HCVAfrica

HIGH CONSERVATION VALUE

Western Plantain-eater (*Crinifer piscator*)

All photos taken during 2021 Ghana Trip

TERRESTRIAL FAUNA STUDY

FORM GHANA, FOREST RESTORATION, TAIN II RESERVE

NOVEMBER 2021

CONTENTS

LIST OF TABLES

LIST OF FIGURES

1 INTRODUCTION

HCV Africa was approached by Ms Rosa Diemont, the Manager of Landscape Restoration Programme for Tain II Forest Reserve in Ghana to conduct a biodiversity baseline study to update and amend the existing studies completed in 2018. The approach presented in this document and specifically the field survey methodologies are in line with international best practices such as the International Finance Corporation Performance Standard 6 (IFC PS6) and High Conservation Value (HCV) methodologies.

The landscape restoration program for Tain II forest reserve is an initiative of Form International and Form Ghana and is active in the transitional zone between the humid forested ecozones and the savannah zone of Ghana, in and around the Tain II Forest Reserve. The Forest Reserve is located in the Berekum District, Western Ghana and has been previously described as a "highly degraded forest". To support Ghana in sustainable forest management, FORM Ghana (Form) is leading private international funding programmes to develop forest plantation in the reserve, which previously hosted some significant tropical rainforest fragments of the Upper Guinea Forest Ecosystem.

Form Ghana manages forest plantations and have actively restored approximately 12,000 hectares of degraded Forest within their 20 000 ha lease area [1]. The project area is located approximately 45 km northwest of Sunyani Town, Ghana (Figure 1-1). The assessment focussed around the fauna biodiversity within the remnant natural forest patches and natural forest restoration areas within the Tain II Forest Reserve.

[1] https://forminternational.nl/portfolio/form-ghana/

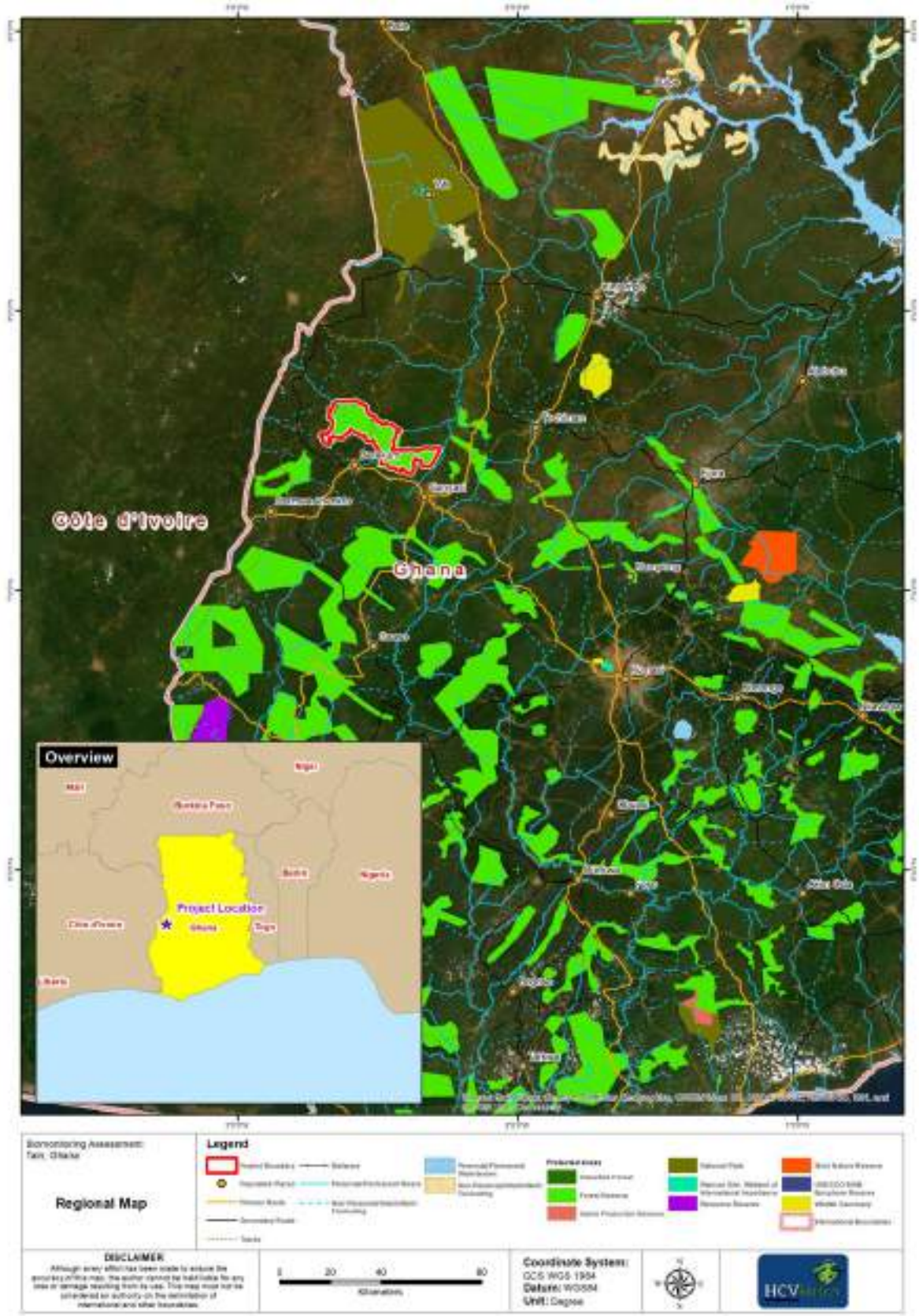

Figure 1-1: Local setting of the Project

2 METHODOLOGY¶

Desktop studies and research on fauna for the Project, broader landscape and provincial ecology included:

- Global Biodiversity Information Facility (GBIF) database, for point-based distribution data that formed the basis on which expected species lists were expanded on.
- IUCN (2018) - International Union for Conservation of Nature (IUCN) Red List of Threatened Species
- GIS data sets used included the following:
    - Mayaux et al. (2004) - A new land cover map of Africa for the year 2000;
    - Arino et al. (2012) - GlobCover 2009 land cover map;
    - Sayre et al. (2013) - A New Map of Standardized Terrestrial Ecosystems of Africa;
    - Olson et al. (2001) - Terrestrial ecoregions of the world: a new map of life on Earth; and
    - IUCN (2018) - Spatial datasets for distribution of fauna species according to the International Union for the Conservation of Nature (IUCN).
    - Sentinel satellite imagery is procured from the European Space Agency (ESA) via Amazon S3[2]. The botanist also used:
    - National Aeronautics and Space Administration (NASA) Shuttle Radar Topography Mission (SRTM) (V3.0, 1 arcsec resolution); and
    - Digital Elevation Model (DEM) (United States Geological Survey (USGS) Earth Explorer website[3]).

The use of GBIF to create an expected species list likely inflates the expected species list due to inclusion of habitat types possible to the AOI but not actually present in the AOI. Thus, the species lists expected should be refined after the planned site survey based on species-specific habitat requirements along with a good understanding of the habitat types and quality in the AOI.

Basic terrain analysis was performed on the DEM using the SAGA GIS software that encompasses slope and channel network analyses to detect hillslopes and potential drainage lines. Drainage channels produced from the DEM are classified according to their branching complexity or Strahler Order where a Strahler Order of five is normally used as the threshold for detecting a channel (Strahler, 1957).

A supervised semi-automatic classification is performed by defining Regions of Interest (ROI) and performing a maximum likelihood classification. The resulting habitats are interpreted in conjunction with the results from the terrain analysis, these adjusted manually, where needed.

Fieldwork was conducted over a five-day period during the wet season wet season (13-17 October 2021). Surveys involved a combination of both active (point counts, opportunistic sampling and live trapping) as well as passive (traps and motion cameras) sampling techniques. The conservation status of present and potentially occurring species was based on the IUCN Red List of threatened species (IUCN, 2021).

[2] http://sentinel-pds.s3-website.eu-central-1.amazonaws.com/
[3] http://earthexplorer.usgs.gov/

Figure 2–1: Examples of some of the active and passive sampling techniques employed during the field survey; A) Bat acoustic surveys using ultrasonic bat detector; B) Motion cameras; C) Mist net; D) installing array trap

2.1 Avifaunal survey

2.1.1 Desktop research

Prior to fieldwork a desktop research was conducted on the available literature for the region and its potentially occurring species. Key literary sources included:

- Sinclair and Ryan (2010), primarily for distribution and taxonomic ordering but also habitat preferences and migratory status.
- Baidu et al. (2001), for information on biome-restricted species and general information on the country's birdlife.
- Lepage (2021) for the national inventory. Taxonomy and nomenclature were based on Clements, (2021).
- The IUCN Red List of threatened species (IUCN, 2021), for the conservation status and nomenclature of the various species.

2.1.2 Fieldwork

Sampling consisted of standardized point counts as well as random diurnal and nocturnal incidental surveys. Standardized point counts (following Buckland et al. 1993) were conducted to gather data on the species composition and relative abundance of species within the three broad habitat types identified within the concession. Each point count was run over a 5 min period. The horizontal detection limit was set a 100 m. At each point the observer documented the date, start time and end time, habitat, numbers of each species, detection method (seen or heard), behavior (perched or flying) and flight direction and general notes on habitat and nesting suitability for conservation important species. To supplement the species inventory with cryptic and illusive species that may not have been detected during the rigid point count protocol, diurnal and nocturnal incidental searches were conducted. This involved the opportunistic sampling of species between point count periods, river scanning, spotlighting and road cruising.

2.1.3 Data analysis

Point count data was arranged into a matrix with point count samples in rows and species in columns. The table formed the basis of the various subsequent statistical analyses. This data was first used to generate a species

accumulation curve to assess sampling adequacy. Random accumulation was assumed over 100 permutations. Next, to distinguish similarities / differences in the species composition between the four identified avifaunal habitats the matrix was converted into a Bray-Curtis dissimilarity matrix and used to generate a two-axis non-metric multidimensional scaling (NMDS) ordination. Thirdly count data were used to establish dominant species and calculate the diversity of each habitat. Shannon's Diversity Index H was the metric used to estimate diversity. All statistical analyses were performed in the R statistical environment.

2.2 Mammal survey

2.2.1 Active Sampling

2.2.1.1 Opportunistic Sampling

Between checking traps, most mammal survey time was spent actively searching for species, particularly those of conservation concern (SCC), by looking in key habitats (otherwise known as target species searches). Incidental observations were made while traversing the site. Mammals were detected from visual observations, tracks, droppings, burrows and any other signs of their presence. Spotlighting during slow night drives was used to detect crepuscular and nocturnal species.

2.2.1.2 Mist netting for bats

A specialized ultra-fine gauge, 6 m mist net was installed on two occasions one in the Tain II reserve and once in the Asukese Forest Reserve. The net was erected at sunset and was monitored constantly for three hours thereafter. An ultrasonic time expansion bat detector was left running aside the net for the duration of the mist netting.

2.2.1.3 Live trapping for small terrestrial mammals

Live trapping was conducted for small mammals using Sherman traps. Trapping of small mammals was conducted at one site within the AOI. Traps were installed in locations where trapping success was expected to be highest. The small mammal trapping sites consisted of a series of collapsible stainless-steel Sherman traps, spaced at approximately 25 m intervals. Each Sherman trap was covered by plant material to provide shade and baited (daily, if necessary) with a mixture of peanut butter, oats, canola oil and syrup.

2.2.2 Passive Sampling

Passive sampling involved the use of motion sensitive cameras and acoustic recordings at various locations within the project area. Motion-sensitive cameras were deployed along paths, streams and road junctions deemed likely to channel local wildlife to detect shy, cryptic and / or illusive species. Cameras were baited.

2.2.3 Interviews

Select members of the local community (hunters and elders) were interviewed to glean as much local knowledge on mammals as possible. Questions centered on establishing presence / absence of SCC species, location of observed SCC, date / time last seen, approximate numbers, uses, opinions and superstitions regarding mammals.

2.3 Herpetofauna survey

2.3.1 Desktop Assessment

The desktop assessment involved the collation all relevant data and literature as pertaining to the occurrence of amphibian and reptile species, particularly those of conservation concern (SCC) in the region. The main aim of the desktop analysis was to establish potential site sensitivity, level of assessment / field protocol and to inform target species searches for Species of Conservation Concern (SCC). The conservation status of herpetofauna was obtained from the IUCN Red List of Threatened Species (IUCN 2021). Important resources used in the desktop assessment included:

- Channing and Rödel (2019) A comprehensive field guide to the amphibians of Africa. Used for identification, nomenclature, taxonomy and natural history information of present and potentially occurring amphibians.
- iNaturalist (2021). Global online biodiversity portal. Used for species information, identifications and submissions of records of reptiles and amphibian on site.
- IUCN (2021). Global red list. Used secondarily for distribution ranges and species conservation status of both reptiles and amphibians.
- Channing (2001). Comprehensive book on the frogs of Central and Southern Africa. Used secondarily to aid identification of amphibians.
- Trape et al. (2012). Used as primary resource for identification and distribution of lizards (includes chameleons, geckos, skinks and varanids)

2.3.2 Active Sampling

The majority of fieldwork time was spent actively sampling. This involved four main survey approaches which are detailed below.

2.3.2.1 Timed Diurnal and Nocturnal Habitat Searches

This involved searching as many representative portions of each main habitat type as possible while recording the location and time spent doing so. Searches involved looking under rocks and bark, in tree holes, scraping debris, spotlighting in rock crevices, burrow investigations, looking for shedding's and eggs and photographing herpetofauna from a distance with a telephoto lens. Due to the secretive and often nocturnal nature of many herpetofauna species this protocol was repeated at night.

2.3.2.2 Timed Nocturnal Amphibian Counts

Amphibian diversity represents a good surrogate for habitat integrity. This together with the vocal and congregatory nature of amphibians makes them a prime candidate for more rigid and quantifiable survey protocols that are otherwise difficult to achieve for reptiles within the timeframes typically associated with basic assessments. Sampling at each site was performed for a similar duration of time. Numbers of each detected species were recorded together with the method of detection (heard or seen). The walked length / position as well as the duration of the search was recorded along with prevailing weather conditions, habitat type, photographs and impacts.

2.3.3 Adhoc sampling

All herpetofauna detected in the time between the above-mentioned sampling protocols were be considered adhoc incidental records. This included all observations made while road cruising at night (driving at slower speeds on surrounding roads). Additionally, other members of the biodiversity specialist team actively participated in reporting / documenting any incidental observations of herpetofauna (photographs, GPS points).

2.3.4 Live Trapping

Reptiles are one of the more challenging biodiversity groups to monitor. They are cryptic, illusive and notoriously difficult to detect. As such considerable effort was initially invested on passive sampling. This involved the installation and checking of four array trap arrays. Each array trap consisted of three 8 m long drift fences arranged in the shape of a "Mercedes" sign. Each of the three arms of the array was fitted with two funnel traps on either side of the fence such that there were six funnel traps per array. In addition, pitfall traps were installed at each end as well as in the centre of the array. Each pitfall and funnel were covered.

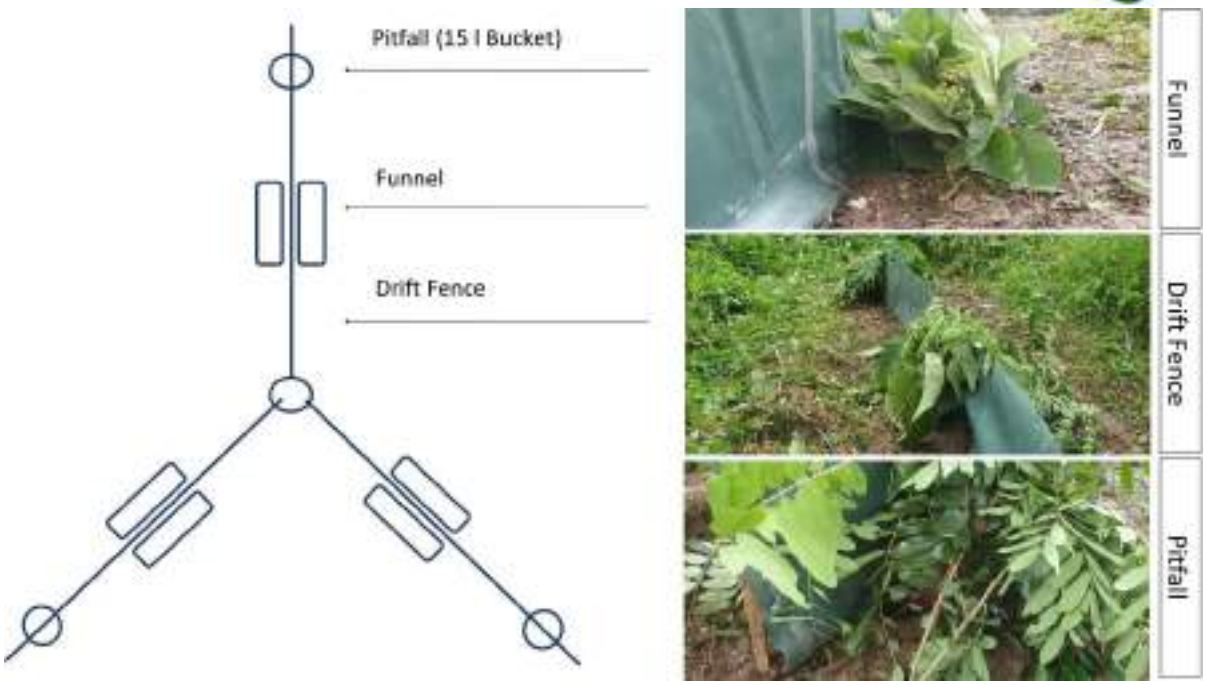

Figure 2–2: Diagram of trap array and examples of each trap element

Figure 2–3: Photographs of the four trap arrays: A) A2; B) A4; C) A1; D) A3

2.3.5 Interviews

Select members of the local community (hunters and elders) were interviewed to glean as much local knowledge on herpetofauna as possible. Questions centered on establishing presence / absence of SCC species, location of observed SCC, date / time last seen, approximate numbers, uses.

2.3.6 Habitat Terminology

"Primary forest" or "virgin forest" are terms often used to describe forests that have not been disturbed through anthropogenic activity (Voorhoeve, 1965; Hall & Swaine, 1981). Hall & Swaine presented two arguments against this usage, namely that such forests are unlikely to exist in Africa and that natural disturbance (e.g., tree fall) is often hard to distinguish from forest changes due to anthropogenic disturbances. They therefore use the term "primary" to differentiate forests with a high and more or less closed canopy from "secondary" forests consisting of a more broken canopy with a well-defined lower and tangled undergrowth layer. They further imply that

secondary forest species are mostly absent from primary forest, but that primary forest species may be present in secondary forest. Estimates suggest that the successional period from pioneer to mature high forest can last between 300 and 400 years (Voorhoeve, 1965).

Conventional terminology refers to primary forest as undisturbed forest. In the strict definition of primary forest, no such forest patches were recorded or are expected to occur in the AOI. Although areas of closed evergreen forest were observed by the HCV Africa biodiversity team, these have been impacted by anthropogenic activities (e.g. logging and charcoal production) and are moderately to severely disturbed forest patches that lack continuous upper stratum. The forest patches in the AOI are mostly closed evergreen forest patches embedded in degraded secondary forest patches.

Habitats for this assessment are assessed and classified into two parent categories namely "Natural" and "Modified" habitats and follows the definitions used by the IFC (IFC GN6 (2019)[4]):

- Natural habitats as "areas composed of viable assemblages of plant and/or animal species of largely native origin, and/or where human activity has not essentially modified an area's primary ecological functions and species composition"; and
- Modified habitats are "areas that may contain a large proportion of plant and/or animal species of non-native origin, and/or where human activity has substantially modified an area's primary ecological functions and species composition".

In line with the IFC definitions, all areas in AOI comprising obvious secondary regrowth (e.g., bush that has grown after forest clearance) were assigned to modified habitats. In addition, natural habitats are assigned a qualitative disturbance level ranging from Very Low to Very High (Table 2-1). The rationale behind this is to identify natural habitats that may be vulnerable to conversion into modified habitat.

Table 2-1: Qualitative disturbance categories with associated forest conditions (adapted from Tchouto (2004))

Disturbance class	Forest/Stream condition	Summary description
Very low	Excellent	Virtually undisturbed
Low	Good	Less than 25% disturbed
Moderate	Slightly degraded	25-50% disturbed
High	Mostly degraded	More than 50% disturbed
Very high	Very poor	Farmland and/or areas close to being modified

2.3.7 Sampling

The assessment was conducted over a single season by traversing the site on foot and by vehicle. Based on preliminary interpretation of satellite imagery, sampling sites were selected that were, by the ecologists, perceived as being ecologically sensitive. The focus of the field survey was to obtain coverage and navigate to as many target areas as time and access permitted.

2.3.8 Red Data Assessment

The following parameters were used to assess the Probability of Occurrence of each Red Data species in the observed and expected species lists of fauna:

- Habitat requirements (HR) – Most Red Data fauna have very specific habitat requirements and the presence of these habitat characteristics in the Project Area was evaluated.

[4] Guidance Note 6 Biodiversity Conservation and Sustainable Management of Living Natural Resources (IFC, 2019)

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

Probability of occurrence is presented in four categories, namely:

- 1 = Present (recorded on site)
- 2 = High
- 3 = Moderate
- 4 = Unlikely

The IUCN Red Data categories that were used for the status identification of fauna:

Table 2-2: Red Data Categories used in this report (IUCN, 2010)

Category		Description
Extinct	(EX)	No known individuals remaining.
Extinct in the Wild	(EW)	Known only to survive in captivity.
Critically Endangered	(CR)	Extremely high risk of extinction in the wild.
Endangered	(EN)	High risk of extinction in the wild
Vulnerable	(VU)	High risk of endangerment in the wild.
Near Threatened	(NT)	Likely to become endangered soon.
Least Concern	(LC)	Lowest risk. Does not qualify for a more at-risk category.
Data Deficient	(DD)	Not enough data to assess its risk of extinction.
Not Evaluated	(NE)	Has not yet been evaluated against the criteria.

