

APPENDIX E
Terrestrial Ecology Baseline Report

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February 2019

REPORT ON

**TERRESTRIAL BASELINE ASSESSMENT FOR
THE PROPOSED SOVEREIGN METALS
MALINGUNDE FLAKE GRAPHITE PROJECT
NEAR LILONGWE, MALAWI**

Report Number: 2017/033/01/03

Submitted to:

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EXECUTIVE SUMMARY

Introduction

Hudson Ecology Pty Ltd was appointed by Sovereign Metals Limited (“Sovereign” or “Sovereign Metals”) to conduct a terrestrial ecology assessment for the proposed Malingunde Project (“the Project” or “Project”). The Malingunde Project will involve the extraction of the flake graphite deposit near the settlement of Malingunde, south west of Lilongwe in Malawi.

In order to reach the objectives of the Project, the scope of work included the following:

An extensive literature review in order to determine the expected bioregions, vegetation types and terrestrial fauna and flora associated with the study area;

Terms of Reference

A field survey, conducted during the latter part of the wet season (April 2017), just before the advent of the wet season (October 2017), and in February 2018 in order to determine:

- The local study area, i.e. the area to be affected by the proposed Project (including the Project footprint and surrounding areas likely to be impacted by the Project);
- The current ecological status of the receiving environment, with reference to terrestrial ecological systems, associated with the study area;
- The species of flora and fauna extant within the study area; and
- The presence or absence of species of conservation importance within the study area, or habitats or areas of conservation importance, likely to be affected by the proposed Project.

Compilation of a report detailing the findings of the study. This report includes but is not limited to:

- Survey methods used;
- Analytical methods used;
- General description of baseline environmental conditions;
- Identifications of key potential risks and issues; and
- Recommendations for further work.

Flora

Based on physiognomy, moisture regime, rockiness, slope and soil properties, four main communities were recognised, namely:

- Dambo Grassland Vegetation Community;
- Mixed Riparian Vegetation Community;
- Forest Vegetation Community; and
- Cultivated Lands.

Species diversity in the regional and local study areas can be considered as moderate. Both species richness and abundance being considerably lower during the October 2017 and February 2018 surveys when compared with the April 2017 surveys, and species recorded was a subset of those recorded in the April 2017 surveys. As part of the surveys 114 species were recorded during the April 2017 survey, 81 during the October 2017 survey and 98 during the February 2018 survey. These differences can be attributed to the fact that the October 2017 surveys were conducted before the advent of the annual rains and during the February 2017 many of the annual species were as yet unidentifiable.

One hundred and fourteen (114) plant species were recorded in the Project area representing 29 families. Tree species and shrub species accounted for 31 species (27%) and 18 species (16%) of the total number of species, respectively, while forbs accounted for 27 species (24%) of the total number of species recorded. Grass species accounted for 27% of the total number of species recorded with 31 species. With only 7 species (6%) of the total number of species, cyperoid plants made up the lowest percentage of the total number of species.

Four species of conservation significance was recorded, namely *Burkea africana*, *Azelia quanzensis*, *Pterocarpus angolensis* and *Terminalia sericea* in the riparian forest and the forest fragments. Of species of conservation significance that could potentially occur in the area, one species is currently listed as Least Concern, two species are listed as Near threatened, two species are listed as Vulnerable while one species is listed as Critically endangered..

Fauna

As expected, reptile species diversity for the area was relatively low, with only 12 species being recorded during the April and October 2017 surveys. None of the reptile species recorded are restricted in number or distribution, and none of the species are regarded as protected species by Malawi Legislation nor listed on the International Union for Conservation of Nature (IUCN) Red Data list of Threatened Species.

Only five species of anurans were recorded during the field surveys. None of the species recorded are classified as being restricted in abundance or distribution, although Malawi does host a number of endemic species.

Fifty-seven (57) species of avifauna were recorded during the field surveys. None of the species recorded during the April 2017 survey are restricted in range or abundance, and none of the species recorded are currently listed on the IUCN Red Data list.

Only twenty eight (28) species of avifauna were recorded during the October 2017 and February 2018 field surveys, although none of these species are classified as species of conservation importance.

Species of conservation significance

A total of sixty seven (67) animal species are currently considered as species of conservation importance. Of these species:

- Reptile species constitute 10 of the species of concern (Table 27), of which two are listed as just Red Data list species, six are listed as endemics and two are listed as both Red Data list species and endemic species;
- Anuran species (frogs and toads) constitute nine of the species of concern (Table 27), of which seven are listed as just Red Data list species, two are listed as endemics and three are listed as both Red Data list species and endemic species;
- Avifauna species constitute 32 of the species of concern (Table 28), of which 32 are listed as just Red Data list species, none are listed as endemics and none are listed as both Red Data list species and endemic species; and
- Mammal species constitute 16 of the species of concern (Table 27), of which 15 are listed as just Red Data list species, none are listed as just endemics and one is listed as both Red Data list species and endemic species.

Of the ten reptile species of concern:

- One is listed as critically endangered, 3 are listed as endangered and 8 are listed as endemic; and
- Nine species have a low probability of occurrence in the study area and one has a high probability of occurrence.

Of the nine amphibian (anuran) species of concern:

- Three are listed as vulnerable, 1 is listed as near threatened, 3 are listed as data deficient and 5 are listed as endemic; and
- Eight species have a low probability of occurrence in the study area and one has a high probability of occurrence.

Of the thirty two avian species of concern:

- Three are listed as critically endangered, 7 are listed as endangered, 6 are listed as vulnerable, and 15 are listed as near threatened and 1 is listed as Data deficient. No avian species are listed as endemic; and
- Twelve species have a low probability of occurrence in the study area, 2 have a moderate probability of occurrence and 18 have a high probability of occurrence.

Of the sixteen mammal species of concern:

- One is listed as critically endangered, 2 are listed as endangered, 4 are listed as vulnerable, 4 are listed as near threatened and 5 are listed as Data deficient. One species is listed as endemic; and
- Eleven species have a low probability of occurrence in the study area, 2 have a moderate probability of occurrence and 3 have a high probability of occurrence.

Ecological integrity and conservation importance

The ecological integrity of the vegetation communities were assessed and the results show the following ecological integrity for each of the vegetation communities:

- Dambo Grassland Vegetation Community – Low to moderate ecological integrity;
- Mixed Riparian Vegetation Community – High ecological integrity;
- Forest Vegetation Community – Moderate ecological integrity; and
- Cultivated Lands – Low ecological integrity.

The conservation importance of the vegetation communities were assessed and the results are as follows:

- Dambo Grassland Vegetation Community – Low to moderate conservation importance;
- Mixed Riparian Vegetation Community – High conservation importance;
- Forest Vegetation Community – Moderate conservation importance; and
- Cultivated Lands – Low conservation importance.

The majority of the study area shows significant signs of degradation. The natural woodland structure and species diversity can be observed at reserves such as the Dzalanyama Forest Reserve, approximately 20km to the west of the study area. The destruction of the natural vegetation in the area has subsequently led to greatly reduced flora and fauna diversity in the area with the exclusion of many species that would otherwise be expected. Furthermore, the removal of natural vegetation has created niche gaps for colonisation by exotic invasive species.

Small islands of natural vegetation do still occur within the study area, these mainly take the form of patches of natural woodland or and the largely natural vegetation is the riparian forest surrounding the Kamuzu Dam. Other than the completely

transformed dambos (wetlands) within the local study area, there are two arms of a highly impacted, but not completely transformed, dambo to the north of the local study area. Generally, due to existing impacts, the impacts foreseen by the mine are going to be far reduced in comparison with a similar operation in a more natural area.

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LIST OF ACRONYMS

AFDB	African Development Bank
CITES	Convention on International Trade in Endangered Species of wild fauna and flora
COMEST	The World Commission on the Ethics of Scientific Knowledge and Technology
DEA	Director of Environmental Affairs
EAD	Environmental Affairs Department
EIA	Environmental Impact Assessment
EHS	Environmental, Health and Safety
EMA	Environment Management Act
ESIA	Environmental and Social Impact Assessment
FAO	Food and Agriculture Organization of the United Nations
IFC	International Finance Corporation
NEP	National Environmental Policy
NEAP	National Environmental Action Plan
NGO	Non-governmental organisation
PS	Performance Standards
RAMSAR	Convention on Wetlands of International Importance
SADC	South African Development Community
ZAMCOM	Zambezi Watercourse Commission
ha	Hectares
km	Kilometre
m	metres
Sp.	Species (single)
Spp.	Species (multiple)

1 INTRODUCTION

Hudson Ecology Pty Ltd was appointed by Sovereign Metals Limited (“Sovereign”) to conduct a terrestrial ecology assessment for the proposed Malingunde Project (“the Project” or “Project”). The Project will involve the extraction of the flake graphite deposit near the settlement of Malingunde, south west of Lilongwe in Malawi.

The Malingunde deposit is a substantial “saprolite-hosted” flake graphite deposit. The major graphitic units strike north-northwest and dip shallow-moderately to the north-east. The graphite bearing host units are predominantly weathered feldspar-quartz-graphite gneisses. Depth of weathering (i.e. the base of the saprolite zone) is generally between 18-28 m vertically from surface. The major effect of weathering is the alteration of primary feldspar minerals to clays (predominantly kaolinite) and minor primary sulphides to iron oxyhydroxides. This has resulted in a significant decrease in the mechanical strength (competency) of the primary rock mass. The dominant minerals of quartz and graphite remain inert during the weathering process.

Malingunde is particularly significant for Sovereign as it is hosted within weathered, soft saprolite (clay) material. Saprolite-hosted flake graphite mining operations, similar to those in China and Madagascar, usually have significant cost and environmental advantages over hard rock mining operations due to:

- The free-dig nature and very low strip ratios of the near surface mineralised material;
- Simple processing, generally with no primary crushing and grinding circuit resulting in large capital and operating cost advantages;
- The preservation of coarse flakes in the weathering profile due to graphite’s chemically inert properties; and
- The absence of sulphides offers substantial tailings and waste management advantages.

2 OBJECTIVES

Sovereign commenced the formal Environmental and Social Impact Assessment (ESIA) process, in compliance with Malawian legislative requirements, during the second half of 2017. The ESIA for the Project will adhere to generally accepted international standards and best practice, particularly those prescribed by the International Finance Corporation (IFC) Performance Standards and the Equator Principles. In accordance with these requirements, the baseline/scoping phase of the ESIA will determine which impacts are likely to be significant and should become the main focus of the assessment. The baseline/scoping phase also identifies data availability and gaps. The baseline/scoping process determines the appropriate spatial and temporal scopes for the assessment and suggests suitable survey and research methodologies.

The baseline/scoping phase assessment will also serve as the initial data collection phase for the baseline study. Baseline studies of biodiversity resources provide a reference point against which any future changes associated with a project can be assessed and offer information for subsequent monitoring of biodiversity performance. The baseline study will identify (both in the immediate and wider area around a project site) habitats that will be affected, the range and status of the main species groups that live in the area, the potential presence and status of protected areas or other important areas for biodiversity, and any potential impacts to ecosystem services that might have local, regional or global impacts.

3 SCOPE OF WORK

In order to reach the objectives outlined in section 2, the scope of work included the following:

- An extensive literature review in order to determine the expected bioregions, vegetation types and terrestrial fauna and flora associated with the study area;
- Three field surveys, conducted during the latter part of the wet season (April 2017), the early part of the wet season (October 2017) and the middle of the wet season (February 2018) in order to determine:
 - The local study area, i.e. the area to be affected by the proposed Project (including the Project footprint and surrounding areas likely to be impacted by the Project);
 - The current ecological status of the receiving environment, with reference to terrestrial ecological systems, associated with the study area;
 - The species of flora and fauna extant within the study area;
 - The presence or absence of species of conservation importance within the study area, or habitats or areas of conservation importance, likely to be affected by the proposed Project;

4 DATA AND INFORMATION SOURCES

4.1 Information sources

A number of books, peer-reviewed scientific journal articles, field guides, official databases, previous studies and official internet sources were used as information sources for the purposes of this study. Furthermore, information was obtained from discussions with local inhabitants of the area.

4.2 Primary Data

Primary data for the purposes of this study were collected during the field surveys conducted during April 2017. Data were collected using accepted scientific methodologies and due care was taken during the collection of said data in order to ensure repeatability of the data collection. The Precautionary Principle (COMEST, 2005) was considered during the analysis and interpretation of the data collected.

4.3 Secondary Data

Secondary data were obtained from previous studies conducted in the area. These data were not utilised for the purposes of the report as such, but as a precautionary measure to assure the accuracy of the data collected and well as the accuracy of species identifications.

5 APPROACH

The approach followed to undertake the Baseline level assessment was as follows:

- Step 1: Thoroughly review relevant literature in order to obtain a theoretical understanding of the receiving environment, in which the Project is envisaged to take place.
- Step 2: Confirm relevant national and international regulatory requirements, and World Bank and IFC best practice standards to be addressed during the ecological studies (IFC Performance Standard 6).
- Step 3: Using knowledge of the Project and information obtained through the literature review, broadly define the Project study area.
- Step 4: Conduct a baseline level assessment of the study area, in order to confirm information obtained through the literature review and collect primary data regarding the study area as defined in step 3.
- Step 5: Prepare a baseline report outlining the results of the literature review and field surveys conducted in step 4, with regards to:
 - Mapping: Ground-truthing and mapping the study area. Based on the initial mapping of the study area and data obtained during the scoping level assessment, the study area was refined and mapped based on habitat types (vegetation communities).
 - Biodiversity: A baseline level description of fauna and flora associated with each of the habitat types (vegetation communities), for purposes of determining the sensitivity of the habitat types to possible impacts by the proposed development.
 - Impacts: A preliminary assessment of potential impacts on initial knowledge of the project and the results of the literature review and data collected during the field surveys.
 - Identification of key areas of risk associated with the project, as well as possible issues that will need further assessment during the EIA process.
 - This report also serves to identify further information requirements for the EIA process and potential information gaps, as well as study guidelines, methodology and revision protocols for the EIA.

6 POLICY, LEGISLATIVE AND ADMINISTRATIVE FRAMEWORK

6.1 EIA Compliance

Sovereign is committed to conduct its activities in full compliance with the requirements of national regulations, its obligations under international conventions and treaties, and giving due consideration to international best practices and policies. For this reason this baseline report, as part of the EIA process, has been developed so as to comply with the laws and decrees of the Republic of Malawi and international conventions and treaties, and additionally to comply with international best practice standards.

6.1.1 Malawi Regulatory Framework

The Constitution of the Republic of Malawi, 1994 and as amended, and further national laws and regulations, form the basis of requirements for development of such large scale projects as the proposed Project. The application of the environmental impact assessment (EIA) process in Malawi is based on the principles in the 1992 Rio Declaration on Environment and Development and the legislative requirements of the Environment Management Act (2017) and Guidelines of 1997. By signing the Rio Declaration on Environment and Development, Malawi has committed, among other things, to Principle 17 concerning EIA: ‘Environmental impact assessment, as a national instrument, shall be undertaken for proposed activities that are likely to have a significant adverse impact on the environment and are subject to a decision of a competent national authority’. The Environment Management Act outlines the EIA process for Malawi and requires project developers to comply with that process. The process is managed by the Director of Environmental Affairs (DEA) in the Environmental Affairs Department (EAD). The Act specifies that the types and sizes of projects subject to EIA be prescribed and gazetted. Accordingly, the Project activities are subject to approval under the terms of the Environment Management Act, and as such, the EIA will be undertaken in strict accordance with this regulatory framework, as well as the Environmental Affairs Department’s EIA Guidelines.

6.1.2 International Standards and Guidelines

The Project will comply with the standards of the World Bank and the International Finance Corporation (IFC). Policies and guidelines related to these organisations provide additional environmental and social safeguards and an opportunity to maximise the project benefits to the people of Malawi, while minimising any adverse impact, through compliance with these international best practice standards. The World Bank provides guidance on EIA requirements through the Environmental Assessment Sourcebook (World Bank, 1991) which includes sectoral guidelines. The World Bank EIA process is implemented through a set of Operational Policies/Procedures. The primary objective is to ensure that Bank operations do not cause adverse impacts and that they “do no harm”. The IFC is a member of the World Bank Group, providing finance and development advice for private sector ventures and projects in developing countries. Their Performance Standards on Environmental and Social Sustainability (IFC, 2012) and Environmental, Health and Safety (EHS) Guidelines (IFC, 2007) provide further guidance as a framework when implementing the practical Malawi national legislative and regulatory provisions, and the World Bank Operational Policies.

6.1.3 International Agreements

Malawi is party to a number of internationally acceptable policies, conventions, treaties and protocols, which are relevant to the Project. These agreements serve as the principal framework for international co-operation and collaboration between members of the international community in their efforts to protect the local, regional and global environment. Malawi is bound to the provisions of an international agreement/law only if it signs and submits instruments of ratification in respect of a particular agreement.

6.2 Summary of EIA Regulatory Requirements

A listing of Malawi regulatory and policy requirements, as well as international provisions, relevant to the ecological studies, is provided in Table 1. Details are provided in the subsequent sections.

Table 1: A listing of Malawi regulatory and policy requirements, and international provisions

MALAWI LEGISLATION AND POLICIES	
Legislation	
<ul style="list-style-type: none"> ▪ Constitution of the Republic of Malawi (1994) ▪ Environment Management Act (2017) ▪ Land Act (2016) 	<ul style="list-style-type: none"> ▪ Fisheries Conservation & Management Act (1997) ▪ Forestry Act (1997) ▪ National Parks and Wildlife Act (2004)
Policies & Guidelines	
<ul style="list-style-type: none"> ▪ National Environmental Policy (2004) ▪ Guidelines for Environmental Impact Assessment (1997) ▪ National Land Policy (2002) ▪ National Water Policy (2005) 	<ul style="list-style-type: none"> ▪ National Environmental Action Plan (2002) ▪ National State of Environment Report (2010) ▪ Malawi National Forest Policy (1996) ▪ Other Relevant Malawi Standards
WORLD BANK	
Environmental Assessment Sourcebook (1991)	
Operational Procedures	
<ul style="list-style-type: none"> ▪ OP 4.01: Environmental Assessment 	<ul style="list-style-type: none"> ▪ OP 4.04: Natural Habitats

<ul style="list-style-type: none"> ▪ OP 4.36: Forests
IFC PERFORMANCE STANDARDS
<ul style="list-style-type: none"> ▪ PS1: Assessment and Management of Environmental and Social Risks and Impacts ▪ PS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources
INTERNATIONAL AGREEMENTS
<ul style="list-style-type: none"> ▪ African Convention on the Conservation of Nature and Natural Resources ▪ Convention on Wetlands of International Importance (RAMSAR), especially as Waterfowl Habitat ▪ South African Development Community (SADC) revised Protocol on Shared Watercourses ▪ SADC Protocol on Forestry ▪ Zambezi Watercourse Commission (ZAMCOM) ▪ Other: <ul style="list-style-type: none"> - Rio Declaration, the Convention on Climate Change, the Montreal Protocol, the Convention to Combat Desertification, the Convention on Biodiversity and the Convention on International Trade in Endangered Species of wild fauna and flora (CITES) - The Convention on International Plant Protection, The Convention concerning the Protection of World Cultural and Natural Heritage, The Convention on the Conservation of Migratory species of Wild Animals, The FAO International Undertaking on Plant and Genetic Resources, and The Convention on Biological Diversity

6.2.1 The Constitution of the Republic of Malawi, 1995

6.2.1.1 Accountable and Transparent Decision Making

In line with the Constitutional principles set out in section 12 of the Constitution, public participation and consultation is encouraged for projects such as the Malingunde Project. This principle is based on the presumption that, while organised society delegates its affairs to public institutions, the public retain the right to have an input in decision making and enforcement processes, and to expect, as a minimum, transparency in government decision making.

In that way institutions will not assume they are exclusive custodians of power and will ensure accountability in their actions. As in principle (1)(c): *"the authority to exercise power of State is conditional upon the sustained trust of the people of Malawi and that trust can only be maintained through open, accountable and transparent Government and informed democratic choice"*.

Further, the Constitution in section 146 establishes local government authorities to represent the people over whom they have authority, and to be responsible for their welfare, and gives them the responsibility of, among other things, promoting infrastructural and economic development, through the formulation and execution of local government plans. Consultation at local government level will be required as part of the EIA.

6.2.1.2 Sustainable Environmental Management

The Constitution provides a framework for the integration of environmental considerations into development programs. The implication of this provision is that Government, its cooperating partners and the private sector have a responsibility to ensure that development programs and projects are undertaken in an environmentally responsible manner. The State has a constitutional responsibility to ensure that all programs and projects are undertaken in an environmentally sustainable manner.

The Constitution contains principles of national policy in section 13, including that of sustainable environmental management. The section sets out a broad framework for sustainable environmental management at various levels in Malawi. Section 13 provides that the State shall actively promote the welfare and development of the people of Malawi by progressively adopting and implementing policies and legislation aimed at managing the environment responsibly in order to, under section 13(d):

- a) Prevent the degradation of the environment;
- b) Provide a healthy living and working environment for the people of Malawi;
- c) Accord full recognition to the rights of future generations by means of environmental protection and the sustainable development of natural resources; and
- d) Conserve and enhance the biological diversity of Malawi.

The goal for rural life under section 13 (e) is: *'To enhance the quality of life in rural communities and to recognize rural standards of living as a key indicator of the success of Government policies'*.

Table 2: Key Constitutional Principles and Relevant Project Objectives

Summary of Key Constitutional Principles and Relevant Project Objectives	
Accountable and transparent decision making	Public consultation and participation
	Public communication strategies
	Local government level consultation
Sustainable environmental management	Maintain or improve healthy living environments
	Conserve or enhance biodiversity
	Protect or improve environmental sustainability
	Enhance rural quality of life as a key indicator of project success

6.2.2 Republic of Malawi National Legislative Framework

6.2.2.1 Environment Management Act (2017)

The Environment Management Act (EMA) (2017) is described as a framework piece of legislation on environmental management, protection and conservation. The Act contains general provisions on protection, management, conservation and sustainable utilisation for almost all forms of environmental media.

31. (1) The Minister may, on the recommendation of the Authority, specify, by notice published in the Gazette, the type and size of a project which shall not be implemented unless an Environmental and Social Impact Assessment is carried out.
- (2) A person shall not undertake any project for which an Environmental and Social Impact Assessment is required without the written approval of the Authority, and except in accordance with any conditions imposed in that approval.
- (3) Any other licensing authority shall not grant a permit or licence for the execution of a project referred to in subsection (1) unless an approval for the project is granted by the Authority, or the grant of the permit or licence is made conditional upon the approval of the Authority being granted.
- (4) The Minister may, on the advice of the Authority, make regulations for the effective administration of Strategic Environmental Assessment, Environmental and Social Impact Assessment and Environmental Audit.
32. (1) The Authority shall, in consultation with such lead agency as it may consider appropriate, carry out or cause to be carried out periodic environmental audits of any project for purposes of enforcing the provisions of this Act.
- (2) The owner of the premises or operator of a project for which an Environmental and Social Impact Assessment has been made shall keep records and make annual reports to the authority describing how far the project conforms in operation with the statements made, in the Environmental and Social Impact Assessment.
- (3) A developer shall take all reasonable measures for mitigating any undesirable effects on the environment arising from the implementation of a project which could not reasonably be foreseen in the process of conducting an Environmental and Social Impact Assessment and shall, within a reasonable time, report to the Authority on the effects and measures taken.
- (4) An inspector may enter any land or premises for the purpose of determining how far the activities carried out on that land or premises conform to the statements made in the Environmental and Social Impact Assessment.
33. (1) The Authority shall, in consultation with any lead agency, monitor-
 - (a) all environmental phenomena with a view to making an assessment of any possible changes in the environment and their possible impacts; and
 - (b) the operation of any industry, project or activity with a view to determining its immediate and long-term effects on the environment.
- (2) The Authority shall require a developer whose project requires an Environmental and Social Impact Assessment licence to prepare and submit to the Authority, environmental management plans in a form and manner prescribed by the Authority.
- (3) An inspector may enter upon any land or premises for the purpose of monitoring the effects on the environment of any activities carried out on that land or premises and to enforce compliance with the environmental mitigation and management plans prescribed under subsection (2).
34. The Authority shall, by notice published in the Gazette, prescribe fees necessary for conducting environmental and social impact studies and for covering reasonable costs for scrutinizing Environmental and Social Impact Assessment Reports and for the subsequent monitoring of a project which has been approved for implementation under this Act.

A prescribed list of projects for which EIA is mandatory is given in Malawi’s Guidelines for EIA (1997). Figure 1 sets out the EIA process that is required.

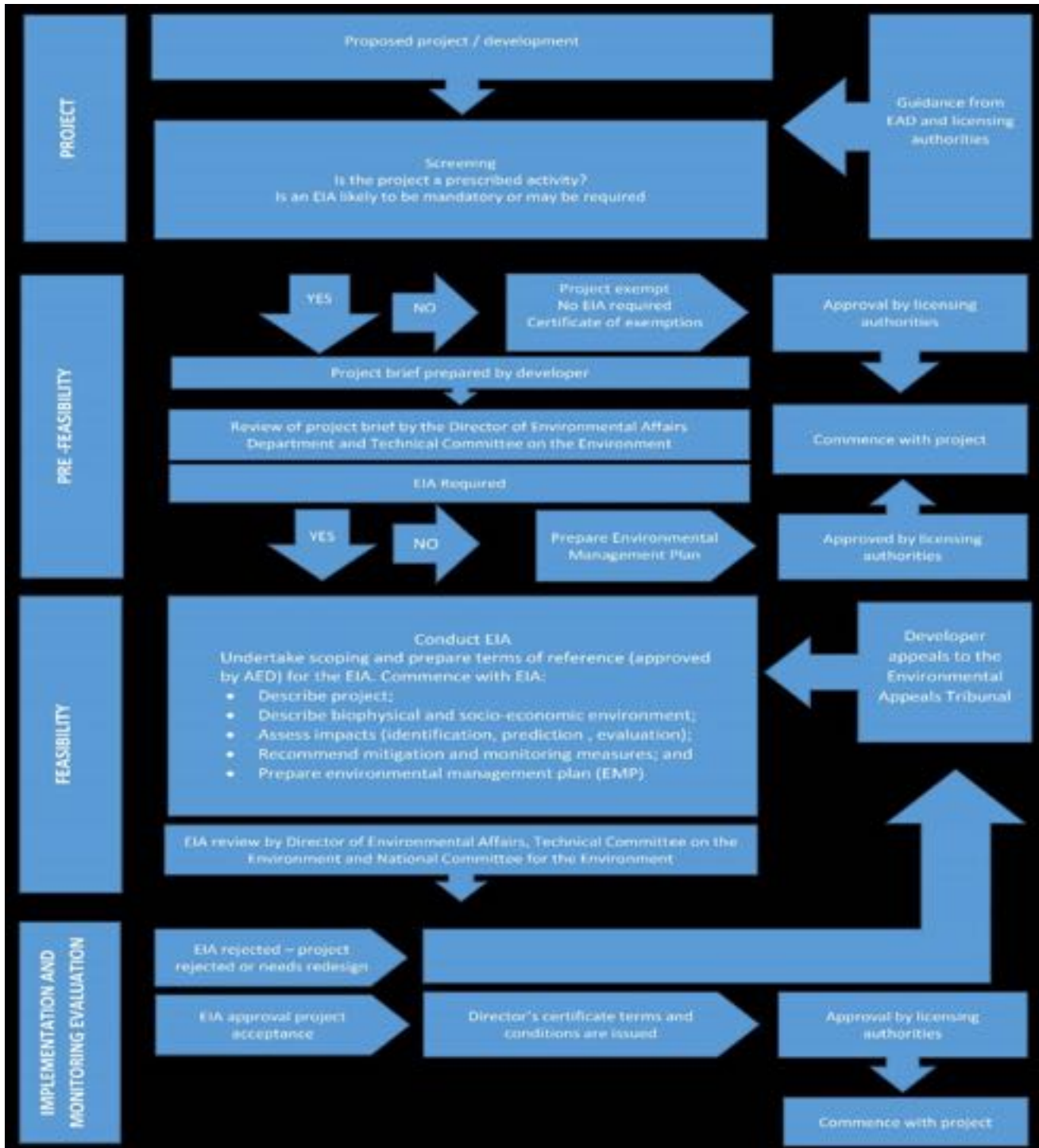


Figure 1: EIA process that is required by Malawi’s Guidelines for EIA, 1997

6.2.2.2 Water Resources Act (2013) CAP 72.03 & Waterworks Act (1995) CAP 72.01

The management of water resources involves two related issues: (1) Provision of a wholesome supply and (2) The removal and disposal of contaminated liquid wastes from the water supply. The Water Resources Act (2013) is the primary legislation dealing with management of water resources.

The Act specifically deals with control, conservation, apportionment and use of water resources of Malawi. The Act prohibits any person to divert, dam, store, abstract or use public water for any other purpose except in accordance with the provisions of this Act.

Under Section 16 (i): It is an offence for any person to interfere with, alter the flow of or pollute or foul any public water. The Act defines pollution or fouling of public water to mean the discharge into or in the vicinity of public water or in a place where public water is likely to flow, of any matter or substance likely to cause injury whether directly to public health, livestock, animal life, fish, crops orchards or gardens which such water is used or which occasions, or which is likely to occasion, a nuisance. Further, under the Regulations, persons are not allowed to discharge into public water any water of less purity or any matter that might affect the river or fish. Section 24: No offence is committed if a discharge is, *inter alia*, under the authority of the Act or any other written law as under the Water Resources (Water Pollution Control) Regulations made pursuant to Section 24 of the Act, the Board is given powers to consider applications for a Ministerial consent to discharge waste or effluent into public water.

Section 6: The right to use public water may be limited if the use may cause damage to natural resources of the area or in the vicinity.

The Water Resources Act operates in conjunction with the Waterworks Act (1995), which also provides for the establishment of Water Resources Boards and water-areas and for the administration of such water-areas and for the development, operation and maintenance of waterworks and waterborne sewerage sanitation systems in Malawi and for matters incidental thereto. The Water Resources Act gives the said Water Boards various powers and duties in connection with water supplies and waterborne sewerage sanitation in their respective water areas.

Firstly, the Act imposes a duty on the Water Boards to provide a supply of portable water sufficient for the domestic purposes of the inhabitants within their respective water- areas. This presupposes a supply of fresh and clean water, free of pollutants because only clean water can be safely used for household purposes. The Act also empowers Water Boards to make by-laws for the regulation of the use and the prevention of pollution and the prevention of pollution of gathering grounds, waterworks and water therein.

In the construction, operation and decommissioning phases of the Project, the proponent will be required to ensure that the existing water supply is not polluted or that any noxious matter is carried into the river and surrounding water systems. Pollution would need to be mitigated during the life of the Project to comply with section 16 of the Water Resources Act and the Regulations.

Table 3: Water Resources Act & Waterworks Act Provisions and Relevant Project Objectives

Summary of Key Water Resources Act & Waterworks Act Provisions and Relevant Project Objectives	
Duties to safeguard safe water supply	Mitigate pollutants that may enter the river system during construction

6.2.2.3 National Parks and Wildlife Act (2004) CAP 66.07

The purposes of the National Parks and Wildlife Act (2004) are to conserve selected examples of wildlife communities, and to protect 'rare, endangered and endemic species of wild plants and animals'. In addition, conflict is to be minimised between people and animals.

Table 4: Key National parks & Wildlife Act Provisions and Relevant Project Objectives

Summary of Key National Parks & Wildlife Act Provisions and Relevant Project Objectives	
Protection of flora and fauna	Determine and assess threatened species
Manage impact on fauna and flora	Mitigate adverse impact on local flora and fauna
	Reduce opportunity for conflict with local animal species during construction, operation and decommissioning activities
Promotion of local participation in protection objectives	Collaborate with local communities to plan ongoing conservation measures

6.2.2.4 Forestry Act (1997) CAP 63.01

The Forestry Act (1997) deals with the management of indigenous forests on customary and private land; forest reserves and protected forest areas; woodlots and plantation forestry and also crosscutting issues including law enforcement and fire management. The Act, among other things seeks to:

- Protect trees and other resources in forest reserves, conserve and enhance biodiversity;
- Protect and facilitate management of trees on customary land, promote community involvement in the conservation of trees, promote sustainable utilization of timber and other forest produce; and
- Protect fragile areas such as river banks and water catchment areas.

Diverse use of forest areas is encouraged under the provisions of the Act, so as to empower local communities' active management of their forest areas.

Forestry Rules set out protected species of trees, and outline permissions required before felling of any protected forest areas may be carried out.

Rehabilitation measures are to be conducted in a manner consistent with the provisions for coordinating forestry development and implementing the Forestry Programme of Action in the SADC region, as in section 5 of the Forestry Act.

