4
Felis nigripes thomasi	Small Spotted Cat	arid country, tall grass, scrub bush	3
Poecilogale albinucha transvaalensis	African Weasel	moist grassland, savanna	3
Galerella pulverulenta pulverulenta	Small Grey Mongoose	various, open country, outbuildings, fynbos, rocky areas	4
Connachaetus gnou	Black Wildebeest	open grassland	1
Damaliccus dorcas phillipsi	Blesbok	grassland	1
Pelea capreolus	Grey Rhebok	rocky hills, rocky mountains, grass cover, grassy slopes	3
Crocidura flavescens	Greater Musk Shrew	shrub, mountain country, vleis	4
Amblysomus iris	Zulu Golden Mole	sandy areas, further unknown	4
Pronolagus crassicaudatus	Natal Red Rock Rabbit	steep hillsides with grass cover	2
Otomys laminatus mariepsi	Laminate Vlei Rat	grassland	1
Otomys laminatus pondoensis	Laminate Vlei Rat	grassland	1
Otomys laminatus fannini	Laminate Vlei Rat	grassland	1

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 33. Mammals listed in the Red Data Book, recorded in the Grassland Biome

Species name	Common name	Habitat	Distribution	Habitat type	Habitat preference mark	RDB Score	RDB status
Chrysopalax villosus rufopallidus	Rough-haired Golden Mole	grassland, fringes of vleis	endemic & limited	2	1, 2	5	Vulnerable
Chrysopalax villosus transvaalensis	Rough-haired Golden Mole	grassland, ringes of vleis	endemic & limited	2	1, 2	5	Vulnerable
Chrysospalax villosus rufus	Rough-haired Golden Mole	grassland, fringes of vleis	endemic & limited	2	1, 2	5	Vulnerable
Felis lybica cafra	African Wild Cat	various, rocky hillsides, scrub, agricultural land, reedbeds, tall grass	wide	3	3, 1, 2, 5	5	Vulnerable
Felis lybica griselda	African Wild Cat	various, rocky hillsides, scrub, agricultural land, reedbeds, tall grass	wide	3	3, 1, 2, 5	5	Vulnerable
Manis temminckii	Pangolin	savanna, savanna woodland, floodplain grassland, rocky outcrops	limited	3	3, 1, 4	5	Vulnerable
Orycteropus afer	Aardvark	grassland, various except desert & forest	wide	3	1, 2, 3	5	Vulnerable
Ourebia ourebi ourebi	Oribi	open habitat, open grassland, floodplains, burned areas, vleis	limited	3	1, 2	5	Vulnerable
Atelerix frontalis frontalis	South African Hedgehog	various, grassland in Tvl., scrub bush, dry cover, gardens	wide	3	3, 2, 1, 5	4	Rare
Crocidura maquassiensis	Maquassie Musk Shrew	rocks among grass, montane grassland	limited	2	1, 4	4	Rare
Civettictis civetta	African Civet	forest, well-watered savanna, underbush	limited	2	3	4	Rare
Felis nigripes thomasi	Small Spotted Cat	arid country, tall grass, scrub bush	endemic & limited	3	1, 3	4	Rare
Felis serval serval	Serval	near permanent water, tall grass, reed beds, underbush	limited	3	1, 2, 3	4	Rare
Hyaena brunnea	Brown Hyaena	woodland savanna, rocky areas, semi-desert scrub	limited	4	3, 4	4	Rare
Mystromys albicaudatus	White-tailed Mouse	savanna grassland, karoo	endemic & limited	4	3	4	Rare
Panthera pardus melanotica	Leopard	wide but generally in mountains, kloofs & dense grass stands	limited	3	1, 3, 4	4	Rare
Poecilogale albinucha transvaalensis	African Weasel	moist grassland, savanna	endemic & limited	3	1, 3	4	Rare
Proteles cristatus cristatus	Aardwolf	grassland, savanna, karroid scrub, woodland	wide	3	1, 3	4	Rare
Amblysomus julianae	Juliana's Golden Mole	savanna , rocky outcrops, grassland	endemic & limited	3	1, 3, 4	3	Indeterminate
Chlorotalpa sclateri montana	Sclater's Golden Mole	high altitiudes of moist kloofs, rocky hillsides	endemic & limited	4	4	3	Indeterminate
Chlorotalpa sclateri sclateri	Sclater's Golden Mole	high altitiudes of moist kloofs, rocky hillsides	endemic & limited	4	4	3	Indeterminate
Myotis welwitschii	Welwitsch's hairy Bat	savanna woodland	marginal	4	3	3	Indeterminate
Pipistrellus kuhlii subtilis	Kuhl's Bat	various, near water, suitable roosting places	endemic & limited	4	3, 2	3	Indeterminate
Pipistrellus rusticus rusticus	Rusty Bat	savanna woodland with riverine conditions	marginal	4	3	3	Indeterminate
Suncus infinitesimus chriseos	Least Dwarf Shrew	termite mounds	endemic & limited	3	1, 3	3	Indeterminate
Tadarida ventralis	Transvaal Free-tailed Bat	unknown	marginal	3	unknown	3	Indeterminate