The online IUCN database was referenced to identify Red Data species and their various threat status categorisations as well as their known distribution range.

3 ASSUMPTIONS AND LIMITATIONS

- It is assumed that all third-party information obtained (e.g. spatial data) and discussed, is correct at the time of writing this report;
- The biodiversity surveys conducted to date have only assessed areas that are accessible and therefore already compromised ecologically (to some extent), due mostly to influences of local people (subsistence agriculture, timber logging etc). In addition, the region is very poorly surveyed with limited good literature references with any reliability;
- Some of the habitats found in the Project Area did not undergo sampling with the same scientific methods as others. This limitation is axiomatic to a study such as this one, where field related limitations such as poor access (due to roads or vegetation), distance to sites and available time dictate the methods applied. However, impacts as a result of the project on this area can be predicted with a moderate degree of confidence and monitoring during construction and operation are therefore recommended to allow for an adaptive management approach; and
- As no other high resolution multi-spectral imagery was available for the Project Area, the spatial resolution of imagery used in the classification of habitat types is limited to the 10 and 20 m pixel size as provided by Sentinel 2 imagery. However, habitat delineations (specifically the riparian forests) within the main project area were refined with a terrain analysis using 30m SRTM data.

4 BASELINE CONDITIONS

4.1 Location

The Project is in the vicinity of the town Berekum, approximately 45km by road, northwest of Sunyani Town.

4.1.1 Local Climate

The long rainy season starts March and ends in June, with the second short rainy season between September and October. The monthly mean rainfall of the project area is presented in Figure 4-1.

The mean minimum and maximum temperatures are presented in Figure 4-1. The highest temperatures are recorded during February, and March with a temperature of 34.8 °C during the day and 22.7 °C at night time). The coldest temperatures are recorded during August with average minimum temperature of 28.2 °C during the day and 21.2 °C at night. On average the standard deviation between the different months of a year is reasonably low resulting in a generally stable climate.

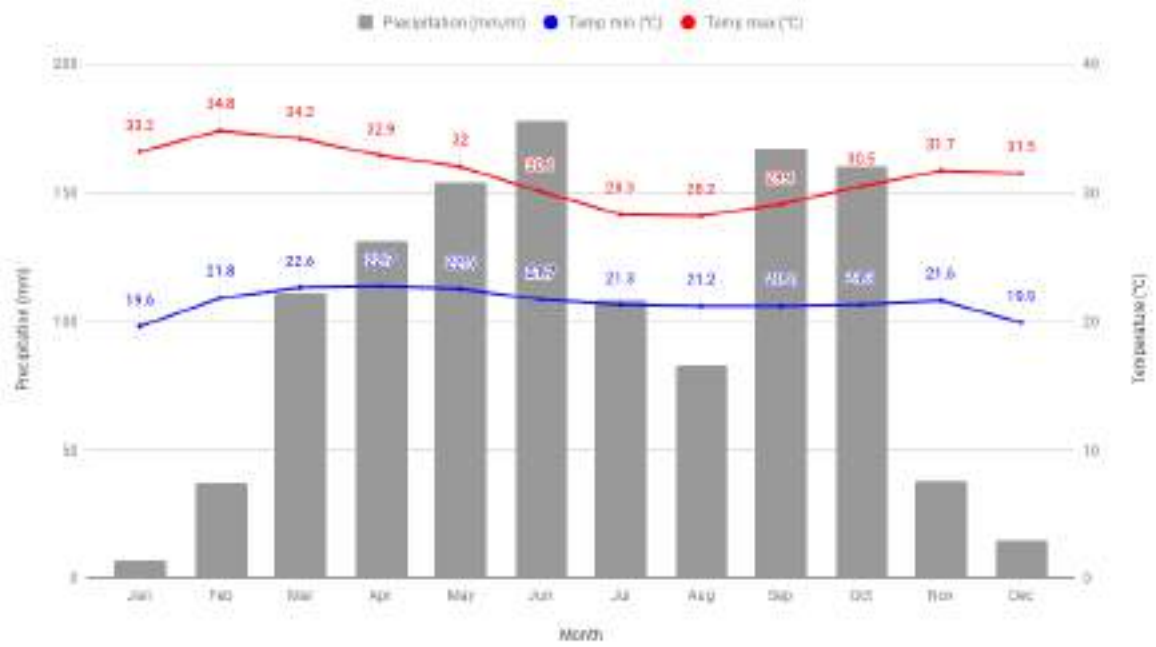

Figure 4-1: Temperature and Rainfall distribution for the project area

4.1.2 Hydrological Setting

Based on the reviewed desktop information, the rivers in the Project Area are likely to comprise of tropical lowland rivers with gallery riparian forest.

The rainfall patterns and subsequent hydrological flood regime is typical of the Tropical Transitional dahomean sub-type hydrological region which results in two distinct flooding periods that occur between March and June and September to October with very dry conditions between November and March (Figure 5–2 and Figure 5–3).

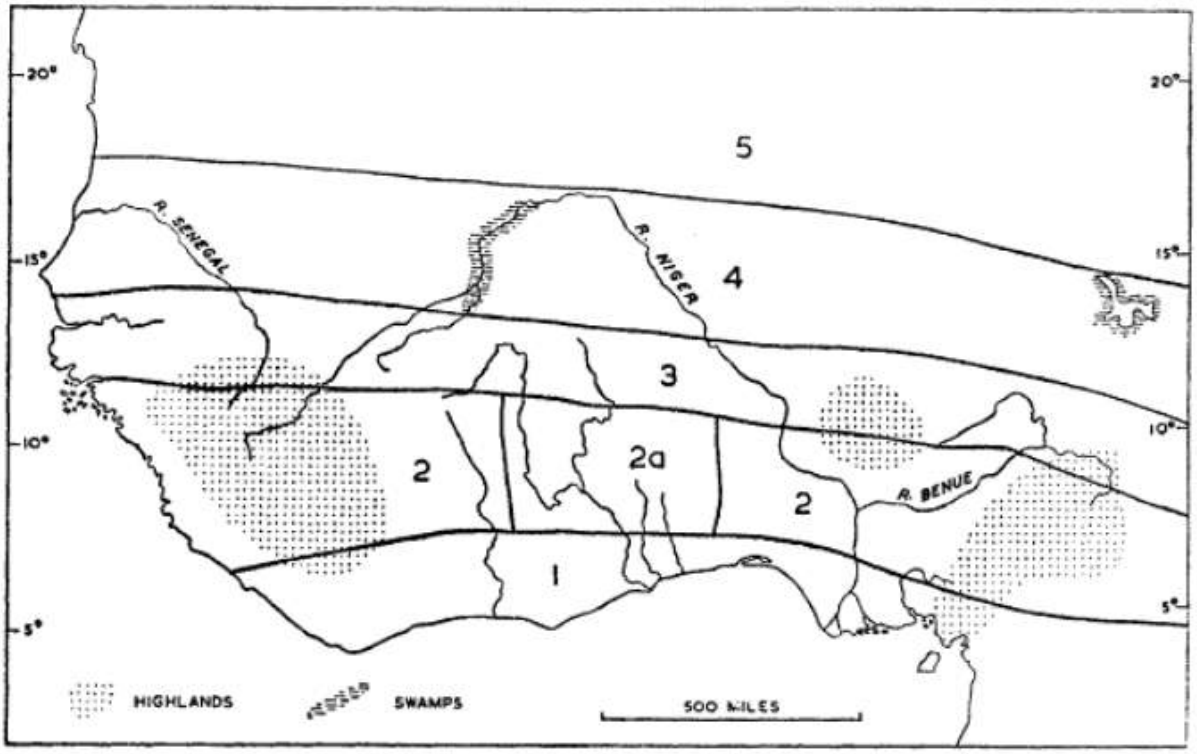

Figure 5–2: Hydrological regions of West Africa. 1 – Equatorial type; 2 – tropical transitional type; 2a – Tropical transitional, dahomean sub-type; 3 – classical tropical type; 4 Sahelian type, 5 Desert and Sub-desert type

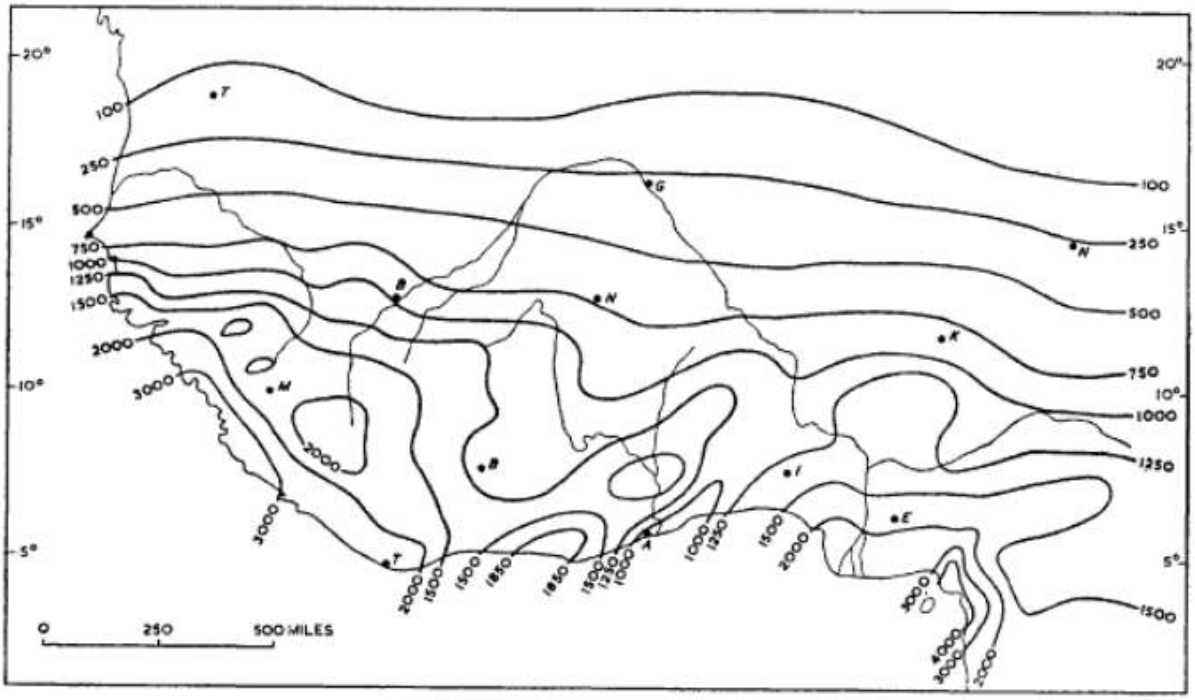

Figure 5–3: Mean annual rainfall in West Africa in millimeters (Ledger, 1964)

4.2 Habitats analysis

This section presents the habitat analysis for the Project Area, as follows:

- Section 4.2.1–field survey coverage of the assessment;
- Section 4.2.2 – the broader landscape (terrestrial ecosystems of African and the world); and
- Section 4.2.3 – the local landscape comprises three major realms (i.e., terrestrial, freshwater (i.e. aquatic), and freshwater-terrestrial (i.e. transitional aquatic-terrestrial interface) which have been sub-divided into 10 ecosystem functional groups (EFG) types comprising eight natural habitat types and 2 modified habitat types.

4.2.1 Site Coverage

A field survey was performed over a period of 5 days from 12th to 16th of October 2021 where the faunal aspects of the Project Area were evaluated (Figure 4-2).

A medium level of confidence for the presence or absence assessment of SCC occurring in the Project Area was achieved. The likelihood of occurrence for SCC not recorded during the assessment was also based on known records for the region as well as the presence of suitable habitat.

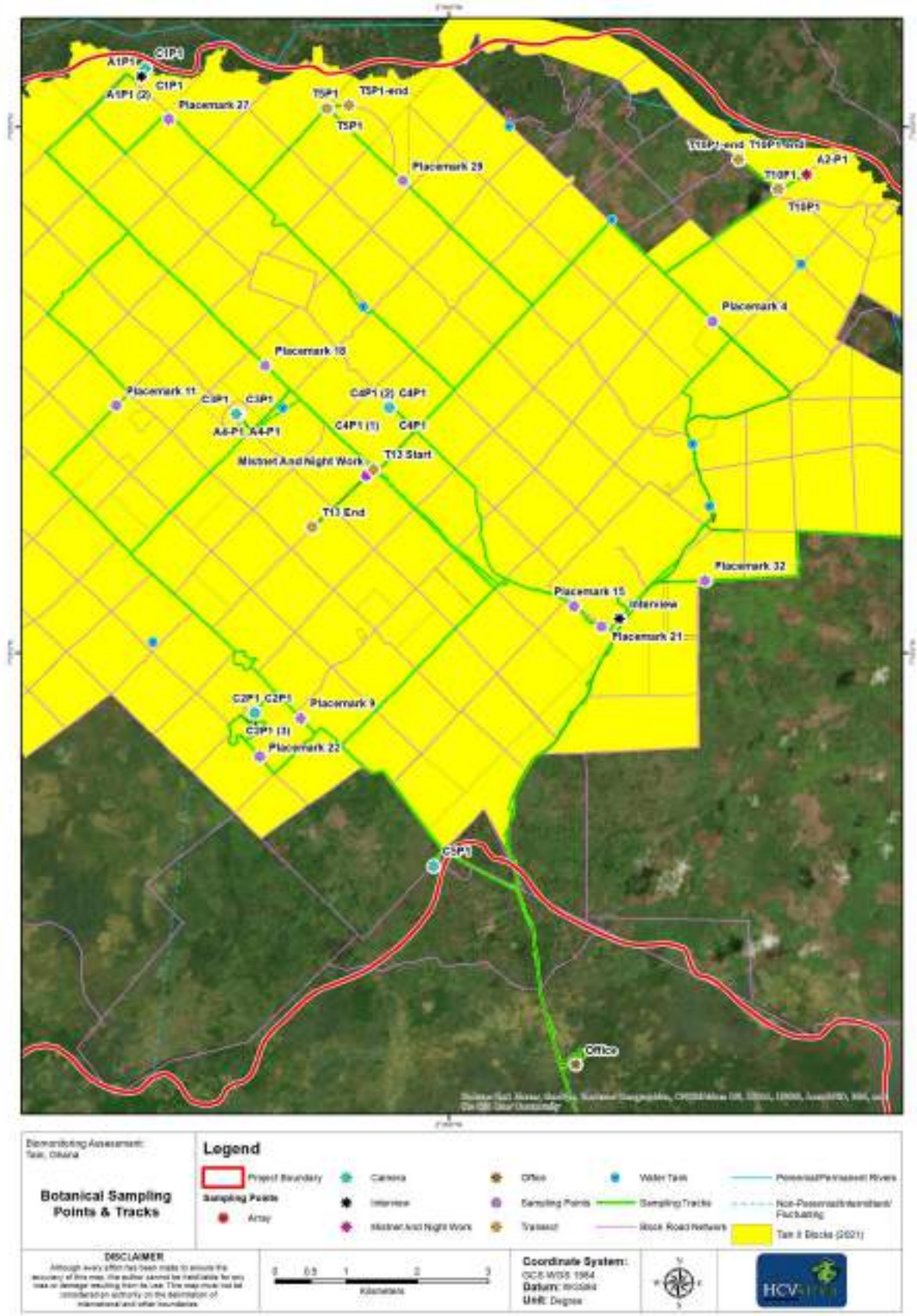

Figure 4-2: Field coverage

4.2.2 Broader Landscape

Africa Terrestrial Ecosystems (Sayre et al., 2013)

According to Sayre, et al. (2013), the Project Area forms part of two macro-ecosystems namely the Guineo-Congolian Evergreen & Semi-Evergreen Rainforest and West-Central African Mesic Woodland & Savanna ecosystems.

The Guineo-Congolian Evergreen & Semi-Evergreen Rainforest macrogroup type is "*formed by broadleaf evergreen forest communities that can attain 30-40 m in height, occurring from the coasts of Western Africa to the Central Congo basin (Guinea through Nigeria, Cameroon, Gabon, Congo and DRC).*"

The West-Central African Mesic Woodland & Savanna macrogroup "*corresponds to the savanna types occurring in the north of the Congo Basin and on to Western Africa, within an annual precipitation range from 800-1500 mm; the dry season lasts several months, and the mean annual temperature is 26-29 degrees C. The types vary from very open to more closed woodlands and shorter bushlands. Among the dominant woody species are Anogeissus leiocarpus and Anogeissus spp., accompanied by Acacia spp., Balanites aegyptiaca, Combretum glutinosum, Commiphora africana, Prosopis africana, Tamarindus indica, and Ziziphus mucronata (White 1983). Wetter woodlands, usually distributed to the south of the range of this type, include Afzelia africana, Burkea africana, Combretum spp., and Terminalia spp. and Isoberlinia woodland. The most common grass genus is Hyparrhenia, which grows very tall.*"

Terrestrial Ecoregions of the World

According to Olson (2001), the Tain II forms part of the Eastern Guinean Lowland Forest ecoregion. This ecoregion contains comparatively less endemic fauna and flora species than the Western Guinean Lowland Forest ecoregion and is regarded as a Critical/Endangered ecoregion on a global scale according to the World Wide Fund for Nature (WWF; [Lebbie, 2016]). Canopy trees within this ecoregion are frequently 30 m tall, with emergents reaching heights greater than 40 m. However, the density and species diversity of trees per hectare are generally regarded as low. Embedded within the main moist evergreen and semi-deciduous forests of the Eastern Guinean Lowland Forest ecoregion, are swamp and riparian forests. Degraded secondary growth because of slash-and-burn agriculture, known as 'farmbush', is becoming an increasingly dominant vegetation type and was observed throughout the AOI.

4.2.3 Local Landscape

Three major realms occur in the Project Area namely, terrestrial, freshwater and the freshwater-terrestrial (i.e. transitional aquatic-terrestrial interface). These realms were subdivided as part of the GIS analysis into 9 ecosystem functional groups (EFG) (). The IFC classification, level of disturbance and current condition of these EFG's are summarised in Table 4-2. The delineation and extent of the EFG's and the IFC classification of these are indicated in Figure 4-3 .

The remnant natural vegetation patches in the AOI can be classified as a mosaic between tropical/sub-tropical forests and savanna. Edaphic habitat types in the AOI include flooded forests and floodplain marshes which follow the drainage lines embedded in the lowland forests and savannas. These edaphic habitats represent the aquatic-terrestrial ecosystems and play significant roles in the local fauna biodiversity.