Table 5: Forestry Act Provisions and Relevant Project Objectives

Summary of Key Forestry Act Provisions and Relevant Project Objectives	
Manage and protect natural forest resources	Document biodiversity
	Document impact of the project
	Obtain necessary permits before felling forest areas
	Rehabilitate species
Forestry Programme of Action	Liaise with Forestry Programme to plan rehabilitation of forest areas
	Liaise with Forestry Programme to initiate planning for development of recreational forest areas

6.2.3 Relevant Policies and Other Instruments

6.2.3.1 National Environmental Policy, 2004

The National Environmental Policy (NEP), 2004, aims to manage the degradation of the environment and depletion of the natural resources on one hand and development on the other. The Policy promotes sustainable social and economic development through sound management of the environment and natural resources. The policy seeks, among other things to:

- a) Secure for all persons now and in the future an environment suitable for their health and wellbeing;
- b) Promote efficient utilization and management of the country's natural resources and encourage, where appropriate long-term self-sufficiency in food, fuel wood and other energy requirements;
- c) Facilitate the restoration, maintenance and enhancement of the ecosystems and ecological processes essential for the functioning of the biosphere and prudent use of renewable resources;
- d) Integrate sustainable environment and natural resources management into the decentralized governance systems and ensure that the institutional framework for the management of the environment and natural resources supports environmental governance in local government authorities;
- e) Enhance public education and awareness of various environmental issues and public participation in addressing them; and
- f) Promote local community, NGO and private sector participation in environment and natural resources management.

The NEP's overall objective is to manage and use water resources efficiently and effectively so as to promote its conservation and availability in sufficient quality and acceptable quality. In order to realise this objective, the NEP lays down a number of guiding principles. The NEP states that the precautionary approach to water quality management shall be pursued with a focus on pollution minimisation and prevention. Further, the NEP advocates the incorporation of the 'polluter pays' principle in water policy and legislation so as to ensure that costs of unsustainable water utilization and management are borne by the party responsible for such conduct. The NEP includes strategies on environmental planning and environmental impact assessment, audits and monitoring, among others. On environmental planning, the objective is to ensure that national and district development plans integrate environmental concerns, in order to improve environmental management and ensure sensitivity to local concerns and needs. The guidelines for EIAs, audits, monitoring and evaluation are regularly reviewed so that adverse

environmental impacts can be eliminated or mitigated and environmental benefits enhanced. In line with the environmental policy (on planning and EIAs, among others), the developers must integrate environmental concerns during the whole cycle of the project i.e. planning, design, and implementation. The implication of the policy is that the project has to put in place measures to reduce adverse impacts arising from the activities of the project and that implementation of the activities of this project must accommodate sustainability issues.

Table 6: National Environmental Policy Provisions and Project Objectives

Summary of National Environmental Policy Provisions and Project Objectives	
Minimise impact on natural environment	Confine necessary construction and associated facilities impact footprint
Encourage self-sufficiency	Manage resources for construction process efficiently
	Aim for local resources being used only for local needs
	Construction needs to be brought in
	Waste management independent of local resources
Restore environment	Assist with advice on rehabilitation plans of the Dam surrounds

6.2.3.2 Guidelines for Environmental Impact Assessment (1997)

The Guidelines for Environmental Impact Assessment outline the process for conducting EIAs and facilitate compliance to the EIA process by developers as provided for in the Environment Management Act. The guidelines provide a list of prescribed projects for which EIA is mandatory. They act as a tool for integrating environmental concerns into development plans at all levels. The proposed Project falls under the list of projects for which EIA is mandatory.

Table 7: Guidelines for Environmental Impact Assessment Provisions and Project Objectives

Summary of Guidelines for Environmental Impact Assessment Provisions and Project Objectives	
Guidelines for undertaking EIA to ensure compliance with Environment Management Act, 1996	Ensure general EIA guidelines are appropriately adhered to.

6.2.3.3 National Water Policy (2005)

Malawi's policy on water resources management requires that:

- a) Water should be managed and used efficiently and effectively in order to promote its conservation and future availability in sufficient quantity and acceptable quality; and
- b) All programs related to water should be implemented in a manner that mitigates environmental degradation and at the same time promotes the enjoyment of the asset by all.

For a long time rivers have been used as a cheap and convenient repository for human and industrial waste. Recently they have come to be recognised as the basis of unique ecosystems worthy of protection in their own right. If the water is to continue to perform this and other many important roles in a sustainable manner then unrestrained disposal of materials into the aqueous environment poses an unacceptable threat.

Table 8: National Water Policy Provisions and Project Objectives

Summary of National Water Policy Provisions and Project Objectives	
Comprehensive water resources management	Prevent or mitigate pollution during construction, operation and decommissioning activities
	Mitigate environmental degradation during construction, operation and decommissioning activities

6.2.3.4 Malawi National Forest Policy (1996)

The policy promotes sustainable contribution of national forests, woodlands and trees towards the improvement of the quality of life in the country by conserving the resources for the benefit of the nation and to the satisfaction of diverse and changing needs of Malawi population, particularly rural smallholders. The policy prevents unnecessary changes in land-use that promote deforestation, or endanger the protection of the forests which have cultural, biodiversity or water catchment values. It also discourages development activities in gazetted forests unless proven to be environmentally friendly for which suitable inter-sectoral and local consultations will be conducted.

Above all, the policy advocates the carrying out of an EIA where actions are likely to have significant adverse impacts on important forests and other resources.

Table 9: Malawi National Forest Policy Provisions and Project Objectives

Summary of Malawi National Forest Policy Provisions and Project Objectives	
Sustainable forestry	Consider original forest policy objectives of forestry protection
	Foster options for community use of forest areas

6.2.3.5 National Environmental Action Plan (NEAP), 2004

The NEAP was originally prepared in 1994 in response to Agenda 21 that required signatories to the 1992 Rio Declaration to prepare an action plan for integrating environmental issues into socio-economic development programs. The NEAP was updated in 2004. The objectives of the NEAP are to:

- a) Document and analyse all major environmental issues and measures in order to alleviate them;
- b) Promote sustainable use of natural resources in Malawi; and
- c) Develop an environmental protection and management plan.

Key issues relevant to this project include:

- Soil erosion;
- Water resources degradation;
- Threat to natural resources; and
- Threat to biodiversity.

In order to protect the environment from further degradation; the NEAP outlines actions that need to be considered to ensure adequate environmental protection. The actions relevant to the establishment of the project in question include:

- EIAs will be required for any development that may affect fragile ecosystems; and
- Government will ensure that workers in hazardous workplaces are supplied with the appropriate protective equipment and undergo pre-employment medical examinations and regular check-ups.

The policy recognises the integration of social issues with environmental issues, so requiring an integrated environmental and social assessment.

Table 10: National Environmental Action Plan Provisions and Project objectives

Summary of National Environmental Action Plan Provisions and Project Objectives	
Action plan for environmental assessment in development programs	Integrate environmental and social assessment
	Develop environmental protection and management plan

6.2.3.6 National State of Environment Report (2010)

The objective of the National State of Environment Report (NSoER) is to provide the status of the environment at national level. The NSoER for Malawi analyses key environmental issues of concern in Malawi including issues related to natural resources management. It presents the relationship between external pressures, status and responses to the problems facing natural resources. The NSoER therefore provides a basis for environmental planning and development of the proposed project.

Table 11: National State of the Environment Report and Project objectives

Summary of National Environmental Action Plan Provisions and Project Objectives	
Key issues of environmental concern for the water sector	Ensure EIA and ESMP appropriately address key natural resources issues related to poor natural resource management.

6.2.4 International Standards

6.2.4.1 World Bank

The World Bank provides guidance on EIA requirements through the World Bank Group Environmental, Health, and Safety Guidelines, which includes sectoral guidelines. It addresses environmental monitoring and management issues, and identifies typical mitigation measures. The World Bank EIA process is implemented through a set of Operational Policies/Procedures

whose primary objective is to ensure that Bank operations do not cause adverse impacts and they “do no harm”. Specific safeguard policies address natural habitats, pest management, cultural property, involuntary resettlement, indigenous peoples, and safety of dams, projects on international waterways and projects in disputed areas. The safeguard policies can be broadly grouped into Environment, Rural Development and Social Development. The World Bank Pollution and Abatement Handbook (1998a) and Environmental Assessment Handbook (1999a) will be considered during the EIA process. World Bank Operational Policies, and their applicability to the Project are summarised in Table 12 below.

Table 12: World Bank Operational Policies

APPLICABLE WORLD BANK OPERATIONAL POLICIES	
OP/BP 4.01: Environmental Assessment (January 1999 and as revised April 2013)	
<p>Ensures that appropriate levels of environmental and social assessment are carried out as part of project design. It also deals with the public consultation process, and ensures that the views of project-affected persons/groups and local NGOs are taken into account. It outlines the contents of environmental assessment reports and environmental management plans for Category A projects.</p> <p>This Policy requires proper Information Disclosure as a prerequisite for meaningful consultation for Category A projects. Public participation is a requirement where a project involves involuntary resettlement or affects indigenous people. Category A projects also requires consultation with affected groups and other stakeholders during at least two stages of the EA process; shortly after categorisation of the project and during preparation of the EA.</p>	<p>This safeguard Policy is relevant because of the size and nature of the Project and its potential to cause adverse impacts, including the need for involuntary resettlement. The Project is designated as a Category A project and therefore requires information disclosure and two stages of consultation. Involuntary resettlement is also likely, thereby requiring public participation.</p>
OP/BP 4.04: Natural Habitats (June 2001)	
<p>Supports the conservation of natural habitats and the maintenance of ecological functions as a basis for sustainable development. The Bank does not support projects that involve the significant conversion or degradation of critical natural habitats.</p>	<p>The Project site contains a range of habitats that support a variety of terrestrial and aquatic animals, as well as providing ecological resources to local peoples. It is not anticipated that the Project would result in significant conversion or degradation of critical natural habitats.</p>
OP 4.36: Forests (November 2002)	
<p>This Policy aims to reduce deforestation and enhance, through sustainable economic development, the environmental and social contribution of forests. The Bank does not support projects which involve significant conversion or degradation of critical forest areas or related critical natural habitats.</p>	<p>Small areas of remnant forest within the Project footprint may be directly impacted, however it is not anticipated these areas are critical natural habitat from a biodiversity point of view.</p>

6.2.4.2 International Finance Corporation (IFC) Standards and Guidelines

The IFC is a member of the World Bank Group, providing finance and development advice for private sector ventures and projects in developing countries. Their Performance Standards provide benchmarks for identifying and managing environmental and social risks. The EIA will take cognisance of the eight IFC Performance Standards and associated guidance notes on Environmental and Social Sustainability (January 2012 edition), which together define the optimal environmental, social and health standards to be upheld throughout the life of a project. Also relevant are World Bank Guidelines and Handbooks for specific issues such as cumulative impact assessment and resettlement. Specifically, they provide guidance to:

- Identify environmental and social impacts, risks and opportunities of projects, with effective community engagement and consultation.
- Identify and minimise impacts on workers, affected communities and the environment, and prioritise active management of impacts.
- Identify specific objectives, such as avoidance of damage of areas of cultural significance. A demonstration of an awareness of these standards is expected as part of an environmental and social due diligence process to be undertaken by the financing institution.

IFC Performance Standards (PSs) and their applicability to the ecology section of the Project are summarised in Table 13 below.

Table 13: Applicable IFC Performance Standards

APPLICABLE IFC PERFORMANCE STANDARDS	
PS1: Assessment and Management of Environmental and Social Risks and Impacts	
This PS promotes the importance of managing environmental and social performance throughout the life of a project through identification and management of risks, and implementation of an effective Environmental and Social Management System (ESMS).	The Project has the potential to cause adverse impacts, including the need for involuntary resettlement. The EIA will therefore identify potential risks and mitigation measures, and incorporate environmental and social measures to manage any residual risks.
PS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources	
This PS addresses sustainable development by biodiversity conservation, maintaining ecosystem services, and sustainably managing living natural resources.	The Project site contains a range of habitats that support a variety of terrestrial and aquatic animals, as well as providing ecological resources to local peoples. However the Project is unlikely to affect critical habitat and most of the areas affected will be agricultural land. Mitigation may include re-establishing riparian vegetation, as well as establishing new graveyard sites in suitable vegetation.

6.2.4.3 African Development Bank

The African Development Bank (AFDB) has a set of environmental/social policies, requirements and recommendations that apply to its projects, similar to those developed by the World Bank. A number of documents are of relevance:

The Bank's policies provide general orientations to mainstream crosscutting themes in Bank projects, as in:

- Involuntary Resettlement Policy (November 2003); and
- African Development Bank Group's Policy on the Environment (February 2004).

The Bank's procedures delineate how to proceed to integrate environmental/social issues in the project cycle, including the development of a resettlement plan when/if appropriate:

- Environmental and Social Assessment Procedures for African Development Bank's Public Sector Operations (June 2001).

The Bank's guidelines details requirements for any specific project, and when delineating potential beneficial/adverse impacts and corresponding enhancement/mitigation measures, outlines a component on migration and resettlement:

- Integrated Environmental and Social Impact Assessment Guidelines (October 2003).

6.2.5 International Agreements

Malawi is party to a number of internationally acceptable policies, conventions, treaties and protocols in order to augment the national policies and laws. International laws and their institutions serve as the principal framework for international co-operation and collaboration between members of the international community in their efforts to protect the local, regional and global environment. Many environmental problems have a trans-boundary effect hence require a concerted effort to manage them. International environmental laws assist in capturing and building consensus between nations on goals for environmental protection, resource conservation and sustainable use. Malawi is bound to the provisions of an international agreement/law, only if it signs and submits instruments of ratification in respect of a particular agreement.

Malawi is signatory to a number of Agreements as summarised below:

- As noted in the Malawi National Forest Policy (1996): 'The Government of Malawi is also a signatory to numerous bilateral and international agreements and conventions linked to the environment and forestry; including the Rio Declaration, the Convention on Climate Change, the Montreal Protocol, the Convention to Combat Desertification, the Convention on Biodiversity and the Convention on International Trade in Endangered Species of wild fauna and flora (CITES).'
- Malawi was an early signatory, in 1973, to the African Convention on the Conservation of Nature and Natural Resources. Malawi has additionally ratified, in 2001, the SADC revised Protocol on Shared Watercourses, in 2002, the SADC Protocol on Fisheries, and in 2003, the SADC Protocol on Forestry.
- As noted by the Malawi Sustainable Development Network Programme (SNDP), it is also a signatory to: The Convention on International Plant Protection, The Convention on Wetland of Significant Importance, The Convention concerning the Protection of World Cultural and Natural Heritage, The Convention on the Conservation of Migratory Species of Wild Animals, The Food and Agriculture Organization (FAO) of the United Nations International Undertaking on Plant and Genetic Resources, and The Convention on Biological Diversity.

- The Convention on Biological Diversity (1992) recognises that protecting biological diversity includes concerns relating to people, food security, medicine, fresh air, water, shelter and a clean and healthy environment.
- In addition, gender equality is a basic human right and development issue, as affirmed in a number of international and regional instruments to which Malawi is signatory, including the Millennium Development Goals (MDGs), and the Protocol on Gender and Development (2008). As noted in the Gender Policy (2008), instruments to which Malawi is committed include: 1987 UN Convention on the Elimination of all Forms of Discrimination Against Women (CEDAW); the 1993 Vienna Conference on Human Rights; the Southern African Development Cooperation (SADC) Declaration on Gender and Development, 1997, and the Protocol to the African Charter on Human and People’s Rights on the Rights of Women in Africa. Malawi’s commitment to gender equality has now been reflected in its Gender Equality Act (2013).
- In respect of social aspects of development, a commitment to labour rights and health is reflected in Malawi’s signatory status on the International Covenant on Economic, Social and Cultural Rights (1993) and the Convention on the Rights of the Child (1989).

Details of Agreements with specific relevance to the Project are provided in Table 14 below:

Table 14: International Agreements and Objectives

Summary of Important International Agreement Provisions and Project Objectives		
African Convention on the Conservation of Nature and Natural Resources	Ratified in 1973	The Convention requires the contracting States to undertake and adopt measures necessary to ensure conservation, utilisation and development of soil, water, flora and fauna resources in accordance with scientific principles and with due regard to the best interests of the people.
		The Convention has implications for the Project due to the potential effects on soil, water, flora and fauna resources.
Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar)	Ratified in 1997	The Ramsar treaty provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources.
		Malawi has only one wetland listed under Ramsar (Lake Chilwa) however this wetland is not affected by the Project.
Convention concerning the Protection of the World Cultural and Natural Heritage	Ratified in 1972	Acknowledge cultural identity related to the natural environment of each district.
Convention on Biological Diversity	Ratified in 1994	Mitigate impact on people, food security, medicine, fresh air, water, shelter and a clean and healthy environment.
SADC revised Protocol on Shared Watercourses	Ratified in 2001	The Protocol is aimed at fostering closer cooperation for judicious, sustainable and coordinated management, protection and utilisation of shared watercourses and advances the SADC agenda of regional integration and poverty alleviation.
		The Protocol is relevant as the Project is on a tributary that ultimately flows into Lake Malawi, a shared water body which forms a boundary between Malawi, Mozambique and Tanzania.
SADC Protocol on Forestry	Ratified in 2003	The Protocol applies to all activities relating to development, conservation, sustainable management and utilisation of all types of forests and trees, and trade in forest products throughout the SADC Region.
		The Project potentially impacts on riparian and remnant graveyard forests.
Zambezi Watercourse Commission (ZAMCOM)	Ratified in 2005	The objective of the Commission “is to promote the equitable and reasonable utilization of the water resources of the Zambezi Watercourse as well as the efficient management and sustainable development thereof.”
		The Protocol is relevant to the Project since the Lilongwe River ultimately flows into Lake Malawi and then the Zambezi River.

7 STUDY AREA

The proposed development area (local study area) is situated approximately 22km, at a bearing of 215 degrees (south-west) of the Malawian capital of Lilongwe. The local study area covers an area of approximately 1885ha (Figure 2) and is situated to the north and adjacent to the Kamuzu Dam. For the purposes of this study a regional study area covering a total of approximately 9100ha was investigated to a lesser extent. No alternative development footprint is currently being considered or was investigated.

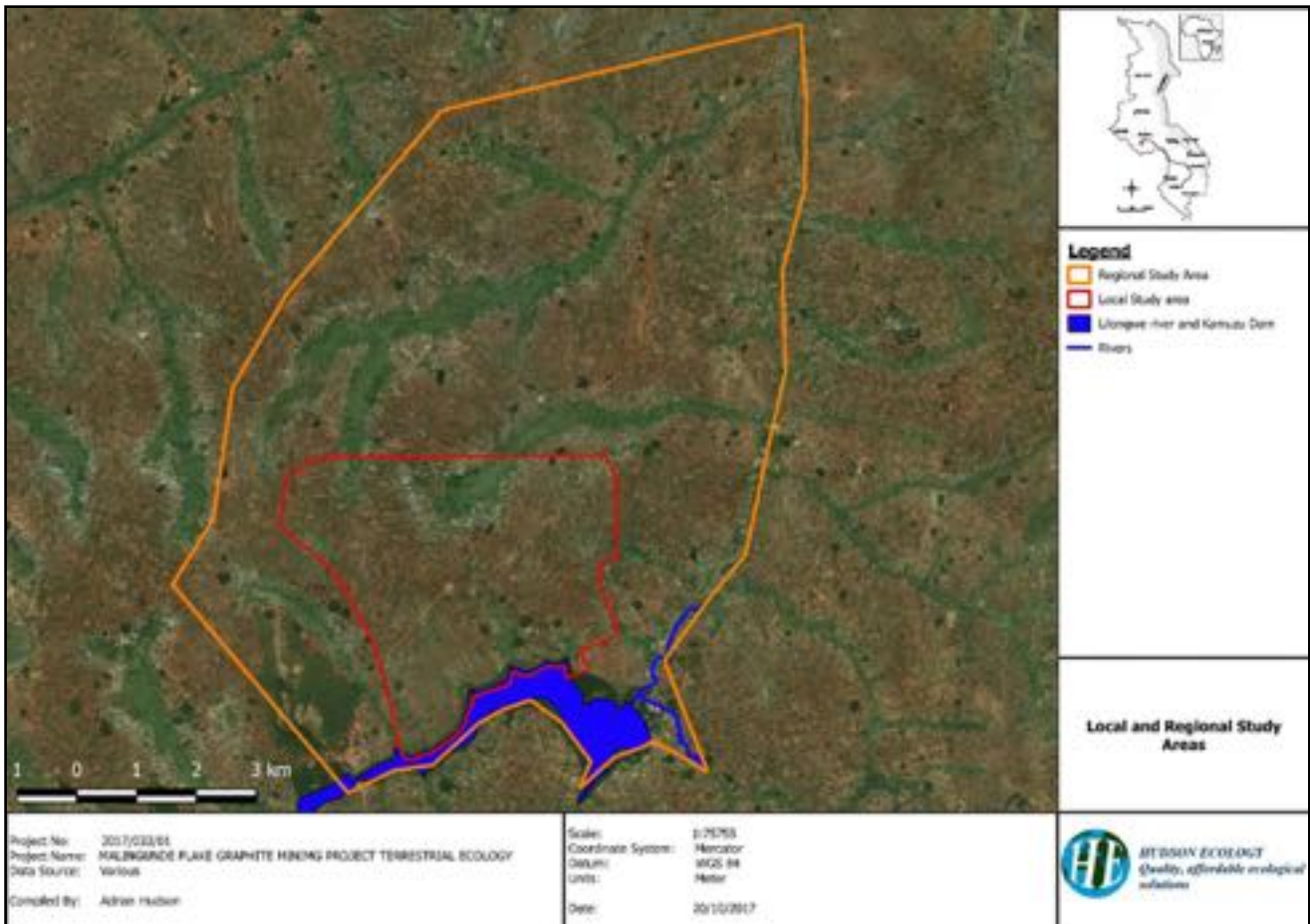


Figure 2: Local and regional study areas investigated

8 METHODOLOGY

8.1 Desktop review of relevant documentation

A number of literature sources were reviewed for the purposes of this report. These include, *inter alia*, vegetation descriptions, field guides and atlases for the various flora and fauna taxa, and scientific articles in order to determine species lists for the area. Previous studies conducted in the area and scientific literature available online were also consulted where necessary.

8.2 Methodologies

In addition to anecdotal information collected from the regional study area, ten study sites were originally selected to represent vegetation communities within the local study area. These study sites were increased to 14 during the second survey (October 2017) and are shown in Figure 3 and co-ordinates of the study sites are given in Table 15. A third survey was conducted during February 2018, this survey was intended to investigate specific areas and two further sites (TESS 15 and TESS 16) were added. It must be noted that the February 2018 surveys were truncated and mainly focused on two further riparian sites than those conducted in the previous two surveys and therefore the terrestrial data from that survey can be considered, to some extent, anecdotal. In order to enable a characterisation of the environment, as well as floral and faunal species that may be impacted

by the proposed Project activities, faunal and floral groups were investigated. These species were then used in order to determine the possible magnitude of the impact of the proposed activities. The following taxa were investigated:

- Vegetation;
- Avifauna;
- Mammals;
- Herpetofauna (Reptiles); and
- Amphibia.

All methods implemented during this investigation are based on accepted scientific investigative techniques and principles, and were performed to accepted standards and norms, whilst taking the limitations of this investigation into consideration. The Precautionary Principle (COMEST, 2005) was applied throughout the assessments.

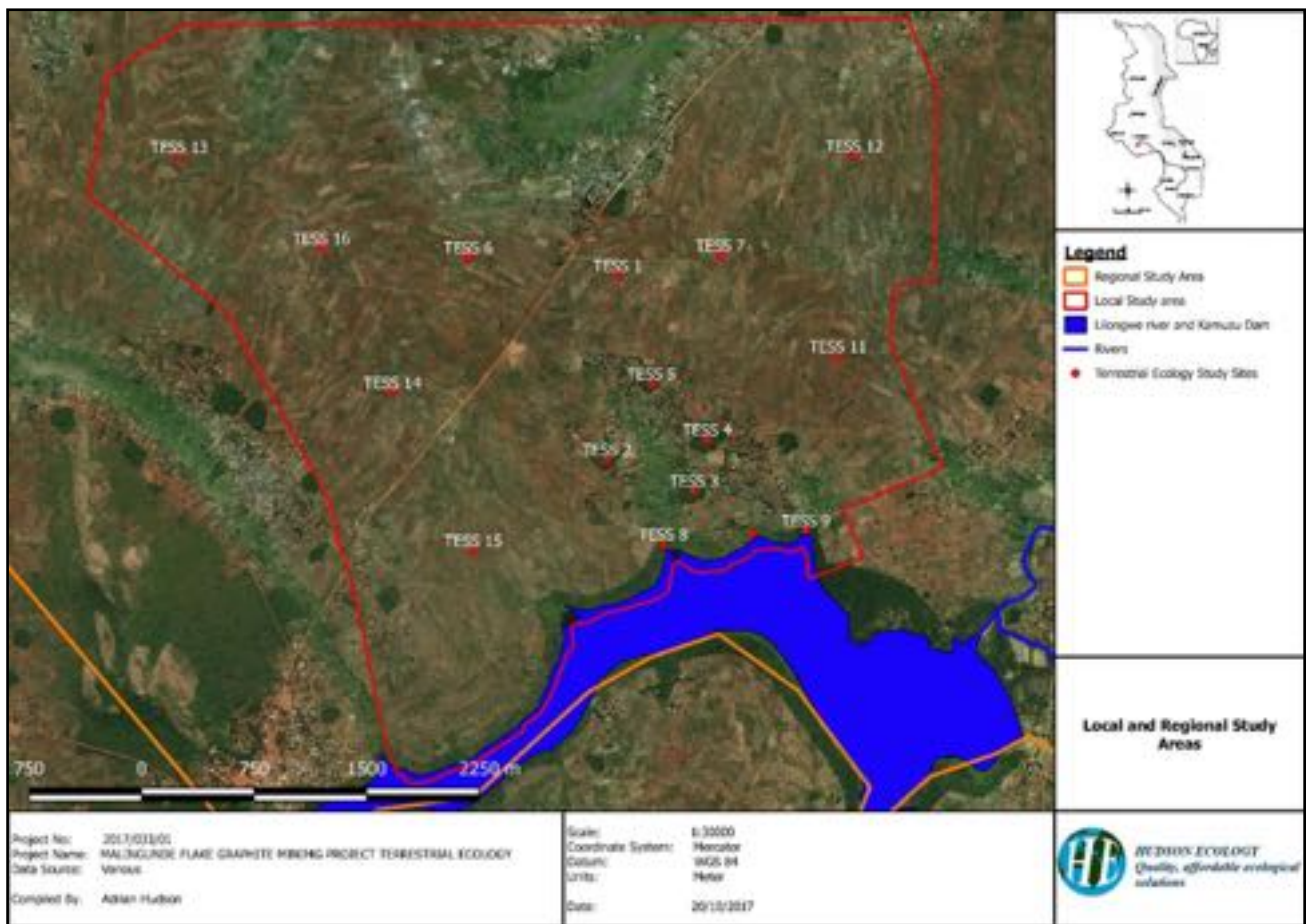


Figure 3: Terrestrial ecology study sites (TESS)

Table 15: Co-ordinates of the terrestrial ecology study sites

Study Site	Latitude	Longitude
TESS 1	14.140551°S	33.663006°E
TESS 2	14.151591°S	33.662345°E
TESS 3	14.153469°S	33.667708°E
TESS 4	14.150391°S	33.668530°E
TESS 5	14.147026°S	33.665077°E
TESS 6	14.139456°S	33.653793°E

Study Site	Latitude	Longitude
TESS 7	14.139344°S	33.669330°E
TESS 8	14.156639°S	33.665817°E
TESS 9	14.155824°S	33.674603°E
TESS 10	14.156027°S	33.671367°E
TESS 11	14.145385°S	33.676597°E
TESS 12	14.133381°S	33.677615°E
TESS 13	14.133446°S	33.635933°E
TESS 14	14.147578°S	33.649101°E
TESS 15	14.157034°	33.654080°
TESS 16	14.138920°	33.644709°

8.2.1 General Floristic Attributes

The vegetation assessment was based on a variation of the Braun-Blanquet method (Mueller-Dombois & Ellenberg, 1974; Westhoff & Van der Maarel, 1978) whereby vegetation is stratified, by means of aerial or satellite imagery with physiognomic characteristics as a first approximation. Stratification was further augmented by sites being selected to represent each of the areas that would be impacted by the current development footprint. Representative areas within these stratifications are then surveyed by means of line-point transects for grasses, sedges and forbs, as well as belt transects for shrubs and trees. Data obtained from these surveys were then subject to analysis to establish differences or similarities between observed units. Results and species lists provided should be interpreted with the survey limitations in Section 9 in mind.

During the flora surveys conducted in April and October 2017, cognisance was taken of the following environmental attributes and general information:

- Biophysical environment (geology, topography, aspect, slope etc.);
- Regional vegetation;
- Current status of habitats;
- Red Data habitat suitability;
- Digital photographs; and
- GPS reference points.

Phytosociological data collected include the following:

- Plant species and growth forms;
- Dominant plant species;
- Cover abundance values; and
- Samples or digital images of unidentified plant species.

The desktop analysis of data was used to establish differences or similarities between vegetation communities, which were then described in terms of floristic species composition as well as driving environmental parameters. Results and species lists provided should be interpreted with the below mentioned survey limitations in mind.

8.2.2 Red Data Flora Assessment

Data collected during the surveys were compared with the International Union for Conservation of Nature (IUCN) Red Data list of Threatened Species and Malawi Threatened and Protected species list to compile a list of plant species of concern that may potentially occur within the study area and that were recorded in the study area.

A survey of these kinds (instantaneous sampling bouts or “snapshot” investigations, as opposed to a long-term study) poses limitations to the identification of Red Data plant species. Therefore, emphasis was placed on the identification of habitat that would be suitable for sustaining Red Data plant species, by associating available habitat to known habitat requirements of Red Data plant species.

8.2.3 Floristic Sensitivity Analysis

Floristic sensitivity analysis was determined by taking two factors into account namely ecological function and conservation importance. This sensitivity was quantified by subjectively assessing the ecological function and conservation importance of the vegetation. These were defined as follows:

Ecological Function:

- High ecological function: Sensitive ecosystems with either low inherent resistance or resilience towards disturbance factors or highly dynamic systems considered to be stable and important for the maintenance of ecosystems integrity (e.g. pristine grasslands, pristine wetlands and pristine ridges);
- Medium ecological function: Relatively important ecosystems at gradients of intermediate disturbances. An area may be considered of medium ecological function if it is directly adjacent to a sensitive/pristine ecosystem; and
- Low ecological function: Degraded and highly disturbed systems with little or no ecological function.

Conservation Importance:

- High conservation importance: Ecosystems with high species richness and usually provide suitable habitat for a number of threatened species. Usually termed 'no-go' areas and unsuitable for development, and should be protected;
- Medium conservation importance: Ecosystems with intermediate levels of species diversity without any threatened species. Low-density development may be allowed, provided the current species diversity is conserved; and
- Low conservation importance: Areas with little or no conservation potential and usually species poor (most species are usually exotic).

The Precautionary Principle was applied throughout this investigation (COMEST, 2005).

8.3 General Fauna Attributes

8.3.1 Reptilia

Suitable areas were identified and sampled using active search and capture methods, searches were concentrated in rocky areas and disused ant hills were investigated for the presence of snakes. Snakes and other reptiles are identified visually and only captured if visual identification is hampered by swift-moving snakes or if the snake is obscured from view. Branch (1996) and Broadley (1971) were used as identification guides, where necessary.

8.3.2 Amphibia

Suitable areas for frogs were sampled by means of active search and capture and acoustic identification methods, especially at night when highest amphibian activity is expected. Areas were also netted for tadpoles and amphibian species identified by means of tadpoles. Du Preez and Carruthers (2009), Mercurio (2011) and Stewart (1967) were used to confirm identification where necessary.

8.3.3 Avifauna

Avifauna were surveyed by means of point counts (Bibby, et al., 1993) and visual identification and the calls of bird species were used to identify species. Wherever possible, visual identification was used to confirm call identifications. Bird ranges were confirmed using Harrison et al (1997). Other literature sources (BirdLife International, 2000; Sinclair & Ryan, 2003; Hockey, et al., 2005) were also utilised in order to identify recorded bird species where necessary.

8.3.4 Mammalia

Visual sightings and ecological indications were used to identify the small mammal inhabitants of the study area. Scats were also collected and used for identification of nocturnal small mammals. A number of reference sources inter alia Stuart and Stuart (2007), Ansell and Dowsett (1988), Kingdon et al. (2013) and Smithers (1983) were used for identification purposes, where necessary.

8.3.5 Red Data Fauna Assessment

The following parameters were used to assess the probability of occurrence of each Red Data species:

- Habitat requirements (HR) – Most Red Data animals have very specific habitat requirements and the presence of these habitat characteristics in the study area was evaluated;
- Habitat status (HS) – The status or ecological condition of available habitat in the area is assessed. Often a high level of habitat degradation prevalent in a specific habitat will negate the potential presence of Red Data species (this is especially evident in wetland habitats); and

- Habitat linkage (HL) – Movement between areas for breeding and feeding forms an essential part of the existence of many species. Connectivity of the study area to surrounding habitat and the adequacy of these linkages are evaluated for the ecological functioning of Red Data species within the study area.

Probability of occurrence is presented in four categories, namely:

- Low;
- Medium;
- High; and
- Recorded.