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

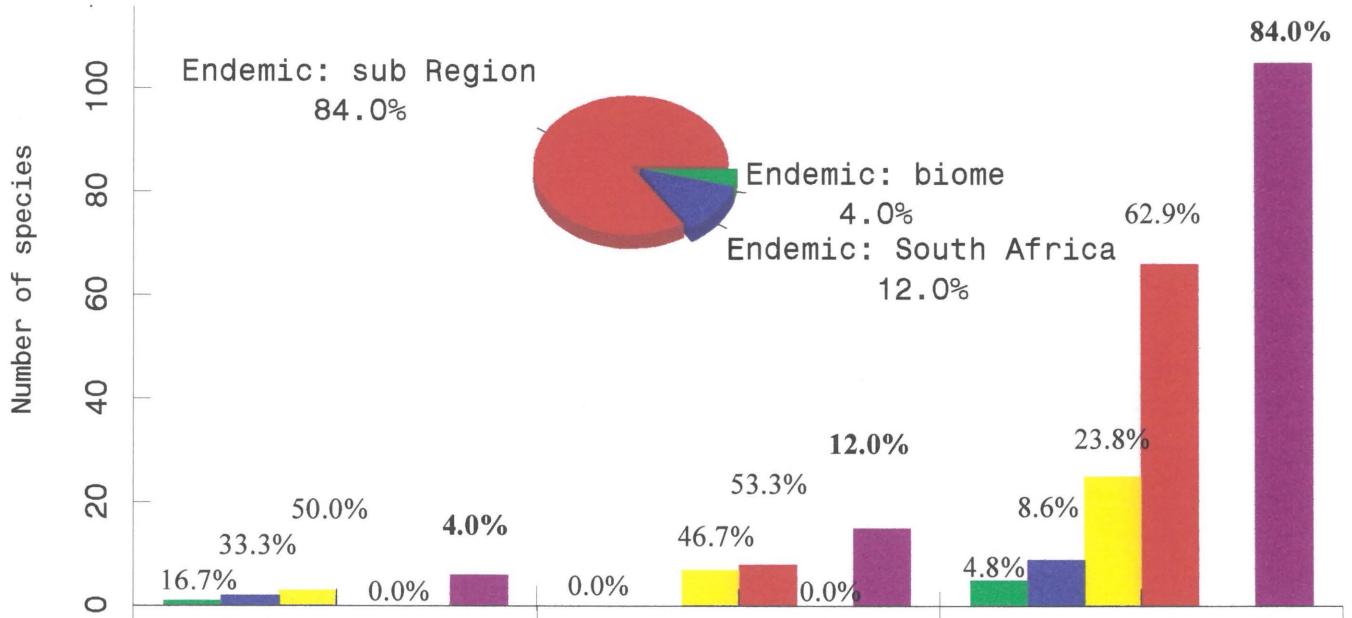
UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

Table 34. Summary of the number of mammal species recorded in the various habitat types within the Grassland Biome, according to their Endemicity status, Red Data Book (RDB) status and food preference

Habitat preference	**Endemicity status**			**RDB status**			**Food preference**							Total: Habitat
	Endemic	Limited	Non-endemic	Vulnerable	Rare	Indeterminate	Insectivore	Carnivore	Herbivore	Granivore	Insect / Vertebrate	Omnivore	Unknown	
Grassland	3	0	5	0	0	0	1	0	5	0	0	2	0	8
Grassland & vlei	4	1	11	0	3	5	6	0	5	0	0	5	0	16
Grassland & other habitats	7	4	52	5	5	4	16	5	19	1	9	12	1	63
Habitats other than grassland	8	2	73	2	1	2	29	1	25	0	6	18	4	83
Human settlements	0	0	2	0	0	0	0	1	0	0	0	1	0	2
Total	11	7	146	7	9	11	52	7	54	1	15	38	5	172

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA



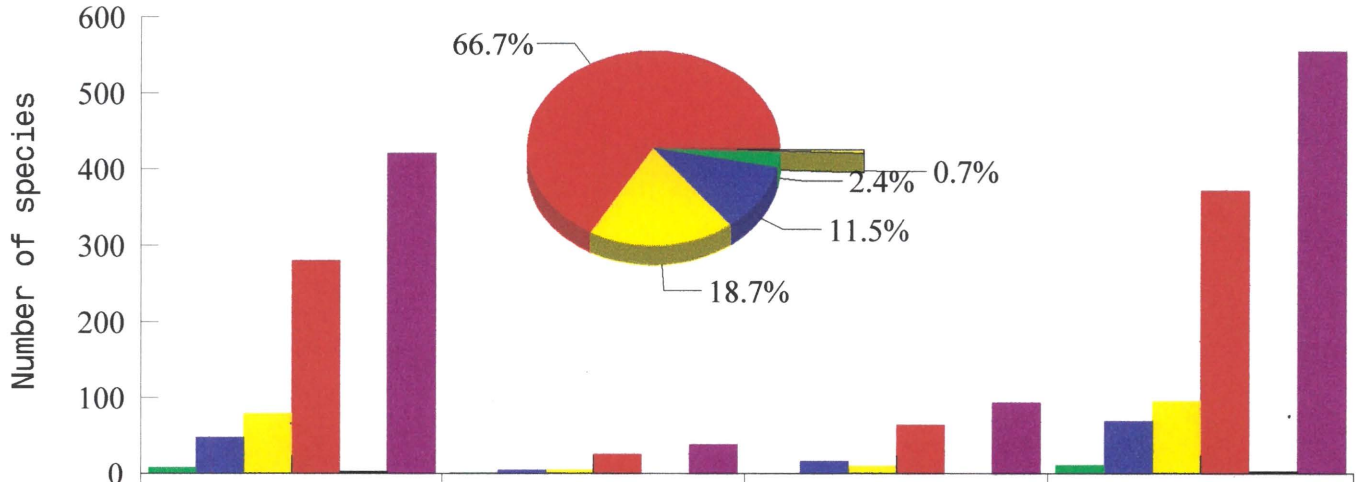
	Endemic: biome	Endemic: South Africa	Endemic: sub Region
Habitat 1	1	0	5
Habitat 2	2	0	9
Habitat 3	3	7	25
Habitat 4	0	8	66
Habitat 5	0	0	0
Total	6	15	105