Table 4-1: Local habitats identified for the Project Area

Group	***Biome***	***Realm***	***Habitat***	***Forest successional stage***	***Description***
Seasonal upland streams	*Rivers and streams biome*	*Freshwater*	*Forest streams*	*N/A*	*Rivers and streams with clear signs of recent disturbance. Disturbance levels range from low in areas with good riparian buffers and canopy cover and limited sedimentation to areas with riparian zones cleared of*

					forest with clear signs of sedimentation.
Seasonal lowland rivers	*Rivers and streams biome*	*Freshwater*	*Rivers*	*N/A*	*Rivers and streams with clear signs of recent disturbance. Disturbance levels range from low in areas with good riparian buffers and canopy cover and limited sedimentation to areas with riparian zones cleared of forest with clear signs of sedimentation.*
Tropical/Subtropical lowland rainforests	*Tropical-subtropical forests biome*	*Terrestrial*	*Intact forest/ disturbed forests*	*Disturbed forest*	*Forests with large areas of recent degradation consisting of a highly patchy and disrupted canopy layer. A continuous stand of trees at least 10 m tall, their crowns interlockings.*
Tropical/Subtropical dry forests and thickets	*Tropical-subtropical forests biome*	*Terrestrial*	*Forest/ savanna*	*Forest early mid/succession*	*Former subtropical or tropical forest that has been extensively cleared or impacted by human activities. Often there is some degree of regeneration or there are small fragments of forest remaining. Includes mostly forest types between the plantation blocks; characterized by dominance of introduced tree, shrub and herb species.*
Trophic savannas	*Savannas and grasslands biome*	*Terrestrial*	*Savanna*	*Forest early mid/succession*	*Land covered with grasses and other herbs, with woody plants covering between 10 and 40 per cent of the ground.*
Annual croplands	*Intensive land-use biome*	*Terrestrial*	*Agricultural fields*	*Bare/open ground*	*Includes cereal fields, rice paddies, perennial crops, orchards and groves*
Plantations	*Intensive land-use biome*	*Terrestrial*	*Plantations*	*Teak*	*Plantations are intentionally planted crops, on large scales, usually for uses other than cereal production or pasture.*
Urban and industrial ecosystems	*Intensive land-use biome*	*Terrestrial*	*Urban*	*Bare/open ground*	*Occurs throughout the world. Usually metropolitan and commercial areas dominated by asphalt, concrete and roof. Includes buildings, lawns and parks.*
Derived semi-natural pastures and old fields	*Intensive land-use biome*	*Terrestrial*	*Savanna*	*Forest early mid/succession*	*Semi-natural' grasslands and open shrublands, which arose following the removal of historical woody elements (either forest or savanna species). Consist of a combination of indigenous and exotic species. Mostly cultivated grasslands and shrublands in fields under annual cultivation. In varying stages of cultivation and/or fallow land. Includes secondary grasslands that have regenerated as a result of leaving land fallow lands are included.*

Tropical flooded forests and peat forests	*Palustrine wetlands biome*	*Terrestrial-Freshwater*	*Riparian forest*	*Riparian forest*	*Forests with considerable areas of recent and past disturbance, ranging from areas with contiguous intact canopy to predominantly patchy forest with a heavily disrupted canopy to areas that have been converted on large scales for subsistence farming, with limited ecologically viable forest patches remaining.*

Table 4-2: Disturbance levels and conditions of local habitats identified for the Project Area

Group	***Habitat***	***IFC Habitat***	***Disturbance level***	***Forest/stream condition***
Seasonal upland streams	*Forest streams*	*Natural*	*Moderate to very high*	*Slightly degraded to very poor*
Seasonal lowland rivers	*Rivers*	*Natural*	*Moderate to very high*	*Slightly degraded to very poor*
Tropical/Subtropical lowland rainforests	*Intact forest/ disturbed forests*	*Natural*	*Moderate to high*	*Slightly degraded to poor*
Tropical/Subtropical dry forests and thickets	*Forest/ savanna*	*Natural*	*Moderate to very high*	*Slightly degraded to very poor*
Trophic savannas	*Savanna*	*Natural*	*High to very high*	*Poor to very poor*
Annual croplands	*Agricultural fields*	*Natural*	*Very high*	*Very poor*
Plantations	*Plantations*	*Modified*	*N/A*	*N/A*
Urban and industrial ecosystems	*Urban*	*Modified*	*N/A*	*N/A*
Derived semi-natural pastures and old fields	*Savanna*	*Natural*	*High to very high*	*Poor to very poor*
Tropical flooded forests and peat forests	*Riparian forest*	*Natural*	*Moderate to very high*	*Slightly degraded to very poor*

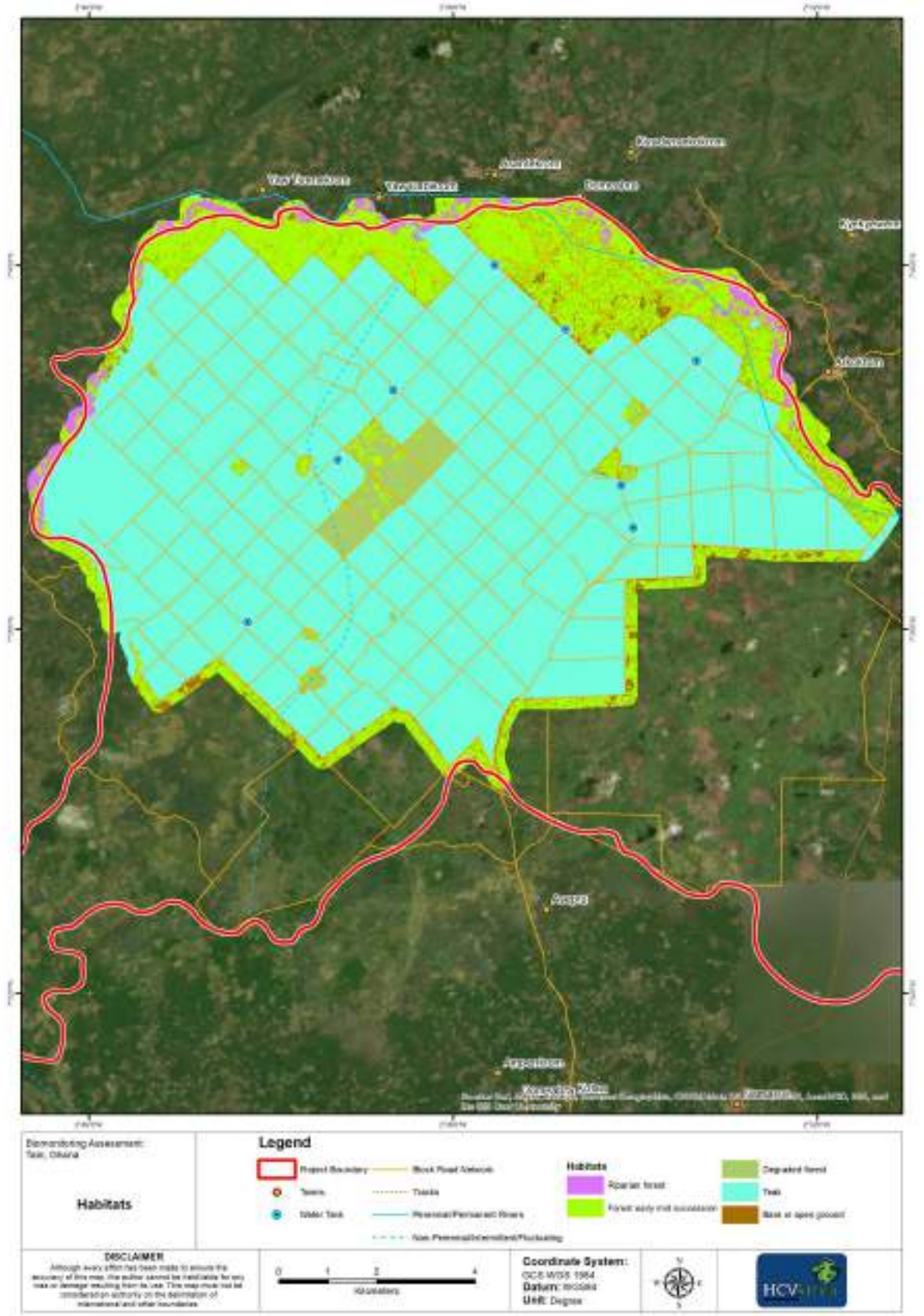

Figure 4-3: Local habitats in relationn to their successional forest stage

***Figure 4-4: Representative* aerial *habitat ph*otos for the project area. A) Control site in Asukase Forest Reserve showing logged forest; B) Disturbed forest with a broken upper canopy layer; C) Disturbed forest lacking emergent canopy cover; D) Belt of riparian forest; E) Forest in early to mid succession; F) Habitat mosaic including forest in early to mid succession (currently wooded savanna) and bushland areas; G) Teak plantation block. Note photographs B-E are taken in the Tain II reserve.**

5 RESULTS AND DISCUSSION

5.1 Avifauna

5.1.1 National

Ghana supports a rich avifaunal assemblage. At present, 773 species are known to occur in the country (Lepage (2021), ranking Ghana 13th in Africa (Butler, 2019). Of these just over 500 species are thought to be resident with the remainder accounted for by intra-African and Palearctic migrants (Baidu et al. 2001). The southern portion of Ghana is situated along the East Atlantic Flyway and the Mediterranean Flyway (Smit and Piersma 1989) and wetlands in this area are known to support high abundances of waterbirds. Ghana's rich birdlife is likely product of the country's position along a distinct bioclimatic gradient from moist forests in the south to dry savannas in the north.

Figure 5–1: Northern White-faced Owl (Ptilopsis leucotis)

5.1.2 Regional to Local Context

5.1.2.1 Expected Diversity

The position of the Tain II Reserve in the Brong Ahafo region of west-central Ghana places it in the transitional boundary (or ecotone) between the forest and savanna biomes. Strictly speaking the reserve is situated in a narrow belt of Dry Semi-Deciduous Inner Zone Forest that separates the moist Upper Guinea Forests from the drier Guinea Savanna woodland to the north (Pappoe et al 2010 Hall and Swaine, 1981). The Upper Guinea Forests in Ghana are under severe pressure with as little as 11% of the original closed canopy forest persisting (in an intact form) in a fragmented network of reserves. Despite this, the region still harbor an impressive inventory of 161 Guinea-Congo Forest endemics and 23 Sudan Guinea Savanna species. Extensive deforestation within this transitional zone (and the Tain II reserve itself) has been accompanied by an influx in savannah species as swathes of deciduous forest are reduced to a dense savanna-like setting, known as farm bush.

Analysis of distribution and habitat information as provided in the literature (IUCN 2021; Sinclair and Ryan, 2010) suggests an exceptional diversity of over 520 species for the region (Appendix 1). However, this includes many

habitat specialists found only in the more contiguous and intact forest reserves further south. Of these, approximately 320 species are considered highly likely to occur within the Tain II Reserve based on habitat suitability[5]. It should be noted that many of these species are wide-ranging, nomadic or seasonal species that are not resident and as such the actual number of species that are likely to occur in the reserve at any given time is probably far lower.

The country hosts 40 Important Bird Areas (IBAs), the closest of which being the Bui National Park (GH025) situated approximately 40 km north of the Tain II reserve. The IBA is recognised on account of its importance in supporting White-bellied Bustard (*Eupodotis senegalensis*) and Abyssinian Ground-Hornbill (*Bucorvus abyssinicus*).

5.1.2.2 Observed Diversity

Previous avifaunal surveys conducted in the Tain II by Attuquayefio (2008) and Oduro and Danqhua (2012) yielded 32 and 59 species respectively such that the known species richness prior to this survey was 76 species. The current (2021) wet season survey (five days) yielded 78 species (including 33 previously unrecorded species), increasing the known avifauna species richness of the Tain II Reserve by 43% to 109 species (Appendix 1).

Photographs of some of the birdlife observed during the survey are shown in Figure 5–2 and Figure 5–3. Data gathered during the current survey indicates that the Tain II avifaunal assemblage is characterized by a mix of hardy and adaptable Upper Guinea forest species and generalist savannah species having presumably infiltrated from the drier climates to the north. This mixed assemblage was to be expected given the Tain II's naturally transitional bioclimatic regime coupled with the high levels of prior deforestation in the Reserve.

Figure 5–2: Examples of some of the avifauna observed during the survey A) Senegal Parrot (Poicephalus senegalensus), B) African Pied Hornbill (Lophoceros fasciatus), C) Grey-headed Bristlebill (Bleda canicapillus), D) Splendid Starling (Lamprotornis splendidus), E) Green Woodhoopoe (Phoeniculus purpureus)

[5] Indicated in Appendix 1 by a likelihood of occurrence (LO) rating of 1(present) or 2 (high).

Figure 5–3: Examples of some of the avifauan observed during the survey continued: A) Pin-tailed Whydah (Vidua macroura), B) Lizard Buzzard (Kaupifalco monogrammicus), C) African Hobby (Falco cuvierii), D) Vieillot's Weaver (Ploceus nigerrimus), E) Shining Drongo (Dicrurus atripennis), F) Blue-bellied Roller (Coracias cyanogaster)

Overall, the reserve (in its current state) supports a high abundance, but low diversity of birds comprised mainly of seed, fruit and insect eating species. This trend is typical of pioneer to early succession farm bush and secondary forest habitats. Here dense tangles of weedy annuals provide an abundance of seed, insects and refuge for the select few hardy and adaptable species capable of exploiting it. Encouragingly raptor abundance and diversity was moderately high which suggests a healthy small mammal assemblage that would appear to be responding positively to habitat restoration. Table 2 1 provides a list of the top 20 most abundant species for the project area together with the frequency with which each species appeared in the point count samples. Together these species account for 80% of the 230 individuals from 118 observations. The table is sorted from highest to lowest relative abundance.

Table 5-1 Top 20 most abundant avifauna observed in the Tain II Reserve during the current survey

Common Name	Scientific Name	Relative Abundance
Pin-tailed Whydah	*Vidua macroura*	9.6491228
Little Greenbul	*Eurillas virens*	7.4561404

Common Name	Scientific Name	Relative Abundance
Bronze Mannikin	*Spermestes cucullata*	6.1403509
Village Weaver	*Ploceus cucullatus*	5.7017544
Common Bulbul	*Pycnonotus barbatus*	5.7017544
Blue-spotted Wood-dove	*Turtur afer*	5.7017544
Vieillot's Weaver	*Ploceus nigerrimus*	5.2631579
Ahanta Francolin	*Pternistis ahantensis*	5.2631579
Red-eyed Dove	*Streptopelia semitorquata*	4.8245614
Green-backed Camaroptera	*Camaroptera brachyura*	4.8245614
Yellow-mantled Widowbird	*Euplectes macroura*	3.5087719
Guinea Turaco	*Tauraco persa*	3.0701754
African Pied Hornbill	*Lophoceros fasciatus*	2.1929825
Senegal Coucal	*Centropus senegalensis*	2.1929825
African Palm-Swift	*Cypsiurus parvus*	2.1929825
Black-crowned Tchagra	*Tchagra senegalus*	1.754386
Red-faced Cisticola	*Cisticola erythrops*	1.754386
African Grey Hornbill	*Lophoceros nasutus*	1.754386
African Paradise-Flycatcher	*Terpsiphone viridis*	1.3157895
Tawny-flanked Prinia	*Prinia subflava*	1.3157895

5.1.2.3 Sampling Adequacy

The unavoidable limitation associated with rapid surveys such as this is that they provide only a glimpse of the full spectrum of species likely to occur. Nevertheless, a species accumulation curve (Figure 5–4) generated for the point counts within the AOI shows that species accumulation (Figure 5–4) reached a plateau (where the curve has a gradient of one or less) at 16 point count samples. However, it was evident while on site that considerable scope for the detection of other species remains with increased survey duration and seasonal sampling.

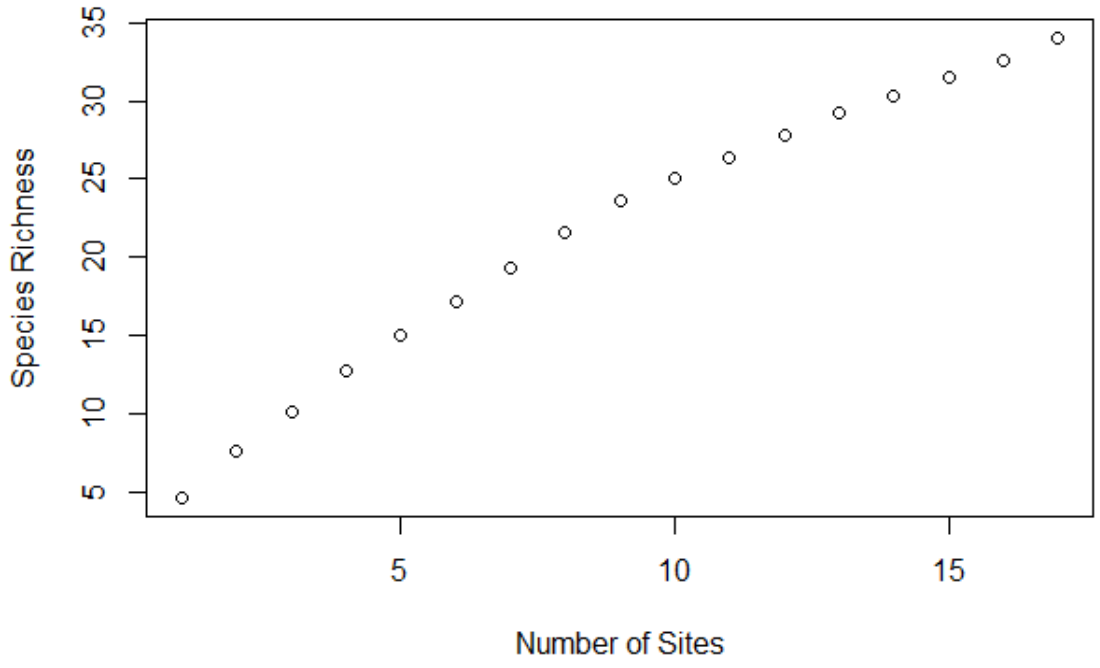

Figure 5–4: Species accumulation curve for the avifaunal point counts

5.1.2.4 Habitat diversity

A summary the avifaunal diversity (as indicated by Shannon's H) within each of the main avifaunal habitats within each area is given in Table 5-2. From this table it is apparent that the highest avian diversity was observed in the

Early-Mid Succession Forest (restoration areas). Diversity here exceeded even that of the control at Asukese Forest and that of the more mature Mid-Late Succession forest within the Tain II reserve. This is likely due to the intermediary nature of the habitat which provides suitable conditions for both savanna and forest species. The degraded secondary forest and weedy pioneer regrowth in this habitat provides a high food availability for seed and insect-eating species as well as raptors. The Asukese Forest, Mid-Late Succession Forest and Degraded forests all supported a similar level of avian diversity but where still more diverse than the Teak Forests which supported a low diversity. The low diversity within the Riparian Forest is more likely an artifact of too few samples in this habitat type and likely supports a similar diversity to the Mid-Late Succession Forests.

Table 5-2 Summary of the avifaunal diversity of each habitat (ranked from highest to lowest) as indicated by Shannon's H

Habitat	Diversity Shanon's (H)
Forest Early-Mid Succession	3.127
Control Asukese Forest (outside)	2.271
Forest Mid-Late Succession	2.189
Degraded Forest	2.127
Teak	1.979
Riparian Forest	1.922

5.1.2.5 Habitat Uniqueness

The non-metric multidimensional scaling (NMDS) ordination shown in Figure 5-5 provides a visual representation of the difference / similarity (or uniqueness) of the species composition between the habitat types. From the ordination it is evident that the control at Asukese Forest supports the most unique avifaunal assemblage which is distinctly different from that within the Tain II Reserve. The forest at Asukese (although degraded by logging) represents a far more intact and contiguous forest landscape and consequently supports a more specialized and unique avifaunal assemblage comprised mainly of Guinea Forest species. Within the Tain II Reserve there is considerable overlap among the bird assemblages occupying the various habitats which is in part due to it being situated in an ecotone but also due to the disturbed and early succession nature of the reserve. With time the avifaunal assemblages occupying each habitat are expected to become more unique (greater dissimilarity) which will be indicated by greater distances between the groupings on the ordination plot. Nevertheless, some generalities can still be deduced. Notably the Riparian and Mid-Late succession forests support a similar assemblage of forest-adapted species that is largely unique from the remaining habitats. The Early-Mid Succession Forests, Degraded Forests and Teak Plantations all show considerable overlap in species composition. The few species found in the Teak Plantations are ubiquitous (found in all other habitats within the reserve).

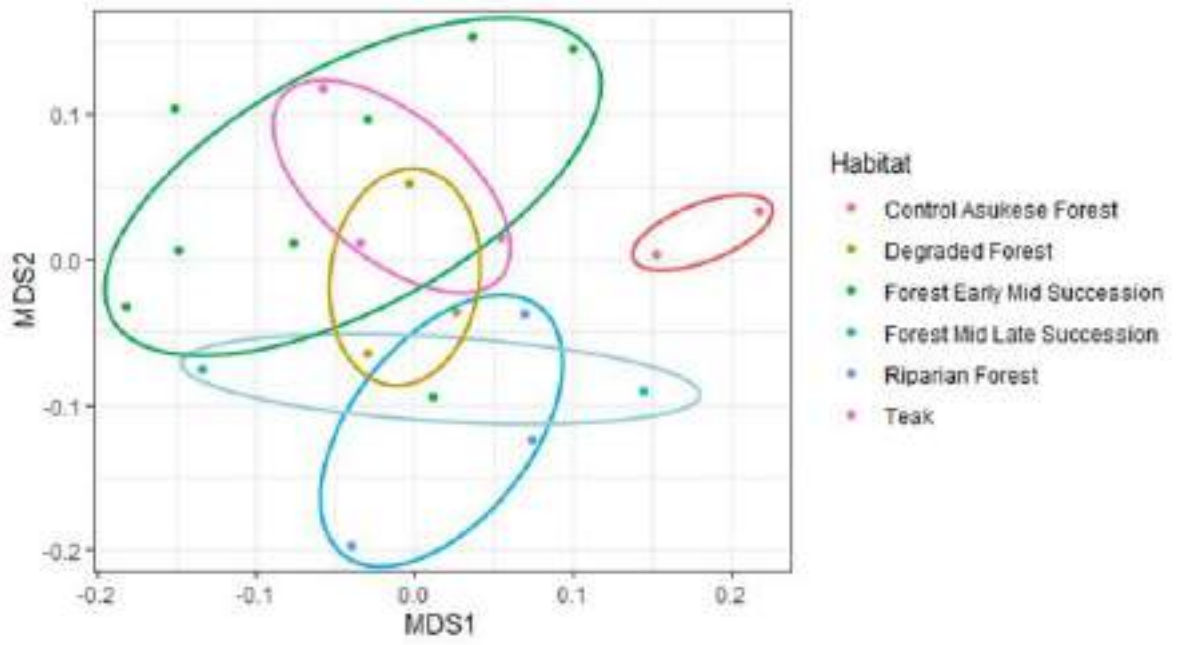

Figure 5-5 Non-metric multidimensional scaling ordination contrasting the avifaunal species assemblages within the Tain II Reserve

5.1.3 Avifaunal Guilds

To better monitor the effects of forest restoration efforts on the local avian diversity as vegetation structure changes, the various present and potentially occurring bird species were categorised into one of four guilds. The guilds represent a gradient from lowest to highest forest-dwelling affinity. Guild 1 includes species that are mainly restricted to savanna habitats, Guild 2 includes species that frequently occupy both savanna and forest habitats, Guild 3 includes species that only occur in forest habitats but are tolerant to forest degradation and Guild 4 includes only obligate forest species that tend to occupy only intact forest.

Should the forest restoration measures successfully result in an increase in closed canopy forest habitat then, theoretically, this should be accompanied by an increase in the prevalence of Guild 3 and 4 species. The ultimate objective would be for the restored forests to support a higher proportion of Guild 3 and especially Guild 4 species in high abundances.

Figure 5–6 provides a graphical representation of both the abundance and proportion of each bird guild occupying each main habitat type. The control at Asukese Forest Reserve illustrates the dominance in forest guilds that one would expect for an established forest. However, the abundances are uncharacteristically low at the control site, but this is simply due to the low sample numbers from the brief sampling (one afternoon). From this graph it is evident that the Early-Mid Succession Forest supports a high overall abundance but is currently dominated by non-forest obligate Guild 1 and 2 species. Some Guild 3 and 4 are, however, present and their proportion will likely increase with time. The Riparian Forest along the Tain River although narrow is still fairly intact and well connected and as such supports a high proportion of forest dwelling species in Groups 3 and 4. The Teak plantations are comprised of a mix of savanna and generalist species (Groups 1 and 2), but distinctly lack obligate forest specialists (Group 4).