In order to assess the status of fauna species of concern in the study area, the following sources were used:

- IUCN Red List Categories and Criteria (IUCN, 2001);
- IUCN Red List of Threatened Species (IUCN, 2016); and
- Malawi Threatened and Protected species list.

9 SURVEY ASSUMPTIONS AND LIMITATIONS

- Accuracy of the maps, ecosystems, routes and desktop assessments were made using Google earth and converting the .kml files to .shp files and are subject to the accuracy of Google Earth imagery with some loss of accuracy during the conversion process;
- GPS co-ordinates are accurate to within 10m and lines drawn on maps can only be assumed to be accurate to within a distance of 50m;
- Data obtained from published articles, reference books, field guides, official databases or any other official published or electronic sources are assumed to be correct and no review of such data was undertaken by Hudson Ecology Pty Ltd;
- Satellite imagery obtained was limited to imagery on Google Earth, thus the ability to accurately map vegetation communities was limited;
- Time and budget constraints did not allow for an intensive survey of the entire study area during the baseline/EIA phase surveys, and as with any survey of this kind, rare and cryptic species may have been overlooked during the study;
- Every possible precaution was taken to reduce the effect of the above-mentioned limitations on the data collected for this study;
- The fact that a species or Red Data species was not recorded during a survey cannot support the assumption that the species in question does not occur in the area, it can only indicate a decreased probability of the species occurring in the area. This is particularly pertinent if the species has been recently or historically recorded in the area;
- Ecological studies should be undertaken over a number of seasons in order to obtain long term ecological data. Studies are usually conducted in this way in order to eliminate the effects of unusual climatic conditions or other unusual conditions prevailing at the study area during the time of study. The results of this study are based on a literature review and biannual field surveys conducted in April and October 2017;
- The wet season study conducted in April 2017 did not represent ideal conditions for a wet season study as it was conducted in the latter part of the wet season and many annual plant species were not emergent, and thus no longer visible or identifiable for study. Many migratory bird species may also no longer have been present in the area. In order to try and remedy this a second field survey was conducted in October of 2017, however due to an extended dry season, this survey was not an ideal wet season survey either.

10 RESULTS

10.1 Physical Setting

10.1.1 Location

The Project area falls within the Southern Miombo woodlands ecoregion. This ecoregion is discontinuous in distribution and consists of four parts, separated by the drainage systems of Zimbabwe and Zambia. The largest section covers most of Zimbabwe, and spills over into Mozambique on the eastern side of the Chimanimani Mountain Range. Zambezi Mopane Woodland surrounds most of this area and separates this block from the second largest section of the Southern Miombo Woodland ecoregion (White, 1983). North of the Zambezi Valley, this portion encompasses the southern third of Zambia, the western parts of Malawi and northern Tete province in Mozambique. In the northern and north-western parts of this ecoregion, the vegetation is mostly supplanted by Central Zambezi Miombo Woodland. The remaining segments are located in southern Mozambique, separated by the Rio Save and adjacent to White's (1983) Zanzibar-Inhambane mosaic to the east. To the west of this ecoregion, mopane and undifferentiated woodland of the Zambezi Mopane Woodland ecoregion predominates.

The majority of the ecoregion is located on the Central African Plateau at elevations between 1,000 and 1,500 m. Although the area is characteristically flat or undulating plains, intrusive granites and gneisses dominate geologically, and regularly rise up above the woodland as rounded hills (also known as dwalas) or inselbergs. Numerous grassy wetlands are interspersed along drainage lines in vleis or dambos (Barnes, 1998). Highly weathered, acidic, and nutrient-poor soils, mainly alfisols and some oxisols in wetter locations, predominate and are more than 3 m deep in places. Shallow stony soils are common along the escarpment and around inselbergs. Soils are generally well-drained. To the west, the ecoregion ranges marginally onto aeolian Kalahari sands. The portions of the ecoregion in Mozambique are located at much lower elevations, from 200 to 800 m, and are found on sedimentary Karoo Sandstones (Barnes, 1998).

10.1.2 Geomorphology

The study area is located in the gradually undulating South Lilongwe Plain. Three major erosion surfaces have been documented in this area: post-Gondwana residuals, African erosion surface and post-African erosion. The oldest of these, the post-Gondwana surface of the early and mid-Cretaceous age is now only represented by residuals (inselbergs) which rise above the level of the surrounding plain.

The African cycle of erosion, which transpired in the late Cretaceous – early Miocene age formed an extensive plain in the Central Region of Malawi of which the South Lilongwe Plain is but a part. This surface reached a state of extreme old age, characterised by its monotonous flatness, before the post-African cycle of erosion was initiated in late-Miocene times.

The mature African surface is somewhat downwarped in the vicinity of Lilongwe, this feature possibly being associated with Rift Valley faulting in the area to the east. Incipient post-African erosion has penetrated along the floor of the major river valleys and in places a composite surface results, the African and post-African surfaces merging gently and indiscernibly on the interfluves.

The level of the plain demonstrates a gentle southward rise over a distance of 56.3 km from an elevation of 1,143 m at Lilongwe to 1,295 m on the Mozambique border. Slight rises also occur towards the eastern and western margins of the plain. Inselbergs rise from the surface of the plain along interfluves. Towards the east these tend to be more prominent and surrounded by lower hills at 1,250 – 1,280 m above sea level (Thatcher & Walter, 1968).

The Lilongwe river is one the three main river systems draining the South Lilongwe Plain. This river is composed of five main tributaries, Likuni, Katete, Lisungwe, Manjiri and Nathenje. The headwaters of these rivers form a complex network of deeply dissected valleys which frequently follow joint directions, shear zones and foliation within Dzalanyama Granite. Small dambos lie at the source of each tributary stream and rarely dry up at all, but the smallest streams in the Dzalanyama continue to flow throughout the year.

The South Lilongwe Plain and Dzalanyama Range are largely underlain by granulites, gneisses and schists of the Precambrian Basement Complex; thick superficial deposits comprising various types of residual soils, river alluvium and dambo soils cover much of the South Lilongwe Plain. Brown and Young (1965) have classified the soils as latosols which vary from highly ferruginous to sandy ferallitic types. The various types of these soils frequently grade into one another. The depth of weathering is very variable in this area; wells drilled for rural water supplies have in places penetrated as much as 45 m of weathered rocks (Thatcher & Walter, 1968). Considering the information from the boreholes close to the study area, weathered rocks reach around 43 m in depth.

10.1.3 Climate

The ecoregion generally experiences a tropical savanna climate with three distinct seasons: a hot dry season from mid-August through October; a hot wet season from November through March; and a warm dry season from April through early August. Mean maximum temperatures range between 18°C and 27°C, but are typically around 24°C. The ecoregion experiences mean minimum temperatures between 9°C and 15°C, and is virtually frost-free. Temperatures are considerably higher in the lowland areas of the ecoregion. Rainfall is highly seasonal, with a marked winter drought usually lasting from 4 to 7 months (Cole, 1986). The mean annual rainfall is around 600 to 800 mm in the main part of the ecoregion in Zimbabwe and increases to about 1,000 mm in the lower-elevation portion in Mozambique.

10.1.4 Soils

According to the geological map (1:100,000), red-brown sandy clay soils (Qr) dominate the study area. Their colour depends on the degree of cultivation and the percentage of humus present. These soils are probably derived largely from the micaceous rocks and, to a lesser extent, from pyretic and hornblendic rocks, including metagabbros. A surface float of quartz, kyanite and,

less commonly, tourmaline is typically developed over these soils which broadly may be correlated with the ferruginous soils of Brown and Young's (1965) classification.

In the Lilongwe River, the 2.5 km stretch in the upstream limit of the study area is occupied by dambo soil (Thatcher & Walter, 1968). This area of impeded drainage is occupied by hydromorphic soils; dark grey, black and mottled soils mainly composed of clay minerals. The thin humus of the A-horizon supports only shallow rooted plants, like grasses. The low permeability of clays combined with the poor site drainage produce a waterlogged soil liable to seasonal flooding.

10.1.5 Current Status and Land Use

The type of miombo woodland in this area constitutes a relatively small part of the miombo woodland in Malawi and is more prevalent in Zambia and Zimbabwe, therefore much of the current status of this type of miombo woodland is dependent on the status in these two countries. Historically, miombo vegetation was relatively underpopulated, partially due to poor soils, which made it unsuitable for cultivation (Chenje & Johnson, 1994). The great rinderpest epidemic of the late nineteenth century further contributed to the depopulation of both people and livestock in the area. This allowed thick woodland vegetation to grow, which provided ideal habitat for the proliferation of the tsetse fly (an insect that causes livestock and human sleeping sickness) (Misana, et al., 1996). Since the tsetse fly does not affect wildlife, and the area is sparsely populated, miombo provides excellent habitat for game parks. Dry savannas (which include miombo habitat) are today one of the most extensively protected vegetation types in southern Africa (Chenje & Johnson, 1994). However, in recent years miombo has been facing increasing pressure due to human population expansion and activities. Aside from protected areas, there is little undisturbed miombo left (Chenje & Johnson, 1994).

Fortunately, Zimbabwe, which contains the largest contiguous section of the ecoregion, is internationally renowned for its well-organised, effective and enlightened conservation effort (Stuart, et al., 1990). It is also responsible for having spearheaded community-based conservation in southern Africa through the CAMPFIRE Program. About 13 percent of Zimbabwe's total land area is protected (Chenje & Johnson, 1994). Zambia's protected areas cover 32 percent of the country, although most of these areas fall into the Central Miombo Woodland ecoregion. These areas have suffered from insufficient management in the past (Stuart, et al., 1990).

Although there are only three official Zambian protected areas that fall into the ecoregion, Game Management Areas (GMAs) cover most of the remaining area of in the Zambian portion of this ecoregion. North Luangwa National Park, bounded by the Muchinga Escarpment in the west and the Luangwa River in the east, is mostly covered by miombo vegetation, with some open grassland on the floodplain. Lukusuzi National Park is found in the eastern watershed area of the Luangwa River. Almost half the park consists of plateau where miombo is dominant, although grassland is also found on the plateau and along rivers. Both parks have an abundance of wildlife representative of the ecoregion. The expansive Lower Zambezi National Park lies on the northern bank of the Zambezi River. Miombo vegetation covers the slopes while mopane and *Vachellia* dominate in the valley. A wide variety of game occurs in the area, although poaching has drastically reduced black rhino and elephant populations (Stuart & Stuart, 1992).

The miombo regions of Zimbabwe support a large number of small protected areas, many of which are found in rugged wilderness terrain. These parks and reserves include Chizarira National Park, Chirisa Safari Area, Matusadona National Park, and Mavuradonha Safari Area, which are all found in the north regions of the country. Other smaller parks such as Nyanga National Park, Mazowe Botanical Reserve, Sebakwe, Robert McLlwaine, Lake Kyle, and Ngezi Recreational Parks are much more accessible, as they are close to main transport routes or major towns, but do not harbour significant populations of charismatic large mammals. Private wildlife conservancies are becoming more numerous in Zimbabwe, offering consumptive and non-consumptive safaris.

Mozambique, having suffered serious upheavals through years of civil war, does not presently have any effectively managed areas. Almost all wildlife was wiped out over the years for meat and to finance the war. Some management plans and efforts are, however, beginning to be reapplied to Gorongosa National Park, a protected area that falls into the ecoregion.

10.1.6 Regional Overview of the Ecoregion

The overall faunal diversity of this ecoregion is fairly high, as many of its species overlap with surrounding miombo and savanna ecoregions. Annual droughts can last up to seven months and fires are frequent. As a result, many species are at least seasonally dependent on non-miombo sites within or adjacent to the ecoregion to provide food, water or shelter. These non-miombo

refuges also provide a greater variety of habitats, resulting in higher richness in ecotonal areas within the ecoregion, such as near inselbergs or rivers, than in areas of uniform miombo woodland (Rodgers, et al., 1996).

While miombo woodland in general provides important habitat for many large animals, the ecoregion does not support high densities of mammals per unit area, probably due to the seasonally arid conditions and poor soil, and hence forage quality. Several threatened animals occur in this ecoregion, including the critically endangered black rhino (*Diceros bicornis*) and the endangered elephant (*Loxodonta africana*) (Hilton-Taylor, 2000). Although the ecoregion does not support these globally endangered animals in very large numbers, it is still important habitat because both species are known to have potentially large home ranges (Kindgon, 1997) and utilise miombo habitat. Of the 50,000 to 60,000 elephants thought to occur in this ecoregion, roughly 27,000 animals are concentrated in mopane woodland that borders this ecoregion (Stuart, et al., 1990). Until a few years ago these areas supported the largest population of black rhino in Africa (about 2,200) (Stuart, et al., 1990). White rhinos (*Ceratotherium simum*) are also known to inhabit the region and are listed as lower risk by the IUCN Red List (Hilton-Taylor, 2000).

The overall paucity of large animals in this ecoregion favours the roan antelope (*Hippotragus equinus*), one of the mammals largely restricted to this habitat type, as it prefers habitats that have few competitors or carnivores (Kindgon, 1997). Other ungulates typical of this ecoregion include sable (*H. niger*), Lichtenstein's hartebeest (*Signoceros lichtensteinii*), southern reedbuck (*Redunca arundium*), greater kudu (*Tragelaphus strepsiceros*), eland (*Taurotragus oryx*), and buffalo (*Synerus caffer*) (East, 1998). Tsessebe (*Damaliscus lunatus*) are also known to occur in the area (Stuart & Stuart, 1992).

Most of the ungulates characteristic of miombo woodland are specialised grazers that selectively feed on nutrient-rich, actively growing grass shoots (Frost, 1996). This means that they require large foraging areas, as they often have to move seasonally through the landscape in search of suitable fodder. For example, sable antelope remain within miombo woodland for much of the rainy season (October to May), but move out during the dry season (Kindgon, 1997). Many of these ungulates also rely on ecotones or non-miombo habitat within the ecoregion. For example, Lichtenstein's hartebeest prefers the ecotone between miombo and dambos (Smithers & Wilson, 1979), while the southern reedbuck is most often found in rank grass valleys and glades within miombo woodland (Kindgon, 1997).

Large carnivores characteristic of the region include lion (*Panthera leo*), leopard (*P. pardus*), cheetah (*Acinonyx jubatus*), spotted hyena (*Crocuta crocuta*), and the endangered African wild dog (*Lycaon pictus*). Smaller predators include caracal (*Felica caracal*), side-striped jackal (*Canis adustus*) as well as Selous's mongoose (*Paracynictis selousi*), which is a fairly range-restricted species.

Of the nearly 500 bird species found in the region, none are strictly endemic. However, six species are either largely confined to the ecoregion or have extremely small distribution ranges. Lilian's lovebird (*Agapornis lilianae*), mostly inhabits mopane woodland in the Zambezi Valley, but seasonally wanders into more mixed woodland on alluvial terraces (Harrison, et al., 1997). The boulder chat (*Pinarornis plumosus*) is found in well-wooded terrain with large boulders. Stierling's woodpecker (*Dendropicops stierlingi*) is confined to two small areas of southern Malawi with the remainder of the population restricted to the Eastern Miombo Woodland ecoregion, while Chaplin's barbet (*Lybius chaplini*), endemic to south-central Zambia, is a locally common resident of miombo woodland. The latter species is considered lower risk/near threatened by BirdLife International (2000). The pink-throated twinspot (*Hypargos margaitatus*) and the lemon-breasted canary (*Serinus citrinipectus*) have restricted ranges and utilise miombo woodland, although their main ranges fall outside this ecoregion. Three globally threatened species are also found in this ecoregion, including two vulnerable species, the Cape vulture (*Gyps coprotheres*) and the lesser kestrel (*Fao naumanni*), as well as the lower risk Taita faon (*Fao fasciinucha*), which is threatened by pesticide use in northern Zimbabwe (Barnes, 1998; BirdLife International, 2000).

Reptiles are the only animal group with high levels of endemism in this ecoregion, with 30 species of snakes and lizards predominantly or exclusively found in south miombo. However only four species are strict endemics: regal girdled lizard (*Cordylus regius*), dwarf wolf snake (*Cryptolycus nanus*), ocellated flat lizard (*Platysaurus ocellatus*), and *Platysaurus oshaughnessyi*.

10.1.7 Types and Severity of Threats

A large proportion of this miombo ecoregion has been completely transformed. Outside protected areas, some of the most immediate threats result from expanding cultivation, commercial logging, overgrazing, rapid population growth, and too-frequent fires (Chenje & Johnson, 1994). Although habitat is fairly well conserved in protected areas, even national parks are affected by people who increasingly encroach onto protected land to search for fuel, wood, or new grazing or farming areas

(Misana, et al., 1996). Poaching, especially of black rhinos and elephants, is a continuing problem and has resulted in severe losses of animals, despite extensive protection efforts (Misana, et al., 1996).

The large-scale cultivation of cash crops, such as maize, wheat, and especially tobacco, has seen a huge conversion of miombo into agricultural land. In the case of tobacco, growing this export crop has led to large losses of woodland, both for land and fuelwood (Moyo, et al., 1993). These losses are increased by a need for fresh land each year to avoid risk of root-knot nematodes, as well as for the curing of tobacco, which is presently often carried out using charcoal (Misana, et al., 1996). Several wildlife species are perceived as pests by farmers and are frequently eliminated on private lands. For example, livestock farmers have eradicated the African wild dog from large areas, while the armadillo is routinely exterminated on agricultural land (Kindgon, 1997). Leopards are normally not tolerated by livestock farmers, leading to the large scale persecution of these animals.

Expanding rural populations and the subsistence use of resources place substantial strain on the ecoregion. More than 80 percent of the people living in miombo depend on fuelwood for cooking, heat, and light, and grazing pressures of communal livestock populations are considerable, (Misana, et al., 1996). Hunting for bushmeat was once conducted primarily for subsistence and cultural traditions. Now, the trade is becoming commercialised, often catering to the urban market (TRAFFIC, 2000). Other species are used for traditional medicine, for example, the scales of the ground pangolin (*Manis temminckii*) are used as love charms (Kindgon, 1997).

10.2 Flora Assessment

Floristically, the Southern Miombo woodlands ecoregion forms part of a belt of miombo woodland that extends from Angola, in the west, to Tanzania, in the east. This miombo band is synonymous with the Zambezi Phytocorion, the largest of White's (1983) Regional Centers of Endemism within Africa. Miombo plant communities are dominated by trees belonging to the family Caesalpiniaceae, and characterised by *Brachystegia* and *Julbernardia* species.

The Southern Miombo woodlands ecoregion, mapped by White (1983) as drier Zambezi miombo, is floristically impoverished, although areas of serpentine soils in Zimbabwe provide localized sites of speciation and endemism (Frost, 1996). *B. spiciformis* and *J. globiflora* predominate. Other common tree species include *Uapaca kirkiana*, *B. boehmii*, *Monotes glaber*, *Faurea saligna*, *F. speciosa*, *Combretum molle*, *Albizia antunesiana*, *Strychnos spinosa*, *S. cocculoides*, *Flacourtia indica*, and *Vangueria infausta*. The graminoid layer is usually poorly defined and sparse.

This ecoregion can be found in association with a number of other vegetation communities. Where drainage is poor, *Vachellia* savannas or grassland may become locally dominant (Werger, 1978). Other associated vegetation includes dry deciduous forest and thicket, as well as deciduous riparian vegetation (White, 1983).

10.2.1 Vegetation Communities

Vegetation in Malawi is extensively miombo woodland, deciduous forests, and thickets, evergreen and semi-evergreen forests and montane grassland. Malawi has about 5,500 to 6,000 flowering plants, and 250 species of bryophytes, 200 of which are mosses. Out of the documented more than 6,000 plant species, 253 are considered threatened, vulnerable, rare or endangered (Malawi Environmental Affairs Department, 2010).

Flora assessments were conducted at the end of the wet season in April 2017 and just before the advent of the wet season in October 2017, based on physiognomy, moisture regime, rockiness, slope and soil properties, four main communities were recognised, namely:

- Dambo Grassland Vegetation Community;
- Mixed Riparian Vegetation Community;
- Forest Vegetation Community;
- Cultivated Lands.

These vegetation communities are shown in Figure 4. A further "vegetation community" namely township vegetation community was identified within the villages and settlements in the area, but due to the transformed nature of these areas, these communities were not extensively surveyed or mapped. The April 2014 surveys took place at the end of the wet season and further surveys were conducted in October 2017. However, due to an extended dry season, the wet season had not yet commenced in October 2017 and vegetation growth was very limited, and vegetation recorded in most areas was a subset of the vegetation recorded during the April 2017 surveys.

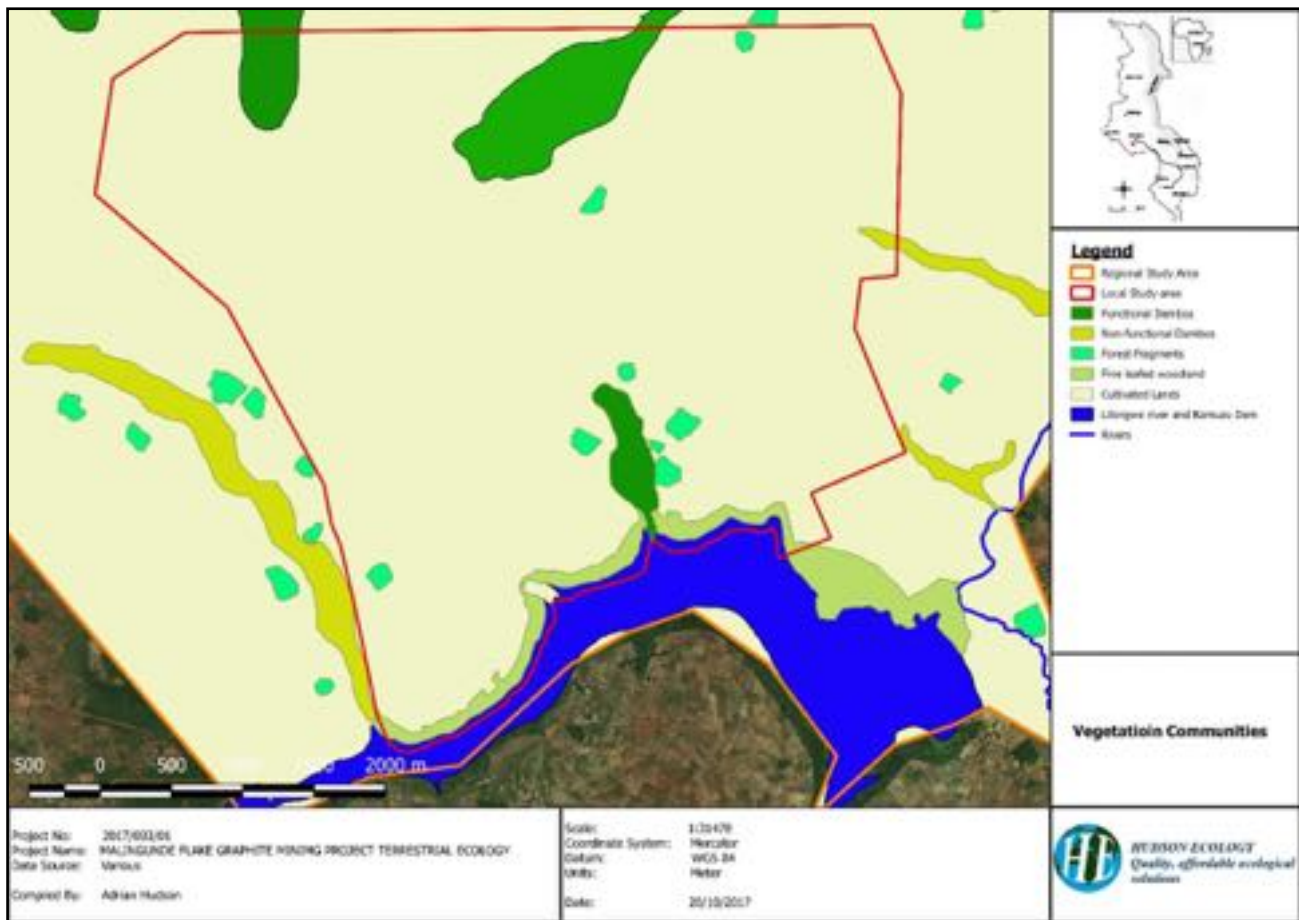


Figure 4: Vegetation Communities recorded in, and adjacent to, the study area

The total area of the local study area (project footprint) was calculated to be approximately 1885ha. Table 16 indicates the relative size of each of the vegetation communities to the local study area. Note that these calculations do not include the vegetation communities investigated outside of the local study area.

Table 16: Vegetation communities and the areas of the vegetation communities in the local study area

Vegetation Community	Area in ha	% of total study area
Dambo Grassland Vegetation Community	102	5%
Mixed Riparian Vegetation Community	75	4%
Forest Woodland Vegetation Community	15	1%
Cultivated Lands	1693	90%
Total	1885	100%

10.2.1.1 Dambo Grasslands

Dambos (sometimes termed vleis) are seasonally waterlogged, predominantly grass covered, shallow depressions bordering headwater drainage lines (Figure 5). They are generally found in higher rainfall flat plateau areas, and have river-like branching forms. In this report the word ‘dambo’ and wetland can be used interchangeably with no difference in meaning. Dambo grasslands are located to the north and northwest of the local study area (Figure 4). One dambo is located within the study area and runs in a north-south direction towards the Kamuzu Dam. This dambo has however been extensively transformed by agricultural activities and only a very small area, adjacent and to the north of the Kamuzu Dam, can be classified as a functional wetland. Generally dambos in the area are characterised by a gently sloping channelled or unchannelled valley with large grassy floodplains. Due to the fact that the dambo within the local study area is so extensively transformed that it can be characterised as cultivated lands, and no longer as a functional dambo, the dambos to the north and northwest were investigated in order

to obtain an indication of species likely to occur in this vegetation community. Furthermore these dambos could possibly be impacted upon by runoff from the proposed mining activities. Three other dambos to the east and west of the local study area have been completely transformed by cultivation and were not assessed as dambos.

This vegetation community varies along a cross-section, based on the soil type and soil moisture composition. Species dominance is not uniform and occurs in mosaics of local dominance of different species. In the outer, drier parts of the dambo the grass community is dominated by *Hyparrhenia filipendula*, *Setaria incrassata*, *Sporobolus pyramidalis*, *Loudetia simplex*, *Pogonarthria squarrosa*, *Hyperthelia dissoluta*, *Cynodon dactylon*, *Eragrostis chapelieri*, *Setaria pumila*, *Stereochlaena cameronii* and *Eragrostis superba*. This area of the dambo is often interspersed by weeds and woody species such as *Kigellia africana*, *Piliostigma thonningii*, *Senna siamea*, *Solanum delagoense*, *Bidens biternata*, *B. pilosa*, *Tagetes minuta*, *Conyza albida*, *Sesbania microphylla* and *Oldenlandia corymbosa*. Closer to the channel of the dambo, vegetation changes so that the grass species are dominated by species such as *Hemarthria altissima*, *Paspalum urvillei*, *Arundinella nepalensis*, *Aristida junciformis*, and sedges such as *Cyperus esculentus*, *Cyperus tenax*, *Kylinga erecta*, *Pycreus aethiops*, *Typha latifolius* and *Typha domingensis*. Forb species closer to the channel include *Ranunculus multifidus*, *Verbena bonariensis*, *Senecio strictifolius*, *Helichrysum* species, *Kniphofia linearifolia* and *Polygonum senegalense*, while the channel itself may host aquatic macrophytes such as *Azolla nilotica*, *Pistia stratiotes*, *Utricularia cf. intermedia*, *Persicaria lapathifolia*, *Nymphaea nouchali* and *N. lotus*. Although wetlands have intrinsic conservation importance the degraded and in some cases transformed nature of the wetlands in the study area do reduce the conservation importance of these areas slightly. Ecological integrity is also compromised in this vegetation community due to anthropogenic impacts of variable nature, extent and intensity. The ecological importance of this vegetation community may be regarded as low to moderate, while the conservation importance is moderate. Species recorded in, and adjacent to, the dambos in the regional study area are given in Table 17.

Table 17: Species recorded in the dambos in the regional study area

Trees	Forbs	Grasses	Cyperoids
<i>Kigellia africana</i>	<i>Bidens biternata</i>	<i>Hemarthria altissima</i>	<i>Cyperus digitatus</i>
<i>Piliostigma thonningii</i>	<i>Bidens pilosa</i>	<i>Andropogon eucomus</i>	<i>Cyperus esculentus</i>
<i>Senna didymobotrya</i>	<i>Conyza albida</i>	<i>Andropogon gayanus</i>	<i>Cyperus tenax</i>
	<i>Ceratotheca triloba</i>	<i>Aristida junciformis</i>	<i>Kylinga erecta</i>
	<i>Conyza albida</i>	<i>Arundinella nepalensis</i>	<i>Pycreus aethiops</i>
	<i>Conyza welwitschii</i>	<i>Brachiaria deflexa</i>	<i>Typha latifolius</i>
	<i>Euphorbia cyparissoides</i>	<i>Cynodon dactylon</i>	<i>Typha domingensis</i>
	<i>Haumaniastrum sericeum</i>	<i>Dactyloctenium aegyptium</i>	
	<i>Helichrysum species</i>	<i>Digitaria scalarum</i>	
	<i>Kniphofia linearifolia</i>	<i>Eleusine indica</i>	
	<i>Oldenlandia corymbosa</i>	<i>Eragrostis capensis</i>	
	<i>Oldenlandia herbacea</i>	<i>Eragrostis chapelieri</i>	
	<i>Polygonum senegalense</i>	<i>Hyparrhenia filipendula</i>	
	<i>Ranunculus multifidus</i>	<i>Melinis repens</i>	
	<i>Senecio strictifolius</i>	<i>Monocymbium cereiiforme</i>	
	<i>Sesbania microphylla</i>	<i>Paspalum urvillei</i>	
	<i>Solanum campylacanthum</i>	<i>Pogonarthria squarrosa</i>	
	<i>Tagetes minuta</i>	<i>Setaria pumila</i>	
	<i>Verbena bonariensis</i>	<i>Sporobolus pyramidalis</i>	
	<i>Azolla nilotica</i>	<i>Sporobolus subtilis</i>	
	<i>Pistia stratiotes</i>	<i>Themeda triandra</i>	
	<i>Utricularia cf. intermedia</i>	<i>Oryza barthii</i>	
	<i>Rorippa nasturtium-aquaticum</i>	<i>Ischaemum afrum</i>	
	<i>Persicaria lapathifolia</i>	<i>Brachiaria humidicola</i>	
	<i>Nymphaea nouchali</i>	<i>Echinochloa pyramidalis</i>	

Trees	Forbs	Grasses	Cyperoids
	<i>Nymphaea lotus</i>	<i>Entolasia imbricata</i> <i>Hyparrhenia nyassae</i>	



Figure 5: An example of one of the dambos to the north of the local study area

10.2.1.2 Mixed Riparian Woodland

Mixed riparian (or riverine) woodland vegetation occurs along the banks of more permanent water bodies such as perennial rivers and dams. This vegetation community is comprised of a mixture of fine- and broadleaved tree species as well as a well-developed shrub layer and poorly developed grass and forb layers. This vegetation community demonstrates a far lesser degree of degradation than other vegetation communities in the region and the main form of disturbance occurs in the form of invasive species propagation in the vegetation community. This vegetation community comprises of a range of tree species including *Vachellia polyacantha*, *Vachellia sieberiana*, *Albizia antunesiana*, *Burkea africana*, *Combretum molle*, *Ekebergia benguelensis*, *Faurea speciosa*, *Piliostigma thonningi*, *Antidesma venosum*, *Azelia quanzensis* and *Trichilia emetic*. Common shrub species in this vegetation community include *Eriosema ellipticum*, *Eriosema engleranum*, *Euclea crispa*, *Gnidia kraussiana*, *Indigofera arrecta*, *Lippia javanica*, *Lopholaena coriifolia*, *Maytenus senegalensis*, *Rhynchosia resinosa*, *Flueggea virosa* and *Diospiros heterophylla*. Due to the increased canopy cover the grass and forb layers are poorly defined and grasses found in this vegetation community include *Aristida junciformis*, *Eragrostis* spp.

Exotic species in this vegetation community include *Bidens biternata*, *Bidens pilosa*, *Solanum delagoense*, *Tagetes minuta*, *Verbena bonariensis* and *Lantana camara*. Impacts on this vegetation community are low to moderate and do not reduce the ecological integrity and conservation importance of this vegetation community significantly, although a number of factors will affect the significance of the reduction. The ecological integrity of this vegetation community can be described as high, while the conservation importance of these vegetation communities can also be described as high. The list of species recorded in this vegetation community is given in Table 18.