Habitat type 1 = grassland
Habitat type 2 = grassland & vlei/cultivated areas
Habitat type 3 = grassland & shrub/savanna/desert/other habitats
Habitat type 4 = habitats other than grassland
Habitat type 5 = human settlements

Figure 4 Bird endemicity of the Grassland Biome, with the number of species within each habitat type expressed as a percentage of the number of total endemics found in the Grassland Biome.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA



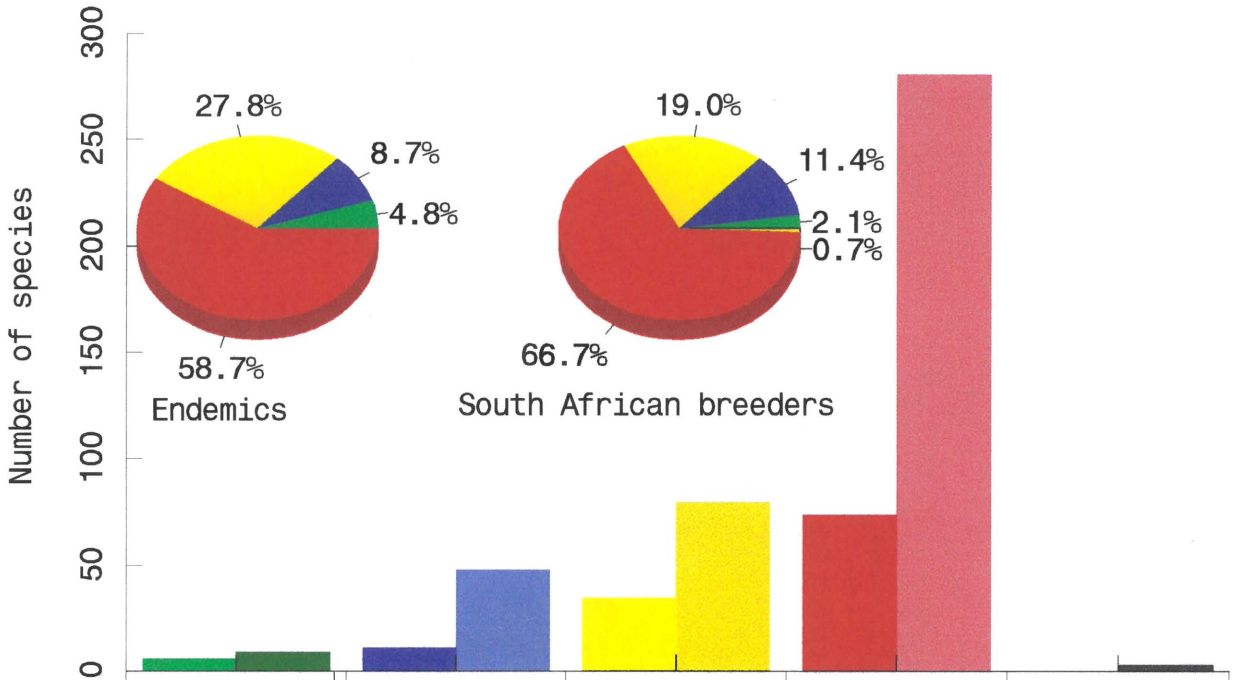
	South Africa	Migrant breeder	Non breeding migrant	Total: Habitats
Habitat 1	9	2	1	12
Habitat 2	48	5	17	70
Habitat 3	80	6	11	97
Habitat 4	281	26	65	372
Habitat 5	3	0	0	3
Total	421	39	94	554

Figure 5 Breeding status of Grassland Biome birds, with the number of species occurring within each habitat type presented in the pie diagram as a percentage of the total of bird species included in the inventory.