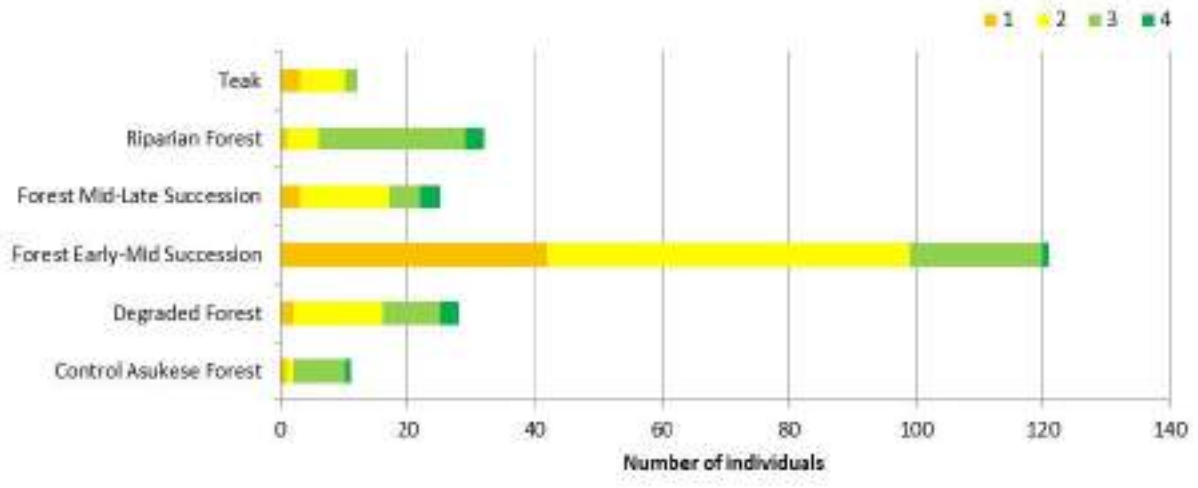

Figure 5–6: Avifauna guild assemblages per habitat. Guild 1, savanna (orange); guild 2, forest/savanna (yellow); guild 3, disturbed forest (light green); guild 4, intact Forest (dark green)

5.1.4 Species of Conservation Concern

This section provides an overview of the project area's potential to support species of conservation concern (SCC), a term which is extended to include red-listed species (Globally or locally Threatened or Near-threatened species), endemic and biome-restricted species and other species deemed to be of conservation importance.

5.1.4.1 Red-listed species

The distributions ranges of 30 red-listed species overlap the project area (as indicated by Sinclair and Ryan, 2010 and / or the IUCN, 2021). Of these, 20 species are at least some potential to occur within the AOI but only three are considered highly likely to occur based on habitat suitability. These include Beaudouin's Snake-Eagle (*Circaetus beaudouini*), Rufous Fishing-Owl (*Scotopelia ussheri*) and Red-footed Falcon (*Falco vespertinus*).

However, no bird SCC were observed within the Tain II Reserve during the current survey, nor have any been recorded during preceding surveys (Attuquayefio, 2008; Oduro and Danqhua, 2012). The fact that no bird SCC were recorded from three independent surveys since 2008 suggests localised extirpation of all regionally occurring SCC avifauna. This is a concerning observation. However, the highly vagile nature of most of these species provides hope that at least some SCC will return as the forest restoration programme matures. Encouragingly interviews with local community members suggest the sporadic occurrence of Grey Parrot (*Psittacus erithacus*) and, due to the highly secretive nature of many of these species, it is likely that some species (e.g. Rufous Fishing-Owl) may have been overlooked. The most likely occurrence of any persisting SCC would be along the Riparian Forests of the Tain River and in the few remaining pockets of natural forest. However, these forest patches are, in their current state too small and fragmented to support resident populations of the larger regionally occurring SCC such as Brown-cheeked Hornbill (*Bycanistes cylindricus*) and Yellow-casqued Hornbill (*Ceratogymna elata*).

Six of the regionally occurring threatened species are considered unlikely to occur for the following reasons. Shelley's Eagle-Owl (*Bubo shelleyi*), Ghana Cuckooshrike (*Lobotos lobatus*), Yellow-bearded Greenbul (*Criniger olivaceus*), White-breasted Guineafowl (*Agelastes meleagrides*) and White-necked Rockfowl (*Picathartes gymnocephalus*) are precluded by a lack suitably natural, tall and contiguous closed canopy forest while Abyssinian Ground-Hornbill (*Bucorvus abyssinicus*) is precluded by a lack of open dry savanna and grassland habitat.

Table 5-3 Present and potentially occurring conservation important avifauna

Common Name	Scientific Name	LO	Status
White-backed Vulture	*Gyps africanus*	3	CR (D)
Hooded Vulture	*Necrosyrtes monachus*	3	CR (D)
White-headed Vulture	*Trigonoceps occipitalis*	3	CR (D)
Bateleur	*Terathopius ecaudatus*	3	EN (D)
Timneh Parrot	*Psittacus erithacus*	3	EN (D)
Tawny Eagle	*Aquila rapax*	2	VU (D)
Baudouin's Snake-Eagle	*Circaetus beaudouini*	2	VU (D)
Abyssinian Ground-Hornbill	*Bucorvus abyssinicus*	4	VU (D)
Brown-cheeked Hornbill	*Bycanistes cylindricus*	3	VU (D)
Yellow-casqued Hornbill	*Ceratogymna elata*	3	VU (D)
White-breasted Guineafowl	*Agelastes meleagrides*	4	VU (D)
Ghana Cuckooshrike	*Lobotos lobatus*	4	VU (D)
White-necked Rockfowl	*Picathartes gymnocephalus*	4	VU (D)
Yellow-bearded Greenbul	*Criniger olivaceus*	4	VU (D)
Shelley's Eagle-Owl	*Bubo shelleyi*	4	VU (D)
Rufous Fishing-Owl	*Scotopelia ussheri*	2	VU (D)
Pallid Harrier	*Circus macrourus*	3	NT (D)
Crowned Eagle	*Stephanoaetus coronatus*	3	NT (D)
Great Snipe	*Gallinago media*	3	NT (D)
Long-tailed Cuckoo	*Cercococcyx lemaireae*	3	NT (D)
Red-footed Falcon	*Falco vespertinus*	2	NT (D)
Denham's Bustard	*Neotis denhami*	4	NT (D)
Red-fronted Antpecker	*Parmoptila rubrifrons*	3	NT (D)
Lagden's Bushshrike	*Malaconotus lagdeni*	4	NT (D)
Rufous-winged Illadopsis	*Illadopsis rufescens*	3	NT (D)
Green-tailed Bristlebill	*Bleda eximius*	4	NT (D)
Copper-tailed Starling	*Hylopsar cupreocauda*	3	NT (D)
Yellow-footed Honeyguide	*Melignomon eisentrauti*	4	NT (D)
Black-capped Rufous-Warbler	*Bathmocercus cerviniventris*	4	DD (D)
Maned Owl	*Jubula lettii*	3	DD (S)

Key: IUCN (2021) global status, letters in parentheses indicate population trend, D= Decreasing, S = Stable, U = Uncertain. Endemicity; End = Endemic, N-end = Near Endemic. Likelihood of occurrence (LO): 1 = Present; 1a = Present Anecdotal; 2 = High; 3 = Moderate 4 = Unlikely.

5.1.4.2 Biome restricted species

The region supports 184 biome restricted species. These include 161 Guinea–Congo Forest biome and 23 Sudan–Guinea Savanna biome restricted species, alluding to the region's historically more forested rather than open savannah nature. The current survey added five new biome restricted species, bringing the total number of bio restricted species known to occur in the Tain II reserve to 31 species. These species are listed in Table 5-4.

Table 5-4 Biome restricted avifauna known to occur in the Tain II Reserve

Common Name	Scientific Name	LO	Status	BR
African Pied Hornbill	*Lophoceros fasciatus*	1	LC (U)	GCFB
Black-headed Paradise-Flycatcher	*Terpsiphone rufiventer*	1	LC (D)	GCFB
Shining Drongo	*Dicrurus atripennis*	1	LC (D)	GCFB
Vieillot's Weaver	*Ploceus nigerrimus*	1	LC (S)	GCFB
Guinea Turaco	*Tauraco persa*	1	LC (S)	GCFB
Speckled Tinkerbird	*Pogoniulus scolopaceus*	1	LC (D)	GCFB
Green Hylia	*Hylia prasina*	1	LC (S)	GCFB
Cassin's Hawk-Eagle	*Aquila africana*	1	LC (D)	GCFB
Chocolate-backed Kingfisher	*Halcyon badia*	1	LC (D)	GCFB
Tiny Sunbird	*Cinnyris minullus*	1	LC (S)	GCFB
Blue-bellied Roller	*Coracias cyanogaster*	1	LC (D)	SGSB
Senegal Parrot	*Poicephalus senegalus*	1	LC (D)	SGSB
Honeyguide Greenbul	*Baeopogon indicator*	1p	LC (S)	GCFB
Grey-headed Bristlebill	*Bleda canicapillus*	1p	LC (S)	GCFB
Blue-headed Wood-Dove	*Turtur brehmeri*	1p	LC (D)	GCFB
Blue-throated Roller	*Eurystomus gularis*	1p	LC (D)	GCFB
Red-rumped Tinkerbird	*Pogoniulus atroflavus*	1p	LC (S)	GCFB
Yellow-billed Barbet	*Trachyphonus purpuratus*	1p	LC (D)	GCFB
Ahanta Francolin	*Pternistis ahantensis*	1p	LC (D)	GCFB
Simple Greenbul	*Chlorocichla simplex*	1p	LC (S)	GCFB
Black-throated Coucal	*Centropus leucogaster*	1p	LC (S)	GCFB
Hairy-breasted Barbet	*Tricholaema hirsuta*	1p	LC (D)	GCFB
Buff-throated Sunbird	*Chalcomitra adelberti*	1p	LC (S)	GCFB
Little Green Sunbird	*Anthreptes seimundi*	1p	LC (S)	GCFB
Fire-bellied Woodpecker	*Chloropicus pyrrhogaster*	1p	LC (I)	GCFB
Buff-spotted Woodpecker	*Campethera nivosa*	1p	LC (S)	GCFB
Slender-billed Greenbul	*Stelgidillas gracilirostris*	1p	LC (S)	GCFB
Olive-green Camaroptera	*Camaroptera chloronota*	1p	LC (U)	GCFB
Icterine Greenbul	*Phyllastrephus icterinus*	1p	LC (S)	GCFB
Lavender Waxbill	*Glaucestrilda caerulescens*	1p	LC (S)	SGSB
Splendid Sunbird	*Cinnyris coccinigastrus*	1p	LC (S)	SGSB

Key: IUCN (2021) global status, letters in parentheses indicate population trend, D= Decreasing, S = Stable, U = Uncertain. Endemicity; End = Endemic, N-end = Near Endemic. LO (Likelihood of Occurrence): 1 = Present Current Survey; 1p = Present Previous Survey; 2 = High; 3 = Moderate; 4 = Low.

5.1.5 Indicator species

A significant increase in the abundances of all bird species listed in Appendix 1 under Guilds 3 and 4 should be considered an indication of successful forest restoration.

5.2 Mammals

5.2.1 National to regional context

Ghana is situated on the western edge of the Guinean Forests of West Africa, one of the most important and threatened biodiversity hotspots on earth Myers et al, 2000) from a mammal perspective. In fact, with over 550 species (45 endemic spp.) these forests host half of Africa's mammalian taxa and supports the highest mammalian diversity of all the biodiversity hotpots. Additionally, the Guinea forests rank 7th in the world in terms of mammal density with an average of 4.3 individuals per km^2 (CEPF, 2000). By far the greatest proportion of these species are represented by rodents and bats.

Although Ghana lacks a recent peer-reviewed annotated inventory or atlas of its mammal fauna scientific research in the country is proceeding rapid pace and progress to this end is being made with the production of numerous much needed localised surveys (mostly within reserves) in the last two decades. Consequently, the regional species inventory for this project was compiled using distribution data, habitat information and species status' as provided by the IUCN (2021). Based on this information some 120 mammal species are considered to have the potential to occur in the Brong Ahofo region. This does however include some species that are only likely to occur in some of the larger more contiguous forest patches in the region and therefore the on-site diversity is likely to be considerably lower.

Figure 5–7: Mega-colony of African Straw-coloured Fruit Bat (Eidolon helvum)

5.2.2 Local context

5.2.2.1 Expected Diversity

Due to its position along a forest-savanna ecotone the Tain II reserve has the potential to support a high diversity of small to medium-sized mammals. Indeed, a published survey conducted by Attuquayefio (2008) on the mammals of the Brong Ahofo highlighted the Tain II reserve as supporting the highest mammal diversity of the five reserves assessed in the region. Based on distribution and habitat preferences a total of 122 species of mammals are considered highly likely to occur within the project area. Most of these species are comprised of bats and to a lesser extent rodents and shrews which are notoriously difficult to survey comprehensively. Of these, the presence of 13 species was confirmed within the AOI during fieldwork. Some examples of mammals encountered on site are shown in Figure 5–9.

5.2.2.2 Observed Diversity

Previous mammal surveys conducted in the Tain II by Attuquayefio (2008) and Oduro and Danqhua (2012) yielded 6 and 13 species respectively such that the known species richness prior to this survey was 19 species. The current (2021) wet season survey (five days) yielded 24 species (including 11 previously unrecorded species), increasing the known avifauna species richness of the Tain II Reserve by 61% to 30 species (Appendix 2).

Figure 5–8: Mammals caught on camera trap: A) Cusimanse (Crossarchus obscurus) and B) Giant Gambian Pouched Rat (Cricetomys gambianus)

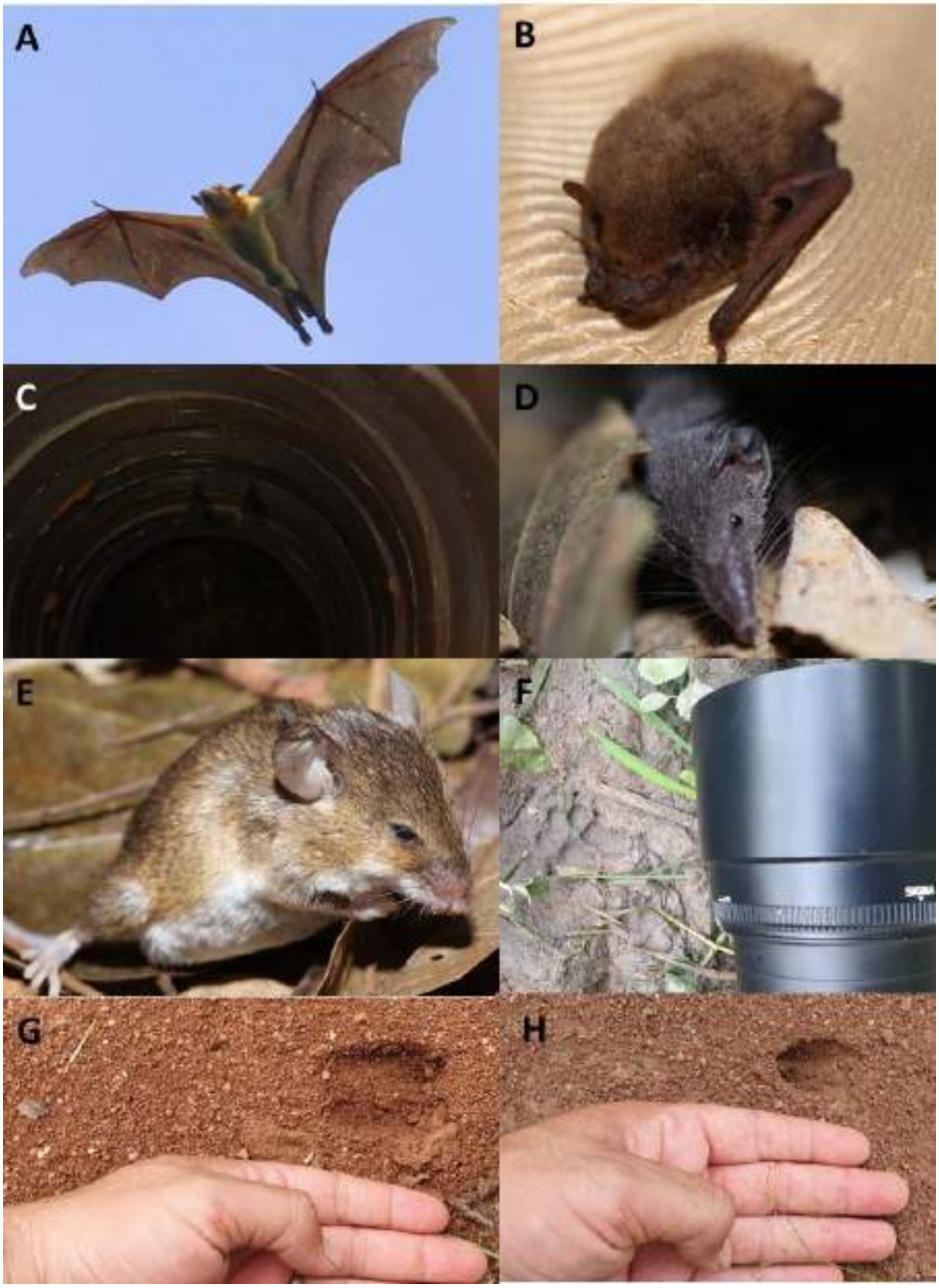

Figure 5–9: Examples of mammal species detected in the reserve: A) African Straw-coloured Fruit Bat (Eidolon helvum), B) Brown Pipistrelle (Neoromicia brunnea), C) Egyptian Slit-faced Bat (Nycteris thebaica), D) West African Pygmy Shrew (Crocidura cf. obscurior), E) Temminck's Mouse (Mus musculoides), F) African Civet (Civettictis civetta), G) Bushbuck (Tragelaphus scriptus), H) Maxwell's Duiker (Philantomba maxwellii)

A list of the mammals observed during the current survey together with the total number of individuals recorded per sampling site is given in Table 5-5.

Table 5-5 Mammal species recorded during the current survey

Common Name	Scientific Name	A1	A2	A3	AV14	C1	C2	C5	T13	O	CO	I
Water Mongoose	*Atilax paludinosus*	1					1					
Kusimanse	*Crossarchus obscurus*					3	4					
Slender Mongoose	*Herpestes sanguineus*											
Cape Clawless Otter	*Aonyx capensis*											
African Civet	*Civettictis civetta*											x
Forest Buffalo	*Syncerus caffer nanus*											x
Bushbuck	*Tragelaphus scriptus*							1				x
Maxwell's Duiker	*Philantomba maxwellii*							1	2			x
Common Warthog	*Phacochoerus africanus*											x
Cyclops Roundleaf Bat	*Hipposideros cyclops*										1	
African Straw-coloured Fruit Bat	*Eidolon helvum*						30		>2000			x
Hammer-headed Fruit Bat	*Hypsignathus monstrosus*											
Egyptian Slit-faced Bat	*Nycteris thebaica*										3	
Brown Pipistrelle	*Neoromicia brunnea*									1		
Cape Serotine	*Neoromicia capensis*										1	
Thomas's Bushbaby	*Galagoides thomasi*						2				2	
Western Potto	*Perodicticus potto*										1	
Black Rat	*Rattus rattus*											
Giant Gambian Pouched Rat	*Cricetomys gambianus*						1					
Temminck's Mouse	*Mus musculoides*		1									
Green Bush Squirrel	*Paraxerus poensis*								1			
Striped Ground Squirrel	*Xerus erythropus*		2									
Greater Cane Rat	*Thryonomys swinderianus*				1							x
African White-bellied Pangolin	*Phataginus tricuspis*						1					x
West African Pygmy Shrew	*Crocidura cf. obscurior*		1	1								

A = Array; C = Camera Trap Site; CO = Control at Asukese Reserve; I = Interview; O = Offices; T = Transect

5.2.3 Species of Conservation Concern

A total of 41 IUCN Red-listed species may occur in the Brong Ahafo region based on known distribution ranges as provided by the IUCN (2021). However, the high degree of forest fragmentation from commercial and subsistence cultivation practices within the reserve limits the number of potentially occurring red-listed mammals to 30 species of which 20 are considered highly likely to occur in the reserve.

The current wet season survey revealed the presence of five red-listed mammal species within the Tain II reserve (discussed below). Of these four were recorded by means of direct evidence (in the form visual observation, capture or signs) while one was confirmed through multiple, independent, anecdotal accounts given by interviewed locals. Red-listed species recorded by means of direct evidence included African White-bellied

Pangolin (*Phataginus tricuspis*), Brown Pipistrelle (*Neoromicia brunnea*), Western Potto (*Perodicticus potto*) and African Straw-coloured Fruit Bat (*Eidolon helvum*) while anecdotal reports centred on the sporadic presence of Forest Buffalo (*Syncerus caffer nanus*). Interviews further suggest that Chimpanzee (*Pan troglodytes*) and Bongo (*Tragelaphus eurycerus*), although once present, have not been seen in several years and have likely been locally extirpated. Patas Monkey (*Erythrocebus patas*) and Large-headed Forest Shrew (*Crocidura grandiceps*) have previously been recorded in the reserve.

Other potentially occurring threatened mammals include Baer's Wood Mouse (*Hylomyscus baeri*) and Black-bellied Pangolin (*Phataginus tetradactyla*) as well as three primates that frequently go to ground and venture into farm bush, croplands and degraded forest namely Lowe's Monkey (*Cercopithecus lowei*) and Van Beneden's Colobus (*Procolobus verus*). All other threatened species are considered unlikely to occur. Giant Pangolin (*Smutsia gigantea*) is unlikely to occur based on a lack of open savannah habitat. Roloway Monkey (*Cercopithecus roloway*), White-thighed Colobus (*Colobus vellerosus*), Miss Waldron's Red Colobus (*Piliocolobus waldroni*) and White-naped Mangabey (*Cercocebus lunulatus*) are arboreal primates that are typically associated with primary and mature secondary forest with a low tolerance for forest degradation. Similarly, a lack of suitably large forest patches occurs within the AOI to support African Golden Cat (*Caracal aurata*).