Figure 6: An example of mixed riparian vegetation occurring in the study area

Table 18: Species recorded in the mixed riparian woodland in the regional study area

Trees	Shrubs	Forbs	Grasses
<i>Vachellia polyacantha</i>	<i>Laggera crispata</i>	<i>Bidens biternata</i>	<i>Aristida junciformis</i>
<i>Vachellia sieberiana</i>	<i>Eriosema ellipticum</i>	<i>Bidens pilosa</i>	<i>Cynodon dactylon</i>
<i>Albizia antunesiana</i>	<i>Eriosema engleranum</i>	<i>Ceratotheca triloba</i>	<i>Eragrostis spp.</i>
<i>Burkea africana</i>	<i>Euclea crispa</i>	<i>Conyza albida</i>	<i>Heteropogon contortus</i>
<i>Combretum molle</i>	<i>Gnidia kraussiana</i>	<i>Conyza welwitschii</i>	<i>Hyparrhenia filipendula</i>
<i>Cussonia arborea</i>	<i>Helichrysum kraussii</i>	<i>Euphorbia cyparissoides</i>	<i>Hyperthelia dissoluta</i>
<i>Ekebergia benguelensis</i>	<i>Indigofera arrecta</i>	<i>Haumaniastrum sericeum</i>	<i>Perotis patens</i>
<i>Faurea speciosa</i>	<i>Lippia javanica</i>	<i>Helichrysum species</i>	<i>Pogonarthria squarrosa</i>
<i>Ozoroa insignis</i>	<i>Lopholaena coriifolia</i>	<i>Oldenlandia corymbosa</i>	<i>Sporobolus pyramidalis</i>
<i>Strychnos spinosa</i>	<i>Maytenus heterophylla</i>	<i>Polygonum senegalense</i>	
<i>Vangueria infausta</i>	<i>Maytenus senegalensis</i>	<i>Ranunculus multifidus</i>	
<i>Piliostigma thonningii</i>	<i>Pavetta schumanniana</i>	<i>Senecio strictifolius</i>	
<i>Dichrostachys cinerea</i>	<i>Rhynchosia resinosa</i>	<i>Sesbania microphylla</i>	
<i>Antidesma venosum</i>	<i>Flueggea virosa</i>	<i>Solanum delagoense</i>	
<i>Azzeria quanzensis</i>	<i>Diospiros heterophylla</i>	<i>Tagetes minuta</i>	
<i>Trichillia emetica</i>	<i>Asparagus terrisfolias</i>	<i>Verbena bonariensis</i>	
<i>Psidium guajava*</i>		<i>Euphorbia tirucalli</i>	
<i>Bauhinia thonningii</i>			
<i>Gmelina arborea*</i>			

Trees	Shrubs	Forbs	Grasses
<i>Eucalyptus saligna</i> <i>Senna siamea</i>			

10.2.1.3 Forest vegetation community

Forest vegetation communities are found mostly surrounding ancestral graveyards (manda), which represent forest islands (Figure 7) of relatively unspoiled vegetation due to their sacred value and communities' beliefs (Mauambeta, et al., 2010), with smaller patches in cultivated dambo grassland. This habitat has a good representation of older and larger trees, typically with dense canopy cover, and includes indigenous trees such as *Rauvolfia caffra*, *Julbemardia globiflora*, *Kigellia africana*, *Parinari curatellifolia*, *Ochna puhra*, *Pericopsis angolensis*, *Toonia ciliata*, *Vangueriopsis lanciflora*, *Piliostigma thonningii* and *Cussonia arborea*. Due to the disturbance by livestock and the high density of the crown cover (60%) the shrub, grass and forb layers are poorly defined, with the shrub layer being particularly poorly defined. Shrub species recorded in this vegetation community include *Euclea crispa*, *Gnidia kraussiana*, *Helichrysum kraussii*, *Indigofera arrecta*, *Lantana camara* and *Leptactina benguelensis*. The grass layer is sparse and characterised by *Eragrostis* spp., *Heteropogon contortus*, *Hyperthelia dissoluta*, *Melinis repens*, *Pogonarthria squarrosa* and *Sporobolus pyramidalis*, while the forb layer is dominated by exotic species such as *Achyranthes aspera* and *Bidens pilosa*, in high densities, as well as species such as *Polygonum senegalense*, *Ranunculus multifidus*, *Senecio strictifolius*, *Sesbania microphylla* and *Solanum* spp. The full list of recorded species for this vegetation community is given in Table 19. Forest woodlands in the project area are restricted to isolated stands of vegetation with minimal connection with more expansive regional forests found within forest reserves in the region. Although these forests are significant from a cultural point of view and may hold some intrinsic importance to biodiversity in the region, there are a number of factors which reduce the ecological integrity of these forest woodlands. These factors are:

- The lack of connectivity of these forests, to one another and to more expansive forests in the region, thus movement between these resource patches is impeded to a very high degree;
- Edge effects on these forest patches, these habitat fragments exhibit especially pronounced edge effects that may extend throughout the habitat. As the edge effects increase, the impacts from surrounding areas increase, such as the infestation by invasive species; and
- Due to their proximity to settlements grazing pressure, on the grass, forb and even shrub layers of these habitat patches, is high.

Furthermore, these impacts also reduce the ecological integrity and conservation importance of this vegetation community, although many factors will affect the significance of the reduction. The ecological integrity of this vegetation community can be described as moderate, while the conservation importance of these vegetation communities can also be described as moderate. Note: The social aspects of these areas may be very significant due to the graveyards (manda) in these areas. The list of species recorded in the Forest vegetation community is given in Table 19.

Table 19: List of recorded species for the Forest vegetation community

Trees	Shrubs	Forbs	Grasses
<i>Brachystegia spiciformis</i>	<i>Blumea alata</i>	<i>Achyranthes aspera</i>	<i>Cynodon dactylon</i>
<i>Burkea africana</i>	<i>Eriosema engleranum</i>	<i>Amaranthus hybridus</i>	<i>Eragrostis</i> spp.
<i>Cussonia arborea</i>	<i>Euclea crispa</i>	<i>Bidens biternata</i>	<i>Heteropogon contortus</i>
<i>Julbemardia globiflora</i>	<i>Gnidia kraussiana</i>	<i>Bidens pilosa</i>	<i>Hyparrhenia filipendula</i>
<i>Kigellia africana</i>	<i>Helichrysum kraussii</i>	<i>Ceratotheca triloba</i>	<i>Hyperthelia dissoluta</i>
<i>Ochna pulchra</i>	<i>Indigofera arrecta</i>	<i>Conyza albida</i>	<i>Melinis repens</i>
<i>Parinari curatellifolia</i>	<i>Lantana camara</i>	<i>Conyza welwitschii</i>	<i>Perotis patens</i>
<i>Toonia ciliata</i> *	<i>Leptactina benguelensis</i>	<i>Datura stramonium</i>	<i>Pogonarthria squarrosa</i>
<i>Piliostigma thonningii</i>	<i>Lopholaena coriifolia</i>	<i>Euphorbia cyparissoides</i>	<i>Sporobolus pyramidalis</i>
<i>Dichrostachys cinerea</i>	<i>Maytenus senegalensis</i>	<i>Haumaniastrum sericeum</i>	
<i>Pericopsis angolensis</i>	<i>Pavetta schumanniana</i>	<i>Helichrysum species</i>	
<i>Terminalia sericea</i>		<i>Kniphofia linearifolia</i>	
<i>Vangueriopsis lanciflora</i>		<i>Oldenlandia corymbosa</i>	
<i>Pterocarpus angolensis</i>		<i>Oldenlandia herbacea</i>	

Trees	Shrubs	Forbs	Grasses
<i>Trichilia emetica</i> <i>Piliostigma thonningii</i> <i>Rauvolfia caffra</i> <i>Senna didymobotrya</i> <i>Agave (cf) sisalana</i>		<i>Polygonum senegalense</i> <i>Ranunculus multifidus</i> <i>Senecio strictifolius</i> , <i>Sesbania microphylla</i> <i>Solanum delagoense</i> <i>Tagetes minuta</i> <i>Verbena bonariensis</i> <i>Euphorbia tirucalli</i>	



Figure 7: An example of one of the natural forest fragments found within the study area

10.2.1.4 Cultivated lands

Cultivated land within the local study area consists of cultivated dambo and cropland, and covers approximately 89% of the local study area. Cultivated lands in the dambo areas are used to grow crops such as vegetables (especially a number of variety of squashes, *Cucurbita* sp.), tomatoes (*Solanum lycopersicum*), Irish potatoes (*Solanum tuberosum*), maize (*Zea mays*) and sugarcane (*Saccharum officinarum*). During the dry season some of these areas are irrigated from shallow groundwater wells or the river. The remainder of the cultivated land area is cultivated for the purposes of maize (*Zea mays*) and groundnuts (*Arachis villosulicarpa*). These areas are often devoid of trees or very sparsely populated by scattered trees. Tree species found in this vegetation community include exotic species of economic importance, for wood such as *Eucalyptus saligna* and *Gmelina arborea*, and fruit, such as *Mangifera indica* and *Psidium guajava*. Indigenous trees that occur in this vegetation community include *Kigellia africana*, *Piliostigma thonningii*, *Senna siamea* and *Dichrostachys cinerea*. The shrub layer in this vegetation is virtually non-existent although coppicing trees do occur in areas, while forb species in these areas are dominated by weed species such as *Bidens biternata*, *Bidens pilosa*, *Oldenlandia herbacea*, *Sesbania microphylla*, *Solanum delagoense*, *Tagetes minuta* and *Verbena bonariensis*. Due to the fact that these areas are heavily grazed when not cultivated, the grass layer is

relatively sparse and dominated by unpalatable and sub-climax species such as: *Aristida junciformis*, *Cynodon dactylon*, *Eragrostis spp.*, *Heteropogon contortus* and *Hyparrhenia filipendula*.

Due to the significant and widespread anthropogenic impacts already existent in this vegetation community, it can be described as transformed with a low ecological integrity and low conservation importance. The list of species recorded in the Cultivated lands vegetation community is given in Table 20.



Figure 8: *Kigellia africana* located within a cultivated land

Table 20 : List of recorded species for the Cultivated lands vegetation community

Trees	Shrubs	Forbs	Grasses	Cyperoids
<i>Kigellia africana</i>	<i>Gnidia kraussiana</i>	<i>Bidens biternata</i>	<i>Aristida junciformis</i>	<i>Cyperus esculentus</i>
<i>Piliostigma thonningii</i>	<i>Blumea alata</i>	<i>Bidens pilosa</i>	<i>Arundinella nepalensis</i>	<i>Cyperus tenax</i>
<i>Dichrostachys cinerea</i>	<i>Eriosema ellipticum</i>	<i>Ceratotheca triloba</i>	<i>Brachiaria deflexa</i>	<i>Kylinga erecta</i>
<i>Faldebia albida</i>	<i>Eriosema englerianum</i>	<i>Oldenlandia herbacea</i>	<i>Cynodon dactylon</i>	
<i>Bauhinia thonningii</i>	<i>Euclea crispa</i>	<i>Conyza welwitschii</i>	<i>Dactyloctenium aegyptium</i>	
<i>Senna didymobotrya</i>	<i>Helichrysum kraussii</i>	<i>Euphorbia cyparissoides</i>	<i>Eragrostis capensis</i>	
	<i>Indigofera arrecta</i>	<i>Sesbania microphylla</i>	<i>Eragrostis spp.</i>	
	<i>Lippia javanica</i>	<i>Helichrysum species</i>	<i>Heteropogon contortus</i>	
	<i>Lopholaena coriifolia</i>	<i>Kniphofia linearifolia</i>	<i>Hyparrhenia filipendula</i>	
	<i>Maytenus heterophylla</i>	<i>Solanum delagoense</i>	<i>Melinis repens</i>	
	<i>Maytenus senegalensis</i>	<i>Senecio strictifolius,</i>	<i>Paspalum urvillei</i>	
	<i>Pavetta schumanniana</i>	<i>Polygonum senegalense</i>	<i>Pogonarthria squarrosa</i>	
	<i>Rhynchosia resinosa</i>	<i>Ranunculus multifidus</i>	<i>Sporobolus pyramidalis</i>	

Trees	Shrubs	Forbs	Grasses	Cyperoids
		<i>Tagetes minuta</i> <i>Verbena bonariensis</i>	<i>Themeda triandra</i>	

10.2.1.5 Species Richness and Abundance

Species diversity in the regional and local study areas can be considered as moderate. Both species richness and abundance being considerably lower during the October 2017 and February 2018 surveys when compared with the April 2017 surveys, and species recorded was a subset of those recorded in the April 2017 surveys. During the surveys 114 species were recorded during the April 2017 survey, 81 during the October 2017 survey and 98 during the February 2018 survey (APPENDIX A). These differences can be attributed to the fact that the October 2017 surveys were conducted before the advent of the annual rains and the February 2017 many of the annual species were as yet unidentifiable.

One hundred and fourteen (114) plant species were recorded in the Project area representing 29 families. Tree species and shrub species accounted for 31 species (27%) and 18 species (16%) of the total number of species, respectively, while forbs accounted for 27 species (24%) of the total number of species recorded. Grass species accounted for 27% of the total number of species recorded with 31 species. With only 7 species (6%) of the total number of species cyperoid plants made up the lowest percentage of the total number of species. A comprehensive species list (including the surveys in which they were recorded) is included in APPENDIX A, while the number of species recorded in each of the vegetation communities is given in Table 21.

Table 21: Number of species recorded per vegetation community

Vegetation Community	Number of species recorded	% of total number of species
Dambo Grassland Vegetation Community	63	55%
Mixed Riparian Vegetation Community	63	55%
Forest Woodland Vegetation Community	61	54%
Cultivated Lands.	51	45%
Total number of species	114	100%

10.2.2 Species of Conservation Importance

The plant species of conservation importance that could potentially occur in the area are given in Table 22. One species is currently listed as Least concern, two species are listed as Near threatened, two species are listed as Vulnerable while one species is listed as Critically endangered. Four species, namely *Burkea africana*, *Azelia quanzensis*, *Pterocarpus angolensis* and *Terminalia sericea* were recorded in the riparian forest and the forest fragments.

Table 22: Species of conservation importance that may occur in the study area

Scientific Name	Common Name	Growth Form	IUCN Status	Malawi National Status	Probability of occurrence
<i>Aerangis distincta</i>	Distinct Aerangis	Arboreal orchid	Not Listed	Protected	Low
<i>Azelia quanzensis</i>	Mahogany Bean	Tree	Not Listed	Protected	Recorded
<i>Aloe bulbicaulis</i>		Succulent	Not Listed	Protected	Low
<i>Aloe cannellii</i>		Succulent	Not Listed	Protected	Low
<i>Aloe chabaudii</i> var. <i>chabaudii</i>	Grey Aloe	Succulent	Not Listed	Protected	Low
<i>Aloe cryptopoda</i>		Succulent	Not Listed	Protected	Low
<i>Aloe myriacantha</i>		Succulent	Not Listed	Protected	Low
<i>Aloe swynnertonii</i>		Succulent	Not Listed	Protected	Low
<i>Borassus aethiopum</i>	Deleb Palm	Palm	Least Concern	Protected	Low
<i>Breonadia microcephala</i> (<i>Adina microcephala</i>)	Redwood	Tree	Not Listed	Protected	High
<i>Bridelia micrantha</i>	Coast Gold leaf	Tree	Not Listed	Protected	High
<i>Burkea africana</i>	Ash	Tree	Not Listed	Protected	Recorded

Scientific Name	Common Name	Growth Form	IUCN Status	Malawi National Status	Probability of occurrence
<i>Colophospermum mopane</i>	Mopane	Tree	Not Listed	Protected	Low
<i>Cordia africana</i>	Wild Mango	Tree	Not Listed	Protected	High
<i>Dalbergia melanoxylon</i>	African Blackwood	Tree	Near Threatened	Protected	High
<i>Humularia descampsii</i>		Tree	Not Listed	Protected	Low
<i>Hyphaene crinata</i>	Doum Palm	Palm	Not Listed	Protected	Low
<i>Khaya anthotheca</i>	Mahogany	Tree	Vulnerable	Protected	High
<i>Milicia excelsa</i>	Iroko	Tree	Not Listed	Protected	Moderate
<i>Morinda asteroscepa</i>		Forb	Vulnerable	Protected	Low
<i>Morus mesozygia</i>	African mulberry	Tree	Critically Endangered	Protected	Low
<i>Prunus africana</i>	African cherry	Tree	Vulnerable	Protected	Moderate
<i>Pterocarpus angolensis</i>	African Teak	Tree	Near Threatened	Protected	Recorded
<i>Rytigynia adenodonta</i>		Forb	Not Listed	Protected	Low
<i>Terminalia sericea</i>	Silver cluster leaf	Tree	Not Listed	Protected	Recorded

The probability of occurrence of the species of conservation importance are shown graphically in Figure 9. Fourteen species have a low probability of occurrence, while two species have a moderate and five species a high probability of occurrence respectively. As mentioned above one species of conservation importance was recorded.

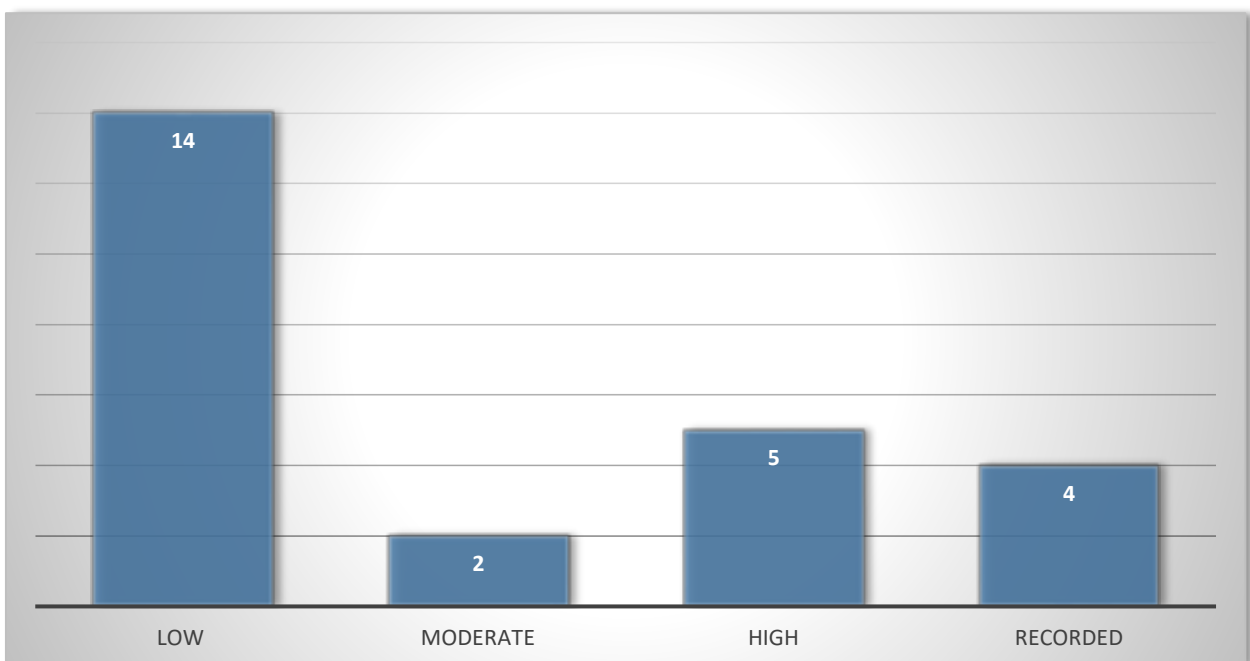


Figure 9: A graphic representation of the probability of occurrence of species of conservation importance

10.3 Fauna Assessment

10.3.1 Recorded Faunal Species

10.3.1.1 Herpetofauna

There are 140 species of reptiles recorded in Malawi, represented in 22 families. Species likely to occur in the area as well as Malawian species of conservation importance were determined, using relevant literature, and these species are given in APPENDIX B. As expected species diversity for the area was relatively low, with only 12 species being recorded during the three surveys (Table 23). There are numerous explanations for the low species diversity, and these can be split into explanations for temporary reduction in species richness and permanent reduction in species richness. These explanations are summarised as follows:

Temporary reduction in species richness:

- Weather – with colder winters and more moderate days, reptile species richness declines due to lower levels of activity in exothermic species such as reptiles; and
- Higher rainfall – during times of higher rainfall reptile prey species (small mammals birds insects and other species are often more dispersed thus dispersing the reptile predators often making recording of these species more difficult due to reduced density in highly favourable areas.

Permanent reduction in species richness:

- Habitat destruction – much of this area has been denuded of natural habitat thus greatly reducing the number of species, and abundance of individuals of the species, historically occurring in the area;
- Persecution – reptiles, particularly snakes, are one of the most severely persecuted taxa in the world and are usually killed due to fear or superstition;
- Food – many reptile species, particularly terrapins and tortoises, are utilised as a food source and in areas with high population density, such as the study area, these species and the abundances of individuals are greatly reduced.

Table 23: Reptile species recorded during the April and October 2017 field surveys.

FAMILY	BIOLOGICAL NAME	COMMON NAME	IUCN STATUS	April 2017	October 2017	February 2018
AGAMIDAE	<i>Agama mossambica</i>	Mozambique Agama	Vulnerable	Recorded	Recorded	Recorded
COLUBRIDAE	<i>Dasypeltis scabra</i>	Egg-eating Snake	Not Listed	Recorded	Not Recorded	Not Recorded
COLUBRIDAE	<i>Philothamnus semivariegatus</i>	Spotted Bush Snake	Not Listed	Recorded	Not Recorded	Recorded
CROCODYLIDAE	<i>Crocodylus niloticus</i>	Nile Crocodile	Not Listed	Recorded	Not Recorded	Recorded
GEKKONIDAE	<i>Lygodactylus capensis</i>	Cape Dwarf Gecko	Not Listed	Recorded	Not Recorded	Recorded
LAMPROPHIIDAE	<i>Duberria lutrix</i>	Common Slug-eater	Not Listed	Recorded	Not Recorded	Not Recorded
	<i>Amblyodipsas polylepis</i>	Common Purple-glossed Snake	Not Listed	Recorded	Recorded	Not Recorded
	<i>Lycophidion capense</i>	Cape Wolf Snake	Not Listed	Recorded	Recorded	Recorded
SCINCIDAE	<i>Trachylepis margaritifera</i>	Rainbow skink	Not Listed	Recorded	Recorded	Recorded
	<i>Trachylepis varia</i>	Variable Skink	Not Listed	Recorded	Recorded	Recorded
VIPERIDAE	<i>Causus rhombeatus</i>	Rhombic Night Adder	Not Listed	Recorded	Not Recorded	Recorded
	<i>Bitis arietans</i>	Puff Adder	Not Listed	Recorded	Recorded	Recorded

Species diversity showed a considerable decline during the October 2017 surveys, probably due to very dry conditions prevailing throughout the study area, while the slightly wetter conditions during the February 2018 survey showed a slight increase in species diversity. None of the species recorded are restricted in number or distribution and only one of the species is listed on the IUCN Red Data list. The species of conservation importance are further discussed in section 10.3.2.

10.3.1.2 Amphibia

Anura (frogs and toads) are by far the largest group of amphibians (3,500 species) worldwide, and occupy a vast range of habitats. There are 91 species of anurans recorded in Malawi, these species are given in APPENDIX C. Only five species of anurans were recorded during the April 2017, October 2017 and February 2018 field surveys, and these are listed in Table 24. This is considerably lower than the expected number of species, although a number of factors influenced the number of species recorded in the study area, namely:

- No night surveys were conducted, the majority of frog species in a water body are identified through acoustic surveys of waterbodies at night;
- Amphibians are particularly threatened due to habitat destruction. As wetlands are drained and transformed for agriculture their breeding sites disappear and those left are often affected by pollution or other anthropogenic impacts;

- With other prey species such as small mammals being reduced in number, through anthropogenic impacts, predators (particularly snakes and birds) will increasingly target anurans as a food source; and
- The removal of insects and other prey species from the food chain affects amphibians and very few amphibian species are protected.

Table 24: Amphibian species recorded during the April and October 2017 field surveys.

FAMILY	BIOLOGICAL NAME	COMMON NAME	IUCN STATUS	April 2017	October 2017	February 2018
BREVICIPITIDAE	<i>Breviceps mossambicus</i>	Mozambique Rain Frog	Not Listed	Recorded	Not recorded	Recorded
BUFONIDAE	<i>Amietophrynus gutturalis</i>	African Common Toad	Not Listed	Recorded	Recorded	Recorded
	<i>Amietophrynus garmani</i>	Garman's Toad	Not Listed	Recorded	Not recorded	Not recorded
HYPEROLIIDAE	<i>Hyperolius pusillus</i>	Water Lily Reed Frog	Not Listed	Recorded	Not recorded	Not recorded
HYPEROLIIDAE	<i>Kassina senegalensis</i>	Senegal Kassina	Not Listed	Recorded	Recorded	Recorded

Due to the dry prevailing conditions during the October 2017 surveys the amphibian species diversity was further reduced during this period, but did recover to some extent during the February 2018 surveys. It must be noted that the February 2018 surveys were truncated and mainly focused on two further riparian sites than those conducted in the previous two surveys and therefore the terrestrial data from that survey can be considered, to some extent, anecdotal. None of the species recorded are classified as being restricted in abundance or distribution, although Malawi does host a number of endemic species, and none of the species recorded are listed under the IUCN Red Data list. Amphibian species of conservation importance are further discussed in section 10.3.2.

10.3.1.3 Avifauna

About 646 species from 78 families, comprising 456 residents, 94 intra-African migrants of regular occurrence (most of which probably breed in Malawi), 77 regular and 12 vagrant Palaearctic species have been documented in Malawi. Over a third of all bird species in Malawi are considered to be uncommon or rare and of at least limited conservation concern. Ninety-four birds in Malawi are restricted range species, found in only one or a few biomes, but there are no true national endemic bird species. Only fifty-seven (57) species of avifauna were recorded during the April 2017, October 2017 and February 2018 field surveys, and these species are listed in Table 25. This is far lower than the expected number of species for this area. The reduction in number of species recorded in the area, during the April and October 2017 study can be attributed to a number of factors namely:

- Destruction of habitat;
- Overutilisation of avifauna as a food source;
- The survey was conducted late in the wet season and some migratory bird species may have begun their migrations; and
- Reduction of prey species (particular prey species for larger raptors, which compete with humans in rural Africa).

Table 25: Avifauna species recorded during the April and October 2017 field surveys

BIOLOGICAL NAME	COMMON NAME	STATUS	April 2017	October 2017	February 2018
<i>Acrocephalus schoenobaenus</i>	Sedge Warbler	Not Listed	Recorded	Not recorded	Recorded
<i>Mirafra rufocinnamomea</i>	Flappet Lark	Not Listed	Recorded	Recorded	Recorded
<i>Halcyon senegalensis</i>	Woodland Kingfisher	Not Listed	Recorded	Recorded	Recorded
<i>Corythornis cristatus</i>	Malachite Kingfisher	Not Listed	Recorded	Recorded	Recorded
<i>Dendrocygna bicolor</i>	Fulvous Whistling-Duck	Not Listed	Recorded	Not recorded	Recorded
<i>Alopochen aegyptiaca</i>	Egyptian Goose	Not Listed	Recorded	Recorded	Not recorded
<i>Apus affinis</i>	Little Swift	Not Listed	Recorded	Not recorded	Recorded
<i>Ardea cinerea</i>	Grey Heron	Not Listed	Recorded	Recorded	Recorded
<i>Burhinus capensis</i>	Spotted Thick-knee	Not Listed	Recorded	Recorded	Recorded

BIOLOGICAL NAME	COMMON NAME	STATUS	April 2017	October 2017	February 2018
<i>Vanellus coronatus</i>	Crowned Lapwing	Not Listed	Recorded	Recorded	Recorded
<i>Anastomus lamelligerus</i>	African Openbill	Not Listed	Recorded	Not recorded	Not recorded
<i>Cisticola lais</i>	Wailing Cisticola	Not Listed	Recorded	Recorded	Recorded
<i>Cisticola aberrans</i>	Rock-loving Cisticola	Not Listed	Recorded	Recorded	
<i>Cisticola natalensis</i>	Croaking Cisticola	Not Listed	Recorded	Recorded	Recorded
<i>Apalis thoracica</i>	Bar-throated Apalis	Not Listed	Recorded	Not recorded	Recorded
<i>Cisticola fulvicapilla</i>	Piping Cisticola	Not Listed	Recorded	Recorded	Not recorded
<i>Urocolius indicus</i>	Red-faced Mousebird	Not Listed	Recorded	Recorded	Recorded
<i>Streptopelia capicola</i>	Ring-necked Dove	Not Listed	Recorded	Recorded	Not recorded
<i>Streptopelia semitorquata</i>	Red-eyed Dove	Not Listed	Recorded	Recorded	Recorded
<i>Coracias caudatus</i>	Lilac-breasted Roller	Not Listed	Recorded	Recorded	Recorded
<i>Centropus senegalensis</i>	Senegal Coucal	Not Listed	Recorded	Not recorded	Recorded
<i>Chrysococcyx cupreus</i>	African Emerald Cuckoo	Not Listed	Recorded	Not recorded	Not recorded
<i>Dicrurus adsimilis</i>	Fork-tailed Drongo	Not Listed	Recorded	Recorded	Recorded
<i>Emberiza tahapisi</i>	Cinnamon-breasted Bunting	Not Listed	Recorded	Recorded	Recorded
<i>Estrilda astrild</i>	Common Waxbill	Not Listed	Recorded	Recorded	Recorded
<i>Uraeginthus angolensis</i>	Southern Cordonbleu	Not Listed	Recorded	Not recorded	Recorded
<i>Serinus mennelli</i>	Black-eared Seedeater	Not Listed	Recorded	Recorded	Recorded
<i>Hirundo rustica</i>	Barn Swallow	Not Listed	Recorded	Not recorded	Recorded
<i>Delichon urbicum</i>	Common House-Martin	Not Listed	Recorded	Not recorded	Not recorded
<i>Lanius collurio</i>	Red-backed Shrike	Not Listed	Recorded	Recorded	Recorded
<i>Lybius torquatus</i>	Black-collared Barbet	Not Listed	Recorded	Recorded	Recorded
<i>Pogoniulus chrysoconus</i>	Yellow-fronted Tinkerbird	Not Listed	Recorded	Recorded	Recorded
<i>Motacilla aguimp</i>	African Pied Wagtail	Not Listed	Recorded	Recorded	Recorded
<i>Nectarinia famosa</i>	Malachite Sunbird	Not Listed	Recorded	Recorded	
<i>Chaomitra senegalensis</i>	Scarlet-chested Sunbird	Not Listed	Recorded	Recorded	Recorded
<i>Numida meleagris</i>	Helmeted Guineafowl	Not Listed	Recorded	Recorded	Recorded
<i>Oriolus auratus</i>	African Golden Oriole	Not Listed	Recorded	Not recorded	Not recorded
<i>Passer griseus</i>	Northern Grey-headed Sparrow	Not Listed	Recorded	Recorded	Recorded
<i>Petronia supercilialis</i>	Yellow-throated Petronia	Not Listed	Recorded	Not recorded	Recorded
<i>Coturnix delegorguei</i>	Harlequin Quail	Not Listed	Recorded	Not recorded	Recorded
<i>Campethera abingoni</i>	Golden-tailed Woodpecker	Not Listed	Recorded	Recorded	Recorded
<i>Batis molitor</i>	Chinspot Batis	Not Listed	Recorded	Recorded	Not recorded
<i>Ploceus ocularis</i>	Spectacled Weaver	Not Listed	Recorded	Not recorded	Not recorded
<i>Ploceus cucullatus</i>	Village Weaver	Not Listed	Recorded	Recorded	Recorded
<i>Euplectes orix</i>	Southern Red Bishop	Not Listed	Recorded	Recorded	Recorded
<i>Euplectes albonotatus</i>	White-winged Widowbird	Not Listed	Recorded	Not recorded	Recorded
<i>Pycnonotus barbatus</i>	Common Bulbul	Not Listed	Recorded	Recorded	Recorded
<i>Gallinula chloropus</i>	Eurasian Moorhen	Not Listed	Recorded	Recorded	Not recorded

BIOLOGICAL NAME	COMMON NAME	STATUS	April 2017	October 2017	February 2018
<i>Crecopsis egregia</i>	African Crake	Not Listed	Recorded	Not recorded	Recorded
<i>Lamprotornis chalybaeus</i>	Greater Blue-eared Starling	Not Listed	Recorded	Recorded	Recorded
<i>Cinnyricinclus leucogaster</i>	Violet-backed Starling	Not Listed	Recorded	Recorded	Recorded
<i>Creatophora cinerea</i>	Wattled Starling	Not Listed	Recorded	Not recorded	Recorded
<i>Bostrychia hagedash</i>	Hadada Ibis	Not Listed	Recorded	Recorded	Recorded
<i>Passer domesticus</i>	House Sparrow	Exotic	Not recorded	Not recorded	Recorded
<i>Turdus libonyana</i>	Kurrichane Thrush	Not Listed	Recorded	Not recorded	Not recorded
<i>Upupa epops africana</i>	African Hoopoe	Not Listed	Recorded	Recorded	Recorded
<i>Zosterops senegalensis</i>	African Yellow White-eye	Not Listed	Recorded	Recorded	Recorded

None of the species recorded during the surveys are restricted in range or abundance, and none of the species recorded are currently listed on the IUCN Red Data list. A large number of species in Malawi are, however, listed on the IUCN Red Data lists, and a number of them are likely to occur in this area. The species of conservation importance further discussed in section 10.3.2. Species diversity was considerably lower during the October 2017 surveys, this was likely due to the dry conditions prevailing in the study area during this survey.