Habitat type 1 = grassland
Habitat type 2 = grassland & vlei/cultivated areas
Habitat type 3 = grassland & shrub/savanna/desert/other habitats
Habitat type 4 = habitats other than grassland
Habitat type 5 = human settlements

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA



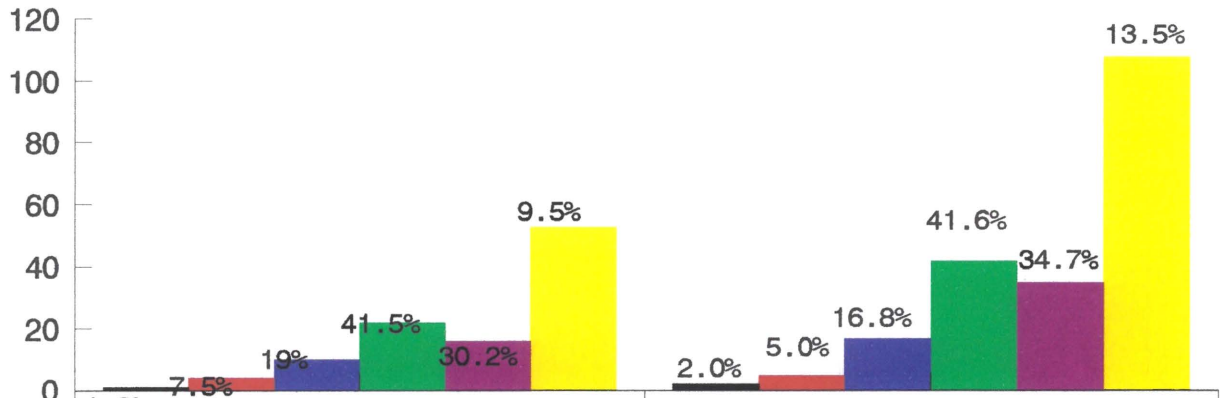
	Habitat 1	Habitat 2	Habitat 3	Habitat 4	Habitat 5
Endemics	6	11	35	74	0
SA breeders	9	48	80	281	3

Figure 6 Breeding status of Grassland Biome birds, with the number of endemic breeders within each habitat type. The number of species within each category is expressed as a percentages of the total number of species in the catergory. The dotted bars respresent South African breeders.

Habitat type 1 = grassland
Habitat type 2 = grassland & vlei/cultivated areas
Habitat type 3 = grassland & shrub/savanna/desert/other habitats
Habitat type 4 = habitats other than grassland
Habitat type 5 = human settlements

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

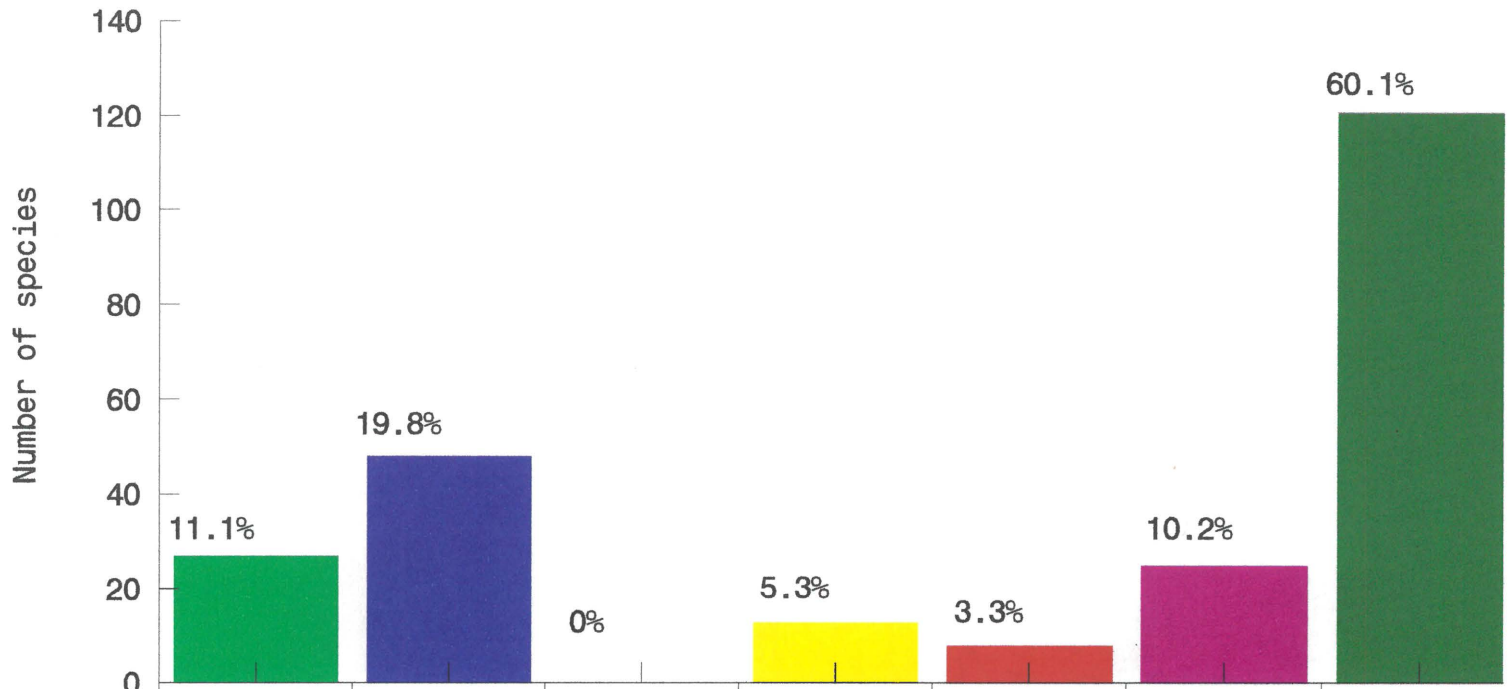


	Grassland Biome	South Africa
Extinct	1	2
Endangered	4	5
Vulnerable	10	17
Rare	22	42
Indeterminate	16	35
Total	53	108