5.2.3.1.1 African White-bellied Pangolin (Phataginus tricuspis) - Endangered

This species was detected in Forest Block NF3 (-2.624599664; 7.592408182) by means of signs in the form of scratching, tree hole den and termite discards. According to a knowledgeable farmer Mr Aboagye Williams (Block F26) the species is frequently observed in the small forest patches that persist within the reserve particularly at night. this secretive species is typically associated with moist lowland forest but does appear somewhat adaptable as it is often reported to occur in secondary forests and even abandoned oil palm plantations (IUCN, 2019). Like all other pangolins this species is threatened by persecution for the bushmeat market and for trafficking. It is the most commonly available pangolin in the African bushmeat markets (IUCN, 2019).

5.2.3.1.2 Forest Buffalo (Syncerus caffer nanus)

Forrest Buffalo are known to occur in the reserve based on two independent and corroborating accounts provided by local farmers namely Mr. Isaac KwakuAdje (from Tainso) and Mr Aboagye Williams (Block F26). Both farmers report having seen a small herd of Forest Buffalo a year ago (2020) near the southern boomed entrance to the reserve (inside the reserve). Both farmers, however, mention that the buffalos were shot at by other farmers due to fears of Inter-breeding with cattle. The species may well return provided persecution is abated. These large, secretive animals are one of the least studied large mammals in Africa. The species typically inhabits large stands of dense forest. A study on the habitat preferences of this species by Melletti et al. (2007) reveals that open canopy forest clearings surrounded by large trees appear to be an important prerequisite for the occurrence of the species with the authors suggesting that they play a role in facilitating social interactions between the members of the herd and allowing the herd to rest and ruminate together. Although the conservation status of this species is poorly known it is clear that their numbers have declined substantially due to poaching and deforestation (Melletti et al. 2007). Although buffalo bulls may harass and even attempt to breed with domestic cows, the prevailing understanding is that the pairing will not result in hybrid offspring. Fertilisation will occur but the embryo will not develop past the blastula stage due to chromosal mismatch. A more immediate and pressing cause for conflict usually stems from disease transmission (buffalo can be reservoirs for zoonotic diseases for domestic cattle). Solutions to ease conflict generally center on keeping them seperate by partitioning grazing areas and water holes and using kraals and fences. Zoonotic disease transmission can also be achieved by administering prophylaxis especially during wet season. Clear zones for buffalos and cattle should be decided upon. One saving grace is that the buffalo in Tain II should be able to persist in forested areas and along the Tain River riparian zone, areas that are generally sub-optimal for cattle production.

5.2.3.1.3 Straw-coloured Fruit Bat (Eidolon helvum)

A very large maternal roost colony of Straw-coloured Fruit Bat was discovered near Transect T13 (Block PF78). This roost supports several thousand individuals and mass congregations of this magnitude should be considered important on a regional to national scale. The large forest block/s occupied as a roost by these bats needs to be

conserved in-situ. Human access should be discouraged so as not to disturb the bats but also because megachiropteran bats such as these are well known and prolific vectors for some of Africa's most dangerous human-infecting zoonotic viruses (e.g. Ebola and Marburg Viruses). Pesticides, vermicides and hunting are a threat to this species.

5.2.3.1.4 Brown Pipistrelle (Neoromicia brunnea)

A single individual was captured at the plantation office accommodation. This species is listed as Near Threatened on account of its global population which is rapidly declining (25% over the past 10 years) due to loss of its preferred forest habitat (IUCN, 2021).

5.2.3.1.5 Western Potto (Perodicticus potto) - Outside Tain II Reserve

A single individual was heard calling when leaving the Asukese Forest control site at night. The species listed as Near Threatened due to rapid rates of forest loss across a large part of its range (IUCN 2021).

Table 5-6 Present and potentially occurring mammal SCC

Common Name	Scientific Name	LO	Status
Roloway Monkey	*Cercopithecus roloway*	4	CR (D)
White-thighed Colobus	*Colobus vellerosus*	4	CR (D)
Miss Waldron's Red Colobus	*Piliocolobus waldroni*	4	CR (D)
Forest Elephant	*Loxodonta cyclotis*	4	CR (D)
African White-bellied Pangolin	*Phataginus tricuspis*	1	EN (D)
Giant Pangolin	*Smutsia gigantea*	4	EN (D)
White-naped Mangabey	*Cercocebus lunulatus*	4	EN (D)
Chimpanzee	*Pan troglodytes*	2	EN (D)
Baer's Wood Mouse	*Hylomyscus baeri*	2	EN (D)
Golden Cat	*Caracal aurata*	4	VU (D)
Leopard	*Panthera pardus*	4	VU (D)
Black-bellied Pangolin	*Phataginus tetradactyla*	2	VU (D)
Lowe's Monkey	*Cercopithecus lowei*	2	VU (D)
Van Beneden's Colobus	*Procolobus verus*	2	VU (D)
Hippopotamus	*Hippopotamus amphibius*	4	VU (S)
Cape Clawless Otter	*Aonyx capensis*	1	NT (D)
Bay Duiker	*Cephalophus dorsalis*	3	NT (D)
Yellow-backed Duiker	*Cephalophus silvicultor*	3	NT (D)
Forest Buffalo	*Syncerus caffer nanus*	1a	NT (D)
Bongo	*Tragelaphus eurycerus*	2	NT (D)
Jones' Roundleaf Bat	*Hipposideros jonesi*	2	NT (D)
Large-eared Free-tailed Bat	*Otomops martiensseni*	2	NT (D)
African Straw-coloured Fruit Bat	*Eidolon helvum*	1	NT (D)
Pohle's Fruit Bat	*Scotonycteris ophiodon*	3	NT (D)
Brown Pipistrelle	*Neoromicia brunnea*	1	NT (D)
Lesser Spot-nosed Guenon	*Cercopithecus petaurista*	3	NT (D)
Patas Monkey	*Erythrocebus patas*	1p	NT (D)
Western Potto	*Perodicticus potto*	1	NT (D)
Large-headed Forest Shrew	*Crocidura grandiceps*	1p	NT (U)
Slender-tailed Squirrel	*Protoxerus aubinnii*	3	NT (U)
Trevor's Mops Map	*Mops trevori*	3	DD (D)
Royal Genet	*Genetta poensis*	4	DD (U)
Russet Wrinkle-lipped Bat	*Chaerephon russatus*	3	DD (U)
Mouselike pipistrelle	*Hypsugo musciculus*	2	DD (U)
Aellen's Pipistrelle	*Pipistrellus inexspectatus*	2	DD (U)
Light-winged Lesser House Bat	*Scotoecus albofuscus*	2	DD (U)
Robbins's House Bat	*Scotophilus nucella*	2	DD (U)
Pel's Scaly-tailed Squirrel	*Anomalurus pelii*	4	DD (U)
Ghana Rufous-nosed Rat	*Oenomys ornatus*	3	DD (U)

Jackson's Fat Mouse	*Steatomys jacksoni*	3	**DD (U)**
Small Sun Squirrel	*Heliosciurus punctatus*	3	**DD (U)**

Key: IUCN (2021) global status, letters in parentheses indicate population trend, D= Decreasing, S = Stable, U = Uncertain. Endemicity; End = Endemic, N-end = Near Endemic. Likelihood of occurrence (LO): 1 = Present; 1a = Present Anecdotal; 1p = Present previous study only; 2 = High; 3 = Moderate 4 = Unlikely.

5.3 Herpetofauna

The Tain II reserve is situated on the edge of the Guinean Forest Biodiversity hotspot, one of the most biodiverse areas on earth (Myers et al. 2000). The herpetofauna assemblage occupying this hotspot are highly unique supporting at least 20 endemic reptiles and 118 endemic amphibians (Carr et al. 2015). Most of the herpetofauna in these forests show very close genetic affinities to those within the Central African Forests (Rödel and Ernst, 2000).

Ghana has a long history of herpetological research with the first formal collections stretching back as far as the 15th century (detailed by Hughes, 1988).In spite having being the hub for herpetological collections in West Africa, until recently (at least post-millennium), the body of scientific literature remained scant, directionless and largely anecdotal (Hughes, 1988; Rodel and Agyei, 2003). However, this appears to have changed following the first Conservation Priority Setting Workshop in Ghana (Bakarr et al. 2001). Since then, there has been a resurgence in directed, systematic herpetofauna surveys as the scientific community comes to realise just how diverse and understudied Ghanaian herpetofauna really is (Rodel and Agyei, 2003). The last published attempt at a nation-wide inventory of herpetofauna was made by Hughes (1988) who listed 150 Reptiles and 70 amphibians for the country. Current estimates provided by the IUCN (2021) lists 147 reptiles and 85 amphibian species for the country.

Figure 5–10: White-lipped Frog (Amnirana albolabris)

5.3.1 Reptiles

5.3.1.1 Local Context

The known distribution ranges of 122 species of reptile overlap the Brong Ahafo region. Of these some 39 species are considered highly likely to occur based on habitat availability and suitability (indicated by a likelihood of occurrence or LO value of 2 in Appendix 3). This represents a moderate-high reptile diversity in the West African Context. None of the highly likely species are national endemics but many are Guinean Forest endemics. The previous herpetofauna surveys conducted in the Tain II by Oduro and Danqhua (2012) yielded six reptile species. The current (2021) wet season survey (five days) yielded ten species (two from Asukese Forest). The findings of the current survey raise the total reptile inventory for Tain II to 16 species (Appendix 3).

Figure 5–11: Examples of reptile species observed in the reserve: A) Tropical House Gecko (Hemidactylus mabouia), B) Panaspis cf. togoensis (Togo Snake-eyed Skink), C) Marsh Terrapin (Pelomedusa subrufa), D) Guinea Leaf-toed Gecko (Hemidactylus muriceus), E) Ball Python (Python regius), F) Forest Cobra (Naja melanoleuca)

A list of the reptiles observed during the current survey together with the total number of individuals recorded per sampling site is given in Table 2-8. The most common and ubiquitous species in the Tain II is Senegal Skink (*Trachylepis affinis*). This and Togo Snake-eyed Skink (*Panaspis* cf. *togoensis*) were caught at all trap sites and were particularly abundant at A2 (Early-Mid Succession Forest habitat). The mature riparian forest at site AV14 (along the Tain River) yielded the only records of Common Agama (*Agama agama*) and the forest specialist Guinea Leaf-toed Gecko (*Hemidactylus muriceus*). Tropical House Gecko (*Hemidactylus mabouia*) is abundant on the walls of the Form Ghana office buildings. The hardy and adaptable Marsh Terrapin (*Pelomedusa subrufa*),

a savanna species, can be found in some of the larger ponds and road puddles in the reserve. Sampling at the control site in Asukese Forest yielded Senegal Skink and an exceptionally large Forest Cobra (*Naja melanoleuca*) shedding. The presence of the four remaining species was ascertained through discussions with Form Ghana staff and interviews with local farmers.

Table 5-7 Reptile species recorded during the current survey

Common Name	Scientific Name	A1	A2	A3	A4	AV14	T5	O	CO	I
Common Agama	*Agama agama*					1				
West African Slender-snouted Crocodile	*Mecistops cataphractus*									x
Tropical House Gecko	*Hemidactylus mabouia*							>10		
Guinea Leaf-toed Gecko	*Hemidactylus muriceus*					1				
Forest Cobra	*Naja melanoleuca*								1	
Ball Python	*Python regius*									x
African Rock Python	*Python sebae*									x
Senegal Skink	*Trachylepis affinis*	2	7	2	2				2	
Togo Snake-eyed Skink	*Panaspis cf. togoensis*	1	5	1	1					
Home's Hinge-back Tortoise	*Kinixys homeana*									x
Marsh Terrapin	*Pelomedusa subrufa*						2			

5.3.1.2 Species of Conservation Concern

Based on the available distribution data eleven reptile species of conservation concern (SCC) have the potential to occur within the Brong Ahafo region. Of these, four are known to occur in the reserve. These include the Critically Endangered West African Slender-snouted Crocodile *(Mecistops cataphractus*) and Home's Hinge-back Tortoise (*Kinixys homeana*) as well as the Near-Threatened Ball Python (*Python regius*) and African Rock Python (*Python sebae*). Multiple farmers along the Tain River attest to seeing what they believe are West African Slender-snouted Crocodile when the river fills during the rainy season. The species is notoriously secretive an illusive and its presence and abundance can only be ascertained through a dedicated crocodile survey. Home's Hinge-back Tortoise (*Kinixys homeana*) are equally difficult to detect and simply requires long-term adhoc sampling in forested areas during the onset of the rainy season when millipede abundance is high. The presence of these strictly forest dwelling tortoises suggests highlights the importance of the patches of natural forest which persist and suggest they still support a functional leaf litter ecosystem. Other SCC considered highly likely to occur but not found to occur include African Softshell Turtle (*Trionyx triunguis*) and Senegal Flapshell Turtle (*Cyclanorbis senegalensis*). Both are likely to move up the Tain River when it floods.

Table 5-8 Present and potentially occurring reptile SCC

Common Name	Scientific Name	LO	Status
West African Slender-snouted Crocodile	Mecistops cataphractus	1a	CR (D)
Home's Hinge-back Tortoise	Kinixys homeana	1a	CR (D)
Nubian Flapshell Turtle	*Cyclanorbis elegans*	4	CR (D)
African Dwarf Crocodile	*Osteolaemus tetraspis*	4	VU (0)
Senegal Flapshell Turtle	*Cyclanorbis senegalensis*	2	VU (D)
African Softshell Turtle	*Trionyx triunguis*	2	VU (D)
Ball Python	*Python regius*	1p	NT (D)
African Rock Python	*Python sebae*	1p	NT (D)
Lined Centipede-eater	*Aparallactus lineatus*	3	NT (U)
William's Worm Lizard	*Cynisca williamsi*	3	DD (U)
Chabanaud's Fringe-fingered Lizard	*Acanthodactylus boueti*	3	DD (U)

5.3.2 Amphibians

5.3.2.1 Local Context

The known distribution ranges of 55 species of amphibians overlap the Brong Ahafo region. Of these 42 species are considered highly likely to occur based on habitat availability and suitability (indicated by a likelihood of occurrence or LO value of 2 in Appendix 3). This represents a high diversity in the West African Context. The previous herpetofauna surveys conducted in the Tain II by Oduro and Danqhua (2012) yielded 12 amphibian species. The current (2021) wet season survey yielded 13 species. The findings of the current survey raise the total amphibian inventory for Tain II to 20 species (Appendix 3).

Species found during the current survey are listed in Table 5-9 along with the sites from which they were recorded and their abundances.

Although the highest amphibian abundances were encountered at depressions within open degraded habitats the most unique assemblages were encountered at wetlands within forested habitats. Open degraded habitats were characterised by a high abundance of common, tolerant species such as Northern Flat-backed Toad (*Sclerophrys maculata*), Common Toad (*Sclerophrys regularis*), Crowned Bullfrog (*Hoplobatrachus occipitalis*), Dotted Reed Frog (*Hyperolius guttulatus*). More closed canopy habitats were characterised by species such as Green Tree Frog (*Leptopelis viridid*), Uniform Reed Frog (*Hyperolius concolor*), Lime Reed Frog (*Hyperolius fusciventris*).

Table 5-9 Amphibian species recorded during the current survey

Common Name	Scientific Name	A1	A2	A3	A4	F1	F2	T10	CO
Mottled squeaker	*Arthroleptis poecilonotus*	4	18	1	3				
Green Tree Frog	*Leptopelis viridis*		1			2			2
Northern Flat-backed Toad	*Sclerophrys maculata*					20	4		
Common Toad	*Sclerophrys regularis*					1	1		
Crowned Bullfrog	*Hoplobatrachus occipitalis*					6	5		
Marbled Piglet Frog	*Hemisus marmoratus*	3	5						
Striped Spiny Reed Frog	*Afrixalus dorsalis*					30	40		15
Lime Reed Frog	*Hyperolius fusciventris*						15		10
Dotted Reed Frog	*Hyperolius guttulatus*					1	10		20
Snoring Puddle Frog	*Phrynobatrachus natalensis*		1			10		4	
Ridged Puddle Frog	*Phrynobatrachus plicatus*	3	1						2
Broad-banded Grass Frog	*Ptychadena bibroni*							2	2
White-lipped Frog	*Amnirana albolabris*								4

5.3.2.2 Amphibian Guilds

Amphibians, like birds, are another faunal group that lend themselves well to quantitative assessment. Similarly, all present and potentially occurring amphibians have been classified into one of four guilds along a gradient from lowest to highest forest-dwelling affinity. Guild 1 includes species that are mainly restricted to savanna habitats, Guild 2 includes species that frequently occupy both savanna and forest habitats, Guild 3 includes species that only occur in forest habitats but are tolerant to forest degradation and Guild 4 includes only obligate forest species that tend to occupy only intact forest. Successful re-establishment of forest habitat should see an increase in the prevalence of Guild 3 and 4 species. The ultimate objective would be for the restored forests to support a higher proportion of Guild 3 and especially Guild 4 species in high abundances.

Figure 5–12 provides a graphical representation of both the abundance and proportion of each amphibian guild occupying each main habitat type. Interestingly all four trap sites showed a high proportion of forest dwelling species which makes sense given that they were installed in forest settings. Sites T10, F1 and F2 were dominated by savanna/forest generalists (Guild 2) which was to be expected as they were ponds in open habitat previously cleared for teak production. The control site at Asukese Forest Reserve (outside of the Tain II reserve) showed some forest species (Guild 3) including the only record of *Amnirana albolabris* but was otherwise dominated by habitat generalists (Guild 2).

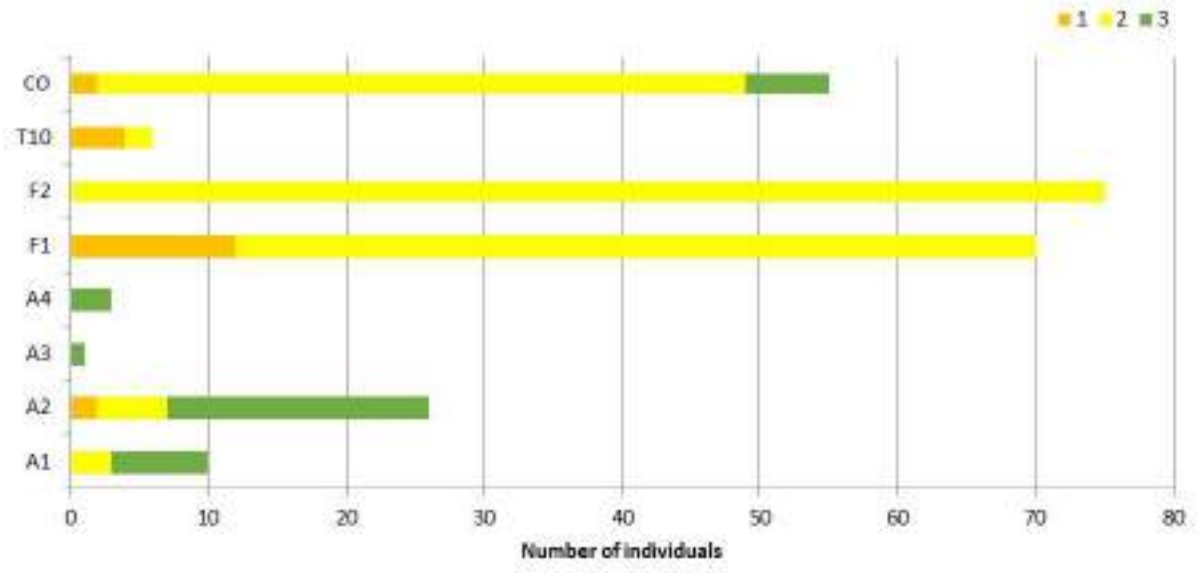

Figure 5–12: Amphibian guild assemblages per habitat. Guild 1, savanna (orange); guild 2, forest/savanna (yellow); guild 3, disturbed forest (light green); guild 4, intact Forest (dark green)

Figure 5–13: Examples of amphibian species detected during the survey: A) Northern Flat-backed Toad (Sclerophrys maculata), B) Common Toad (Sclerophrys regularis), C-D) Mottled squeaker (Arthroleptis poecilonotus), E) Marbled Piglet Frog (Hemisus marmoratus), F) Dotted Reed Frog (Hyperolius guttulatus), G) Lime Reed Frog (Hyperolius fusciventris), H) White-lipped Frog (Amnirana albolabris)

Figure 5–14: Examples of amphibian species detected during the survey: A) Broad-banded Grass Frog (Ptychadena bibroni), B) Green Tree Frog (Leptopelis viridis), C) Ridged Puddle Frog (Phrynobatrachus plicatus), D) Snoring Puddle Frog (Phrynobatrachus natalensis), E) Dotted Reed Frog (Hyperolius guttulatus), F) Striped Spiny Reed Frog (Afrixalus dorsalis)

5.3.2.3 Species of Conservation Concern

A total of five amphibian SCC have the potential to occur within the region. No SCC amphibians have been recorded in Tain II nor where they found during the current survey. In its current state, the Tain II is only likely to support two species namely Ghana Puddle Frog (*Phrynobatrachus ghanensis*) and Tai Forest Treefrog (*Leptopelis occidentalis*) but with time and success of the forest restoration program forest within the reserve may prove suigtable for forest obligate SCC such as Forest Running Frog (*Kassina arboricola*), Laurent's Reed Frog (*Hyperolius laurenti*) and Green-throated Reed Frog (*Hyperolius viridigulosus*).