10.3.1.4 Mammalia

About 195 mammal species from 37 families have been recorded in Malawi. Only twenty eight (28) species of mammalia were recorded during the April and October 2017 field surveys, and these species are listed in Table 26. This is far lower than the expected number of species for this area. The reduction in number of species recorded in the area, during the April and October 2017 studies can be attributed to a number of factors namely:

- Destruction of habitat;
- Introduction of domestic animals which outcompete and predate indigenous species;
- Overutilisation of mammal species as a food source; and
- Reduction of prey species (particular prey species for larger mammalian predators, which would compete with humans in rural Africa).

Table 26: Mammal species recorded during the April and October 2017 field surveys

FAMILY	BIOLOGICAL NAME	COMMON NAME	IUCN STATUS	April 2017	October 2017	February 2018
ORYCTEROPODIDAE	<i>Orycteropus afer</i>	Aardvark	Not Listed	Recorded	Recorded	Recorded
GALAGIDAE	<i>Galago moholi</i>	Mohol bushbaby	Not Listed	Recorded	Not recorded	Not recorded
CERCOPIITHECIDAE	<i>Chlorocebus pygerythrus</i>	Vervet monkey	Not Listed	Recorded	Not recorded	Not recorded
HYSTRICIDAE	<i>Hystrix africaeaustralis</i>	Cape porcupine	Not Listed	Recorded	Not recorded	Recorded
THRYONOMYIDAE	<i>Thryonomys gregorianus</i>	Lesser cane rat	Not Listed	Recorded	Not recorded	Recorded
SCIURIDAE	<i>Paraxerus flavovittis</i>	Striped bush squirrel	Not Listed	Recorded	Recorded	Not recorded
NESOMYIDAE	<i>Dendromus melanotis</i>	Gray climbing mouse	Not Listed	Recorded	Not recorded	Not recorded
	<i>Dendromus mesomelas</i>	Brant's climbing mouse	Not Listed	Recorded	Not recorded	Recorded
	<i>Steatomys pratensis</i>	Fat mouse	Not Listed	Recorded	Recorded	Not recorded
	<i>Cricetomys gambianus</i>	Gambian pouched rat	Not Listed	Recorded	Recorded	Not recorded
	<i>Saccostomus campestris</i>	South African pouched mouse	Not Listed	Recorded	Not recorded	Recorded
MURIDAE	<i>Acomys spinosissimus</i>	Spiny mouse	Not Listed	Recorded	Recorded	Not recorded
	<i>Otomys angoniensis</i>	Angoni vlei rat	Not Listed	Recorded	Recorded	Not recorded

FAMILY	BIOLOGICAL NAME	COMMON NAME	IUCN STATUS	April 2017	October 2017	February 2018
	<i>Tatera leucogaster</i>	Bushveld gerbil	Not Listed	Recorded	Recorded	Not recorded
	<i>Aethomys kaiseri</i>	Kaiser's rock rat	Not Listed	Recorded	Not recorded	Not recorded
	<i>Dasymys incomtus</i>	African marsh rat	Not Listed	Not recorded	Recorded	Recorded
	<i>Grammomys dolichurus</i>	Woodland thicket rat	Not Listed	Recorded	Not recorded	Not recorded
	<i>Lemniscomys rosalia</i>	Single-striped grass mouse	Not Listed	Recorded	Recorded	Recorded
	<i>Mastomys natalensis</i>	Natal multimammate mouse	Not Listed	Recorded	Recorded	Recorded
	<i>Mus minutoides</i>	African pygmy mouse	Not Listed	Not recorded	Not recorded	Not recorded
	<i>Pelomys fallax</i>	Creek groove-toothed swamp rat	Not Listed	Recorded	Recorded	Not recorded
	<i>Rhabdomys pumilio</i>	Four-striped grass mouse	Not Listed	Recorded	Recorded	Recorded
SORICIDAE	<i>Crocidura cyanea</i>	Reddish-gray musk shrew	Not Listed	Recorded	Recorded	Not recorded
	<i>Crocidura hirta</i>	Lesser red musk shrew	Not Listed	Recorded	Not recorded	Not recorded
	<i>Sylvisorex megalura</i>	Climbing shrew	Not Listed	Recorded	Recorded	Not recorded
HERPESTIDAE	<i>Galerella sanguinea</i>	Slender mongoose	Not Listed	Recorded	Recorded	Not recorded
	<i>Helogale parvula</i>	Common dwarf mongoose	Not Listed	Recorded	Recorded	Not recorded
MUSTELIDAE	<i>Ictonyx striatus</i>	Striped polecat	Not Listed	Recorded	Not recorded	Not recorded

Of the mammal species recorded in Malawi, 16 are listed in the IUCN Red Data List. Most of these animals are found in protected areas and their long-term survival outside protected areas could be problematic due to human activities. A number of these species may however occur outside of protected areas and possibly in the study area. These species are further discussed in section 10.3.2.

10.3.2 Fauna Species of conservation importance

A total of sixty seven (67) animal species (Table 27), currently considered as species of conservation importance, thus either endemic to Malawi or listed as Red Data List species according to the IUCN Red List (IUCN, 2016), occur in Malawi. Of these species:

- Reptile species constitute 10 of the species of concern (Table 27), of which two are listed as just Red Data list species, six are listed as endemics and two are listed as both Red Data list species and endemic species;
- Anuran species (frogs and toads) constitute nine of the species of concern (Table 27), of which seven are listed as just Red Data list species, two are listed as endemics and three are listed as both Red Data list species and endemic species;
- Avifauna species constitute 32 of the species of concern (Table 27), of which 32 are listed as just Red Data list species, none are listed as endemics and none are listed as both Red Data list species and endemic species; and
- Mammal species constitute 16 of the species of concern (Table 27), of which 15 are listed as just Red Data list species, none are listed as just endemics and one is listed as both Red Data list species and endemic species.

Of the ten reptile species of concern:

- One is listed as critically endangered, 3 are listed as endangered and 8 are listed as endemic; and
- Nine species have a low probability of occurrence in the study area and one has a high probability of occurrence.

Of the nine amphibian (anuran) species of concern:

- Three are listed as vulnerable, 1 is listed as Near threatened, 3 are listed as Data deficient and 5 are listed as endemic; and
- Eight species have a low probability of occurrence in the study area and one has a high probability of occurrence.

Of the thirty two avian species of concern:



- Three are listed as critically endangered, 7 are listed as endangered, 6 are listed as vulnerable, 15 are listed as Near threatened and 1 is listed as Data deficient. No avian species are listed as endemic; and
- Twelve species have a low probability of occurrence in the study area, 2 have a moderate probability of occurrence and 18 have a high probability of occurrence.

Of the sixteen mammal species of concern:

- One is listed as critically endangered, 2 are listed as endangered, 4 are listed as vulnerable, 4 are listed as Near threatened and 5 are listed as Data deficient. One species is listed as endemic; and
- Eleven species have a low probability of occurrence in the study area, 2 have a moderate probability of occurrence and 3 have a high probability of occurrence.



Table 27: Species of conservation importance known to occur in Malawi

FAMILY	BIOLOGICAL NAME	COMMON NAME	IUCN STATUS	ENDEMISM	DISTRIBUTION/HABITAT	PROBABILITY OF OCCURRENCE
CHAMAELEONIDAE	<i>Nadzikambia mlanjensis</i>	Mlanje Mountain Chameleon	EN	Malawi Endemic	This species is endemic to Mount Mulanje, Malawi and is found in the remaining evergreen forest fragments on moist southern and eastern facing slopes at mid altitude, and in the forest at high altitude on the Lichenya plateau. A population may exist on the immediately adjacent small inselberg Mt. Mchese (< 5km to the north of Mulanje), but this has not been confirmed. It is also suggested that neighbouring large Mozambican inselbergs might contain additional populations of <i>N. mlanjensis</i> , but most of these mountains have not been surveyed.	Low
	<i>Rhampholeon chapmanorum</i>	Malawi Hill Pygmy Chameleon	CR	Malawi Endemic	This species is only found at Malawi Hill (more specifically, in the Natundu Hills range), near Nsanje, Malawi. It was described from a tiny remnant of lowland seasonal rainforest on the upper south east facing slope within the Matandwe Forest Reserve. The indigenous forest of the Malawi Hill has essentially been destroyed due to human encroachment.	Low
CHAMAELEONIDAE	<i>Rhampholeon platyceps</i>	Mount Mulanje Pygmy Chameleon	EN		<i>Rhampholeon platyceps</i> is endemic to the mid and high altitude evergreen forest fragments of Mount Mulanje and the adjacent Mchese Mountain, Malawi (and essentially part of the same massif). It is found only on the moist southern and eastern-facing slopes where forest occurs in remnant fragmented patches, totalling ca. 61 km ² .	Low
CORDYLIDAE	<i>Platysaurus mitchelli</i>	Mitchell's Flat Lizard		Malawi Endemic	Not known to occur in the area	Low
	<i>Cordylus nyikae</i>	Nyika Girdled Lizard		Malawi Endemic	Not known to occur in the area	Low
GEKKONIDAE	<i>Lygodactylus rex</i>	King Dwarf Gecko		Malawi Endemic	Not known to occur in the area	Low
SCINCIDAE	<i>Eumecia johnstoni</i>	Nyika Serpentineform Skink		Malawi Endemic	Not known to occur in the area	Low
	<i>Trachylepis hildae</i>	Nyika Three-striped Skink		Malawi Endemic	Not known to occur in the area	Low
	<i>Trachylepis mlanjensis</i>	Mlanje Skink		Malawi Endemic	Not known to occur in the area	Low

FAMILY	BIOLOGICAL NAME	COMMON NAME	IUCN STATUS	ENDEMISM	DISTRIBUTION/HABITAT	PROBABILITY OF OCCURRENCE
TRIONYCHIDAE	<i>Cycloderma frenatum</i>	Zambezi Flapshell Turtle	EN		<i>Cycloderma frenatum</i> inhabits rivers and lakes in eastern Africa, from the Rufiji River basin in Tanzania in the north through Lake Malawi and the Rufiji, Rovuma, and Lower Zambezi river basins, extending south to the lower Save (Sabi) River of southeastern Zimbabwe and central Mozambique (Iverson, 1992; Boycott & Bourquin, 2000; Branch, 2008; Gramentz, 2005). It has also been recorded in Zambia.	High
ARTHROLEPTIDAE	<i>Arthroleptis franciei</i>	Ruo River Screeching Frog	VU	Malawi Endemic	This species is known from three threat-defined locations: Mount Mulanje in southern Malawi and Mounts Namuli and Mabu in northern Mozambique, where it occurs as low as 700 m asl in the Ruo Basin and up to the plateau up to at least 2,500 m asl. As the region is poorly surveyed, it is unknown whether this species could occur more widely. Records from the Zomba Mountains (north of Mulanje) still need to be confirmed as the region requires extensive surveying. Records from Mounts Namuli and Mabu in northern Mozambique may not actually belong to this species, but are retained until formally described as a separate species. The extent of occurrence (EOO) is 7,959 km ² , excluding the Zomba records.	Low
BUFONIDAE	<i>Mertensophryne nyikae</i>	Nyika Dwarf Toad	NT	Malawi Endemic	This species is likely to be endemic to the Nyika Plateau in northern Malawi and northeastern Zambia. It is a high-altitude species known from 2,500 m asl, although its precise altitudinal range is not known. Its approximate EOO is 1,431 km ² .	Low
HYPEROLIIDAE	<i>Hyperolius friedemanni</i>	Friedmans Long Reed Frog	DD	Malawi Endemic	This species is only known from two sites - Karonga and Monkey Bay - on the shores of Lake Malawi. However, the limits of its range and that of its congeners remains highly uncertain. As such, its rangemap has been limited to the lakeside sites where it has been recorded. Further research into this species' relationship with others in the <i>Hyperolius nasutus</i> group is likely to amend its distribution, with possible expansion along the lakeshore and further west into Malawi.	Low

FAMILY	BIOLOGICAL NAME	COMMON NAME	IUCN STATUS	ENDEMISM	DISTRIBUTION/HABITAT	PROBABILITY OF OCCURRENCE
HYPEROLIIDAE	<i>Hyperolius inyangae</i>	Nyanga Long Reed Frog	VU		This species is known from the Eastern Highlands of Zimbabwe where it was collected in the Nyanga National Park, and also from Kaningina Forest Reserve in northern Malawi. There have been no records of the species in the intervening areas or in Mozambique thus far and the limits of its distribution remain largely uncertain. Its EOO is 16,195 km ² .	Low
HYPEROLIIDAE	<i>Hyperolius spinigularis</i>	Spiny Reed Frog	VU		This species is restricted to the Mulanje Massif (but not recorded on Mount Mulanje) in southern Malawi and the Namuli Massif in Mozambique. It could occur in other isolated massifs in Mozambique, but the region is poorly surveyed (S. Loader pers. comm. December 2014). Its elevational range is 690-1,250 m asl and its EOO is 5,488 km ² .	Low
PHRYNOBATRACHIDAE	<i>Phrynobatrachus stewartae</i>	Stewart's River Frog	DD		This very poorly known species is so far known only from three localities: Rumpi, in northern Malawi; Mulenge Forest, in south-central Tanzania, and Katavi National Park, in western Tanzania. It presumably occurs in intervening locations, and perhaps more widely. Its altitudinal range is unclear, though it has been reported from a site at about 800 m asl and probably occurs above 1,200 m asl.	Low
PHRYNOBATRACHIDAE	<i>Phrynobatrachus ukingensis</i>	Ukinga River Frog	DD		This species occurs in the Ukinga and Rungwe Mountains of southern Tanzania, in the Misuku Mountains and at Nchenachena in northern Malawi, and at Maroka (in the highlands southwest of Zomba) in southern Malawi. It has recently been found much further to the north in the Uluguru Mountains of eastern Tanzania. It presumably occurs more widely, in particular between the currently known sites. It is a montane species, probably occurring above 1,000 m asl, and perhaps ranging to over 2,000 m asl in places.	Low
PTYCHADENIDAE	<i>Ptychadena broadleyi</i>	Broadley's Ridged Frog		Malawi Endemic	Not known to occur in the area	Low
PYXICEPHALIDAE	<i>Amietia johnstoni</i>	Johnston's river frog		Malawi Endemic	Not known to occur in the area	Low
ACCIPITRIDAE	<i>Aquila nipalensis</i>	Steppe Eagle	EN		Migratory - Known from the area	High

FAMILY	BIOLOGICAL NAME	COMMON NAME	IUCN STATUS	ENDEMISM	DISTRIBUTION/HABITAT	PROBABILITY OF OCCURRENCE
	<i>Circus macrourus</i>	Pallid Harrier	NT		Migrate to the Afrotropics (Sudan, South Sudan, Eritrea, Djibouti, Ethiopia, Somalia, Kenya, Uganda, Rwanda, Burundi, Tanzania, Malawi, Zambia, Zimbabwe, Mozambique, Chad, Niger, Mali, Senegal, Gambia, Sierra Leone, Guinea-Bissau, Liberia, Ivory Coast, Ghana, Togo, Benin, Burkina Faso, Nigeria, Cameroon, Central African Republic, Democratic Republic of Congo, Angola, Namibia, Botswana, Swaziland and South Africa)	High
	<i>Buteo oreophilus</i>	Mountain Buzzard	NT		<i>Buteo oreophilus</i> is distributed from Ethiopia, west through Kenya, Uganda, South Sudan and Rwanda to eastern Democratic Republic of Congo, and south to Tanzania, Burundi and Malawi.	Low
	<i>Terathopius ecaudatus</i>	Bateleur	NT		Known to occur in the area	High
	<i>Stephanoaetus coronatus</i>	Crowned Eagle	NT		Known to occur in the area	High
	<i>Polemaetus bellicosus</i>	Martial Eagle	VU		Known to occur in the area	High
	<i>Gyps africanus</i>	White-backed Vulture	CR		This species is the most widespread and common vulture in Africa, although it is now undergoing rapid declines.	High
	<i>Trigonoceps occipitalis</i>	White-headed Vulture	CR		Locally extinct	Low
	<i>Torgos tracheliotos</i>	Lappet-faced Vulture	EN		Locally extinct	Low
	<i>Necrosyrtes monachus</i>	Hooded Vulture	CR		This species is widespread in sub-Saharan Africa; from Senegal (with higher densities in the west, for at least the southern part of the country, with possibly 2,350-2,700 pairs in the Ziguinchor Département) and southern Mauritania east through southern Niger and Chad, to southern Sudan, South Sudan, Ethiopia and western Somalia, southwards to northern Namibia and Botswana, and through Zimbabwe to southern Mozambique and northeastern South Africa	High
ACROCEPHALIDAE	<i>Acrocephalus griseldis</i>	Basra Reed Warbler	EN		The highest populations of breeding individuals between 2005 and 2011 were found in Central Marshes, West Hammar Marshes, Hawizeh and Dalmaj, with these populations amounting to c.90% of the total breeding population (Nature Iraq in press). It winters in Sudan, South Sudan, Ethiopia, south Somalia, southeast Kenya (Urban et al. 1997), east Tanzania, south Malawi (few records) and Mozambique.	LOW

FAMILY	BIOLOGICAL NAME	COMMON NAME	IUCN STATUS	ENDEMISM	DISTRIBUTION/HABITAT	PROBABILITY OF OCCURRENCE
ARDEIDAE	<i>Ardeola idae</i>	Madagascar Pond-Heron	EN		It has a large non-breeding range in Central and East Africa including the Comoro Islands, Mozambique, Zimbabwe, Zambia, Malawi, Tanzania, Kenya, Uganda, Burundi, Rwanda and Democratic Republic of Congo. It is present almost throughout Madagascar, but is always uncommon	High
BUCORVIDAE	<i>Bucorvus leadbeateri</i>	Southern Ground-Hornbill	VU		Known to occur in the area	High
CISTICOLIDAE	<i>Apalis chariessa</i>	White-winged Apalis	VU		<i>Apalis chariessa</i> has a disjunct range in Kenya (possibly extinct), Tanzania, Malawi and Mozambique. In Kenya, the nominate subspecies is known only from the lower Tana River, but has not been seen since 1961	Low
CISTICOLIDAE	<i>Apalis flavigularis</i>	Yellow-throated Apalis	EN		<i>Apalis flavigularis</i> is restricted to three massifs (Mt Mulanje, Mt Zomba, Mt Malosa) in southeast Malawi, east of the Nyasa-Shire Rift	Low
FAONIDAE	<i>Fao fasciinuca</i>	Taita Faon	VU		It is recorded from southern Ethiopia, eastern South Sudan, eastern Uganda, Kenya (probably occurring at low densities throughout the country), Tanzania (scattered records), eastern Zambia (a few sites), Malawi (two recent records), Zimbabwe (20-50 pairs, but recently reported to be in decline	Moderate
FAONIDAE	<i>Fao vespertinus</i>	Western Red-footed Faon	NT		Migratory species - known to occur in the area	High
GRUIDAE	<i>Buggeranus carunculatus</i>	Wattled Crane	VU		Not known to occur in the region	Low
	<i>Balearica regulorum</i>	Grey Crowned-Crane	EN		Known to be resident in the area	High
HIRUNDINIDAE	<i>Hirundo atrocaerulea</i>	Blue Swallow	VU		Occurs only in northern and southern Malawi	Low
LARIDAE	<i>Rynchops flavirostris</i>	African Skimmer	NT		Widely distributed through central Africa and known to occur in the area	High
MUSCICAPIDAE	<i>Sheppardia gunningi</i>	East Coast Akalat	NT		Not known to occur in the area	Low
OTIDIDAE	<i>Neotis denhami</i>	Denham's Bustard	NT		Although very widely distributed, it has suffered population declines through much of its range. The Rift Valley in Kenya was formerly regarded as its stronghold, but there are now probably fewer than 300 in all of, and its range has contracted. It is now regarded as the most endangered of its family in Kenya.	High
PHOENICOPTERIDAE	<i>Phoeniconaias minor</i>	Lesser Flamingo	NT		Not known to occur in the area	Low
PICIDAE	<i>Dendropicos stierlingi</i>	Stierling's Woodpecker	NT		Occurs in southern Tanzania, northern Mozambique and adjacent southern Malawi	Low
PLOCEIDAE	<i>Ploceus olivaceiceps</i>	Olive-headed Weaver	NT		Known to occur in the area	High

FAMILY	BIOLOGICAL NAME	COMMON NAME	IUCN STATUS	ENDEMISM	DISTRIBUTION/HABITAT	PROBABILITY OF OCCURRENCE
PSITTACULIDAE	<i>Agapornis lilianae</i>	Lilian's Lovebird	NT		<i>Agapornis lilianae</i> occurs along the Zambezi Valley in Mozambique and into Zimbabwe, northwards along the Luangwa River into Zambia and southern Tanzania, and along the Shire River into Malawi, where it occurs throughout Liwonde National Park	Moderate
SAGITTARIIDAE	<i>Sagittarius serpentarius</i>	Secretarybird	VU		Widespread throughout southern Africa - known to occur in the area	High
SCOLOPACIDAE	<i>Calidris ferruginea</i>	Curlew Sandpiper	NT		Migratory species - known to occur in the area	High
	<i>Numenius arquata</i>	Eurasian Curlew	NT		Known to occur in the area	High
	<i>Gallinago media</i>	Great Snipe	NT		From early August, it migrates through central Asia, central and south-eastern Europe (notably Turkey and Cyprus) Tunisia and Egypt, with birds gathering in wet high-plateau grasslands in Ethiopia. When these dry out in October, birds follow the rains south and west to Sudan, South Sudan, Chad, Burkina Faso, Mali, Mauritania, Senegal, Sierra Leone, Liberia, Côte d'Ivoire, Ghana, Togo, Benin, Nigeria, Cameroon, Gabon, Congo, Democratic Republic of Congo, Kenya, Uganda, Rwanda, Burundi, Tanzania, Malawi, Zambia, Zimbabwe, Mozambique, South Africa, Angola and Namibia.	High
TURDIDAE	<i>Geokichla guttata</i>	Spotted Ground-Thrush	EN		Resident subspecies in southern Malawi	Low
MACROSCELIDIDAE	<i>Elephantulus fuscus</i>	Dusky elephant shrew	DD		There are 22 documented locations (some may have more than one specimens) - nine from southern Malawi, 12 from southern Mozambique, and one from southern Zimbabwe. One specimen dates from about 2005, the rest pre-date 1968. Habitat seems to be savanna or woodland, but nothing else is known. The locations fall within a polygon that is about 146,000 km ² . Based only on the size of this area, one could guess that it is not Near Threatened, and perhaps Least Concern. However, Malawi and much of Zimbabwe are densely populated by people, and it may be that suitable habitat has been greatly reduced given the lack of recent records.	Low
SCIURIDAE	<i>Paraxerus lucifer</i>	Black and red bush squirrel	DD		This species is limited to northern Malawi (Misuku Hills and Nyika Plateau region at around 2,000 m asl) and southwestern Tanzania (in the Poroto Mountains and Mount Rungwe).	Low

FAMILY	BIOLOGICAL NAME	COMMON NAME	IUCN STATUS	ENDEMISM	DISTRIBUTION/HABITAT	PROBABILITY OF OCCURRENCE
GLIRIDAE	<i>Graphiurus johnstoni</i>	Johnston's African dormouse	DD	Malawi Endemic	This species appears to be limited to southern Malawi. The range limits are not well known.	Low
SORICIDAE	<i>Myosorex gnoskei</i>	Nyika burrowing shrew	EN		This species is endemic to the Nyika Plateau in Nyika National Park, Malawi, and has been found from 2,100 to 2,300 m asl.	Low
PTEROPODIDAE	<i>Epomophorus anelli</i>	Ansell's epauletted fruit bat	DD		This species is currently only known from Malawi, where it has been collected in the Kasungu National Park and (most probably) the Karonga area.	Low
VESPERTILIONIDAE	<i>Neoromicia flavescens</i>	Yellow pipistrelle	DD		This poorly known species appears to have been recorded from Angola (type locality at Galanga), Burundi, and Cameroon, Malawi (including the Shire Highlands, Mozambique, Uganda (Kampala) and Somalia (Shonto Forest) The distribution is uncertain and further studies are needed to clarify the species range.	Low
MANIDAE	<i>Manis temminckii</i>	Ground pangolin	VU		The most widespread African pangolin species, recorded from southeastern Chad, through South Sudan, much of East Africa and southern Africa as far south as the Northern Cape and North West Provinces of South Africa and northeast KwaZulu-Natal Province	High
FELIDAE (CATS)	<i>Acinonyx jubatus jubatus</i>	South African cheetah	VU		Restricted to nature reserves	Low
	<i>Panthera leo</i>	Lion	VU		Restricted to nature reserves	Low
	<i>Panthera pardus pardus</i>	African leopard	VU		Leopards are widely distributed across Africa and Asia, but populations have become reduced and isolated, and they are now extirpated from large portions of their historic range. Due to their wide geographic range, secretive nature and habitat tolerance, these animals are regularly found in areas where they were thought to be locally extinct.	Moderate
CANIDAE	<i>Lycaon pictus lupinus</i>	East African wild dog	EN		Restricted to nature reserves	Low

FAMILY	BIOLOGICAL NAME	COMMON NAME	IUCN STATUS	ENDEMISM	DISTRIBUTION/HABITAT	PROBABILITY OF OCCURRENCE
MUSTELIDAE	<i>Lutra maculicollis</i>	Speckle-throated otter	NT		Although this species has a large distribution they are restricted to areas of permanent fresh water, offering good shoreline cover and an abundant prey base. Thus, while the distribution range is large, the spatial size of their occupied habitats is much smaller and unknown, particularly due to the widespread habitat destruction and pollution problems reported for much of the African continent.	High
MUSTELIDAE	<i>Aonyx capensis</i>	African clawless otter	NT		The African clawless otter is the most widely distributed otter species in Africa, with a range stretching from Senegal and Mali throughout most of West Africa to Sudan and Ethiopia, and then southwards throughout East Africa to the Western Cape of South Africa. They are absent from the Congo basin, where they are replaced by the Congo Clawless Otter (<i>Aonyx congicus</i>), the two species being sympatric in Uganda and Rwanda.	High
EQUIDAE	<i>Equus quagga crawshayi</i>	Crawshay's zebra	NT		Restricted to nature reserves	Low
RHINOCEROTIDAE	<i>Diceros bicornis minor</i>	South-central black rhinoceros	CR		Restricted to nature reserves	Low
BOVIDAE	<i>Kobus vardonii</i>	Puku	NT		The Puku (<i>Kobus vardonii</i>) formerly occurred widely in grasslands near permanent water within the savannah woodlands and floodplains of south-central Africa. It has been eliminated from large parts of its former range and reduced to fragmented, isolated populations, but some of these are still numerous. Large numbers now occur in only two countries, Tanzania and Zambia	Low

10.4 Ecological Integrity

Ecological integrity is a term used to describe the level to which ecological patterns and processes are still present and functional in an ecosystem, for this reason the term *ecological integrity* can be interchangeable with the term *ecological function* of a system. Factors which influence the ecological integrity of a system include:

Patterns (observable factors):

- Vegetation zonation;
- Connectivity;
- Area to edge ratio (edge effects);
- Species present;
- Association of species;
- Population densities; and
- Animal behaviour.

Processes (underlying factors):

- Nutrient cycling;
- Herbivory;
- Competition;
- Predation risk;
- Nutrient availability;
- Rainfall;
- Fire regime;
- Hydrological regime;
- Patterns of disturbance;
- Energy flow; and
- History

The presence or absence of these factors, as well as the functional level of the present factors are assessed in order to determine the ecological integrity of a system. The assessment of these factors is often subjective to the observer, particularly in short term studies such as this.

Based on the abovementioned factors the ecological integrity of the vegetation communities was assessed and the results are shown in Figure 10. Due to the spatial displacement of vegetation communities it is possible for the same vegetation community, in different areas, to have varying levels of ecological integrity. The ecological integrity of the vegetation communities is as follows:

- Dambo Grassland Vegetation Community – Low to moderate ecological integrity;
- Mixed Riparian Vegetation Community – High ecological integrity;
- Forest Vegetation Community – Moderate ecological integrity; and
- Cultivated Lands – Low ecological integrity.

10.5 Conservation Importance

Conservation Importance is the degree of importance, which can be assigned to an ecological system, for the careful preservation and protection of something; particularly the planned management of a system to prevent exploitation, destruction, or neglect.

Factors which influence conservation importance are, *inter alia*:

- Species richness;
- Suitable habitat for a number of threatened species;
- Inherent importance to biodiversity;
- Importance of a system to maintain hydrological regimes; and
- Importance of a system for CO₂ scrubbing or removal of toxins.

Based on the abovementioned factors the conservation importance of the vegetation communities was assessed and the results are shown in Figure 11. Due to the spatial displacement of vegetation communities it is possible for the same vegetation community, in different areas, to have varying levels of conservation importance. The conservation importance of the vegetation communities is as follows:

- Dambo Grassland Vegetation Community – Low to moderate conservation importance;
- Mixed Riparian Vegetation Community – High conservation importance;
- Forest Vegetation Community – Moderate conservation importance; and
- Cultivated Lands – Low conservation importance.

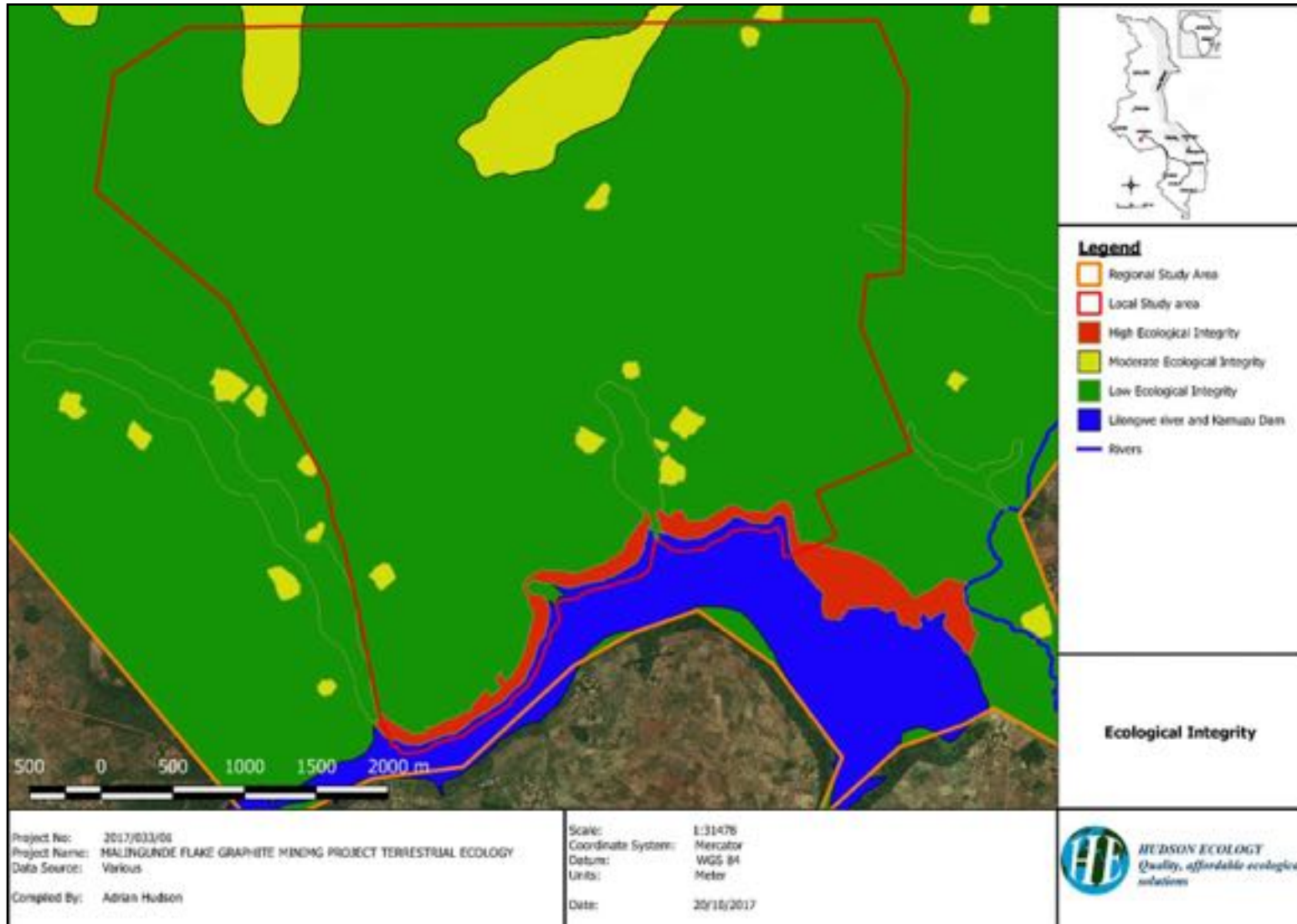


Figure 10: Ecological integrity of the local study area and adjacent areas

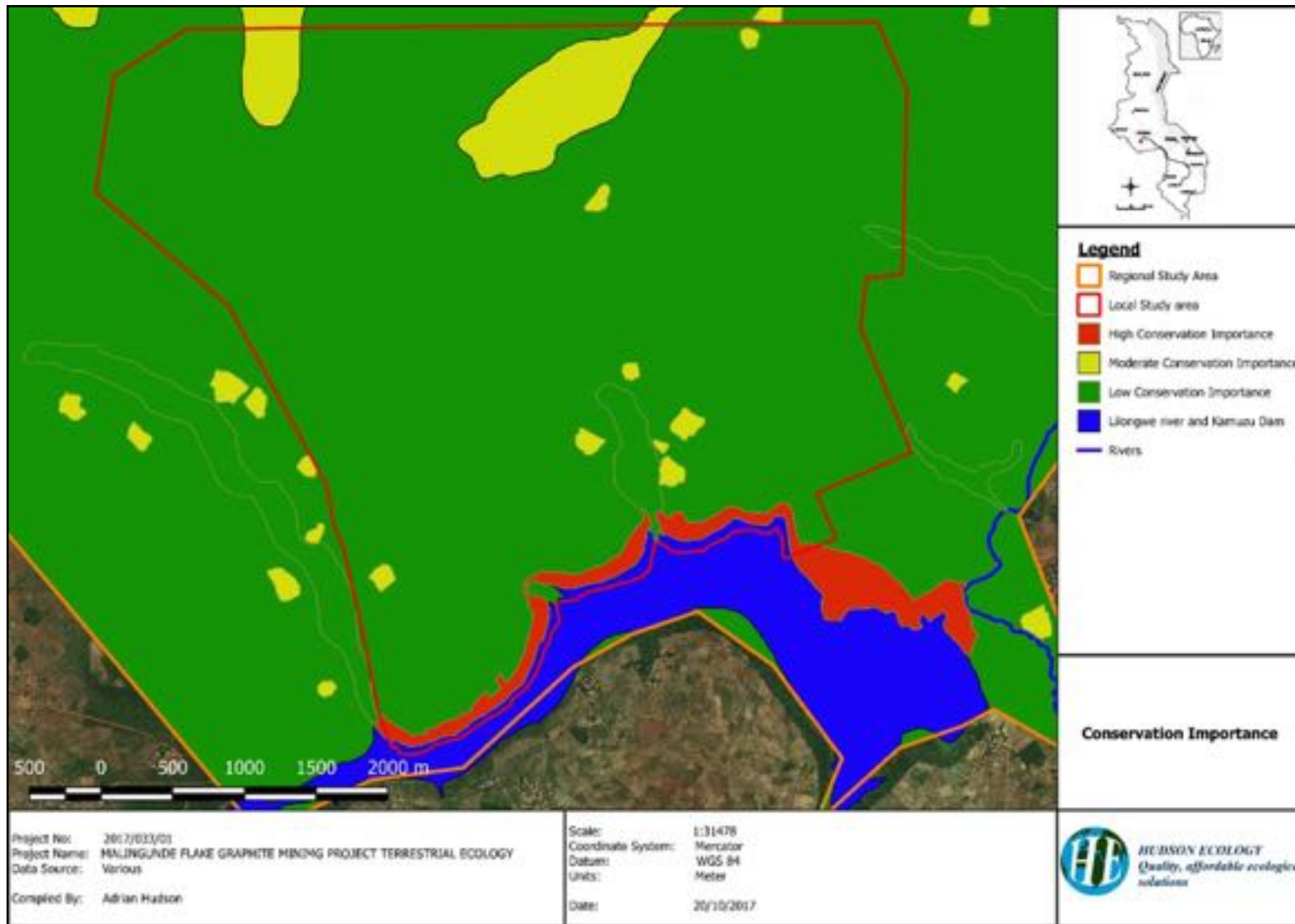


Figure 11: Conservation importance of the local study area and adjacent areas

11 DISCUSSION AND CONCLUSIONS

11.1 Flora

Based on physiognomy, moisture regime, rockiness, slope and soil properties, seven main communities were recognised, namely:

- Dambo Grassland Vegetation Community;
- Mixed Riparian Vegetation Community;
- Forest Vegetation Community;
- Cultivated Lands.