Figure 7 Threatened Grassland Biome birds, with the number of species in each threatened category expressed as a percentage of the total number of species in that category.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA



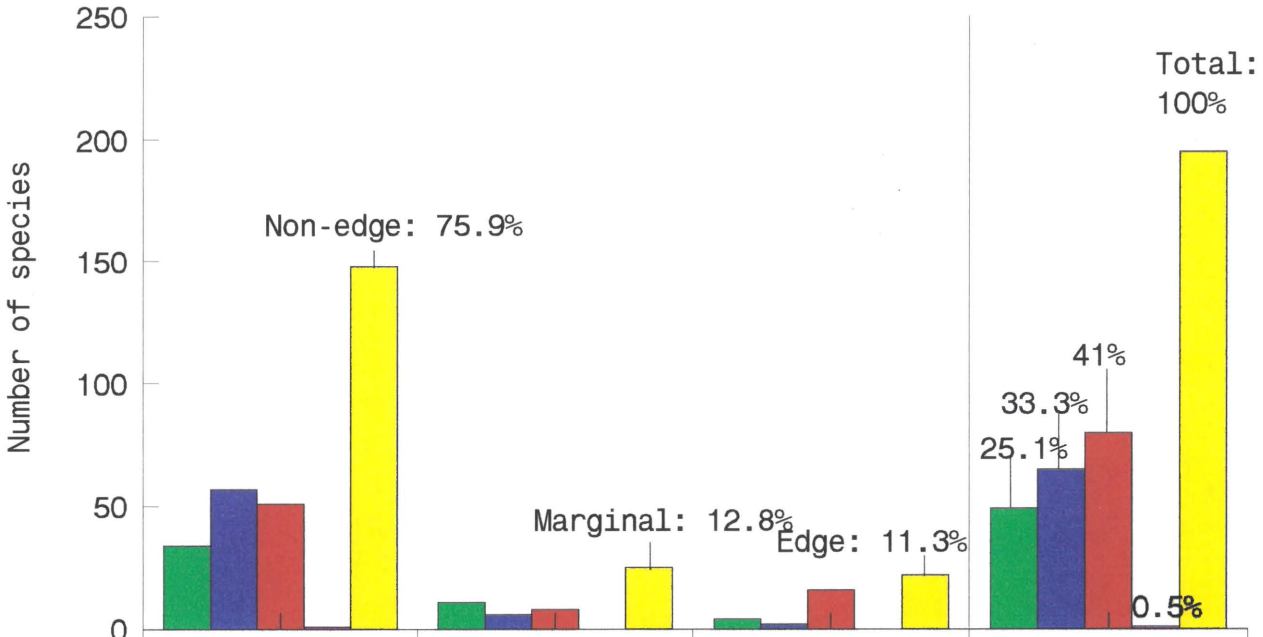
	Habitat 1	Habitat 2	Habitat 3	Habitat 4	Habitat 5	Habitat 6	Total
Number	27	48	0	13	8	25	121

Figure 9 The number of endemic herpetofauna species represented in each vegetation type within the Grassland Biome, with each value also expressed as a percentage of the total number of species recorded in the Grassland Biome.

Habitat type 1 = grassland
Habitat type 2 = grassland & savanna/woodland/desert/karoo/shrub
Habitat type 3 = grassland/savanna uncertainty
Habitat type 4 = rocky areas/termitaria/streams within grassland
Habitat type 5 = rocky areas within several habitat types
Habitat type 6 = habitats excluding grassland