Table 5-10 Present and potentially occurring amphibian SCC

Scientific Name	Common Name	LO	Status
Kassina arboricola	Forest Running Frog	4	**VU (D)**
Phrynobatrachus ghanensis	Ghana Puddle Frog	2	**NT (D)**

Scientific Name	Common Name	LO	Status
Leptopelis occidentalis	Tai Forest Treefrog	3	**NT (D)**
Hyperolius laurenti	Laurent's Reed Frog	4	**NT (D)**
Hyperolius viridigulosus	Green-throated Reed Frog	4	**NT (D)**

5.3.2.4 Species of Conservation Concern

The following species are highlighted as amphibian indicators of forest habitats. Although four Guild 3 species have been recorded within the Tain II reserve no Guild 4 have yet been detected suggesting a lack of suitably intact forest at present.

Table 5-11 Present and potentially occurring amphibian SCC

Scientific Name	Common Name	LO	Status
Guild 3			
Arthroleptis poecilonotus	Mottled squeaker	1	LC (S)
Leptopelis spiritusnoctis	Ghostly Tree Frog	1p	LC (U)
Afrixalus nigeriensis	Nigeria Banana Frog	2	LC (D)
Afrixalus vibekensis	Vibeke's Spiny Reed Frog	2	LC (D)
Afrixalus weidholzi	Weidholz's Banana Frog	2	LC (U)
Hyperolius concolor	Uniform Reed Frog	1p	LC (I)
Phrynobatrachus calcaratus	Boutry Puddle Frog	1p	LC (D)
Phrynobatrachus plicatus	Ridged Puddle Frog	1	LC (U)
Phrynobatrachus villiersi	Villier's Puddle Frog	3	LC (D)
Xenopus tropicalis	Tropical Clawed Frog	2	LC (S)
Amnirana albolabris	White-lipped Frog	1c	LC (U)
Amnirana occidentalis	Western White-lipped Frog	3	LC (D)
Guild 4			
Cardioglossa occidentalis	Western Long-fingered Frog	4	LC (D)
Leptopelis occidentalis	Tai Forest Treefrog	3	NT (D)
Sclerophrys superciliaris	Cameroon Toad	2	LC (U)
Sclerophrys togoensis	Togo Toad	3	LC (D)
Hyperolius viridigulosus	Green-throated Reed Frog	4	NT (D)
Kassina arboricola	Forest Running Frog	4	VU (D)
Phrynobatrachus alleni	Allen's Puddle Frog	2	LC (D)
Phrynobatrachus ghanensis	Ghana Puddle Frog	2	NT (D)

5.4 Invertebrates

5.4.1 Odonata

5.4.1.1 Local context

The known distribution ranges of 186 species of Odonata overlap the Ghana region. Of these some 50 species are considered highly likely to occur based on habitat availability and suitability (indicated by a likelihood of occurrence or LO value of 2 in Appendix 5). This represents a moderate Odonata diversity in the West African Context.

Dragonfly species were recorded during the transects as well as through incidental findings while meandering through the project area. This invertebrate group was chosen as part of the monitoring as they are valuable indicators of water quality and habitat disturbance (Steytler & Samways 1995). Dragonfly habitat preferences differ amongst species (refer to Table 5-12), and the following variables play an important role in habitat selection and therefore presence:

- Waterflow characteristics (e.g. flowing vs stagnant water)
- Fringing vegetation type and quality (e.g. natural vs alien vegetation, grasses vs herbs vs sedges)

- Open vs closed canopy cover (e.g. percentage shade)
- Water quality (e.g. pH)

They are like butterflies in that they are mostly diurnal and activity increases during sunny and dry conditions. The guild assemblages of the dragonflies recorded during the assessment are indicated in Figure 5-15. Representative photographs of species recorded are shown in Figure 5-16.

Table 5-12: Habitat preferences and sensitivity of dragonfly species recorded during the survey

Species	Sensitivity	Habitat
Chlorocyphidae sp.	Somewhat tolerant	Require flowing water and cover
Pseudagrion sp1	Sensitive	Require more complex habitat including aquatic-marginal vegetation
Copera sp.	Somewhat tolerant	Favours swampy habitats
Pseudagrion sp2	Sensitive	Require more complex habitat including aquatic-marginal vegetation
Umma cincta	Sensitive	Forest species adapted to full forest cover
Orthetrum sp2	Tolerant	Small ponds in open habitat
Orthetrum sp3	Tolerant	Small ponds in open habitat
Ceriagrion sp.	Tolerant	Small ponds in open habitat
Orthetrum cf hintzii	Tolerant	Open and closed habitat
Orthetrum cf. hintzii female	Tolerant	Open and closed habitat
Orthetrum sp1	Tolerant	Open and closed habitat
Palpopleura lucia	Tolerant	Small ponds in open habitat
Palopleura portia	Tolerant	Small ponds in open habitat
Phaon camerunensis	Sensitive	Forest species adapted to full forest cover
Trithemis arteriosa	Tolerant	Small ponds in open habitat

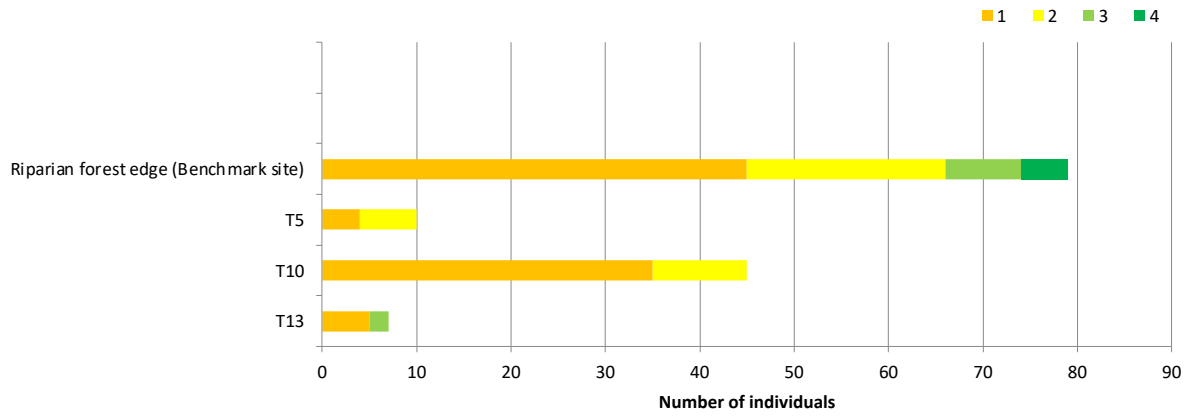

Figure 5-15: Odonata guild assemblages per transect. Guild 1, savanna (orange), Guild 2, forest/ savanna (yellow), Guild 3, disturbed forest (light green), Guild 4, intact forest (dark green). Note the benchmark site is in the Tain II reserve

Figure 5-16: Photographs of conspicuous Odonata recorded during the survey: A) Copera sp.; B) Orthetrum sp2.; C) Ceriagrion sp.; D) Pseudagrion sp2.; E) Orthetrum cf. hintzii (female); F) Pseudagrion sp1.; G) Orthetrum cf. hintzii (male); H) Trithemis arteriosa; I) Palopleura portia; J) Orthetrum sp1; K) Palopleura lucia; L) Phaon camerunensis; M) Orthetrum sp3; N) Chlorocyphidae sp.; O) Umma cincta

5.4.1.2 Species of conservation concern

Only one Odonata SCC is known to occur within Ghana. The species is the Legrand's Cruiser and is currently listed as Data Deficient according to the IUCN. It prefers streams with course detritus and/or a gravelly stream floor bottom with good overlying forest cover. It has a LO within the project area.

Table 5-13: Odonata SCC previously recorded within Ghana

Scientific Name	Common Name	LO	Status
Phyllomacromia legrandi	Legrand's Cruiser	4	**DD (U)**

6 CURRENT IMPACTS AND HABITAT QUALITY

Various stressors (i.e. threats and/or risks) were observed and recorded in the project area during the October 2021 survey. These stressors are grouped into four broad categories with summary descriptions of the various sub-categories of each stressor in the tables below.
The four main stressors are

A. Exploitive activities;
B. Inappropriate management;
C. Pest and problem species; and
D. Mass movement of material in and out of habitats

Table 6-1: Stressor A - Exploitive activities

Stressor A: Exploitive activities (Tier 1)			
Tier 2	Tier 3	Tier 4	Summary description
Farming	Cultivation		Monoculture plantations negatively impact on ecosystem function and biological diversity.
Harvesting	Timber harvesting	Furniture/housing/ charcoal production	Signs of timber harvesting (illegal) were noted in the AOI (mostly within Asukase Reserve). Numerous valuable large forest timber species are selectively targeted by illegal loggers and felled for use in local construction, for making furniture, and for commercial or illegal export. Local communities within the project region rely on the production of charcoal as a fuel source for cooking and as means to generate income. Felled trees are cut into sizable chunks which are set alight and left to smoulder in deep charcoal pits or heaps covered with earth. Besides the loss of high value and RTE timber species, uncontrolled logging within forests (e.g. Asukase Reserve) significantly affects forest structure and therefore viable habitat needed for the survival of biological communities.
Hunting			Trapping signs, signs of firearm use, and hunting dogs were observed in the remaining forest patches of the project area.

Table 6-2: Stressor B - Inappropriate management

Stressor B: Inappropriate management[6] (Tier 1)			
Tier 2	Tier 3	Tier 4	Summary description
Inappropriate fire regime	Frequency		Slash and burn agriculture comprised clearing vegetation which is left for a period to dry and then burned. The process of burning creates a carbon- and phosphorous-rich layer in otherwise

[6] Inappropriate management is an umbrella term used in this context to group different stressors related to poor land management irrespective of knowledge. The term on its own does not imply specific persons/organisations.

Stressor B: Inappropriate management[6] (Tier 1)			
Tier 2	Tier 3	Tier 4	Summary description
			nutrient-poor topsoil which improves agricultural productivity. Soils are depleted within two to three growing seasons, so the cycle is repeated. When the farmers abandon the land, a pioneer succession stage begins which is characterised by high disturbance levels and greater susceptibility to colonisation from alien/invasive plant species.
Inappropriate water regime	Drainage		Historically wetter swampy areas have been drained to develop commercial plantations and increase the area of land available. Although these channels are mostly unlined and still vegetated, construction has caused significant alteration in the terrain and watercourses.
	River regulation		Lack of riparian reserve (i.e., buffer zones) due to a combination of clearance for plantation establishment, roads and reserves or general access, was noted in places; riparian reserves are needed for ecological functioning of aquatic ecosystems.

Table 6-3: Stressor C - Pest and problem species

Stressor C: Pest and problem species (Tier 1)			
Tier 2	Tier 3	Tier 4	Summary description
Plants	Competition	Alien/Invasive plant species	The remaining natural forest habitats (i.e. remnant lowland, riparian and swamp forest habitats between the planted blocks) are dominated by alien and/or invasive plant species.

Table 6-4: Stressor D - Mass movement of material in/out of habitats

Stressor D: Mass movement of material in/out of habitats (Tier 1)			
Tier 2	Tier 3	Tier 4	Summary description
Mass movement of material to habitat	Soil	Erosion, sedimentation, and dust	Access roads, commercial and subsistence agricultural activities have led to erosion and sedimentation (through dust and runoff) of watercourses. Soil from areas stripped of vegetation, is transported to streams and carried in rivers as suspended solids that impact downstream lakes and aquatic environments. Negative impacts from the suspended solids impacts aquatic fauna and flora, through decreased visibility and oxygen depletion (e.g., eutrophication).

6.1 Management and mitigation plans for stressors

Management and mitigation measures are proposed for each of the stressors identified above and summarized in
Table 6-5.

Table 6-5: Mitigation recommendations

Stressor	Mitigation
Farming - Cultivation	Remnant forest patches serve as important steppingstones in the landscape to allow for the dispersal of plants and their protection should be part of plantation management (of blocks).
Timber harvesting	Control access by local people to reduce incidence of illegal timber harvesting.
Hunting	
Inappropriate fire regime	
Inappropriate water regime	Establishing and maintaining buffer zones in the riparian forests; swamp forests and degraded lowland forests should be prioritised for this work. Ortho-rectified aerial imagery for conservation target areas should be obtained (easily through the use of UAV technology) to identify and delineate habitats where restoration is required; and The imagery and spatial data would serve as a baseline against which restorative actions can be measured/monitored.
Pest and problem species	Develop and implement an integrated alien invasive species (AIS) management plan that clearly identifies target species. Options for controlling AIS should be reviewed so that the most suitable methods are used (e.g., physical, chemical, biological and cultural control methods, or combination of any, depending on the location, access, prevailing environment, and available skills). Opportunities for using local communities / labour for weed control should be assessed when reviewing options. Opportunities for training staff and local should be assessed as managing pests and AIS will be an ongoing task.
Mass movement of material into habitats	Refer to aquatic specialist report for details regarding mitigation against erosion, dust and sedimentation

6.2 Current habitat sensitivity and importance

The current habitat sensitivity and importance for maintaining the fauna biodiversity within the Project Area is indicated in Figure 6-1. The importance and sensitivity were evaluated based on current habitat quality defined here as the ability of the ecosystem to provide and maintain the conditions necessary for the persistence of fauna individuals and populations. It is assumed to be a variable that continuously ranges between low, medium, and high dependent on the resources available to fauna. Habitat with a high quality is therefore regarded as being relatively intact with functional and structural characteristics within the range of historical values. The areas indicated at present as having very high and high sensitivities are therefore regarded as areas where conservation efforts should be focused around. Management and monitoring plans are also tailored mostly around these areas.

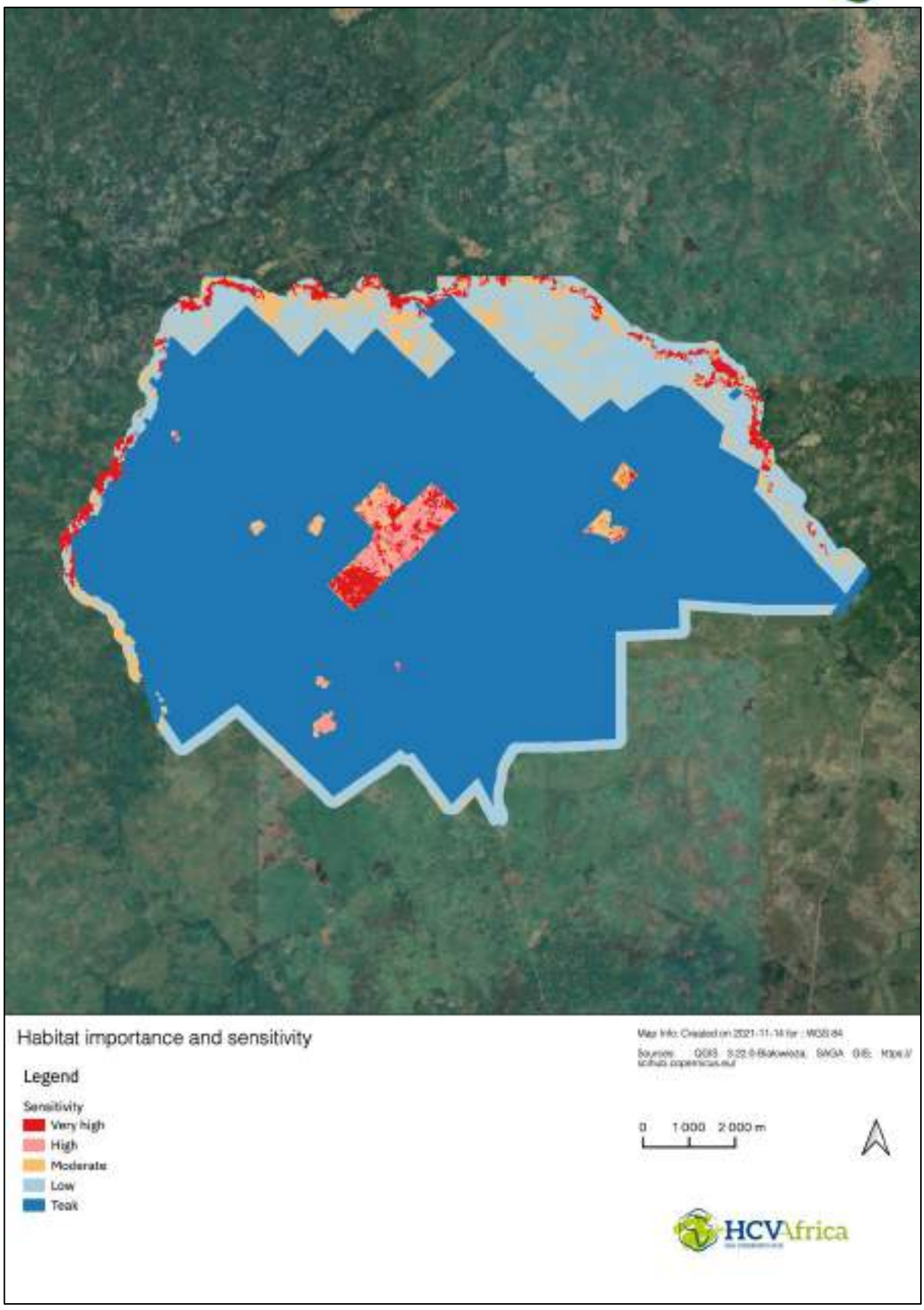

Figure 6-1: Habitat sensitivity

7 MONITORING PLAN

The overarching aim of fauna monitoring within the Tain II reserve should be to track changes in faunal species assemblages to gauge success and status of forest regeneration efforts in reserve. Presented in Table 8-1 below is a monitoring plan to act as a guide for the continuation of long-term monitoring in the reserve. It has been designed to accommodate a rapid assessment approach geared towards prioritizing species detection over quantitative rigour while at the same time being cost effective, practical and repeatable.

Sampling sites will likely be added, removed or changed as time goes by but it is important to try and keep as many the same as possible.

7.1 Management and monitoring plans to enhance or maintain conservation areas i.e. habitats required to support the fauna individuals and populations

Management and monitoring objectives for

Conservation management and monitoring objectives	
Overarching goal	Objective
Habitat protection	Protection from fire
	Protect from human intrusion
Habitat reconstruction	Reconstruction of ecosystems in degraded areas, through the re-establishment of dominant, indigenous vegetation types. Identifying and propagating faster growing pioneer tree and shrub species in the on-site nursery: planting such species will encourage in rapid ecological succession at the outset of rehabilitation projects. This is important to provide a resilient ecological framework for the establishment of more complex ecological layers.
Habitat maintenance	Restore natural processes through the safeguarding of natural successional stages within riparian reserves and areas that have been cleared in the past. E.g. by implementing strict riparian buffers and safeguarding designated areas, natural succession from pioneer forest stage towards secondary and ultimately mature stages is expedited. This process increases ecological complexity and diversity to allow for the establishment of resilient habitats that can facilitate complex natural processes (e.g. nutrient cycling, species recruitment etc.).
	Remove threatening processes (e.g., stressors discussed in Table 6-1, Table 6-2, Table 6-3, Table 6-4).
Population manipulation	Reintroduction of tree and shrub species. This adds an additional layer of complexity on top of habitat reconstruction wherein specific plant species are reintroduced to increase overall biodiversity.
Education	Raise public awareness of threats to species and habitats.
	Highlight the need for sustainable use of natural resources.
	Encourage active participation and interest in environmental care and protection.
Reduce illegal collection	Identify target plant species and protect Conservation areas from public.

Monitoring plan	
Monitoring protocol code	Form_Hab_1
Stressor(s)	Physical modification of habitat & reduction in connectivity of habitats.
Receptor(s)	Forest morphology, contiguous terrestrial flora communities (habitat types).
Variables	Area (ha) and locations of detectable changes.
Sampling method	• Web-based monitoring of medium resolution (10-20 m) satellite imagery using a change detection algorithm; use free open source GIS tools that automatically acquire and analyse free Sentinel imagery from the European Space Agency (ESA). Images are captured every 5 days which should enable cloud-free sections of the Concession to be recorded throughout the year; • On-site evaluations are required when large-scale vegetation changes are recognised; the 0.1 ha method should be used to describe and map vegetation communities (Gentry, 1982); and • Tree species-richness (species ha^{-1}), tree density (number of trees ha^{-1}) and diameter of trees at breast height (dbh; in cm) should be recorded. Emphasis should be placed on changes in vegetation structure and species composition.
Sampling frequency	• Bi-annual monitoring using remote sensing imagery; • Ad hoc on-site evaluations in response to changes in vegetation change detected through remote sensing; and • Annual in-field vegetation monitoring.
Sampling site(s)	Monitor entire project area (remote sensing) and target sampling sites as needed.
Vegetation change and action thresholds	• Changes in contiguous patches of vegetation outside of specific project-related activities with a footprint area of > 1 ha should be investigated in-field; and • Cumulative changes in area > 5% from the original contiguous cluster of a specific vegetation type requires investigation (i.e., the cause of the disturbance(s) so if they are due to project-related activities (directly or indirectly), change can be quantified.
Data analysis	• Newly acquired aerial/satellite imagery should be compared to the original baseline (land cover of the assessment) using GIS. All areas where change has been detected (e.g., infrastructure, vegetation clearing) should be mapped and categorized; • Areas of vegetation change that are not project-related should be flagged and investigated through a site visit to determine their cause; and • Georeferenced photographs should be taken to document any changes because this will assist with the characterisation of the vegetation community.
Reporting requirements	Bi-annual reporting, indicating: • areas of change expressed as percentage change (%) for each contiguous cluster of specific vegetation type; • areas of change, including cause, which are not directly attributable to project activities (e.g., illegal logging); • actions to be developed and implemented (e.g., stopping activities to avoid non-compliance according to good practice standards); and • All reports should include GIS shapefiles and original georeferenced photographs.