Species diversity in the regional and local study areas can be considered as moderate. Both species richness and abundance being considerably lower during the October 2017 and February 2018 surveys when compared with the April 2017 surveys, and species recorded was a subset of those recorded in the April 2017 surveys. During the surveys 114 species were recorded during the April 2017 survey, 81 during the October 2017 survey and 98 during the February 2018 survey. These differences can be attributed to the fact that the October 2017 surveys were conducted before the advent of the annual rains and the February 2017 many of the annual species were as yet unidentifiable.

One hundred and fourteen (114) plant species were recorded in the Project area representing 29 families. Tree species and shrub species accounted for 31 species (27%) and 18 species (16%) of the total number of species, respectively, while forbs accounted for 27 species (24%) of the total number of species recorded. Grass species accounted for 27% of the total number of species recorded with 31 species. With only 7 species (6%) of the total number of species cyperoid plants made up the lowest percentage of the total number of species.

Four species of conservation significance was recorded, namely *Burkea africana*, *Azelia quanzensis*, *Pterocarpus angolensis* and *Terminalia sericea* in the riparian forest and the forest fragments. Of species of conservation significance that could potentially occur in the area, one species is currently listed as Least concern, two species are listed as near threatened, two species are listed as Vulnerable while one species is listed as critically endangered.

11.2 Fauna

As expected reptile species diversity for the area was relatively low, with only 12 species being recorded during the April and October 2017 surveys. None of the reptile species recorded are restricted in number or distribution and none of the species are regarded as protected species by Malawi Legislation and none of the species recorded are listed on the IUCN Red Data list.

Only five species of anurans were recorded during the field surveys. None of the species recorded are classified as being restricted in abundance or distribution, although Malawi does host a number of endemic species.

Fifty-seven (57) species of avifauna were recorded during the field surveys. None of the species recorded during the 2017 survey are restricted in range or abundance, and none of the species recorded are currently listed on the IUCN Red Data list.

Twenty eight (28) species of mammals were recorded during the field surveys, although none of these species are classified as species of conservation importance.

A total of sixty seven (67) animal species, currently considered as species of conservation importance. Of these species:

- Reptile species constitute 10 of the species of concern, of which two are listed as just Red Data list species, six are listed as endemics and two are listed as both Red Data list species and endemic species;
- Anuran species (frogs and toads) constitute nine of the species of concern, of which seven are listed as just Red Data list species, two are listed as endemics and three are listed as both Red Data list species and endemic species;
- Avifauna species constitute 32 of the species of concern, of which 32 are listed as just Red Data list species, none are listed as endemics and none are listed as both Red Data list species and endemic species; and
- Mammal species constitute 16 of the species of concern, of which 15 are listed as just Red Data list species, none are listed as just endemics and one is listed as both Red Data list species and endemic species.

Of the ten reptile species of concern:

- One is listed as critically endangered, 3 are listed as endangered and 8 are listed as endemic; and
- Nine species have a low probability of occurrence in the study area and one has a high probability of occurrence.

Of the nine amphibian (anuran) species of concern:

- Three are listed as vulnerable, 1 is listed as Near threatened, 3 are listed as Data deficient and 5 are listed as endemic; and
- Eight species have a low probability of occurrence in the study area and one has a high probability of occurrence.

Of the thirty two avian species of concern:

- Three are listed as critically endangered, 7 are listed as endangered, 6 are listed as vulnerable, 15 are listed as near threatened and 1 is listed as Data deficient. No avian species are listed as endemic; and
- Twelve species have a low probability of occurrence in the study area, 2 have a moderate probability of occurrence and 18 have a high probability of occurrence.

Of the sixteen mammal species of concern:

- One is listed as critically endangered, 2 are listed as endangered, 4 are listed as vulnerable, 4 are listed as near threatened and 5 are listed as Data deficient. One species is listed as endemic; and
- Eleven species have a low probability of occurrence in the study area, 2 have a moderate probability of occurrence and 3 have a high probability of occurrence.

11.3 Ecological Integrity and Conservation Importance

The ecological integrity of the vegetation communities were assessed and the results show that the following ecological integrity for each of the vegetation communities:

- Dambo Grassland Vegetation Community – Low to moderate ecological integrity;
- Mixed Riparian Vegetation Community – High ecological integrity;
- Forest Vegetation Community – Moderate ecological integrity; and
- Cultivated Lands – Low ecological integrity.

The conservation importance of the vegetation communities were assessed and the results are as follows:

- Dambo Grassland Vegetation Community – Low to moderate conservation importance;
- Mixed Riparian Vegetation Community – High conservation importance;
- Forest Vegetation Community – Moderate conservation importance; and
- Cultivated Lands – Low conservation importance.

The majority of the study area shows significant signs of degradation. This is particularly apparent from the transformation of much of the natural vegetation for the purpose of cropping of mainly maize and groundnuts. The transformation is not limited to the terrestrial vegetation but many of the wetlands in the area have also been transformed for the purpose of agriculture. This transformation has, however, begun with the historical denudation of the natural Miombo woodland of the area. The natural woodland structure and species diversity can be seen at reserves such as the Dzalanyama Forest Reserve, approximately 20km to the west of the study area. The destruction of the natural vegetation in the area has subsequently led to greatly reduced flora and fauna diversity in the area with the exclusion of many species that would otherwise be expected. Furthermore, the removal of natural vegetation has created niche gaps for colonisation by exotic invasive species.

Small islands of natural vegetation do still occur within the study area, these mainly take the form of patches of natural woodland or forests that have been conserved due to the fact that they host ancestral grave sites (Manda), thus being seen as sacred sites. The other area of largely natural vegetation is the riparian forest surrounding the Kamuzu Dam. The vegetation in this area is largely natural all though some harvesting of resources is evident. These areas can, however, no longer be categorised as anywhere close to pristine natural vegetation, a number of impacts are evident in these areas, *inter alia*, edge effects due to the large ratio of edge to surface area, heavy infestations of exotic species such as *Bidens pilosa* and *Lantana camara*, as well as grazing pressure within the forests.

Other than the completely transformed dambos (wetlands) within the local study area, there are two arms of a highly impacted, but not completely transformed, dambo to the north of the local study area. Runoff to these dambos should be avoided in the same way that runoff into the Kamuzu Dam to the south should be avoided.



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APPENDIX A

Plant species recorded in the regional study area

FAMILY	Species	Recorded		
		April 2017	October 2017	February 2018
Trees				
ANACHARDIACEAE	<i>Ozoroa insignis</i>	Recorded	Recorded	Recorded
APOCYANACEAE	<i>Rauvolfia caffra</i>	Recorded	Recorded	Recorded
ARALIACEAE	<i>Cussonia arborea</i>	Recorded	Recorded	Recorded
ASPARAGACEA	<i>Agave (cf) sisalana*</i>	Recorded	Recorded	Recorded
BIGNONIACEAE	<i>Kigellia africana</i>	Recorded	Recorded	Recorded
CHRYSOBALANACEAE	<i>Parinari curatellifolia</i>	Recorded	Recorded	Recorded
COMBRETACEAE	<i>Combretum molle</i>	Recorded	Recorded	Recorded
COMBRETACEAE	<i>Terminalia sericea</i>	Recorded	Recorded	Recorded
FABACEAE	<i>Vachellia sieberiana</i>	Recorded	Recorded	Recorded
FABACEAE	<i>Vachellia polycantha</i>	Recorded	Recorded	Recorded
FABACEAE	<i>Albizia antunesiana</i>	Recorded	Recorded	Recorded
FABACEAE	<i>Brachystegia spiciformis</i>	Recorded	Recorded	Recorded
FABACEAE	<i>Piliostigma thonningii</i>	Recorded	Recorded	Recorded
FABACEAE	<i>Burkea africana</i>	Recorded	Recorded	Recorded
FABACEAE	<i>Faidherbia albida</i>	Recorded	Recorded	Recorded
FABACEAE	<i>Julbemardia globiflora</i>	Recorded	Recorded	Recorded
FABACEAE	<i>Pericopsis angolensis</i>	Recorded	Recorded	Recorded
FABACEAE	<i>Pterocarpus angolensis</i>	Recorded	Recorded	Recorded
FABACEAE	<i>Afzelia quanzensis</i>	Recorded	Recorded	Recorded
FABACEAE	<i>Senna didymobotrya</i>	Recorded	Recorded	Recorded
LAMIACEAE	<i>Gmelina arborea*</i>	Recorded	Recorded	Recorded
LOGANIACEAE	<i>Strychnos spinosa</i>	Recorded	Recorded	Recorded
MELIACEAE	<i>Ekebergia benguelensis</i>	Recorded	Recorded	Recorded
MELIACEAE	<i>Toonia ciliata*</i>	Recorded	Recorded	Recorded

MELIACEAE	<i>Trichilia emetica</i>	Recorded	Recorded	Recorded
MYRTACEAE	<i>Psidium guajava*</i>	Recorded	Recorded	Recorded
OCHNACEAE	<i>Ochna pulchra</i>	Recorded	Recorded	Recorded
PHYLLANTHACEAE	<i>Antidesma venosum</i>	Recorded	Recorded	Recorded
PROTEACEAE	<i>Faurea speciosa</i>	Recorded	Recorded	Recorded
RUBIACEAE	<i>Vangueria infausta</i>	Recorded	Recorded	Recorded
RUBIACEAE	<i>Vangueriopsis lanciflora</i>	Recorded	Recorded	Recorded
Shrubs				
ASPARAGACEAE	<i>Asparagus terrisfolias</i>	Recorded	Recorded	Recorded
ASTERACEAE	<i>Laggera crispata</i>	Recorded	Not recorded	Not recorded
ASTERACEAE	<i>Helichrysum kraussii</i>	Recorded	Recorded	Recorded
ASTERACEAE	<i>Lopholaena coriifolia</i>	Recorded	Recorded	Recorded
CELASTRACEAE	<i>Maytenus heterophylla</i>	Recorded	Recorded	Recorded
CELASTRACEAE	<i>Maytenus senegalensis</i>	Recorded	Recorded	Recorded
EBENACEAE	<i>Euclea crispa</i>	Recorded	Recorded	Recorded
EBENACEAE	<i>Diospiros heterophylla</i>	Recorded	Recorded	Recorded
FABACEAE	<i>Eriosema ellipticum</i>	Recorded	Not recorded	Recorded
FABACEAE	<i>Eriosema engleranum</i>	Recorded	Recorded	Recorded
FABACEAE	<i>Indigofera arrecta</i>	Recorded	Recorded	Recorded
FABACEAE	<i>Rhynchosia resinosa</i>	Recorded	Recorded	Recorded
PHYLLANTHACEAE	<i>Flueggea virosa</i>	Recorded	Recorded	Recorded
RUBIACEAE	<i>Leptactina benguelensis</i>	Recorded	Recorded	Recorded
RUBIACEAE	<i>Pavetta schumanniana</i>	Recorded	Recorded	Recorded
THYMALAEACEAE	<i>Gnidia kraussiana</i>	Recorded	Recorded	Recorded
VERBENACEAE	<i>Lantana camara</i>	Recorded	Recorded	Recorded
VERBENACEAE	<i>Lippia javanica</i>	Recorded	Recorded	Recorded
Forbs				

AMARANTHACEAE	<i>Achyranthes aspera</i>	Recorded	Recorded	Recorded
AMARANTHACEAE	<i>Amaranthus hybridus</i>	Recorded	Not recorded	Not recorded
ARACEAE	<i>Pistia stratiotes</i>	Recorded	Not recorded	Not recorded
ASPHODELACEAE	<i>Kniphofia linearifolia</i>	Recorded	Recorded	Recorded
ASTERACEAE	<i>Bidens biternata*</i>	Recorded	Not recorded	Recorded
ASTERACEAE	<i>Bidens pilosa*</i>	Recorded	Not recorded	Recorded
ASTERACEAE	<i>Conyza albida</i>	Recorded	Not recorded	Recorded
ASTERACEAE	<i>Conyza welwitschii</i>	Recorded	Not recorded	Not recorded
ASTERACEAE	<i>Helichrysum species</i>	Recorded	Not recorded	Not recorded
ASTERACEAE	<i>Senecio strictifolius,</i>	Recorded	Not recorded	Recorded
ASTERACEAE	<i>Tagetes minuta*</i>	Recorded	Not recorded	Recorded
BRASSICACEAE	<i>Rorippa nasturtium-aquaticum*</i>	Recorded	Not recorded	Recorded
EUPHORBIACEAE	<i>Euphorbia cyparissoides</i>	Recorded	Recorded	Recorded
FABACEAE	<i>Sesbania microphylla</i>	Recorded	Not recorded	Recorded
LAMIACEAE	<i>Haumaniastrum sericeum</i>	Recorded	Recorded	Recorded
LENTIBULARIACEAE	<i>Utricularia cf. intermedia</i>	Recorded	Not recorded	Not recorded
NYMPHAEACEAE	<i>Nymphaea nouchali</i>	Recorded	Not recorded	Recorded
PEDALIACEAE	<i>Ceratotheca triloba</i>	Recorded	Not recorded	Recorded
POLYGONACEAE	<i>Persicaria lapathifolia</i>	Recorded	Not recorded	Not recorded
POLYGONACEAE	<i>Polygonum senegalense</i>	Recorded	Recorded	Recorded
RANUNCULACEAE	<i>Ranunculus multifidus</i>	Recorded	Recorded	Recorded
RUBIACEAE	<i>Oldenlandia corymbosa</i>	Recorded	Not recorded	Not recorded
RUBIACEAE	<i>Oldenlandia herbacea</i>	Recorded	Not recorded	Not recorded
SALVINIACEAE	<i>Azolla nilotica</i>	Recorded	Not recorded	Recorded
SOLANACEAE	<i>Datura stramonium*</i>	Recorded	Not recorded	Not recorded
SOLANACEAE	<i>Solanum campylacanthum*</i>	Recorded	Recorded	Recorded
VERBENACEAE	<i>Verbena bonariensis*</i>	Recorded	Not recorded	Not recorded

Graminoids				
POACEAE	<i>Andropogon eucomus</i>	Recorded	Not recorded	Not recorded
POACEAE	<i>Andropogon gayanus</i>	Recorded	Not recorded	Recorded
POACEAE	<i>Aristida junciformis</i>	Recorded	Not recorded	Not recorded
POACEAE	<i>Arundinella nepalensis</i>	Recorded	Recorded	Recorded
POACEAE	<i>Brachiaria deflexa</i>	Recorded	Not recorded	Recorded
POACEAE	<i>Brachiaria humidicola</i>	Recorded	Recorded	Recorded
POACEAE	<i>Cynodon dactylon</i>	Recorded	Recorded	Recorded
POACEAE	<i>Dactyloctenium aegyptium</i>	Recorded	Not recorded	Not recorded
POACEAE	<i>Digitaria scalarum</i>	Recorded	Recorded	Recorded
POACEAE	<i>Echinochloa pyramidalis</i>	Recorded	Recorded	Recorded
POACEAE	<i>Eleusine indica</i>	Recorded	Not recorded	Recorded
POACEAE	<i>Entolasia imbricata</i>	Recorded	Recorded	Recorded
POACEAE	<i>Eragrostis capensis</i>	Recorded	Recorded	Recorded
POACEAE	<i>Eragrostis chapelieri</i>	Recorded	Recorded	Recorded
POACEAE	<i>Eragrostis spp.</i>	Recorded	Not recorded	Not recorded
POACEAE	<i>Hemarthria altissima</i>	Recorded	Recorded	Recorded
POACEAE	<i>Heteropogon contortus</i>	Recorded	Recorded	Recorded
POACEAE	<i>Hyparrhenia filipendula</i>	Recorded	Recorded	Recorded
POACEAE	<i>Hyparrhenia nyassae</i>	Recorded	Recorded	Recorded
POACEAE	<i>Hyperthelia dissoluta</i>	Recorded	Recorded	Recorded
POACEAE	<i>Ischaemum afrum</i>	Recorded	Recorded	Recorded
POACEAE	<i>Melinis repens</i>	Recorded	Not recorded	Recorded
POACEAE	<i>Monocymbium ceresiiforme</i>	Recorded	Not recorded	Recorded
POACEAE	<i>Oryza barthii</i>	Recorded	Not recorded	Recorded
POACEAE	<i>Paspalum urvillei</i>	Recorded	Recorded	Recorded
POACEAE	<i>Perotis patens</i>	Recorded	Recorded	Recorded

POACEAE	<i>Pogonarthria squarrosa</i>	Recorded	Recorded	Recorded
POACEAE	<i>Setaria pumila</i>	Recorded	Not recorded	Not recorded
POACEAE	<i>Sporobolus pyramidalis</i>	Recorded	Recorded	Recorded
POACEAE	<i>Sporobolus subtilis</i>	Recorded	Recorded	Recorded
POACEAE	<i>Themeda triandra</i>	Recorded	Recorded	Recorded
Cyperoids				
CYPERACEAE	<i>Cyperus digitatus</i>	Recorded	Recorded	Recorded
CYPERACEAE	<i>Cyperus esculentus</i>	Recorded	Recorded	Recorded
CYPERACEAE	<i>Cyperus tenax</i>	Recorded	Recorded	Recorded
CYPERACEAE	<i>Kylinga erecta</i>	Recorded	Recorded	Recorded
CYPERACEAE	<i>Pycnus aethiops</i>	Recorded	Recorded	Recorded
CYPERACEAE	<i>Typha domingensis</i>	Recorded	Recorded	Recorded
CYPERACEAE	<i>Typha latifolius</i>	Recorded	Recorded	Recorded

APPENDIX B

Reptile species historically recorded in Malawi

FAMILY	BIOLOGICAL NAME	COMMON NAME	IUCN STATUS	ENDEMISM
Agamidae	<i>Acanthocercus atricollis</i>	Black-necked Agama		
Agamidae	<i>Agama mossambica</i>	Mozambique Agama		
Agamidae	<i>Agama kirkii</i>	Kirk's Rock Agama		
Chamaeleonidae	<i>Trioceros incornutus</i>	Poroto Mountain Chameleon		
Chamaeleonidae	<i>Trioceros goetzei</i>	Iloilo Chameleon		
Chamaeleonidae	<i>Trioceros melleri</i>	Meller's Chameleon		
Chamaeleonidae	<i>Chamaeleo dilepis</i>	Flap-necked Chameleon		
Chamaeleonidae	<i>Nadzikambia mlanjensis</i>	Mlanje Mountain Chameleon	EN	Malawi Endemic
Chamaeleonidae	<i>Rhampholeon chapmanorum</i>	Malawi Hill Pygmy Chameleon	CR	Malawi Endemic
Chamaeleonidae	<i>Rhampholeon platyceps</i>	Mount Mulanje Pygmy Chameleon	EN	
Colubridae	<i>Dasypeltis scabra</i>	Egg-eating Snake		
Colubridae	<i>Natriciteres olivacea</i>	Olive Marsh Snake		
Colubridae	<i>Dasypeltis medici</i>	East African Egg Eater		
Colubridae	<i>Philothamnus punctatus</i>	Spotted Green Snake		
Colubridae	<i>Philothamnus semivariiegatus</i>	Spotted Bush Snake		
Colubridae	<i>Philothamnus hoplogaster</i>	Green Water Snake		
Cordylidae	<i>Platysaurus torquatus</i>	Striped Flat Lizard		
Cordylidae	<i>Platysaurus intermedius nyasae</i>			
Cordylidae	<i>Platysaurus mitchelli</i>	Mitchell's Flat Lizard		Malawi Endemic
Cordylidae	<i>Cordylus nyikae</i>	Nyika Girdled Lizard		Malawi Endemic
Crocodylidae	<i>Crocodylus niloticus</i>	Nile Crocodile		
Elapidae	<i>Dendroaspis polylepis</i>	Black Mamba		
Elapidae	<i>Naja annulifera</i>	Snouted Cobra		
Elapidae	<i>Dendroaspis angusticeps</i>	Eastern Green Mamba		
Elapidae	<i>Elapsoidea semiannulata</i>	Angolan Garter Snake		
Gekkonidae	<i>Hemidactylus mabouia</i>	Tropical House Gecko		
Gekkonidae	<i>Hemidactylus platycephalus</i>	Flathead Leaf-toed Gecko		
Gekkonidae	<i>Lygodactylus capensis</i>	Cape Dwarf Gecko		
Gekkonidae	<i>Lygodactylus rex</i>	King Dwarf Gecko		Malawi Endemic
Gerrhosauridae	<i>Matobosaurus validus</i>	Giant Plated Lizard		
Gerrhosauridae	<i>Gerrhosaurus flavigularis</i>	Yellow-throated Plated Lizard		
Lacertidae	<i>Nucras ornata</i>	Ornate Scrub Lizard		
Lacertidae	<i>Nucras taeniolata</i>	Striped Scrub Lizard		
Lamprophiidae	<i>Psammophis subtaeniatus</i>	Stripe-bellied Sand Snake		
Lamprophiidae	<i>Prosymna ambigua</i>	Angolan Shovel-snout		
Lamprophiidae	<i>Gonionotophis nyassae</i>	Black File Snake		
Lamprophiidae	<i>Lycophidion acutirostre</i>	Eastern Wolf Snake		
Lamprophiidae	<i>Lycodonomorphus whytii</i>	Whyte's Water Snake		
Lamprophiidae	<i>Duberria lutrix</i>	Common Slug-eater		
Lamprophiidae	<i>Hemirhagerrhis hildebrandtii</i>	Eastern Bark Snake		
Lamprophiidae	<i>Lycodonomorphus leleupi</i>	Mulanje Water Snake		
Lamprophiidae	<i>Psammophylax variabilis</i>	Grey-bellied Grass Snake		
Lamprophiidae	<i>Amblyodipsas polylepis</i>	Common Purple-glossed Snake		
Lamprophiidae	<i>Lycophidion capense</i>	Cape Wolf Snake		
Pelomedusidae	<i>Pelusios nanus</i>	African Dwarf Mud Turtle		
Pythonidae	<i>Python natalensis</i>	Southern African Python		
Scincidae	<i>Trachylepis bocagii</i>	Bocage's Skink		

FAMILY	BIOLOGICAL NAME	COMMON NAME	IUCN STATUS	ENDEMISM
Scincidae	<i>Mochlus sundevalli</i>	Sundevall's Writhing Skink		
Scincidae	<i>Melanoseps ater</i>	Longtail Limbless Skink		
Scincidae	<i>Trachylepis lacertiformis</i>	Bronze Rock Skink		
Scincidae	<i>Trachylepis punctatissima</i>	Montane Speckled Skink		
Scincidae	<i>Trachylepis margaritifera</i>	Rainbow skink		
Scincidae	<i>Trachylepis maculilabris</i>	Speckle-lipped Mabuya		
Scincidae	<i>Trachylepis mlanjensis</i>	Mulanje Skink		
Scincidae	<i>Trachylepis varia</i>	Variable Skink		
Scincidae	<i>Trachylepis maculilabris</i>	Speckle-lipped Mabuya		
Scincidae	<i>Eumecia johnstoni</i>	Nyika Serpentine Skink		Malawi Endemic
Scincidae	<i>Trachylepis hildae</i>	Nyika Three-striped Skink		Malawi Endemic
Scincidae	<i>Trachylepis mlanjensis</i>	Mlanje Skink		Malawi Endemic
Testudinidae	<i>Kinixys zombensis</i>	Eastern Hinged-Back Tortoise		
Trionychidae	<i>Cycloderma frenatum</i>	Zambezi Flapshell Turtle	EN	
Varanidae	<i>Varanus niloticus</i>	Nile Monitor		
Viperidae	<i>Causus rhombeatus</i>	Rhombic Night Adder		
Viperidae	<i>Bitis arietans</i>	Puff Adder		
Viperidae	<i>Causus defilippii</i>	Snouted Night Adder		

APPENDIX C

Amphibian species historically recorded in Malawi

FAMILY	BIOLOGICAL NAME	COMMON NAME	IUCN STATUS	ENDEMISM
ARTHROLEPTIDAE	<i>Leptopelis parvocagii</i>	Lake Upemba Forest Tree Frog		
ARTHROLEPTIDAE	<i>Leptopelis mossambicus</i>	Mozambique Forest Tree Frog		
ARTHROLEPTIDAE	<i>Leptopelis argenteus</i>	Silvery Tree Frog		
ARTHROLEPTIDAE	<i>Leptopelis bocagii</i>	Bocage's Tree Frog		
ARTHROLEPTIDAE	<i>Leptopelis flavomaculatus</i>	Yellow-spotted Tree Frog		
ARTHROLEPTIDAE	<i>Arthroleptis stenodactylus</i>	Common Squeaker		
ARTHROLEPTIDAE	<i>Arthroleptis franței</i>	Ruo River Screeching Frog	VU	
ARTHROLEPTIDAE	<i>Arthroleptis reichei</i>	Poroto Screeching Frog		
ARTHROLEPTIDAE	<i>Arthroleptis xenochirus</i>	Plain Squeaker		
ARTHROLEPTIDAE	<i>Arthroleptis xenodactyloides</i>	Dwarf Squeaker		
BREVICIPITIDAE	<i>Breviceps poweri</i>	Power's Rain Frog		
BREVICIPITIDAE	<i>Breviceps mossambicus</i>	Mozambique Rain Frog		
BUFONIDAE	<i>Amietophrynus gutturalis</i>	African Common Toad		
BUFONIDAE	<i>Schismaderma carens</i>	African Split-skin Toad		
BUFONIDAE	<i>Amietophrynus kisoensis</i>	Kisolo Toad		
BUFONIDAE	<i>Amietophrynus maculatus</i>	Flat-backed Toad		
BUFONIDAE	<i>Mertensophryne lindneri</i>			
BUFONIDAE	<i>Mertensophryne nyikae</i>	Nyika Dwarf Toad	NT	
BUFONIDAE	<i>Mertensophryne taitana</i>	Taita Toad		
BUFONIDAE	<i>Poyntonophrynus beiranus</i>	Beira Toad		
BUFONIDAE	<i>Amietophrynus garmani</i>	Garman's Toad		
CAECILIIDAE	<i>Boulengerula changamwensis</i>			
CAECILIIDAE	<i>Scolecophorus kirkii</i>	Kirk's Caecilian		
HEMISOTIDAE	<i>Hemisis guineensis</i>	Guinea Snout-burrower		
HEMISOTIDAE	<i>Hemisis marmoratus</i>	Shovel-nosed frog		
HYPEROLIIDAE	<i>Hyperolius kachalolae</i>	Kachalola Reed Frog		
HYPEROLIIDAE	<i>Hyperolius spinigularis</i>	Spiny-throated Reed Frog		
HYPEROLIIDAE	<i>Hyperolius pusillus</i>	Water Lily Reed Frog		
HYPEROLIIDAE	<i>Hyperolius argus</i>			
HYPEROLIIDAE	<i>Hyperolius marmoratus</i>	Painted Reed Frog		
HYPEROLIIDAE	<i>Hyperolius quinquevittatus</i>	Five-striped Reed Frog		
HYPEROLIIDAE	<i>Hyperolius mitchelli</i>	Mitchell's Reed Frog		
HYPEROLIIDAE	<i>Hyperolius tuberilinguis</i>	Tinker Reed Frog		
HYPEROLIIDAE	<i>Hyperolius marginatus</i>			
HYPEROLIIDAE	<i>Hyperolius acuticeps</i>			
HYPEROLIIDAE	<i>Hyperolius pictus</i>	Variable Reed Frog		
HYPEROLIIDAE	<i>Hyperolius glandicolor</i>	Gong Rock Frog		
HYPEROLIIDAE	<i>Hyperolius kivuensis</i>	Kivu Reed Frog		
HYPEROLIIDAE	<i>Afrixalus delicatus</i>	Delicate Spiny Reed Frog		
HYPEROLIIDAE	<i>Afrixalus fornasini</i>	Fornasini's Spiny Reed Frog		
HYPEROLIIDAE	<i>Kassina maculata</i>	Red-legged kassina		
HYPEROLIIDAE	<i>Kassina senegalensis</i>	Senegal Kassina		
HYPEROLIIDAE	<i>Hyperolius substriatus</i>			
HYPEROLIIDAE	<i>Afrixalus crotalus</i>			
HYPEROLIIDAE	<i>Afrixalus quadrivittatus</i>			
HYPEROLIIDAE	<i>Afrixalus brachycnemis</i>			
HYPEROLIIDAE	<i>Afrixalus aureus</i>	Golden Dwarf Reed Frog		
HYPEROLIIDAE	<i>Hyperolius friedemanni</i>	Friedmans Long Reed Frog	DD	Malawi Endemic
HYPEROLIIDAE	<i>Hyperolius inyangae</i>	Nyanga Long Reed Frog	VU	