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

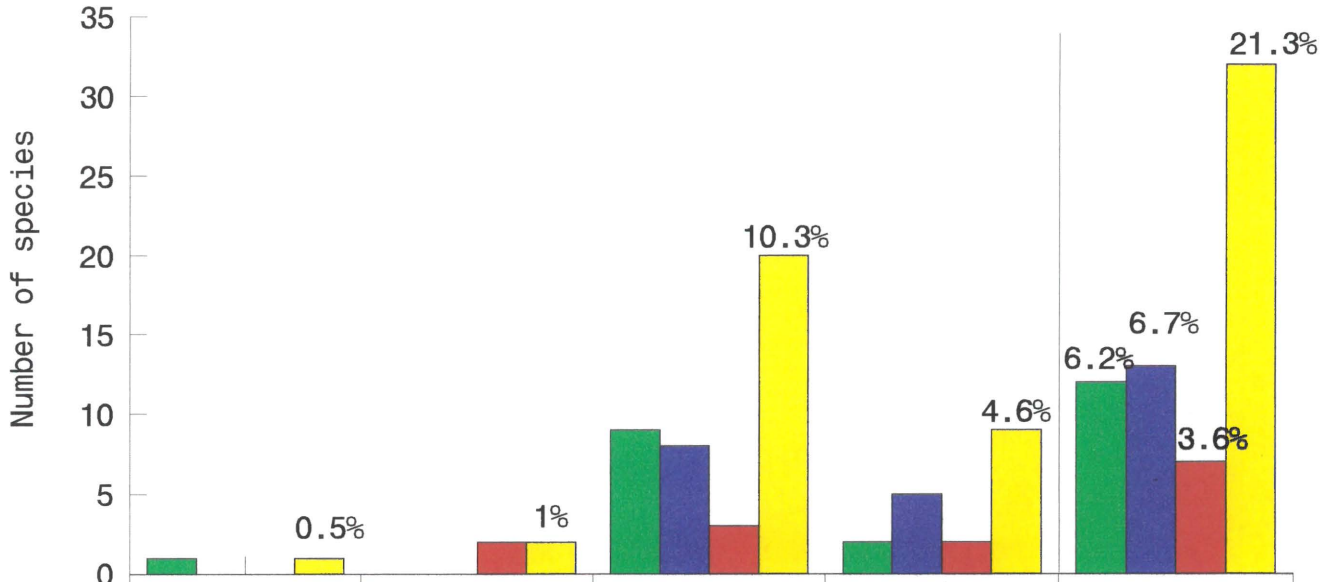


	Non-edge	Marginal	Egde	Total
Grassland	34	11	4	49
Grassland & Other	57	6	2	65
Non-grassland	51	8	16	80
Unknown	1	0	0	1
Total	148	25	22	195

Figure 11 The number of butterfly species present in the habitat types within the Grassland Biome, as well as their "Boundary status". The total number of species within each category is given as a percentage of the total number of butterfly species included in this study.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

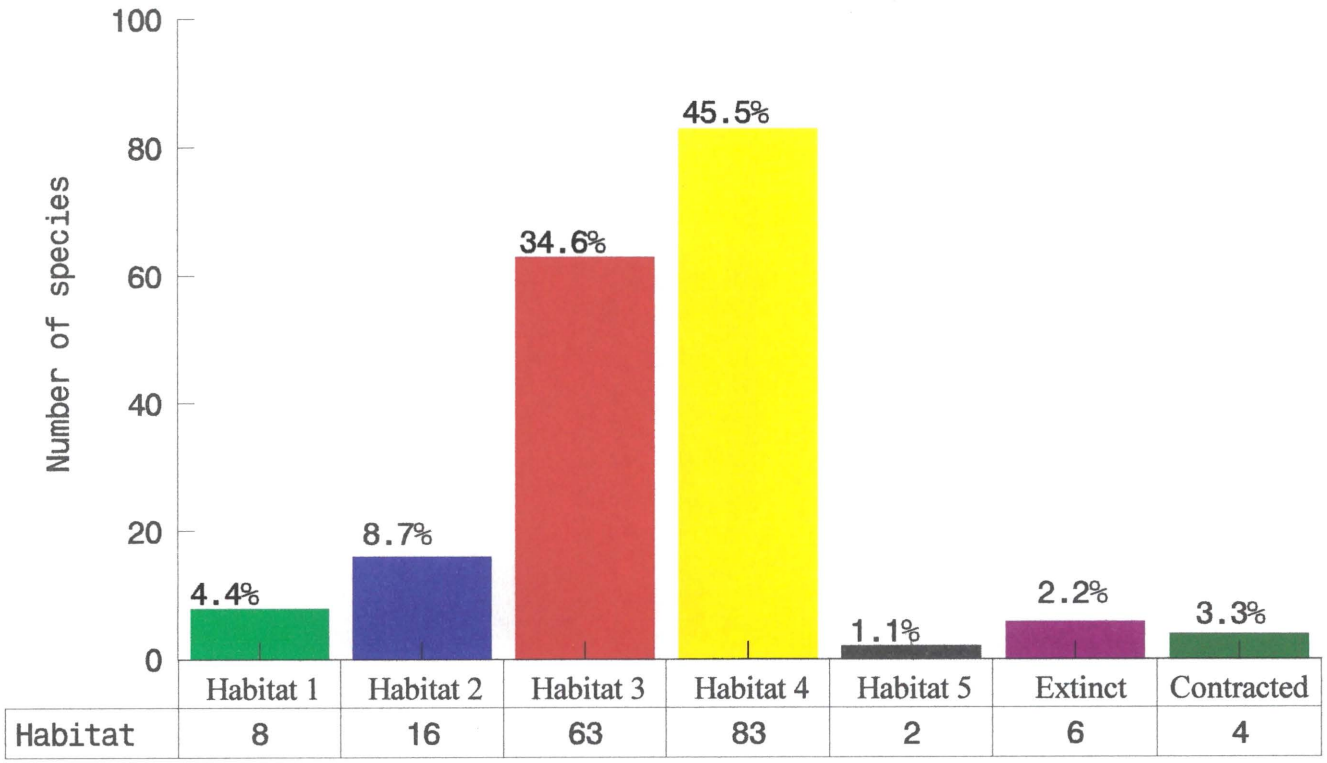


	Extinct	Vulnerable	Rare	Indeterminate	Total
Non-edge	1	0	9	2	12
Marginal	0	0	8	5	13
Edge	0	2	3	2	7
Total	1	2	20	9	32

Figure 12 The Red Data Book status of the butterflies recorded in the Grassland Biome, with the total number of species within each category being expressed as a percentage of the total of species included in this study.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA



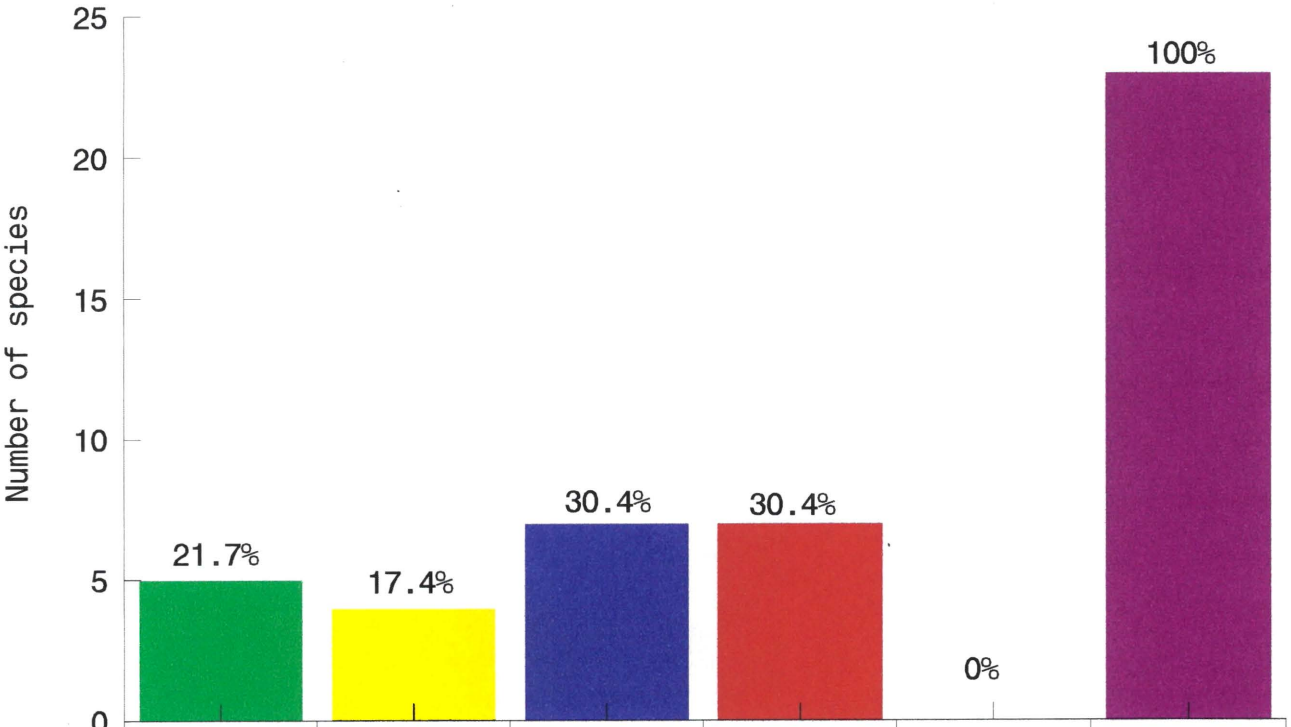
Habitat	Habitat 1	Habitat 2	Habitat 3	Habitat 4	Habitat 5	Extinct	Contracted
Habitat	8	16	63	83	2	6	4

Figure 13 Mammal distribution in the various Grassland Biome habitat types, also expressed as percentages of the total number of mammal species found within the Grassland Biome.

Habitat type 1 = grassland
Habitat type 2 = grassland & vlei/cultivated areas
Habitat type 3 = grassland & shrub/savanna/desert/other habitats
Habitat type 4 = habitats other than grassland
Habitat type 5 = human settlements

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA



	Habitat 1	Habitat 2	Habitat 3	Habitat 4	Habitat 5	Total
Endemics	5	4	7	7	0	23

Figure 14 The number of endemic mammal species found in each habitat type within the Grassland Biome, with each value also expressed as a percentage of the total number of Grassland Biome endemic mammals.

Habitat type 1 = grassland
Habitat type 2 = grassland & vlei/cultivated areas
Habitat type 3 = grassland & shrub/savanna/desert/other habitats
Habitat type 4 = habitats other than grassland
Habitat type 5 = human settlements