Health & safety (H&S) considerations	Using Unmanned Aerial Vehicle (UAV) to acquire aerial imagery requires environmental health and safety (EHS) approval from local aviation authorities; comply with national legislation and regulations.
Indicator or performance criteria	Positive performance will be indicated through: • Increased tree density (number of trees ha−1) in forest habitats; • Increased number of large trees (trees ≥ 10 cm DBH ha−1) in forest habitats; • Increased plant species diversity or species richness (species ha−1); and • Increased annual AGLB (Mg dry weight ha−1).
Monitoring protocol code	Form_Hab_2
Stressor(s)	Alien/invasive species becoming established.
Receptor(s)	Terrestrial and aquatic flora communities (composition and distribution).
Variables	Date, location, species, density estimate, size of area.
Sampling method	Visual inspection of road verges, construction sites (e.g., plantation roads and other infrastructure development) and operational areas, particularly where vegetation clearing has occurred; such activities create opportunities for AIS to grow (e.g., through importing materials which contain AIS, vehicles coming in from other areas), disturbing ground and clearing vegetation).
Sampling frequency	• Bi-annual inspections; • Ongoing daily inspections, on an ad hoc basis, will be beneficial as new aliens/invaders could be readily removed. (before taking over). Observations should be made by all staff on the plantation; identification and the means of reporting such species should be part of staff training / induction; and • Posters illustrating alien / invader species would help reinforce the message (and is cost-effective).
Sampling site(s)	All infrastructure sites (e.g., housing, processing plant), roads and roadsides, and plantations should be monitored; this should include a 20 m buffer around each of these areas.
Population density trigger and action thresholds	No specific threshold is required as presence alone dictates the need for management actions geared towards eradication.
Data analysis	• Graphical inspection of summary statistics (e.g., number of species detected, total extent of infested area); • Geospatial analysis of AIS infestations to determine eradication actions and implementing controls to minimise spread; • Specific analyses to consider seed dispersal mechanisms (e.g., wind/water) is required to predict future spreading patterns and therefore, enable proactive measures to be implanted to prevent spreading; and • Evaluation of the effectiveness of AIS control measures that have been implemented.
Reporting requirements	Bi-annual reporting summarising data that has been collected / recorded and recommendations for corrective actions, where required.
Health & safety considerations	• No H&S requirements beyond the standard operation protocols; • Standard field safety precautions regarding weather, insects, heat, potentially dangerous animals, and dehydration are applicable and should be followed when areas are investigated on site.
Indicator or performance criteria	• Decrease in number of AIS species detected; • Decrease in total extent of infested area

8 CONCLUSION

The Tain II forest reserve was found to support high faunal diversity. This diversity is attributable to the reserve's position along a major bioclimatic ecotone between moist Guinean Forests to the south and drier Sudan-Guinean Savannas to the north. Consequently, the faunal assemblages, although predominantly associated with the Guinean Forest Biome are comprised of a mix of forest and savanna species. The higher than expected prevalence of savanna species within the reserve is attributed mainly to the high levels of deforestation that has occurred within the project area which has created vast areas of savanna-like habitat known as farm bush. These areas, particularly nearer the Tain River in the north have been the focus of the Form Ghana forest restoration efforts. Avifaunal assemblage, in particular, attest to the significant progress which has been made in this regard. Data from systematic avifaunal point counts throughout the reserve reveals that the early succession forest regeneration areas support by far the highest avian diversity of all the identified habitats. The most unique faunal assemblages are still, however, associated with the small remnant patches of natural semi-deciduous Guinean Forests. These forest patches host resident populations of threatened species such as the endangered White-bellied Pangolin and transitory populations of Forest Buffalo, while the Tain River system likely supports Slender Snouted Crocodile (based on anecdotal accounts) when it floods during the wet season. It is important to note that the reserve supports an exceptionally high diversity of butterflies. Other noteworthy faunal observations include a very large colony of African Straw-Coloured Fruit Bats, as well as a very high small mammal abundance and diversity which is evidenced by a high diversity and abundance of birds of prey. Overall, although the Tain II reserve remains heavily impacted by deforestation, forest restoration efforts such as this are making significant progress as evidenced by the high faunal abundances in these habitats compared with non-restored areas and highlights the importance of continued efforts and monitoring

Table 8-1 Fauna monitoring plan for forest restoration efforts in the Tain II Reserve

FAUNA MONITORING PLAN			
Herpetofauna			
WHERE?	**WHEN?**	**HOW?**	**WHO?**
Field work			
At each herpetofauna sampling site as listed in the methods section of the report. This includes the control site in Asukese Forest Reserve	Sites must be surveyed at least annually in the height of the rainy season in June. Preferably however, sampling should be done bi-annually at the peak of each of the two rainy seasons (June and September) At night, amphibian diversity and prevailing weather conditions must be recorded.	• At each site perform visual- and acoustic-based counts of amphibian species as well as counts of reptiles Sample for at least 1 hour per site • Record at each site: site code, observer names, distance traversed, species, number of individuals of each species, date, time start, time stop, weather conditions, habitat condition and any obvious impacts Record location of each sampling site with GPS • Take photo at same position each time (preferably with good quality phone as the pictures are georeferenced) • Photograph at least one representative of each species at each site. • Catch all species which look different and take them back to camp, take diagnostic photographs ID, release • **Required:** o Smart Phone o Camera: (preferably digital SLR with macro lens) o Headlamps o Ziploc bags, water and sampling bottles	Form Ghana Biodiversity Team: A dedicated fauna monitoring team comprising at least two persons who both must perform field work.
Data analysis and reporting			
For the Form Ghana focal portion of the Tain II reserve, compare to control at Asukese Forest Reserve	Annually, within a month after completing all the field work.	• Refer to baseline report for guidance, use as template and update accordingly. • Describe any assumptions, limitations, and differences in the monitoring methodology used. • Compare the following with baseline and provide possible explanations for significant differences o Latest total number of species detected in the study area, with the baseline value o Latest overall abundances with the baseline abundances o Relative proportion of each amphibian guild at each site, as defined by their abundances. o Prevalence of each of the nominated indicator species in the study area • Conclude by highlighting all significant changes in amphibian diversity, habitat and impacts, and provide recommendations for the way forward. • **Required:** o Computer o Microsoft Excel o Microsoft Word	Form Ghana Biodiversity Team: Comprising two persons, including one data analyser and report compiler, and one report reviewer.

Avifauna			
Fieldwork			
WHERE?	**WHEN?**	**HOW?**	**WHO?**
At the avifaunal point count localities as listed in the methodologies section of this report	At least annually in rainy season when migrants are in (October), but preferably both dry (August) and wet seasons (October)	• Re-visit the point count localities, add new ones as desired (but remember you must re-sample them each time • Conduct point counts for 10 min at each point • At each point count record: o Site code and habitat (in the title) o Date, time, position (if using Bird Lasser, all recorded automatically) o Number of each species o Take Photos of each new species observed • **Required:** o Binoculars o Smartphone loaded with Bird Lasser App (to log species) and Avenza App (GPS) o Otherwise: Notepad and pen o Camera (preferably with at least 200 mm zoom lens) o Bird book: Either Birds of Africa South of the Sahara or Birds of Ghana	Form Ghana Biodiversity Team: Comprising two persons
Data analysis and reporting			
For the Form Ghana focal portion of the Tain II reserve, compare to control at Asukese Forest Reserve	Annually, within a month after completing all the field work.	• Refer to baseline report for guidance, use as template and update accordingly. • Describe any assumptions, limitations, and differences in the monitoring methodology used. • Compare the following with baseline and provide possible explanations for significant differences: o Latest total number of species detected in the study area, with the baseline value o Latest overall abundances with the baseline abundances o Latest number of observations (each species entry for a site) with the baseline abundances o Relative proportion of each bird guild at each site, as defined by their relative abundances. o Prevalence of each of the nominated indicator species in the reserve • Conclude by highlighting all significant changes in avian diversity, habitat and impacts, and provide recommendations for the way forward. • **Required:** o Computer o R statistical software (free) o R studio (free) o Microsoft Excel o Microsoft Word	Form Ghana Biodiversity Team: Comprising two persons, including one data analyser and report compiler, and one report reviewer.
Mammals			

WHERE?	WHEN?	HOW?	WHO?
Field work			
At each non-avifaunal sampling site as listed in the methods section of the report. This includes the control site in Asukese Forest Reserve	At least annually in rainy season when migrants are in (October), but preferably both dry (August) and wet seasons (October)	**Active searching:** • At each non-avifaunal sampling site look for any signs of mammal presence in the form of tracks, dung, fruit discards, scratchings, burrows, dens, tree holes, termite excavations, calls and visual observations • Take photo of site name and take photo of the site (facing same way each time) • Record date, time, observer, habitat conditions and impacts, number of each sign of each species and what type of sign it was • Photograph each mammal sign then ID each sign and note as an observation **Mistnetting:** • Mistnet at a minimum of three locations per survey (one night each) Install mistnet at safe location free of local motorbike and foot traffic • At least one person should monitor mist net constantly (installer / handler must be one of the trained personnel) • The other person can herp in close proximity or search for nocturnal mammals and birds Ensure a bat detector is running near the net for the duration of the trapping **Sherman trapping:** • Install at least five Sherman traps at four locations (preferably more if possible 20) • Set each trap at 25 m intervals • Bait with peanut butter **Motion Cameras:** • Install all three motion cameras • Select sites in good forest with deep leaf litter, near water or fruiting trees • Bait with a mixture of cat food and fruit • Service every two weeks to check SD cards and battery power, refresh as necessary • Download every two weeks and back up to cloud (e.g. google drive) **Required:** • Mistnet and ropes / poles (6m ultrafine gauge) • Bat detector	Form Ghana Biodiversity Team: Comprising two persons

		• Motion cameras and bait (form has three Browning Trail Cameras as issued following current survey) • Sherman traps and bait • Handling and measuring gear: Gloves, callipers, small scale (100g), ruler	
Data analysis and reporting			
For theForm Ghana focal portion of the Tain II reserve, compare to control at Asukese Forest Reserve	Annually, within a month after completing all the field work.	• Refer to baseline report for guidance, use as template and update accordingly. • Describe any assumptions, limitations, and differences in the monitoring methodology used. • Compare the following with baseline and provide possible explanations for significant differences o Latest total number of species detected in the study area, with the baseline value o Latest overall abundances with the baseline abundances o Relative proportion of each mammal guild at each site, as defined by their abundances. o Prevalence of each of the nominated indicator species in the study area • Conclude by highlighting all significant changes in amphibian diversity, habitat and impacts, and provide recommendations for the way forward. • **Required:** o Computer o Microsoft Excel o Microsoft Word	Form Ghana Biodiversity Team: Comprising two persons, including one data analyser and report compiler, and one report reviewer.

INVERTEBRATE MONITORING PLAN			
Odonata			
WHERE?	**WHEN?**	**HOW?**	**WHO?**
Field work			

At each Odonata sampling site as listed in the methods section of the report. Sampling should be done around freshwater where adults often congregate in (or at the edges of) open areas, such as forest clearings, roadsides and grassy fields, to feed on insects.	Sites must be surveyed at least annually in the height of the rainy season in June. Preferably however, sampling should be done bi-annually at the peak of each of the two rainy seasons (June and September) During the day and prevailing weather conditions must be recorded. Most species prefer warm (sunny) weather and are most active during midday, However, some species are only active in twilight (dusk, dawn) and spend the day hiding in the vegetation.	• A butterfly net with a net opening of 0.5 m is suitable for most occasions. The net should preferably have a telescopic lens in order to extend or shorten as needed. • At each site perform a visual inspection in order to record general habitat characteristics e.g. flowing vs stagnant water, open vs closed vegetation cover etc.) Sample for at least 1 hour per site • Record at each site: site code, observer names, distance traversed, species, number of individuals of each species, date, time start, time stop, weather conditions, habitat condition and any obvious impacts Record location of each sampling site with GPS • Take photo at same position each time (preferably with good quality phone as the pictures are georeferenced) • Photograph at least one representative of each species at each site. • Catch all species which look different and take them back to camp using small envelopes. Back at camp take diagnostic photographs for identification • **Required:** o o Drinking water o Smart Phone o 10x magnification handlens o Camera: (preferably digital SLR with macro lens) o Catch net o Envelopes	Form Ghana Biodiversity Team: A dedicated fauna monitoring team comprising at least two persons who both must perform field work.
Data analysis and reporting			
For the Form Ghana focal portion of the Tain II reserve, compare to control at Asukese Forest Reserve	Annually, within a month after completing all the field work.	• Refer to baseline report for guidance, use as template and update accordingly. • Describe any assumptions, limitations, and differences in the monitoring methodology used. • Compare the following with baseline and provide possible explanations for significant differences o Latest total number of species detected in the study area, with the baseline value o Latest overall abundances with the baseline abundances o Relative proportion of each guild at each site, as defined by their abundances. o Prevalence of each of the nominated indicator species in the study area • Conclude by highlighting all significant changes in Odonata diversity, habitat and impacts, and provide recommendations for the way forward. • **Required:** o Computer o Microsoft Excel o Microsoft Word	Form Ghana Biodiversity Team: Comprising two persons, including one data analyser and report compiler, and one report reviewer.

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Appendix 1: Present and potentially occurring avifauna

Family	Common Name	Scientific Name	LO	BR	Guild	Status[1]	2008[2]	2012[3]	2021[4]	Total
ACCIPITRIDAE	Shikra	*Accipiter badius*	2		2	LC (S)				
ACCIPITRIDAE	Red-thighed Sparrowhawk	*Accipiter erythropus*	4	GCFB	4	LC (D)				
ACCIPITRIDAE	Black Goshawk	*Accipiter melanoleucus*	2		2	LC (D)				
ACCIPITRIDAE	Red-chested Goshawk	*Accipiter toussenelii*	3		2	LC (D)				
ACCIPITRIDAE	Cassin's Hawk-Eagle	*Aquila africana*	1	GCFB	4	LC (D)			x	x
ACCIPITRIDAE	Tawny Eagle	*Aquila rapax*	2		1	VU (D)				
ACCIPITRIDAE	African Hawk-Eagle	*Aquila spilogaster*	1		1	LC (D)			x	x
ACCIPITRIDAE	African Cuckoo-Hawk	*Aviceda cuculoides*	2		2	LC (S)				
ACCIPITRIDAE	Grasshopper Buzzard	*Butastur rufipennis*	2		2	LC (D)				
ACCIPITRIDAE	Red-necked Buzzard	*Buteo auguralis*	2		2	LC (I)				
ACCIPITRIDAE	Beaudouin's Snake-Eagle	*Circaetus beaudouini*	2		1	VU (D)				
ACCIPITRIDAE	Banded Snake-Eagle	*Circaetus cinerascens*	2		2	LC (D)				
ACCIPITRIDAE	Brown Snake-Eagle	*Circaetus cinereus*	2		1	LC (D)				
ACCIPITRIDAE	Eurasian Marsh-Harrier	*Circus aeruginosus*	3		1	LC (I)				
ACCIPITRIDAE	Pallid Harrier	*Circus macrourus*	3		1	NT (D)				
ACCIPITRIDAE	Congo Serpent-Eagle	*Dryotriorchis spectabilis*	3	GCFB	4	LC (D)				
ACCIPITRIDAE	Black-winged Kite	*Elanus caeruleus*	1		1	LC (S)			x	x
ACCIPITRIDAE	Palm-nut Vulture	*Gypohierax angolensis*	1		2	LC (S)			x	x
ACCIPITRIDAE	White-backed Vulture	*Gyps africanus*	3		1	CR (D)				
ACCIPITRIDAE	African Fish-Eagle	*Haliaeetus vocifer*	2		1	LC (S)				
ACCIPITRIDAE	Ayres's Hawk-Eagle	*Hieraaetus ayresii*	3		1	LC (S)				
ACCIPITRIDAE	Booted Eagle	*Hieraaetus pennatus*	2		1	LC (U)				
ACCIPITRIDAE	Wahlberg's Eagle	*Hieraaetus wahlbergi*	2		1	LC (S)				
ACCIPITRIDAE	Lizard Buzzard	*Kaupifalco monogrammicus*	2		2	LC (S)				
ACCIPITRIDAE	Long-crested Eagle	*Lophaetus occipitalis*	2		2	LC (I)				
ACCIPITRIDAE	Bat Hawk	*Macheiramphus alcinus*	2		3	LC (S)				
ACCIPITRIDAE	Dark Chanting-Goshawk	*Melierax metabates*	2		2	LC (S)				
ACCIPITRIDAE	Gabar Goshawk	*Micronisus gabar*	2		2	LC (S)				
ACCIPITRIDAE	Yellow-billed Kite	*Milvus aegyptius*	1		2	LC (D)		x	x	x
ACCIPITRIDAE	Black Kite	*Milvus migrans*	2		2	LC (S)				
ACCIPITRIDAE	Hooded Vulture	*Necrosyrtes monachus*	3		1	CR (D)				
ACCIPITRIDAE	European Honey-buzzard	*Pernis apivorus*	3		1	LC (D)				

Family	Common Name	Scientific Name	LO	BR	Guild	Status[1]	2008[2]	2012[3]	2021[4]	Total
ACCIPITRIDAE	African Harrier-Hawk	*Polyboroides typus*	1		2	LC (S)	x		x	x
ACCIPITRIDAE	Crowned Eagle	*Stephanoaetus coronatus*	3		3	NT (D)				
ACCIPITRIDAE	Bateleur	*Terathopius ecaudatus*	3		1	EN (D)				
ACCIPITRIDAE	White-headed Vulture	*Trigonoceps occipitalis*	3		1	CR (D)				
ACCIPITRIDAE	Long-tailed Hawk	*Urotriorchis macrourus*	3	GCFB	4	LC (D)				
PANDIONIDAE	Osprey	*Pandion haliaetus*	4		1	LC (I)				
ANATIDAE	Fulvous Whistling-Duck	*Dendrocygna bicolor*	4		1	LC (D)				
ANATIDAE	White-faced Whistling-Duck	*Dendrocygna viduata*	3		1	LC (I)				
ANATIDAE	African Pygmy-Goose	*Nettapus auritus*	4		3	LC (D)				
ANATIDAE	Spur-winged Goose	*Plectropterus gambensis*	2		1	LC (I)				
ANATIDAE	Hartlaub's Duck	*Pteronetta hartlaubii*	3	GCFB	4	LC (D)				
ANATIDAE	Garganey	*Spatula querquedula*	4		1	LC (D)				
BUCEROTIDAE	Abyssinian Ground-Hornbill	*Bucorvus abyssinicus*	4		1	VU (D)				
BUCEROTIDAE	Brown-cheeked Hornbill	*Bycanistes cylindricus*	3	GCFB	4	VU (D)				
BUCEROTIDAE	Piping Hornbill	*Bycanistes fistulator*	3	GCFB	4	LC (D)				
BUCEROTIDAE	Black-and-white-casqued Hornbill	*Bycanistes subcylindricus*	3	GCFB	4	LC (U)				
BUCEROTIDAE	Black-casqued Hornbill	*Ceratogymna atrata*	3	GCFB	4	LC (D)				
BUCEROTIDAE	Yellow-casqued Hornbill	*Ceratogymna elata*	3	GCFB	4	VU (D)				
BUCEROTIDAE	White-crested Hornbill	*Horizocerus albocristatus*	3	GCFB	4	LC (D)				
BUCEROTIDAE	Black Dwarf Hornbill	*Horizocerus hartlaubi*	3	GCFB	4	LC (D)				
BUCEROTIDAE	Red-billed Dwarf Hornbill	*Lophoceros camurus*	2	GCFB	3	LC (D)				
BUCEROTIDAE	African Grey Hornbill	*Lophoceros nasutus*	1		1	LC (S)		x	x	x
BUCEROTIDAE	African Pied Hornbill	*Lophoceros fasciatus*	1	GCFB	3	LC (U)	x	x	x	x
PHOENICULIDAE	White-headed Woodhoopoe	*Phoeniculus bollei*	2		4	LC (D)				
PHOENICULIDAE	Green Woodhoopoe	*Phoeniculus purpureus*	1		2	LC (D)		x	x	x
PHOENICULIDAE	Black Scimitarbill	*Rhinopomastus aterrimus*	1		1	LC (D)		x	x	x
PHOENICULIDAE	Forest Scimitarbill	*Rhinopomastus castaneiceps*	2		4	LC (D)				
UPUPIDAE	Eurasian Hoopoe	*Upupa epops*	2		2	LC (D)				
APODIDAE	Little Swift	*Apus affinis*	1		1	LC (I)			x	x
APODIDAE	Common Swift	*Apus apus*	1		1	LC (S)			x	x
APODIDAE	African Swift	*Apus barbatus*	2		1	LC (D)				
APODIDAE	Bates's Swift	*Apus batesi*	2	GCFB	4	LC (D)				
APODIDAE	Pallid Swift	*Apus pallidus*	2		1	LC (S)				
APODIDAE	African Palm-Swift	*Cypsiurus parvus*	1		1	LC (I)	x	x	x	x