FAMILY	BIOLOGICAL NAME	COMMON NAME	IUCN STATUS	ENDEMISM
HYPEROLIIDAE	<i>Hyperolius viridis</i>			
HYPEROLIIDAE	<i>Hyperolius spinigularis</i>	Spiny Reed Frog	VU	
MICROHYLIDAE	<i>Phrynomantis bifasciatus</i>	Red-Banded Rubber Frog		
PHRYNOBATRACHIDAE	<i>Phrynobatrachus stewartae</i>	Stewart's River Frog	DD	
PHRYNOBATRACHIDAE	<i>Phrynobatrachus acridoides</i>	Eastern puddle frog		
PHRYNOBATRACHIDAE	<i>Phrynobatrachus parvulus</i>			
PHRYNOBATRACHIDAE	<i>Phrynobatrachus mababiensis</i>	Mababe puddle frog		
PHRYNOBATRACHIDAE	<i>Phrynobatrachus natalensis</i>	Natal puddle frog		
PHRYNOBATRACHIDAE	<i>Phrynobatrachus ukingensis</i>	Ukinga River Frog	DD	
PHRYNOBATRACHIDAE	<i>Phrynobatrachus rungwensis</i>	Rungwe puddle frog		
PHRYNOBATRACHIDAE	<i>Phrynobatrachus perpalmatus</i>			
PIPIDAE	<i>Xenopus laevis</i>	African Clawed Frog		
PIPIDAE	<i>Xenopus muelleri</i>	Muller's Platanna		
PTYCHADENIDAE	<i>Ptychadena schillukorum</i>	Schilluk ridged frog		
PTYCHADENIDAE	<i>Ptychadena oxyrhynchus</i>	Sharp-nosed ridged frog		
PTYCHADENIDAE	<i>Ptychadena broadleyi</i>	Broadleyas Ridged Frog		
PTYCHADENIDAE	<i>Ptychadena upembae</i>	Upemba ridged frog		
PTYCHADENIDAE	<i>Ptychadena mossambica</i>	Mozambique ridged frog		
PTYCHADENIDAE	<i>Ptychadena taenioscelis</i>	Small ridged frog		
PTYCHADENIDAE	<i>Ptychadena guibei</i>	Guibe's ridged frog		
PTYCHADENIDAE	<i>Ptychadena ansorgii</i>	Ansorge's Ridged Frog		
PTYCHADENIDAE	<i>Ptychadena uzungwensis</i>	Udzungwa ridged frog		
PTYCHADENIDAE	<i>Ptychadena mascareniensis</i>	Mascarene Ridged Frog		
PTYCHADENIDAE	<i>Ptychadena porosissima</i>	Grassland ridged frog		
PTYCHADENIDAE	<i>Hildebrandtia ornata</i>	Ornate frog		
PTYCHADENIDAE	<i>Ptychadena broadleyi</i>	Broadley's Ridged Frog		Malawi Endemic
PYXICEPHALIDAE	<i>Nothophryne broadleyi</i>	Mongrel frog		
PYXICEPHALIDAE	<i>Tomopterna marmorata</i>	Marbled sand frog		
PYXICEPHALIDAE	<i>Tomopterna cryptotis</i>	Cryptic sand frog		
PYXICEPHALIDAE	<i>Pyxicephalus adspersus</i>	African Bullfrog		
PYXICEPHALIDAE	<i>Pyxicephalus edulis</i>	Edible bullfrog		
PYXICEPHALIDAE	<i>Amietia angolensis</i>	Common River Frog		
PYXICEPHALIDAE	<i>Amietia johnstoni</i>	Johnston's river frog		Malawi Endemic
PYXICEPHALIDAE	<i>Amietia viridireticulata</i>			
PYXICEPHALIDAE	<i>Strongylopus fuelleborni</i>	Fulleborn's Stream Frog		
PYXICEPHALIDAE	<i>Tomopterna cryptotis</i>	common sand frog		
PYXICEPHALIDAE	<i>Tomopterna tandyi</i>	Tandy's sand frog		
PYXICEPHALIDAE	<i>Tomopterna tuberculosa</i>	Rough sand frog		
PYXICEPHALIDAE	<i>Strongylopus merumontanus</i>			
RANIDAE	<i>Amnirana darlingi</i>	Darling's white-lipped frog		
RANIDAE	<i>Amnirana galamensis</i>	Galam white-lipped frog		
RHACOPHORIDAE	<i>Chiromantis xerampelina</i>	Grey Foam-nest Treefrog		

APPENDIX D

Avifauna species historically recorded in Malawi

FAMILY	BIOLOGICAL NAME	COMMON NAME	STATUS
ACCIPITRIDAE	<i>Kaupifao monogrammicus</i>	Lizard Buzzard	
	<i>Clanga pomarina</i>	Lesser Spotted Eagle	
	<i>Aquila verreauxii</i>	Verreaux's Eagle	
	<i>Aquila rapax</i>	Tawny Eagle	
	<i>Aquila nipalensis</i>	Steppe Eagle	EN
	<i>Accipiter minullus</i>	Little Sparrowhawk	
	<i>Accipiter tachiro</i>	African Goshawk	
	<i>Accipiter ovampensis</i>	Ovampo Sparrowhawk	
	<i>Accipiter melanoleucus</i>	Black Goshawk	
	<i>Accipiter rufiventris</i>	Rufous-chested Sparrowhawk	
	<i>Accipiter badius</i>	Shikra	
	<i>Hieraaetus ayresii</i>	Ayres's Hawk-Eagle	
	<i>Circus ranivorus</i>	African Marsh-Harrier	
	<i>Circus pygargus</i>	Montagu's Harrier	
	<i>Circus aeruginosus</i>	Western Marsh-Harrier	
	<i>Circus macrourus</i>	Pallid Harrier	NT
	<i>Buteo augur</i>	Augur Buzzard	
	<i>Buteo oreophilus</i>	Mountain Buzzard	NT
	<i>Buteo buteo</i>	Common Buzzard	
	<i>Terathopius ecaudatus</i>	Bateleur	NT
	<i>Circaetus pectoralis</i>	Black-breasted Snake-Eagle	
	<i>Circaetus cinereus</i>	Brown Snake-Eagle	
	<i>Circaetus cinerascens</i>	Banded Snake-Eagle	
	<i>Polyboroides typus</i>	African Harrier-Hawk	
	<i>Aviceda cuculoides</i>	African Cuckoo-Hawk	
	<i>Milvus migrans</i>	Black Kite	
	<i>Elanus caeruleus</i>	Black-winged Kite	
	<i>Haliaeetus vocifer</i>	African Fish-Eagle	
	<i>Stephanoaetus coronatus</i>	Crowned Eagle	NT
	<i>Pernis apivorus</i>	European Honey-buzzard	
	<i>Lophaetus occipitalis</i>	Long-crested Eagle	
	<i>Melierax metabates</i>	Dark Chanting-Goshawk	
	<i>Polemaetus bellicosus</i>	Martial Eagle	VU
	<i>Gyps africanus</i>	White-backed Vulture	CR
	<i>Trigonoceps occipitalis</i>	White-headed Vulture	CR
	<i>Torgos tracheliotos</i>	Lappet-faced Vulture	EN
<i>Macheiramphus ainus</i>	Bat Hawk		
<i>Gypohierax angolensis</i>	Palm-nut Vulture		
<i>Necrosyrtes monachus</i>	Hooded Vulture	CR	
<i>Aquila spilogaster</i>	African Hawk-Eagle		
<i>Hieraaetus wahlbergi</i>	Wahlberg's Eagle		
<i>Micronisus gabar</i>	Gabar Goshawk		
ACROCEPHALIDAE	<i>Acrocephalus griseldis</i>	Basra Reed Warbler	EN
	<i>Acrocephalus arundinaceus</i>	Great Reed Warbler	
	<i>Acrocephalus gracilirostris</i>	Lesser Swamp Warbler	
	<i>Acrocephalus palustris</i>	Marsh Warbler	
	<i>Acrocephalus schoenobaenus</i>	Sedge Warbler	
	<i>Acrocephalus scirpaceus</i>		
	<i>Iduna natalensis</i>	African Yellow-Warbler	
	<i>Iduna similis</i>	Mountain Yellow-Warbler	
	<i>Hippolais icterina</i>	Icterine Warbler	
ALAUDIDAE	<i>Mirafra africana</i>	Rufous-naped Lark	
	<i>Mirafra rufocinnamomea</i>	Flappet Lark	
	<i>Eremopterix leucopareia</i>	Fischer's Sparrow-Lark	
	<i>Eremopterix leucotis</i>	Chestnut-backed Sparrow-Lark	
	<i>Calandrella cinerea</i>	Red-capped Lark	
AEDINIDAE	<i>Hayon albiventris</i>	Brown-hooded Kingfisher	
	<i>Hayon leucocephala</i>	Gray-headed Kingfisher	

FAMILY	BIOLOGICAL NAME	COMMON NAME	STATUS
	<i>Hayon chelicuti</i>	Striped Kingfisher	
	<i>Hayon senegalensis</i>	Woodland Kingfisher	
	<i>Aedo semitorquata</i>	Half-collared Kingfisher	
	<i>Ceryle rudis</i>	Pied Kingfisher	
	<i>Corythornis cristatus</i>	Malachite Kingfisher	
	<i>Ispidina picta</i>	African Pygmy-Kingfisher	
	<i>Megaceryle maxima</i>	Giant Kingfisher	
ANATIDAE	<i>Dendrocygna viduata</i>	White-faced Whistling Duck	
	<i>Dendrocygna bicolor</i>	Fulvous Whistling-Duck	
	<i>Thalassornis leuconotus</i>	White-backed Duck	
	<i>Anas undulata</i>	Yellow-billed Duck	
	<i>Anas hottentota</i>	Hottentot Teal	
	<i>Anas sparsa</i>	African Black Duck	
	<i>Anas querquedula</i>	Garganey	
	<i>Anas erythrorhyncha</i>	Red-billed Teal	
	<i>Anas capensis</i>	Cape Teal	
	<i>Netta erythrophthalma</i>	Southern Pochard	
	<i>Nettapus auritus</i>	African Pygmy-Goose	
	<i>Plectropterus gambensis</i>	Spur-winged Goose	
	<i>Sarkidiornis melanotos</i>	Comb Duck	
	<i>Alopochen aegyptiaca</i>	Egyptian Goose	
ANHINGIDAE	<i>Anhinga rufa</i>	African Darter	
APODIDAE	<i>Apus affinis</i>	Little Swift	
	<i>Apus caffer</i>	White-rumped Swift	
	<i>Apus barbatus</i>	African Swift	
	<i>Apus</i>	Common Swift	
	<i>Cypsiurus parvus</i>	African Palm-Swift	
	<i>Neafrapus boehmi</i>	Bat-like Spinetail	
	<i>Schoutedenapus myoptilus</i>	Scarce Swift	
	<i>Telacanthura ussheri</i>	Mottled Spinetail	
	<i>Apus aequatorialis</i>	Mottled Swift	
<i>Apus melba</i>	Alpine Swift		
ARDEIDAE	<i>Egretta ardesiaca</i>	Black Heron	
	<i>Egretta garzetta</i>	Little Egret	
	<i>Ardea purpurea</i>	Purple Heron	
	<i>Ardea cinerea</i>	Grey Heron	
	<i>Ardea alba</i>	Great Egret	
	<i>Ardea goliath</i>	Goliath Heron	
	<i>Ardea melanocephala</i>	Black-headed Heron	
	<i>Ardeola idae</i>	Madagascar Pond-Heron	EN
	<i>Ardeola ralloides</i>	Squacco Heron	
	<i>Ardeola rufiventris</i>	Rufous-bellied Heron	
	<i>Ixobrychus sturmii</i>	Dwarf Bittern	
	<i>Ixobrychus minutus</i>	Little Bittern	
	<i>Bubus ibis</i>	Cattle Egret	
	<i>Botaurus stellaris</i>	Eurasian Bittern	
	<i>Mesophoyx intermedia</i>	Intermediate Egret	
	<i>Gorsachius leuconotus</i>	White-backed Night-heron	
	<i>Butorides striata</i>	Striated Heron	
<i>Nycticorax</i>	Black-crowned Night-Heron		
<i>Ardea alba melanorhynchos</i>	African Great Egret		
BUCEROTIDAE	<i>Lophoceros nasutus</i>	African Grey Hornbill	
	<i>Lophoceros alboterminatus</i>	Crowned Hornbill	
	<i>Lophoceros pallidirostris</i>	Pale-billed Hornbill	
	<i>Tockus leucomelas</i>	Southern Yellow-billed Hornbill	
	<i>Tockus erythrorhynchus</i>	Red-billed Hornbill	
	<i>Bycanistes brevis</i>	Silvery-cheeked Hornbill	
	<i>Bycanistes bucinator</i>	Trumpeter Hornbill	
	<i>Tockus rufirostris</i>	Southern Red-billed Hornbill	

FAMILY	BIOLOGICAL NAME	COMMON NAME	STATUS
BUCORVIDAE	<i>Bucorvus leadbeateri</i>	Southern Ground-Hornbill	VU
BUPHAGIDAE	<i>Buphagus africanus</i>	Yellow-billed Oxpecker	
	<i>Buphagus erythrorhynchus</i>	Red-billed Oxpecker	
BURHINIDAE	<i>Burhinus capensis</i>	Spotted Thick-knee	
	<i>Burhinus vermiculatus</i>	Water Thick-knee	
CALYPTOMENIDAE	<i>Smithornis capensis</i>	African Broadbill	
CAMPEPHAGIDAE	<i>Coracina caesia</i>	Gray Cuckoo-shrike	
	<i>Coracina pectoralis</i>	White-breasted Cuckoo-shrike	
	<i>Campephaga flava</i>	Black Cuckoo-shrike	
CAPRIMULGIDAE	<i>Caprimulgus pectoralis</i>	Fiery-necked Nightjar	
	<i>Caprimulgus europaeus</i>	European Nightjar	
	<i>Caprimulgus fossii</i>	Square-tailed Nightjar	
	<i>Caprimulgus tristigma</i>	Freckled Nightjar	
	<i>Caprimulgus vexillarius</i>	Pennant-winged Nightjar	
CERTHIIDAE	<i>Salpornis spilonotus</i>	Indian Spotted-Creeper	
	<i>Salpornis salvadori</i>	African Spotted-Creeper	
CETTIIDAE	<i>Erythrocerus livingstonei</i>	Livingstone's Flycatcher	
CHARADRIIDAE	<i>Vanellus crassirostris</i>	Long-toed Lapwing	
	<i>Charadrius hiaticula</i>	Common Ringed Plover	
	<i>Charadrius tricollaris</i>	Three-banded Plover	
	<i>Charadrius marginatus</i>	White-fronted Plover	
	<i>Charadrius asiaticus</i>	Caspian Plover	
	<i>Charadrius pecuarius</i>	Kittlitz's Plover	
	<i>Vanellus albiceps</i>	White-headed Lapwing	
	<i>Vanellus lugubris</i>	Senegal Lapwing	
	<i>Vanellus senegallus</i>	African Wattled Lapwing	
	<i>Vanellus armatus</i>	Blacksmith Lapwing	
	<i>Vanellus coronatus</i>	Crowned Lapwing	
CICONIIDAE	<i>Anastomus lamelligerus</i>	African Openbill	
	<i>Ciconia abdimii</i>	Abdim's Stork	
	<i>Ciconia</i>	White Stork	
	<i>Ciconia nigra</i>	Black Stork	
	<i>Ciconia episcopus</i>	Woolly-necked Stork	
	<i>Mycteria ibis</i>	Yellow-billed Stork	
	<i>Leptoptilos crumenifer</i>	Marabou Stork	
	<i>Ephippiorhynchus senegalensis</i>	Saddle-billed Stork	
CISTICOLIDAE	<i>Cisticola erythrops</i>	Red-faced Cisticola	
	<i>Cisticola robustus</i>	Stout Cisticola	
	<i>Cisticola lais</i>	Wailing Cisticola	
	<i>Cisticola brachypterus</i>	Siffling Cisticola	
	<i>Cisticola ayresii</i>	Wing-snapping Cisticola	
	<i>Cisticola cantans</i>	Singing Cisticola	
	<i>Cisticola rufilatus</i>	Gray Cisticola	
	<i>Cisticola woosnami</i>	Trilling Cisticola	
	<i>Cisticola aberrans</i>	Rock-loving Cisticola	
	<i>Cisticola natalensis</i>	Croaking Cisticola	
	<i>Cisticola pipiens</i>	Chirping Cisticola	
	<i>Cisticola njombe</i>	Churring Cisticola	
	<i>Cisticola nigriloris</i>	Black-lored Cisticola	
	<i>Cisticola juncidis</i>	Zitting Cisticola	
	<i>Cisticola galactotes</i>	Winding Cisticola	
	<i>Prinia subflava</i>	Tawny-flanked Prinia	
	<i>Camaroptera brachyura</i>	Green-backed Camaroptera	
	<i>Apalis melanocephala</i>	Black-headed Apalis	
	<i>Apalis thoracica</i>	Bar-throated Apalis	
	<i>Apalis chariessa</i>	White-winged Apalis	VU
<i>Apalis flavida</i>	Yellow-breasted Apalis		

FAMILY	BIOLOGICAL NAME	COMMON NAME	STATUS
	<i>Apalis chapini</i>	Chapin's Apalis	
	<i>Apalis flavigularis</i>	Yellow-throated Apalis	EN
	<i>Apalis ruddi</i>	Rudd's Apalis	
	<i>Eremomela icteropygialis</i>	Yellow-bellied Eremomela	
	<i>Eremomela usticollis</i>	Burnt-neck Eremomela	
	<i>Eremomela scotops</i>	Greencap Eremomela	
	<i>Artisornis metopias</i>	African Tailorbird	
	<i>Cisticola chiniana</i>	Rattling Cisticola	
	<i>Cisticola fulvicapilla</i>	Piping Cisticola	
	<i>Heliolais erythropterus</i>	Red-winged Prinia	
	<i>Apalis flavigularis</i>	Yellow-throated Apalis	
	<i>Calamonastes undosus</i>	Miombo Wren-Warbler	
	<i>Apalis thoracica flavigularis</i>	Yellow-throated apalis	
COLIIDAE	<i>Urocolius indicus</i>	Red-faced Mousebird	
	<i>Colius striatus</i>	Speckled Mousebird	
COLUMBIDAE	<i>Streptopelia senegalensis</i>	Laughing Dove	
	<i>Streptopelia decipiens</i>	Mourning Collared-Dove	
	<i>Streptopelia capicola</i>	Ring-necked Dove	
	<i>Streptopelia semitorquata</i>	Red-eyed Dove	
	<i>Streptopelia lugens</i>	Dusky Turtle-Dove	
	<i>Columba arquatrix</i>	Rameron Pigeon	
	<i>Columba guinea</i>	Speckled Pigeon	
	<i>Columba larvata</i>	Lemon Dove	
	<i>Turtur afer</i>	Blue-spotted Wood-Dove	
	<i>Turtur chaospilos</i>	Emerald-spotted Wood-Dove	
	<i>Turtur tympanistria</i>	Tambourine Dove	
	<i>Treron calvus</i>	African Green Pigeon	
	<i>Oena capensis</i>	Namaqua Dove	
CORACIIDAE	<i>Coracias garrulus</i>	European Roller	
	<i>Coracias caudatus</i>	Lilac-breasted Roller	
	<i>Coracias naevius</i>	Rufous-crowned Roller	
	<i>Coracias spatulatus</i>	Raquet-tailed Roller	
	<i>Eurystomus glaucurus</i>	Broad-billed Roller	
CORVIDAE	<i>Corvus albicollis</i>	White-necked Raven	
	<i>Corvus albus</i>	Pied Crow	
CUCULIDAE	<i>Centropus superciliosus</i>	White-browed Coucal	
	<i>Centropus senegalensis</i>	Senegal Coucal	
	<i>Centropus grillii</i>	Black Coucal	
	<i>Centropus cupreicaudus</i>	Coppery-tailed Coucal	
	<i>Chrysococcyx klaas</i>	Klaas's Cuckoo	
	<i>Chrysococcyx cupreus</i>	African Emerald Cuckoo	
	<i>Chrysococcyx caprius</i>	Dideric Cuckoo	
	<i>Clamator glandarius</i>	Great Spotted Cuckoo	
	<i>Clamator jacobinus</i>	Jacobin Cuckoo	
	<i>Clamator levaillantii</i>	Levaillant's Cuckoo	
	<i>Cuculus poliocephalus</i>	Lesser Cuckoo	
	<i>Cuculus solitarius</i>	Red-chested Cuckoo	
	<i>Cuculus canorus</i>	Common Cuckoo	
	<i>Cuculus clamosus</i>	Black Cuckoo	
	<i>Cuculus gularis</i>	African Cuckoo	
	<i>Cuculus rochii</i>	Madagascar Cuckoo	
	<i>Cercococcyx montanus</i>	Barred Long-tailed Cuckoo	
	<i>Pachycoccyx audeberti</i>	Thick-billed Cuckoo	
<i>Ceuthmochares aereus</i>	Yellowbill		
DICRURIDAE	<i>Dicrurus adsimilis</i>	Fork-tailed Drongo	
	<i>Dicrurus ludwigii</i>	Square-tailed Drongo	
EMBERIZIDAE	<i>Emberiza capensis</i>	Cape Bunting	
	<i>Emberiza flaviventris</i>	Golden-breasted Bunting	
	<i>Emberiza cabanisi</i>	Cabanis's Bunting	

FAMILY	BIOLOGICAL NAME	COMMON NAME	STATUS
	<i>Emberiza tahapisi</i>	Cinnamon-breasted Bunting	
ESTRILDIDAE	<i>Estrilda rhodopyga</i>	Crimson-rumped Waxbill	
	<i>Estrilda astrild</i>	Common Waxbill	
	<i>Estrilda perreini</i>	Black-tailed Waxbill	
	<i>Pyrenestes minor</i>	Lesser Seedcracker	
	<i>Pytilia melba</i>	Green-winged Pytilia	
	<i>Pytilia afra</i>	Orange-winged Pytilia	
	<i>Uraeginthus angolensis</i>	Southern Cordonbleu	
	<i>Hypargos niveoguttatus</i>	Peters's Twinspot	
	<i>Lagonosticta senegala</i>	Red-billed Firefinch	
	<i>Lagonosticta rubricata</i>	African Firefinch	
	<i>Lagonosticta rhodopareia</i>	Jameson's Firefinch	
	<i>Amadina fasciata</i>	Cut-throat	
	<i>Cryptospiza reichenovii</i>	Red-faced Crimson-wing	
	<i>Mandingoa nitidula</i>	Green-backed Twinspot	
	<i>Ortygospiza atricollis</i>	Black-faced Quailfinch	
	<i>Coccyzygia melanotis</i>	Swee Waxbill	
	<i>Paludipasser locustella</i>	Locustfinch	
	<i>Spermestes cucullata</i>	Bronze Mannikin	
	<i>Spermestes fringilloides</i>	Magpie Mannikin	
	<i>Sporaeginthus subflavus</i>	Zebra Waxbill	
<i>Lonchura nigriceps</i>	Red-backed Mannikin		
<i>Spermestes bicolor</i>	Black-and-white Mannikin		
FAONIDAE	<i>Fao cuvierii</i>	African Hobby	
	<i>Fao vespertinus</i>	Red-footed Faon	
	<i>Fao subbuteo</i>	Eurasian Hobby	
	<i>Fao peregrinus</i>	Peregrine Faon	
	<i>Fao tinnunculus</i>	Eurasian Kestrel	
	<i>Fao dickinsoni</i>	Dickinson's Kestrel	
	<i>Fao chicquera</i>	Red-necked Faon	
	<i>Fao biarmicus</i>	Lanner Faon	
	<i>Fao amurensis</i>	Amur Faon	
	<i>Fao fasciinucha</i>	Taita Faon	VU
	<i>Fao ardosiaecus</i>	Grey Kestrel	
	<i>Fao vespertinus</i>	Western Red-footed Faon	NT
<i>Fao naumanni</i>	Lesser Kestrel		
FRINGILLIDAE	<i>Serinus mozambicus</i>	Yellow-fronted Canary	
	<i>Serinus sulphuratus</i>	Brimstone Canary	
	<i>Serinus mennelli</i>	Black-eared Seedeater	
	<i>Serinus reichardi</i>	Reichard's Seedeater	
	<i>Serinus hypostictus</i>	Southern Citril	
	<i>Serinus striolatus</i>	Streaky Seedeater	
	<i>Serinus melanochrous</i>	Tanzania Seedeater	
	<i>Serinus citrinipectus</i>	Lemon-breasted Seedeater	
	<i>Linurgus olivaceus</i>	Oriole Finch	
	<i>Serinus flavivertex</i>	Yellow-crowned Canary	
GLAREOLIDAE	<i>Cursorius temminckii</i>	Temminck's Courser	
	<i>Glareola nuchalis</i>	Rock Pratincole	
	<i>Glareola pratincola</i>	Collared Pratincole	
	<i>Rhinoptilus cinctus</i>	Three-banded Courser	
	<i>Rhinoptilus chaopterus</i>	Bronze-winged Courser	
GRUIDAE	<i>Bugeranus carunculatus</i>	Wattled Crane	VU
	<i>Balearica regulorum</i>	Grey Crowned-Crane	EN
HELIORNITHIDAE	<i>Podica senegalensis</i>	African Finfoot	
HIRUNDINIDAE	<i>Hirundo smithii</i>	Wire-tailed Swallow	
	<i>Hirundo atrocaerulea</i>	Blue Swallow	VU
	<i>Hirundo rustica</i>	Barn Swallow	
	<i>Hirundo dimidiata</i>	Pearl-breasted Swallow	
	<i>Hirundo angolensis</i>	Angola Swallow	

FAMILY	BIOLOGICAL NAME	COMMON NAME	STATUS
	<i>Hirundo albigularis</i>	White-throated Swallow	
	<i>Riparia</i>	Bank Swallow	
	<i>Riparia paludicola</i>	Plain Martin	
	<i>Riparia cincta</i>	Banded Martin	
	<i>Psalidoprocne albiceps</i>	White-headed Sawwing	
	<i>Psalidoprocne pristoptera</i>	Black Sawwing	
	<i>Phedina borbonica</i>	Mascarene Martin	
	<i>Delichon urbicum</i>	Common House-Martin	
	<i>Hirundo daurica</i>	Striated Swallow	
	<i>Cecropis semirufa</i>	Rufous-chested Swallow	
	<i>Cecropis senegalensis</i>	Mosque Swallow	
	<i>Pseudhirundo griseopyga</i>	Gray-rumped Swallow	
	<i>Ptyonoprogne fuligula</i>	Rock Martin	
	<i>Cecropis abyssinica</i>	Lesser Striped-Swallow	
	<i>Cecropis cucullata</i>	Greater Striped-Swallow	
<i>Cecropis daurica</i>	Red-rumped Swallow		
HYLIOTIDAE	<i>Hyltiota australis</i>	Southern Hyltiota	
	<i>Hyltiota flavigaster</i>	Yellow-bellied Hyltiota	
INDICATORIDAE	<i>Indicator variegatus</i>	Scaly-throated Honeyguide	
	<i>Indicator</i>	Greater Honeyguide	
	<i>Indicator minor</i>	Lesser Honeyguide	
	<i>Indicator meliphilus</i>	Pallid Honeyguide	
	<i>Prodotiscus zambesiae</i>	Green-backed Honeyguide	
	<i>Prodotiscus regulus</i>	Wahlberg's Honeyguide	
JACANIDAE	<i>Microparra capensis</i>	Lesser Jacana	
	<i>Actophilornis africanus</i>	African Jacana	
LANIIDAE	<i>Lanius collaris</i>	Common Fiscal	
	<i>Lanius collurio</i>	Red-backed Shrike	
	<i>Lanius souzai</i>	Sousa's Shrike	
	<i>Lanius excubitoroides</i>	Gray-backed Fiscal	
	<i>Corvinella melanoleuca</i>	Magpie Shrike	
LARIDAE	<i>Lanius humeralis</i>	Northern Fiscal	
	<i>Rynchops flavirostris</i>	African Skimmer	NT
	<i>Chlidonias leucopterus</i>	White-winged Tern	
	<i>Chlidonias hybrida</i>	Whiskered Tern	
	<i>Chroicocephalus cirrocephalus</i>	Gray-hooded Gull	
	<i>Gelochelidon nilotica</i>	Gull-billed Tern	
	<i>Hydroprogne caspia</i>	Caspian Tern	
	<i>Onychoprion fuscatus</i>	Sooty Tern	
<i>Thalasseus bengalensis</i>	Lesser Crested Tern		
LEIOTHRICHIDAE	<i>Turdoides jardineii</i>	Arrow-marked Babbler	
LOCUSTELLIDAE	<i>Bradypterus baboecala</i>	Little Rush-Warbler	
	<i>Bradypterus cinnamomeus</i>	Cinnamon Bracken-Warbler	
	<i>Bradypterus lopezi</i>	Evergreen-forest Warbler	
	<i>Locustella fluviatilis</i>	Eurasian River Warbler	
	<i>Schoenicola brevirostris</i>	Fan-tailed Grassbird	
LYBIIDAE	<i>Lybius melanopterus</i>	Brown-breasted Barbet	
	<i>Lybius minor</i>	Black-backed Barbet	
	<i>Lybius torquatus</i>	Black-collared Barbet	
	<i>Pogoniulus bilineatus</i>	Yellow-rumped Tinkerbird	
	<i>Pogoniulus chrysoconus</i>	Yellow-fronted Tinkerbird	
	<i>Pogoniulus leucomystax</i>	Moustached Tinkerbird	
	<i>Pogoniulus simplex</i>	Green Tinkerbird	
	<i>Stactolaema leucotis</i>	White-eared Barbet	
	<i>Stactolaema olivacea</i>	Green Barbet	
	<i>Stactolaema whytii</i>	Whyte's Barbet	
	<i>Trachyphonus vaillantii</i>	Crested Barbet	
	<i>Tricholaema frontata</i>	Miombo Pied Barbet	
	<i>Tricholaema lacrymosa</i>	Spot-flanked Barbet	

FAMILY	BIOLOGICAL NAME	COMMON NAME	STATUS
MACROSPHENIDAE	<i>Sylvietta ruficapilla</i>	Red-capped Crombec	
	<i>Sylvietta whytii</i>	Red-faced Crombec	
	<i>Sylvietta rufescens</i>	Cape Crombec	
	<i>Melocichla mentalis</i>	Moustached Grass-Warbler	
	<i>Melocichla mentalis</i>	Moustached Grass-Warbler	
MALACONOTIDAE	<i>Telophorus sulfureopectus</i>	Orange-breasted Bush-Shrike	
	<i>Telophorus nigrifrons</i>	Black-fronted Bushshrike	
	<i>Telophorus olivaceus</i>	Olive Bushshrike	
	<i>Laniarius funebris</i>	Slate-colored Boubou	
	<i>Laniarius fuelleborni</i>	Fuelleborn's Boubou	
	<i>Laniarius aethiopicus</i>	Tropical Boubou	
	<i>Malaconotus blanchoti</i>	Gray-headed Bushshrike	
	<i>Dryoscopus cubla</i>	Black-backed Puffback	
	<i>Tchagra australis</i>	Brown-crowned Tchagra	
	<i>Nilaus afer</i>	Brubru	
	<i>Tchagra minutus</i>	Marsh Tchagra	
	<i>Tchagra senegalus</i>	Black-crowned Tchagra	
	<i>Telophorus quadricolor</i>	Four-coloured bushshrike	
MEROPIIDAE	<i>Merops pusillus</i>	Little Bee-eater	
	<i>Merops hirundineus</i>	Swallow-tailed Bee-eater	
	<i>Merops superciliosus</i>	Olive Bee-eater	
	<i>Merops boehmi</i>	Boehm's Bee-eater	
	<i>Merops persicus</i>	Blue-cheeked Bee-eater	
	<i>Merops bullockoides</i>	White-fronted Bee-eater	
	<i>Merops nubicoides</i>	Southern Carmine Bee-eater	
MONARCHIDAE	<i>Terpsiphone viridis</i>	African Paradise-Flycatcher	
	<i>Trochocercus cyanomelas</i>	African Crested-Flycatcher	
MOTACILLIDAE	<i>Motacilla cinerea</i>	Grey Wagtail	
	<i>Motacilla flava</i>	yellow wagtail (inactive)	
	<i>Motacilla aguimp</i>	African Pied Wagtail	
	<i>Motacilla clara</i>	Mountain Wagtail	
	<i>Anthus leucophrys</i>	Plain-backed Pipit	
	<i>Anthus trivialis</i>	Tree Pipit	
	<i>Anthus caffer</i>	Bush Pipit	
	<i>Anthus lineiventris</i>	Striped Pipit	
	<i>Anthus richardi</i>	Richard's Pipit	
	<i>Anthus similis</i>	Long-billed Pipit	
	<i>Anthus vaalensis</i>	Buffy Pipit	
	<i>Macronyx ameliae</i>	Rosy-throated Longclaw	
	<i>Macronyx croceus</i>	Yellow-throated Longclaw	
	<i>Macronyx fuelleborni</i>	Fuelleborn's Longclaw	
	<i>Anthus cinnamomeus</i>	Grassveld Pipit	
	<i>Motacilla flava lutea</i>	Yellow-headed Wagtail	
	<i>Motacilla flava</i>	Western Yellow Wagtail	
MUSCICAPIDAE	<i>Saxicola torquatus</i>	African Stonechat	
	<i>Fraseria caerulescens</i>	Ashy Flycatcher	
	<i>Cichladusa arquata</i>	Collared Palm-Thrush	
	<i>Oenanthe</i>	Northern Wheatear	
	<i>Cossypha natalensis</i>	Red-capped Robin-Chat	
	<i>Cossypha caffra</i>	Cape Robin-Chat	
	<i>Cossypha anomala</i>	Olive-flanked Robin-Chat	
	<i>Cossypha heuglini</i>	White-browed Robin-Chat	
	<i>Agricola pallidus</i>	Pale Flycatcher	
	<i>Pseudalethe fuelleborni</i>	White-chested Alethe	
	<i>Pseudalethe choloensis</i>	Cholo Alethe	
	<i>Oenanthe pileata</i>	Capped Wheatear	
	<i>Myrmecocichla arnoti</i>	White-headed Black-Chat	
	<i>Myrmecocichla nigra</i>	Sooty Chat	
<i>Saxicola rubetra</i>	Whinchat		