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA

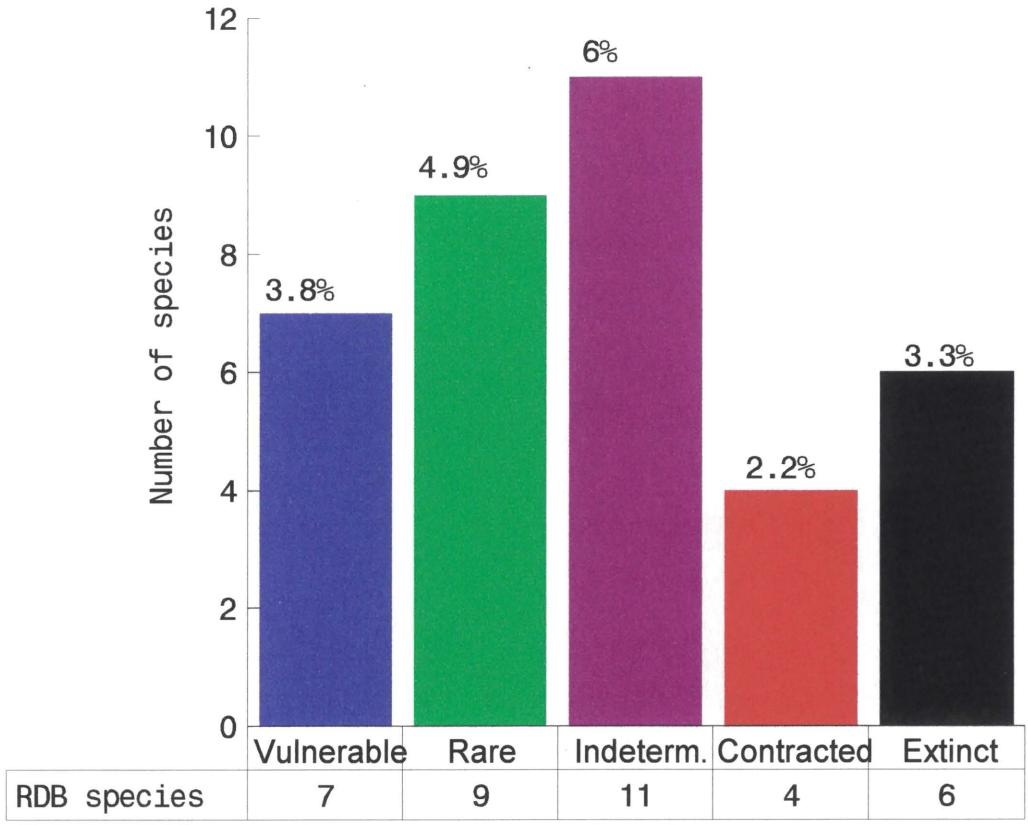
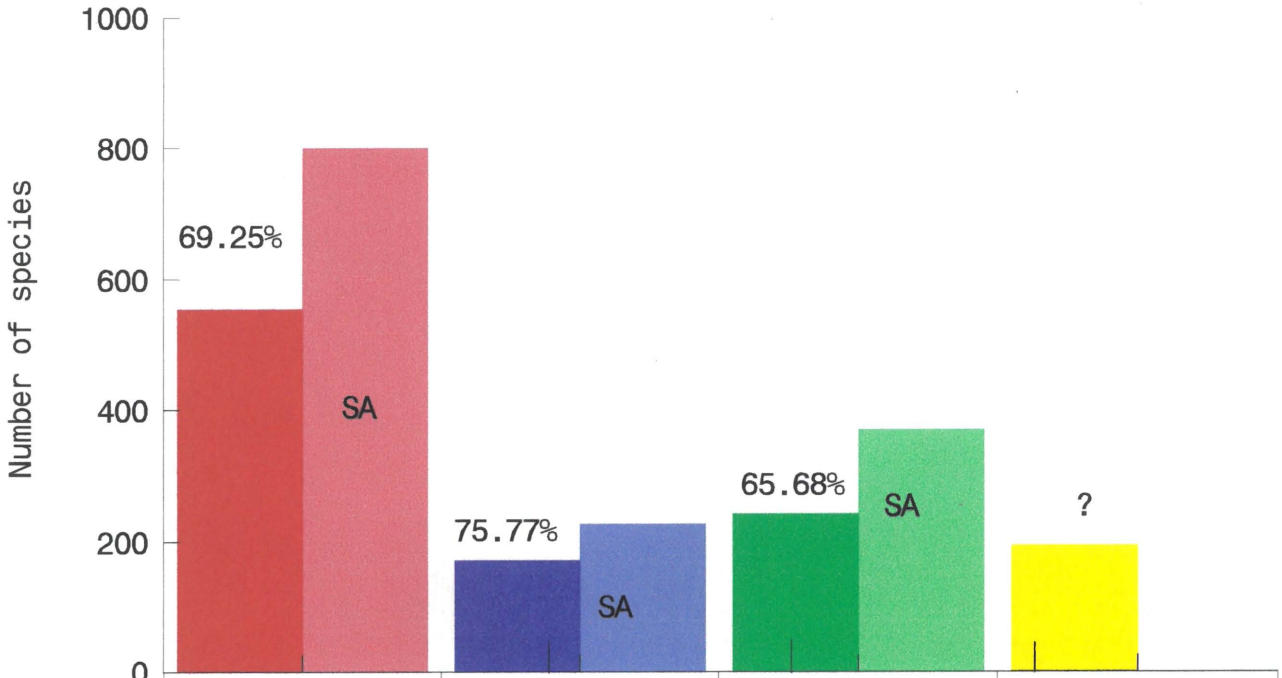


Figure 15 Red Data Book status of Grassland Biome mammals, also expressed as percentages of the total mammal species recorded in the biome.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020

UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
YUNIBESITHI YA PRETORIA



	Birds	Mammals	Herpetofauna	Butterflies
Biome fauna	554	172	243	195
South Africa	800	227	370	?

Figure 16 The number of faunal species found in the Grassland Biome, expressed as a percentage of the total number of species found in South Africa for the particular faunal group.

Digitised by the Department of Library Services in support of open access to information, University of Pretoria, 2020