FAMILY	BIOLOGICAL NAME	COMMON NAME	STATUS
	<i>Muscicapa striata</i>	Spotted Flycatcher	
	<i>Bradornis boehmi</i>	B&A's Flycatcher	
	<i>Muscicapa adusta</i>	Dusky-brown Flycatcher	
	<i>Cercotrichas barbata</i>	Miombo Scrub-Robin	
	<i>Cercotrichas quadrivirgata</i>	Bearded Scrub-Robin	
	<i>Cercotrichas leucophrys</i>	Red-backed Scrub-Robin	
	<i>Luscinia luscinia</i>	Thrush Nightingale	
	<i>Ficedula semitorquata</i>	Semicollared Flycatcher	
	<i>Ficedula albicollis</i>	Collared Flycatcher	
	<i>Monticola angolensis</i>	Miombo Rock-Thrush	
	<i>Melaenornis pammelaina</i>	Southern Black Flycatcher	
	<i>Fraseria plumbea</i>	Grey Tit-Flycatcher	
	<i>Cercomela familiaris</i>	Familiar Chat	
	<i>Sheppardia sharpei</i>	Sharpe's Akalat	
	<i>Sheppardia gunningi</i>	East Coast Akalat	NT
	<i>Pinarornis plumosus</i>	Boulder Chat	
	<i>Pogonocichla stellata</i>	White-starred Robin	
<i>Melaenornis fischeri</i>	White-eyed Slaty-flycatcher		
<i>Thamnolaea cinnamomeiventris</i>	Mocking Cliff-Chat		
MUSOPHAGIDAE	<i>Corythaixoides personatus</i>	Bare-faced Go-away Bird	
	<i>Tauraco livingstonii</i>	Livingstone's Turaco	
	<i>Tauraco porphyreolophus</i>	Purple-crested Turaco	
	<i>Tauraco schalowi</i>	Schalow's Turaco	
	<i>Corythaixoides concolor</i>	Gray Go-away-bird	
NECTARINIIDAE	<i>Nectarinia famosa</i>	Malachite Sunbird	
	<i>Nectarinia kilimensis</i>	Bronze Sunbird	
	<i>Nectarinia johnstoni</i>	Red-tufted Sunbird	
	<i>Anthreptes longuemarei</i>	Violet-backed Sunbird	
	<i>Anthreptes anchietae</i>	Anchietta's Sunbird	
	<i>Nectarinia afra</i>	Greater Double-collared Sunbird	
	<i>Chaomitra senegalensis</i>	Scarlet-chested Sunbird	
	<i>Cinnyris venustus</i>	Variable Sunbird	
	<i>Chaomitra amethystina</i>	Amethyst Sunbird	
	<i>Cinnyris bifasciatus</i>	Purple-banded Sunbird	
	<i>Cinnyris cupreus</i>	Copper Sunbird	
	<i>Cinnyris oustaleti</i>	Oustalet's Sunbird	
	<i>Cinnyris shelleyi</i>	Shelley's Sunbird	
	<i>Cinnyris talatala</i>	White-breasted Sunbird	
	<i>Cyanomitra verticalis</i>	Green-headed Sunbird	
	<i>Hedydipna collaris</i>	Collared Sunbird	
	<i>Nectarinia fueleborni</i>	Eastern Double-collared Sunbird	
<i>Cinnyris manoensis</i>	Miombo Sunbird		
<i>Cyanomitra olivacea</i>	Olive Sunbird		
<i>Nectarinia veroxii</i>	Grey Sunbird		
NICATORIDAE	<i>Nicator gularis</i>	Eastern Nicator	
NUMIDIDAE	<i>Numida meleagris</i>	Helmeted Guineafowl	
	<i>Guttera pucherani</i>	Crested Guineafowl	
ORIOLIDAE	<i>Oriolus auratus</i>	African Golden Oriole	
	<i>Oriolus oriolus</i>	Eurasian Golden Oriole	
	<i>Oriolus larvatus</i>	Black-headed Oriole	
	<i>Oriolus chlorocephalus</i>	Green-headed Oriole	
OTIDIDAE	<i>Neotis denhami</i>	Denham's Bustard	NT
	<i>Lissotis melanogaster</i>	Black-bellied Bustard	
PANDIONIDAE	<i>Pandion haliaetus</i>	Osprey	
PARIDAE	<i>Melaniparus griseiventris</i>	Miombo Tit	
	<i>Melaniparus niger</i>	Southern Black Tit	
	<i>Melaniparus rufiventris</i>	Rufous-bellied Tit	
PASSERIDAE	<i>Passer griseus</i>	Northern Grey-headed Sparrow	
	<i>Petronia superciliaris</i>	Yellow-throated Petronia	

FAMILY	BIOLOGICAL NAME	COMMON NAME	STATUS
	<i>Passer diffusus</i>	Southern Gray-headed Sparrow	
	<i>Passer suahelicus</i>	Swahili Sparrow	
PELECANIDAE	<i>Pelecanus onocrotalus</i>	Great White Pelican	
	<i>Pelecanus rufescens</i>	Pink-backed Pelican	
PELLORNEIDAE	<i>Illadopsis pyrrhoptera</i>	Mountain Illadopsis	
PHALACROCORACIDAE	<i>Phalacrocorax carbo</i>	Great Cormorant	
	<i>Microcarbo africanus</i>	Long-tailed Cormorant	
	<i>Phalacrocorax carbo lucidus</i>	White-breasted Cormorant	
PHASIANIDAE	<i>Francolinus coqui</i>	Coqui Francolin	
	<i>Pternistis hildebrandti</i>	Hildebrandt's Francolin	
	<i>Francolinus shelleyi</i>	Shelley's Francolin	
	<i>Pternistis squamatus</i>	Scaly Francolin	
	<i>Pternistis afer</i>	Red-necked Francolin	
	<i>Francolinus levallantii</i>	Red-wing Francolin	
	<i>Pternistis swainsonii</i>	Swainson's Francolin	
	<i>Francolinus sephaena</i>	Crested Francolin	
	<i>Coturnix coturnix</i>	Common Quail	
	<i>Synoicus adansonii</i>	Blue Quail	
	<i>Coturnix delegorguei</i>	Harlequin Quail	
	<i>Pternistis afer melanogaster</i>		
PHOENICOPTERIDAE	<i>Phoeniconaias minor</i>	Lesser Flamingo	NT
	<i>Phoenicopterus roseus</i>	Greater Flamingo	
	<i>Phoeniculus purpureus</i>	Green Woodhoopoe	
	<i>Rhinopomastus cyanomelas</i>	Common Scimitarbill	
PHYLLOSCOPIIDAE	<i>Phylloscopus ruficapilla</i>	Yellow-throated Wood-Warbler	
	<i>Phylloscopus trochilus</i>	Willow Warbler	
PICIDAE	<i>Campethera cailliautii</i>	Green-backed Woodpecker	
	<i>Campethera abingoni</i>	Golden-tailed Woodpecker	
	<i>Campethera bennettii</i>	Bennett's Woodpecker	
	<i>Dendropicos namaquus</i>	Bearded Woodpecker	
	<i>Dendropicos stierlingi</i>	Stierling's Woodpecker	NT
	<i>Dendropicos fuscescens</i>	Cardinal Woodpecker	
	<i>Dendropicos griseocephalus</i>	Olive Woodpecker	
PITTIDAE	<i>Pitta angolensis</i>	African Pitta	
PLATYSTEIRIDAE	<i>Batis capensis</i>	Cape Batis	
	<i>Batis molitor</i>	Chinspot Batis	
	<i>Batis fratrum</i>	Woodward's Batis	
	<i>Batis soror</i>	Pale Batis	
	<i>Platysteira peltata</i>	Black-throated Wattle-eye	
	<i>Batis crypta</i>	Dark Batis	
PLOCEIDAE	<i>Ploceus bicolor</i>	Forest Weaver	
	<i>Ploceus baglafecht</i>	Baglafecht Weaver	
	<i>Ploceus subaureus</i>	African Golden-weaver	
	<i>Ploceus ocularis</i>	Spectacled Weaver	
	<i>Ploceus cucullatus</i>	Village Weaver	
	<i>Ploceus bertrandi</i>	Bertram's Weaver	
	<i>Ploceus velatus</i>	Southern Masked Weaver	
	<i>Ploceus xanthopterus</i>	Southern Brown-throated Weaver	
	<i>Ploceus xanthops</i>	Holub's Golden-Weaver	
	<i>Ploceus olivaceiceps</i>	Olive-headed Weaver	NT
	<i>Ploceus intermedius</i>	Lesser Masked-Weaver	
	<i>Euplectes orix</i>	Southern Red Bishop	
	<i>Euplectes hordeaceus</i>	Black-winged Bishop	
	<i>Euplectes capensis</i>	Yellow-rumped Widowbird	
	<i>Euplectes albonotatus</i>	White-winged Widowbird	
	<i>Euplectes psammocromius</i>	Buff-shouldered Widowbird	
	<i>Euplectes axillaris</i>	Fan-tailed Widowbird	
	<i>Euplectes ardens</i>	Red-collared Widowbird	
	<i>Quelea quelea</i>	Red-billed Quelea	

FAMILY	BIOLOGICAL NAME	COMMON NAME	STATUS
	<i>Quelea erythropis</i>	Red-headed Quelea	
	<i>Quelea cardinalis</i>	Cardinal Quelea	
	<i>Amblyospiza albifrons</i>	Grosbeak Weaver	
	<i>Plocepasser rufoscapulatus</i>	Chestnut-backed Sparrow-Weaver	
	<i>Plocepasser mahali</i>	White-browed Sparrow-weaver	
	<i>Bubalornis niger</i>	Red-billed Buffalo-Weaver	
	<i>Anaplectes rubriceps</i>	Red-headed Weaver	
	<i>Euplectes macroura</i>	Yellow-shouldered Widowbird	
PODICIPEDIDAE	<i>Tachybaptus ruficollis</i>	Little Grebe	
PROMEROPIDAE	<i>Modulatrix stictigula</i>	Spot-throat	
PSITTACIDAE	<i>Poicephalus cryptoxanthus</i>	Brown-headed Parrot	
	<i>Poicephalus meyeri</i>	Meyer's Parrot	
	<i>Poicephalus robustus robustus</i>	Cape Parrot	
PSITTACULIDAE	<i>Agapornis lilianae</i>	Lilian's Lovebird	NT
PYCNONOTIDAE	<i>Phyllastrephus terrestris</i>	Terrestrial Brownbul	
	<i>Phyllastrephus cerviniventris</i>	Gray-olive Greenbul	
	<i>Phyllastrephus cabanisi</i>	Cabanis's Greenbul	
	<i>Phyllastrephus flavostriatus</i>	Yellow-streaked Bulbul	
	<i>Pycnonotus barbatus</i>	Common Bulbul	
	<i>Chlorocichla flaviventris</i>	Yellow-bellied Greenbul	
	<i>Eurillas virens</i>	Little Greenbul	
	<i>Arizelocichla nigriceps</i>	Eastern Mountain-Greenbul	
	<i>Arizelocichla milanjensis</i>	Stripe-cheeked Greenbul	
	<i>Arizelocichla masukuensis</i>	Shelley's Greenbul	
	<i>Andropadus importunus</i>	Sombre Greenbul	
RALLIDAE	<i>Zapornia pusilla</i>	Baillon's Crake	
	<i>Porzana porzana</i>	Spotted Crake	
	<i>Zapornia flavirostra</i>	Black Crake	
	<i>Rallus caerulescens</i>	African Rail	
	<i>Gallinula angulata</i>	Lesser Moorhen	
	<i>Gallinula chloropus</i>	Eurasian Moorhen	
	<i>Crex crex</i>	Corn Crake	
	<i>Fulica cristata</i>	Red-knobbed Coot	
	<i>Porphyrio porphyrio</i>	Purple Swamphen	
	<i>Porphyrio alleni</i>	Allen's Gallinule	
	<i>Amaurornis marginalis</i>	Striped Crake	
	<i>Crecopsis egregia</i>	African Crake	
RECURVIROSTRIDAE	<i>Himantopus himantopus</i>	Black-winged Stilt	
	<i>Recurvirostra avosetta</i>	Pied Avocet	
REMIZIDAE	<i>Anthoscopus caroli</i>	African Penduline-Tit	
ROSTRATULIDAE	<i>Rostratula benghalensis</i>	Greater Painted-snipe	
SAGITTARIIDAE	<i>Sagittarius serpentarius</i>	Secretarybird	VU
SAROTHRURIDAE	<i>Sarothrura affinis</i>	Striped Flufftail	
	<i>Sarothrura boehmi</i>	Streaky-breasted Flufftail	
	<i>Sarothrura elegans</i>	Buff-spotted Flufftail	
	<i>Sarothrura rufa</i>	Red-chested Flufftail	
SCOLOPACIDAE	<i>Calidris minuta</i>	Little Stint	
	<i>Calidris ferruginea</i>	Curlew Sandpiper	NT
	<i>Tringa nebularia</i>	Common Greenshank	
	<i>Tringa stagnatilis</i>	Marsh Sandpiper	
	<i>Tringa ochropus</i>	Green Sandpiper	
	<i>Numenius arquata</i>	Eurasian Curlew	NT
	<i>Gallinago media</i>	Great Snipe	NT
	<i>Gallinago nigripennis</i>	African Snipe	
	<i>Actitis hypoleucos</i>	Common Sandpiper	
	<i>Tringa glareola</i>	Wood Sandpiper	
SCOPIIDAE	<i>Scopus umbretta</i>	Hamerkop	
STENOSTIRIDAE	<i>Elminia albicauda</i>	White-tailed Blue-Flycatcher	
	<i>Elminia albonotata</i>	White-tailed Crested-Flycatcher	

FAMILY	BIOLOGICAL NAME	COMMON NAME	STATUS
STRIGIDAE	<i>Bubo capensis</i>	Cape Eagle-Owl	
	<i>Glaucidium capense</i>	African Barred Owlet	
	<i>Glaucidium perlatum</i>	Pearl-spotted Owlet	
	<i>Strix woodfordii</i>	African Wood-Owl	
	<i>Scotopelia peli</i>	Pel's Fishing-Owl	
	<i>Bubo lacteus</i>	Verreaux's Eagle-Owl	
	<i>Bubo africanus</i>	Spotted Eagle-owl	
	<i>Otus senegalensis</i>	African Scops-Owl	
	<i>Asio capensis</i>	Marsh Owl	
	<i>Ptilopsis leucotis</i>	Northern White-faced Owl	
	<i>Bubo africanus</i>	Spotted Eagle-Owl	
STURNIDAE	<i>Lamprotornis mevesii</i>	Meves's Glossy-starling	
	<i>Lamprotornis chloropterus</i>	Lesser Blue-eared Glossy-starling	
	<i>Poeoptera kenricki</i>	Kenrick's Starling	
	<i>Lamprotornis chalybaeus</i>	Greater Blue-eared Starling	
	<i>Onychognathus walleri</i>	Waller's Starling	
	<i>Onychognathus morio</i>	Red-winged Starling	
	<i>Onychognathus tenuirostris</i>	Slender-billed Starling	
	<i>Neocichla gutturalis</i>	Babbling Starling	
	<i>Cinnyricinclus leucogaster</i>	Violet-backed Starling	
	<i>Creatophora cinerea</i>	Wattled Starling	
	<i>Lamprotornis elisabeth</i>	Miombo Blue-eared Starling	
	<i>Onychognathus morio</i>	Red-winged Starling	
SYLVIIDAE	<i>Sylvia communis</i>	Greater Whitethroat	
	<i>Sylvia atricapilla</i>	Eurasian Blackcap	
	<i>Sylvia borin</i>	Garden Warbler	
	<i>Sylvia lugens</i>	Brown Warbler	
	<i>Sylvia abyssinica</i>	African Hill Babbler	
THRESKIORNITHIDAE	<i>Platalea alba</i>	African Spoonbill	
	<i>Threskiornis aethiopicus aethiopicus</i>	African Sacred Ibis	
	<i>Bostrychia hagedash</i>	Hadada Ibis	
	<i>Plegadis fainellus</i>	Glossy Ibis	
TROGONIDAE	<i>Apaloderma narina</i>	Narina Trogon	
	<i>Apaloderma vittatum</i>	Bar-tailed Trogon	
TURDIDAE	<i>Turdus libonyana</i>	Kurrichane Thrush	
	<i>Turdus olivaceus</i>	Olive Thrush	
	<i>Geokichla guttata</i>	Spotted Ground-Thrush	EN
	<i>Geokichla gurneyi</i>	Orange Ground-Thrush	
	<i>Psophocichla litsitsirupa</i>	Groundscraper Thrush	
TURNICIDAE	<i>Turnix sylvaticus</i>	Common Buttonquail	
TYTONIDAE	<i>Tyto capensis</i>	African Grass-Owl	
	<i>Tyto alba</i>	Barn Owl	
UPUPIDAE	<i>Upupa epops</i>	Common Hoopoe	
	<i>Upupa epops africana</i>	African Hoopoe	
VANGIDAE	<i>Bias musicus</i>	Black-and-white Shrike-flycatcher	
	<i>Prionops plumatus</i>	White-crested Helmetshrike	
	<i>Prionops retzii</i>	Retz's Helmetshrike	
VIDUIDAE	<i>Vidua paradisaea</i>	Eastern Paradise-Whydah	
	<i>Vidua chalybeata</i>	Village Indigobird	
	<i>Vidua macroura</i>	Pin-tailed Whydah	
	<i>Vidua purpurascens</i>	Purple Indigobird	
	<i>Vidua obtusa</i>	Broad-tailed Paradise-Whydah	
	<i>Vidua codringtoni</i>	Green Indigobird	
	<i>Vidua funerea</i>	Black Widowfinch	
	<i>Anomalospiza imberbis</i>	Cuckoo Finch	
ZOSTEROPIIDAE	<i>Zosterops senegalensis</i>	African Yellow White-eye	

APPENDIX E

Mammal species historically recorded in Malawi

FAMILY	BIOLOGICAL NAME	COMMON NAME	IUCN
MACROSCOLIDAE (Elephant-shrews)	<i>Elephantulus brachyrhynchus</i>	Short-snouted elephant	
	<i>Elephantulus fuscus</i>	Dusky elephant shrew	DD
	<i>Petrodromus tetradactylus</i>	Four-toed elephant shrew	
	<i>Rhynchocyon cirnei</i>	Checkered elephant shrew	NT
ORYCTEROPODIDAE	<i>Orycteropus afer</i>	Aardvark	
PROCAVIIDAE (Hylaxes)	<i>Heterohyrax brucei</i>	Yellow-spotted rock hyrax	
ELEPHANTIDAE (Elephants)	<i>Loxodonta africana</i>	African bush elephant	VU
GALAGIDAE	<i>Galago moholi</i>	Mohol bushbaby	
	<i>Galagoides demidovii</i>	Prince Demidoff's	
	<i>Galagoides granti</i>	Grant's bushbaby	DD
	<i>Galagoides nyasae</i>	Malawi bushbaby	DD
	<i>Galagoides thomasi</i>	Thomas's bushbaby	
	<i>Galagoides zanzibaricus</i>	Zanzibar bushbaby	NT
	<i>Otolemur crassicaudatus</i>	Brown greater galago	
CERCOPITHECIDAE (Old World monkeys)	<i>Chlorocebus pygerythrus</i>	Vervet monkey	
	<i>Cercopithecus mitis</i>	Blue monkey	
	<i>Papio cynocephalus</i>	Yellow baboon	
	<i>Papio ursinus</i>	Chacma baboon	
	<i>Colobus angolensis</i>	Angola colobus	
BATHYERGIDAE	<i>Cryptomys hottentotus</i>	Common mole-rat	
	<i>Cryptomys mechowii</i>	Mechow's mole-rat	
	<i>Heliophobius</i>	Silvery mole-rat	
HYSTRICIDAE (Old World)	<i>Hystrix africaeaustralis</i>	Cape porcupine	
THRYONOMYIDAE (Cane rats)	<i>Thryonomys gregorianus</i>	Lesser cane rat	
ANOMALURIDAE	<i>Anomalurus derbianus</i>	Lord Derby's scaly-tailed	
SCIURIDAE (Squirrels)	<i>Heliosciurus mutabilis</i>	Mutable sun squirrel	
	<i>Paraxerus cepapi</i>	Smith's bush squirrel	
	<i>Paraxerus flavovittis</i>	Striped bush squirrel	DD
	<i>Paraxerus lucifer</i>	Black and red bush squirrel	DD
	<i>Paraxerus palliatus</i>	Red bush squirrel	
GLIRIDAE (Dormice)	<i>Graphiurus johnstoni</i>	Johnston's African	DD
	<i>Graphiurus microtis</i>	Small-eared dormouse	
NESOMYIDAE	<i>Dendromus melanotis</i>	Gray climbing mouse	
	<i>Dendromus mesomelas</i>	Brant's climbing mouse	
	<i>Dendromus mystacalis</i>	Chestnut climbing mouse	
	<i>Dendromus nyikae</i>	Nyika climbing mouse	
	<i>Steatomys pratensis</i>	Fat mouse	
	<i>Beamys major</i>	Greater hamster-rat	NT
	<i>Cricetomys gambianus</i>	Gambian pouched rat	
	<i>Saccostomus campestris</i>	South African pouched	
MURIDAE (Mice, rats, voles, gerbils, hamsters, etc)	<i>Acomys spinosissimus</i>	Spiny mouse	
	<i>Lophuromys flavopunctatus</i>	Yellow-spotted brush-	
	<i>Uranomys ruddi</i>	Rudd's mouse	
	<i>Otomys angoniensis</i>	Angoni vlei rat	
	<i>Otomys denti</i>	Dent's vlei rat	NT
	<i>Otomys lacustris</i>	Tanzanian vlei rat	NT
	<i>Otomys uzungwensis</i>	Uzungwe vlei rat	EN
	<i>Tatera boehmi</i>	Boehm's gerbil	
	<i>Tatera leucogaster</i>	Bushveld gerbil	
	<i>Aethomys chrysophilus</i>	Red rock rat	
	<i>Aethomys kaisereri</i>	Kaiser's rock rat	
	<i>Aethomys namaquensis</i>	Namaqua rock rat	

FAMILY	BIOLOGICAL NAME	COMMON NAME	IUCN
	<i>Aethomys nyikae</i>	Nyika rock rat	
	<i>Arvicanthis niloticus</i>	African grass rat	
	<i>Dasymys incomtus</i>	African marsh rat	
	<i>Grammomys dolichurus</i>	Woodland thicket rat	
	<i>Grammomys ibeanus</i>	Ruwenzori thicket rat	
	<i>Hylomyscus denniae</i>	Montane wood mouse	
	<i>Lemniscomys rosalia</i>	Single-striped grass mouse	
	<i>Lemniscomys striatus</i>	Typical striped grass	
	<i>Mastomys natalensis</i>	Natal multimammate	
	<i>Mus minutoides</i>	African pygmy mouse	
	<i>Mus triton</i>	Gray-bellied pygmy mouse	
	<i>Mylomys dybowskii</i>	African groove-toothed rat	
	<i>Pelomys fallax</i>	Creek groove-toothed	
	<i>Praomys delectorum</i>	Delectable soft-furred	NT
	<i>Rhabdomys pumilio</i>	Four-striped grass mouse	
	<i>Thallomys paeduus</i>	Acacia rat	
<i>Zelotomys hildegardeae</i>	Hildegarde's broad-headed		
LEPORIDAE (Rabbits, hares)	<i>Pronolagus rupestris</i>	Smith's red rock hare	
ERINACEIDAE (Hedgehogs)	<i>Atelerix albiventris</i>	Four-toed hedgehog	
SORICIDAE (Shrews)	<i>Crocidura cyanea</i>	Reddish-gray musk shrew	
	<i>Crocidura fuscomurina</i>	Bicolored musk shrew	
	<i>Crocidura hirta</i>	Lesser red musk shrew	
	<i>Crocidura luna</i>	Moonshine shrew	
	<i>Crocidura silacea</i>	Lesser gray-brown musk	
	<i>Crocidura turba</i>	Turbo shrew	
	<i>Suncus lixus</i>	Greater dwarf shrew	
	<i>Suncus varilla</i>	Lesser dwarf shrew	
	<i>Sylvisorex megalura</i>	Climbing shrew	
PTEROPODIDAE (Flying foxes, Old World fruit bats)	<i>Eidolon helvum</i>	Straw-coloured fruit bat	
	<i>Epomophorus crypturus</i>	Peters's epauletted fruit	
	<i>Epomophorus labiatus</i>	Ethiopian epauletted fruit	
	<i>Epomophorus wahlbergi</i>	Wahlberg's epauletted	
	<i>Epomops dobsoni</i>	Dobson's epauletted fruit	
	<i>Plerotes anchietae</i>	D'Anchieta's fruit bat	DD
	<i>Rousettus aegyptiacus</i>	Egyptian fruit bat	
	<i>Rousettus lanosus</i>	Long-haired rousette	
VESPERTILIONIDAE	<i>Kerivoula argentata</i>	Damara woolly bat	
	<i>Kerivoula lanosa</i>	Lesser woolly bat	
	<i>Myotis bocagii</i>	Rufous mouse-eared bat	
	<i>Myotis tricolor</i>	Cape hairy bat	
	<i>Myotis welwitschii</i>	Welwitsch's bat	
	<i>Eptesicus hottentotus</i>	Long-tailed house bat	
	<i>Glauconycteris argentata</i>	Silvered bat	
	<i>Glauconycteris variegata</i>	Butterfly bat	
	<i>Laephotis botswanae</i>	Botswanan long-eared bat	
	<i>Neoromicia capensis</i>	Cape serotine	
	<i>Neoromicia flavescens</i>	Yellow serotine	DD
	<i>Neoromicia mekorum</i>	Mek's house bat	DD
	<i>Neoromicia nanus</i>	Banana pipistrelle	
	<i>Neoromicia rendalli</i>	Rendall's serotine	
	<i>Neoromicia somalicus</i>	Somali serotine	
<i>Zulu serotine</i>	Neoromicia zuluensis		

FAMILY	BIOLOGICAL NAME	COMMON NAME	IUCN
	<i>Nycticeinops schlieffeni</i>	Schlieffen's bat	
	<i>Pipistrellus rueppelli</i>	Rüppell's pipistrelle	
	<i>Pipistrellus rusticus</i>	Rusty pipistrelle	
	<i>Scotoecus albigula</i>	White-bellied lesser house	DD
	<i>Scotoecus albofuscus</i>	Light-winged lesser house	DD
	<i>Scotoecus hindei</i>	Hinde's lesser house bat	DD
	<i>Scotoecus hirundo</i>	Dark-winged lesser house	DD
	<i>Scotophilus dinganii</i>	African yellow bat	
	<i>Scotophilus nigrita</i>	Schreber's yellow bat	NT
	<i>Scotophilus viridis</i>	Greenish yellow bat	
	<i>Miniopterus fraterculus</i>	Lesser long-fingered bat	
	<i>Miniopterus natalensis</i>	Natal long-fingered bat	NT
MOLOSSIDAE	<i>Chaerephon nigeriae</i>	Nigerian free-tailed bat	
	<i>Chaerephon pumila</i>	Little free-tailed bat	
	<i>Mops condylurus</i>	Angolan free-tailed bat	
	<i>Mops midas</i>	Midas free-tailed bat	
	<i>Otomops martiensseni</i>	Large-eared free-tailed bat	NT
	<i>Tadarida fulminans</i>	Madagascan large free-	
	<i>Tadarida ventralis</i>	African giant free-tailed	NT
EMBALLONURIDAE	<i>Taphozous mauritanus</i>	Mauritian tomb bat	
NYCTERIDAE	<i>Nycteris grandis</i>	Large slit-faced bat	
	<i>Nycteris hispida</i>	Hairy slit-faced bat	
	<i>Nycteris macrotis</i>	Large-eared slit-faced bat	
	<i>Nycteris thebaica</i>	Egyptian slit-faced bat	
	<i>Nycteris woodi</i>	Wood's slit-faced bat	NT
MEGADERMATIDAE	<i>Lavia frons</i>	Yellow-winged bat	
RHINOLOPHIDAE	<i>Rhinolophus blasii</i>	Blasius's horseshoe bat	NT
	<i>Rhinolophus clivosus</i>	Geoffroy's horseshoe bat	
	<i>Rhinolophus darlingi</i>	Darling's horseshoe bat	
	<i>Rhinolophus fumigatus</i>	Rüppell's horseshoe bat	
	<i>Rhinolophus landeri</i>	Lander's horseshoe bat	
	<i>Rhinolophus simulator</i>	Bushveld horseshoe bat	
	<i>Hipposideros caffer</i>	Sundevall's roundleaf bat	
	<i>Hipposideros ruber</i>	Noack's roundleaf bat	
	<i>Triaenops persicus</i>	Persian trident bat	
MANIDAE	<i>Manis temminckii</i>	Ground pangolin	NT
FELIDAE (Cats)	<i>Acinonyx jubatus jubatus</i>	South African cheetah	VU
	<i>Caracal caracal</i>	Caracal	
	<i>Felis silvestris</i>	Wildcat	
	<i>Leptailurus serval</i>	Serval	
	<i>Panthera leo</i>	Llion	VU
	<i>Panthera pardus pardus</i>	African leopard	NT
VIVERRIDAE (Civets, mongooses, etc)	<i>Civettictis civetta</i>	African civet	
	<i>Genetta angolensis</i>	Angolan genet	
	<i>Genetta maculata</i>	Rusty-spotted genet	
NANDINIIDAE	<i>Nandinia binotata</i>	African palm civet	
HERPESTIDAE (Mongooses)	<i>Atilax paludinosus</i>	Marsh mongoose	
	<i>Bdeogale crassicauda</i>	Bushy-tailed mongoose	
	<i>Galerella sanguinea</i>	Slender mongoose	
	<i>Helogale parvula</i>	Common dwarf mongoose	
	<i>Herpestes ichneumon</i>	Egyptian mongoose	
	<i>Mungos mungo</i>	Banded mongoose	

FAMILY	BIOLOGICAL NAME	COMMON NAME	IUCN
	<i>Paracynictis selousi</i>	Selous' mongoose	
	<i>Rhynchogale melleri</i>	Meller's mongoose	
HYAENIDAE (Hyaenas)	<i>Crocuta crocuta</i>	Spotted hyena	
	<i>Hyaena brunnea</i>	Brown hyena	NT
CANIDAE (Dogs, foxes)	<i>Canis adustus</i>	Side-striped jackal	
	<i>Lycaon pictus lupinus</i>	East African wild dog	EN
MUSTELIDAE (Mustelids)	<i>Ictonyx striatus</i>	Striped polecat	
	<i>Poecilogale albinucha</i>	African striped weasel	
	<i>Mellivora capensis</i>	Ratel	
	<i>Lutra maculicollis</i>	Speckle-throated otter	
	<i>Aonyx capensis</i>	African clawless otter	
EQUIDAE (Horses etc)	<i>Equus quagga crawshayi</i>	Crawshay's zebra	
RHINOCEROTIDAE	<i>Diceros bicornis minor</i>	South-central black	CR
SUIDAE (Pigs)	<i>Phacochoerus africanus</i>	Common warthog	
	<i>Potamochoerus larvatus</i>	Bushpig	
HIPPOPOTAMIDAE	<i>Hippopotamus amphibius</i>	Hippopotamus	VU
BOVIDAE (Antelope, sheep and goats)	<i>Aelaphus lichtensteinii</i>	Lichtenstein's hartebeest	
	<i>Connochaetes taurinus</i>	Blue wildebeest	
	<i>Neotragus moschatus</i>	Suni	
	<i>Oreotragus oreotragus</i>	Klipspringer	
	<i>Ourebia ourebi</i>	Oribi	
	<i>Raphicerus sharpei</i>	Sharpe's grysbok	
	<i>Syncerus caffer</i>	African buffalo	
	<i>Tragelaphus angasii</i>	Nyala	
	<i>Tragelaphus oryx</i>	Common eland	
	<i>Tragelaphus scriptus</i>	Bushbuck	
	<i>Tragelaphus strepsiceros</i>	Greater kudu	
	<i>Cephalophus monticola</i>	Blue duiker	
	<i>Cephalophus natalensis</i>	Red forest duiker	
	<i>Sylvicapra grimmia</i>	Common duiker	
	<i>Hippotragus equinus</i>	Roan antelope	
	<i>Hippotragus niger</i>	Sable antelope	
	<i>Aepyceros melampus</i>	Impala	
	<i>Kobus ellipsiprymnus</i>	Waterbuck	
	<i>Kobus vardonii</i>	Puku	
	<i>Redunca arundinum</i>	Southern reedbuck	



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