Family	Common Name	Scientific Name	LO	BR	Guild	Status[1]	2008[2]	2012[3]	2021[4]	Total
APODIDAE	Cassin's Spinetail	*Neafrapus cassini*	2	GCFB	3	LC (S)				
APODIDAE	Sabine's Spinetail	*Rhaphidura sabini*	2	GCFB	3	LC (S)				
APODIDAE	Alpine Swift	*Apus melba*	2		1	LC (S)				
APODIDAE	Black Spinetail	*Telacanthura melanopygia*	2	GCFB	3	LC (S)				
APODIDAE	Mottled Spinetail	*Telacanthura ussheri*	2		2	LC (D)				
CAPRIMULGIDAE	Long-tailed Nightjar	*Caprimulgus climacurus*	2		2	LC (S)				
CAPRIMULGIDAE	Eurasian Nightjar	*Caprimulgus europaeus*	2		2	LC (D)				
CAPRIMULGIDAE	Plain Nightjar	*Caprimulgus inornatus*	2		2	LC (S)				
CAPRIMULGIDAE	Standard-winged Nightjar	*Caprimulgus longipennis*	2		1	LC (S)				
CAPRIMULGIDAE	Brown Nightjar	*Caprimulgus binotatus*	2	GCFB	3	LC (D)				
BURHINIDAE	Senegal Thick-knee	*Burhinus senegalensis*	2		1	LC (U)				
CHARADRIIDAE	Little Ringed Plover	*Charadrius dubius*	2		1	LC (S)				
CHARADRIIDAE	Forbes's Plover	*Charadrius forbesi*	4		1	LC (U)				
CHARADRIIDAE	Common Ringed Plover	*Charadrius hiaticula*	2		1	LC (D)				
CHARADRIIDAE	White-fronted Plover	*Charadrius marginatus*	4		1	LC (D)				
CHARADRIIDAE	Kittlitz's Plover	*Charadrius pecuarius*	3		1	LC (U)				
CHARADRIIDAE	White-headed Lapwing	*Vanellus albiceps*	4		1	LC (S)				
CHARADRIIDAE	Wattled Lapwing	*Vanellus senegallus*	3		1	LC (S)				
CHARADRIIDAE	Spur-winged Lapwing	*Vanellus spinosus*	4		1	LC (I)				
GLAREOLIDAE	Temminck's Courser	*Cursorius temminckii*	4		1	LC (S)				
GLAREOLIDAE	Gray Pratincole	*Glareola cinerea*	4		2	LC (U)				
GLAREOLIDAE	Rock Pratincole	*Glareola nuchalis*	4		2	LC (D)				
GLAREOLIDAE	Collared Pratincole	*Glareola pratincola*	4		2	LC (D)				
GLAREOLIDAE	Bronze-winged Courser	*Rhinoptilus chalcopterus*	4		1	LC (S)				
JACANIDAE	African Jacana	*Actophilornis africanus*	2		2	LC (S)				
LARIDAE	Whiskered Tern	*Chlidonias hybrida*	4		1	LC (S)				
LARIDAE	White-winged Tern	*Chlidonias leucopterus*	4		1	LC (S)				
LARIDAE	Caspian Tern	*Hydroprogne caspia*	4		1	LC (I)				
LARIDAE	Lesser Black-backed Gull	*Larus fuscus*	4		1	LC (I)				
PLUVIANIDAE	Egyptian Plover	*Pluvianus aegyptius*	4		1	LC (D)				
RECURVIROSTRIDAE	Black-winged Stilt	*Himantopus himantopus*	3		1	LC (I)				
ROSTRATULIDAE	Greater Painted-Snipe	*Rostratula benghalensis*	2		1	LC (D)				
SCOLOPACIDAE	Common Sandpiper	*Actitis hypoleucos*	2		1	LC (D)				
SCOLOPACIDAE	Little Stint	*Calidris minuta*	2		1	LC (I)				

Family	Common Name	Scientific Name	LO	BR	Guild	Status[1]	2008[2]	2012[3]	2021[4]	Total
SCOLOPACIDAE	Ruff	*Calidris pugnax*	2		1	LC (D)				
SCOLOPACIDAE	Temminck's Stint	*Calidris temminckii*	4		1	LC (U)				
SCOLOPACIDAE	Common Snipe	*Gallinago gallinago*	2		1	LC (D)				
SCOLOPACIDAE	Great Snipe	*Gallinago media*	3		1	NT (D)				
SCOLOPACIDAE	Jack Snipe	*Lymnocryptes minimus*	3		1	LC (S)				
SCOLOPACIDAE	Spotted Redshank	*Tringa erythropus*	4		1	LC (S)				
SCOLOPACIDAE	Wood Sandpiper	*Tringa glareola*	2		1	LC (S)				
SCOLOPACIDAE	Common Greenshank	*Tringa nebularia*	2		1	LC (S)				
SCOLOPACIDAE	Green Sandpiper	*Tringa ochropus*	4		1	LC (I)				
SCOLOPACIDAE	Marsh Sandpiper	*Tringa stagnatilis*	2		1	LC (D)				
SCOLOPACIDAE	Common Redshank	*Tringa totanus*	4		1	LC (U)				
TURNICIDAE	Black-rumped Buttonquail	*Turnix nanus*	2		2	LC (D)				
TURNICIDAE	Small Buttonquail	*Turnix sylvaticus*	2		2	LC (D)				
CICONIIDAE	Abdim's Stork	*Ciconia abdimii*	2		1	LC (D)				
CICONIIDAE	White Stork	*Ciconia ciconia*	2		1	LC (I)				
CICONIIDAE	Woolly-necked Stork	*Ciconia episcopus*	2		2	LC (S)				
COLUMBIDAE	Speckled Pigeon	*Columba guinea*	2		2	LC (S)				
COLUMBIDAE	Bronze-naped Pigeon	*Columba iriditorques*	2		3	LC (S)				
COLUMBIDAE	Afep Pigeon	*Columba unicincta*	2	GCFB	3	LC (D)				
COLUMBIDAE	Namaqua Dove	*Oena capensis*	1		1	LC (I)			x	x
COLUMBIDAE	Laughing Dove	*Streptophelia senegalensis*	1		1	LC (S)		x	x	x
COLUMBIDAE	Red-eyed Dove	*Streptopelia semitorquata*	1		2	LC (I)	x	x	x	x
COLUMBIDAE	Vinaceous Dove	*Streptopelia vinacea*	2		1	LC (S)				
COLUMBIDAE	African Green-Pigeon	*Treron calvus*	1p		3	LC (D)		x		x
COLUMBIDAE	Bruce's Green-Pigeon	*Treron waalia*	2		3	LC (D)				
COLUMBIDAE	Black-billed Wood-Dove	*Turtur abyssinicus*	2		3	LC (S)				
COLUMBIDAE	Blue-spotted Wood-Dove	*Turtur afer*	1		3	LC (S)	x		x	x
COLUMBIDAE	Blue-headed Wood-Dove	*Turtur brehmeri*	1p	GCFB	3	LC (D)		x		x
COLUMBIDAE	Tambourine Dove	*Turtur tympanistria*	1		3	LC (S)		x	x	x
ALCEDINIDAE	Shining-blue Kingfisher	*Alcedo quadribrachys*	2		3	LC (S)				
ALCEDINIDAE	Pied Kingfisher	*Ceryle rudis*	2		2	LC (U)				
ALCEDINIDAE	Malachite Kingfisher	*Corythornis cristatus*	1		2	LC (S)			x	x
ALCEDINIDAE	White-bellied Kingfisher	*Corythornis leucogaster*	2	GCFB	3	LC (S)				
ALCEDINIDAE	Chocolate-backed Kingfisher	*Halcyon badia*	1	GCFB	4	LC (D)			x	x

Family	Common Name	Scientific Name	LO	BR	Guild	Status[1]	2008[2]	2012[3]	2021[4]	Total
ALCEDINIDAE	Striped Kingfisher	*Halcyon chelicuti*	2		1	LC (S)				
ALCEDINIDAE	Gray-headed Kingfisher	*Halcyon leucocephala*	2		1	LC (S)				
ALCEDINIDAE	Blue-breasted Kingfisher	*Halcyon malimbica*	1		3	LC (D)			x	x
ALCEDINIDAE	Woodland Kingfisher	*Halcyon senegalensis*	2		2	LC (S)				
ALCEDINIDAE	African Dwarf Kingfisher	*Ispidina lecontei*	2	GCFB	4	LC (S)				
ALCEDINIDAE	African Pygmy Kingfisher	*Ispidina picta*	1p		2	LC (S)		x		x
ALCEDINIDAE	Giant Kingfisher	*Megaceryle maxima*	2		1	LC (D)				
CORACIIDAE	Abyssinian Roller	*Coracias abyssinicus*	4		1	LC (I)				
CORACIIDAE	Blue-bellied Roller	*Coracias cyanogaster*	1	SGSB	1	LC (D)			x	x
CORACIIDAE	European Roller	*Coracias garrulus*	2		1	LC (D)				
CORACIIDAE	Rufous-crowned Roller	*Coracias naevius*	2		2	LC (D)				
CORACIIDAE	Broad-billed Roller	*Eurystomus glaucurus*	1p		2	LC (S)		x		x
CORACIIDAE	Blue-throated Roller	*Eurystomus gularis*	1p	GCFB	3	LC (D)		x		x
MEROPIDAE	White-throated Bee-eater	*Merops albicollis*	1p		2	LC (S)		x		x
MEROPIDAE	Red-throated Bee-eater	*Merops bulocki*	2	SGSB	1	LC (S)				
MEROPIDAE	Black Bee-eater	*Merops gularis*	4	GCFB	4	LC (S)				
MEROPIDAE	Swallow-tailed Bee-eater	*Merops hirundineus*	2		1	LC (S)				
MEROPIDAE	Rosy Bee-eater	*Merops malimbicus*	4	GCFB	4	LC (U)				
MEROPIDAE	Northern Carmine Bee-eater	*Merops nubicus*	3		1	LC (D)				
MEROPIDAE	Blue-cheeked Bee-eater	*Merops persicus*	2		2	LC (S)				
MEROPIDAE	Little Bee-eater	*Merops pusillus*	1		1	LC (D)			x	x
CUCULIDAE	Black-throated Coucal	*Centropus leucogaster*	1p	GCFB	3	LC (S)	x			x
CUCULIDAE	Blue-headed Coucal	*Centropus monachus*	2		2	LC (S)				
CUCULIDAE	Senegal Coucal	*Centropus senegalensis*	1		1	LC (S)	x	x	x	x
CUCULIDAE	Long-tailed Cuckoo	*Cercococcyx lemaireae*	3		1	NT (D)				
CUCULIDAE	Olive Long-tailed Cuckoo	*Cercococcyx olivinus*	2	GCFB	3	LC (S)				
CUCULIDAE	Blue Malkoha	*Ceuthmochares aereus*	1		3	LC (S)			x	x
CUCULIDAE	Diederic Cuckoo	*Chrysococcyx caprius*	1		2	LC (S)		x	x	x
CUCULIDAE	African Emerald Cuckoo	*Chrysococcyx cupreus*	1		3	LC (S)			x	x
CUCULIDAE	Yellow-throated Cuckoo	*Chrysococcyx flavigularis*	3	GCFB	4	LC (D)				
CUCULIDAE	Klaas's Cuckoo	*Chrysococcyx klaas*	1		1	LC (S)	x	x	x	x
CUCULIDAE	Great Spotted Cuckoo	*Clamator glandarius*	3		1	LC (S)				
CUCULIDAE	Pied Cuckoo	*Clamator jacobinus*	3		2	LC (S)				
CUCULIDAE	Levaillant's Cuckoo	*Clamator levaillantii*	2		2	LC (S)				

Family	Common Name	Scientific Name	LO	BR	Guild	Status[1]	2008[2]	2012[3]	2021[4]	Total
CUCULIDAE	Common Cuckoo	*Cuculus canorus*	2		2	LC (D)				
CUCULIDAE	Black Cuckoo	*Cuculus clamosus*	2		2	LC (S)				
CUCULIDAE	African Cuckoo	*Cuculus gularis*	2		2	LC (S)				
CUCULIDAE	Red-chested Cuckoo	*Cuculus solitarius*	2		2	LC (S)				
CUCULIDAE	Thick-billed Cuckoo	*Pachycoccyx audeberti*	2		2	LC (D)				
FALCONIDAE	Fox Kestrel	*Falco alopex*	2	SGSB	1	LC (S)				
FALCONIDAE	Grey Kestrel	*Falco ardosiaceus*	1		1	LC (S)		x	x	x
FALCONIDAE	Lanner Falcon	*Falco biarmicus*	2		2	LC (I)				
FALCONIDAE	African Hobby	*Falco cuvierii*	1		2	LC (D)			x	x
FALCONIDAE	Peregrine Falcon	*Falco peregrinus*	2		2	LC (S)				
FALCONIDAE	Red-knecked Falcon	*Falco ruficollis*	2		2	LC (D)				
FALCONIDAE	Eurasian Kestrel	*Falco tinnunculus*	2		2	LC (D)				
FALCONIDAE	Red-footed Falcon	*Falco vespertinus*	2		2	NT (D)				
NUMIDIDAE	White-breasted Guineafowl	*Agelastes meleagrides*	4	GCFB	4	VU (D)				
NUMIDIDAE	Crested Guineafowl	*Guttera pucherani*	2		3	LC (S)				
NUMIDIDAE	Helmeted Guineafowl	*Numida meleagris*	2		1	LC (S)				
ODONTOPHORIDAE	Stone Partridge	*Ptilopachus petrosus*	4		1	LC (S)				
PHASIANIDAE	White-throated Francolin	*Campocolinus albogularis*	2		2	LC (S)				
PHASIANIDAE	Latham's Francolin	*Peliperdix lathami*	2	GCFB	3	LC (D)				
PHASIANIDAE	Ahanta Francolin	*Pternistis ahantensis*	1p	GCFB	3	LC (D)		x		x
PHASIANIDAE	Double-spurred Francolin	*Pternistis bicalcaratus*	1		2	LC (D)	x		x	x
PHASIANIDAE	Blue Quail	*Synoicus adansonii*	2		2	LC (S)				
HELIORNITHIDAE	African Finfoot	*Podica senegalensis*	4		2	LC (D)				
RALLIDAE	Gray-throated Rail	*Canirallus oculeus*	3	GCFB	4	LC (D)				
RALLIDAE	African Crake	*Crex egregia*	3		1	LC (S)				
RALLIDAE	Eurasian Moorhen	*Gallinula chloropus*	3		1	LC (S)				
RALLIDAE	Nkulengu Rail	*Himantornis haematopus*	3	GCFB	4	LC (D)				
RALLIDAE	Allen's Gallinule	*Porphyrio alleni*	3		1	LC (D)				
RALLIDAE	White-spotted Flufftail	*Sarothrura pulchra*	4	GCFB	4	LC (D)				
RALLIDAE	Black Crake	*Zapornia flavirostra*	2		2	LC (U)				
MUSOPHAGIDAE	Great Blue Turaco	*Corythaeola cristata*	1		3	LC (S)	x		x	x
MUSOPHAGIDAE	Western Plantain-eater	*Crinifer piscator*	1		2	LC (S)			x	x
MUSOPHAGIDAE	Violet Turaco	*Musophaga violacea*	3	SGSB	1	LC (S)				
MUSOPHAGIDAE	Yellow-billed Turaco	*Tauraco macrorhynchus*	3	GCFB	4	LC (D)				

Family	Common Name	Scientific Name	LO	BR	Guild	Status[1]	2008[2]	2012[3]	2021[4]	Total
MUSOPHAGIDAE	Guinea Turaco	*Tauraco persa*	1	GCFB	4	LC (S)		x	x	x
OTIDIDAE	Black-bellied Bustard	*Lissotis melanogaster*	4		1	LC (D)				
OTIDIDAE	Denham's Bustard	*Neotis denhami*	4		1	NT (D)				
ACROCEPHALIDAE	Great Reed Warbler	*Acrocephalus arundinaceus*	3		1	LC (D)				
ACROCEPHALIDAE	Sedge Warbler	*Acrocephalus schoenobaenus*	3		1	LC (S)				
ACROCEPHALIDAE	Eurasian Reed Warbler	*Acrocephalus scirpaceus*	3		1	LC (S)				
ACROCEPHALIDAE	Icterine Warbler	*Hippolais icterina*	3		1	LC (D)				
ACROCEPHALIDAE	Melodious Warbler	*Hippolais polyglotta*	3		1	LC (I)				
ACROCEPHALIDAE	Western Olivaceous Warbler	*Iduna opaca*	3		1	LC (D)				
ALAUDIDAE	Flappet Lark	*Mirafra rufocinnamomea*	2		1	LC (D)				
CALYPTOMENIDAE	African Broadbill	*Smithornis capensis*	3		3	LC (D)				
CALYPTOMENIDAE	Rufous-sided Broadbill	*Smithornis rufolateralis*	3	GCFB	4	LC (D)				
CAMPEPHAGIDAE	Red-shouldered Cuckooshrike	*Campephaga phoenicea*	4		3	LC (S)				
CAMPEPHAGIDAE	Purple-throated Cuckooshrike	*Campephaga quiscalina*	4		3	LC (D)				
CAMPEPHAGIDAE	White-breasted Cuckooshrike	*Coracina pectoralis*	4		3	LC (D)				
CAMPEPHAGIDAE	Blue Cuckooshrike	*Cyanograucalus azureus*	4	GCFB	4	LC (D)				
CAMPEPHAGIDAE	Ghana Cuckooshrike	*Lobotos lobatus*	4		4	VU (D)				
CISTICOLIDAE	Yellow-breasted Apalis	*Apalis flavida*	2		2	LC (I)				
CISTICOLIDAE	Black-capped Apalis	*Apalis nigriceps*	2	GCFB	3	LC (S)				
CISTICOLIDAE	Sharpe's Apalis	*Apalis sharpii*	3	GCFB	4	LC (D)				
CISTICOLIDAE	Black-capped Rufous-Warbler	*Bathmocercus cerviniventris*	4	GCFB	4	DD (D)				
CISTICOLIDAE	Green-backed Camaroptera	*Camaroptera brachyura*	1		2	LC (I)	x	x	x	x
CISTICOLIDAE	Olive-green Camaroptera	*Camaroptera chloronota*	1p	GCFB	4	LC (U)		x		x
CISTICOLIDAE	Yellow-browed Camaroptera	*Camaroptera superciliaris*	4	GCFB	4	LC (S)				
CISTICOLIDAE	Siffling Cisticola	*Cisticola brachypterus*	3		1	LC (S)				
CISTICOLIDAE	Zitting Cisticola	*Cisticola juncidus*	1		1	LC (S)		x	x	x
CISTICOLIDAE	Singing Cisticola	*Cisticola cantans*	3		1	LC (S)				
CISTICOLIDAE	Red-faced Cisticola	*Cisticola erythrops*	1		1	LC (S)			x	x
CISTICOLIDAE	Whistling Cisticola	*Cisticola lateralis*	3		1	LC (S)				
CISTICOLIDAE	Winding Cisticola	*Cisticola marginatus*	3		1	LC (S)				
CISTICOLIDAE	Croaking Cisticola	*Cisticola natalensis*	3		1	LC (S)				
CISTICOLIDAE	Rufous-crowned Eremomela	*Eremomela badiceps*	3	GCFB	4	LC (S)				
CISTICOLIDAE	Senegal Eremomela	*Eremomela pusilla*	3	SGSB	1	LC (S)				
CISTICOLIDAE	Oriole Warbler	*Hypergerus atriceps*	2	SGSB	1	LC (S)				

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CISTICOLIDAE	Red-winged Prinia	*Prinia erythroptera*	1p		1	LC (S)	x			x
CISTICOLIDAE	Tawny-flanked Prinia	*Prinia subflava*	1		1	LC (S)	x		x	x
CORVIDAE	Pied Crow	*Corvus albus*	1		2	LC (S)			x	x
CORVIDAE	Piapiac	*Ptilostomus afer*	4	SGSB	1	LC (S)				
DICRURIDAE	Shining Drongo	*Dicrurus atripennis*	1	GCFB	3	LC (D)		x	x	x
DICRURIDAE	Velvet-mantled Drongo	*Dicrurus modestus*	2		3	LC (S)				
DICRURIDAE	Fork-tailed Drongo	*Dicrurus adsimilis*	1		2	LC (S)		x	x	x
EMBERIZIDAE	Cabanis's Bunting	*Emberiza cabanisi*	2		2	LC (S)				
ESTRILDIDAE	Orange-cheeked Waxbill	*Estrilda melpoda*	1		2	LC (S)		x	x	x
ESTRILDIDAE	Lavender Waxbill	*Glaucestrilda caerulescens*	1p	SGSB	1	LC (S)		x		x
ESTRILDIDAE	Black-bellied Firefinch	*Lagonosticta rara*	2	SGSB	1	LC (S)				
ESTRILDIDAE	African Firefinch	*Lagonosticta rubricata*	1		2	LC (S)			x	x
ESTRILDIDAE	Bar-breasted Firefinch	*Lagonosticta rufopicta*	2	SGSB	1	LC (S)				
ESTRILDIDAE	Red-billed Firefinch	*Lagonosticta senegala*	2		2	LC (S)				
ESTRILDIDAE	Green-backed Twinspot	*Mandingoa nitidula*	2		3	LC (S)				
ESTRILDIDAE	Chestnut-breasted Nigrita	*Nigrita bicolor*	3	GCFB	4	LC (S)				
ESTRILDIDAE	Grey-headed Nigrita	*Nigrita canicapillus*	1		4	LC (S)	x	x	x	x
ESTRILDIDAE	White-breasted Nigrita	*Nigrita fusconotus*	3	GCFB	4	LC (S)				
ESTRILDIDAE	Red-fronted Antpecker	*Parmoptila rubrifrons*	3	GCFB	4	NT (D)				
ESTRILDIDAE	Black-bellied Seedcracker	*Pyrenestes ostrinus*	3		2	LC (S)				
ESTRILDIDAE	Red-faced Pytilia	*Pytilia hypogrammica*	3	SGSB	1	LC (S)				
ESTRILDIDAE	Black-and-white Mannikin	*Spermestes bicolor*	2		3	LC (S)				
ESTRILDIDAE	Bronze Mannikin	*Spermestes cucullata*	1		2	LC (S)		x	x	x
ESTRILDIDAE	Magpie Mannikin	*Spermestes fringilloides*	2		3	LC (S)				
ESTRILDIDAE	Western Bluebill	*Spermophaga haematina*	3	GCFB	4	LC (S)				
ESTRILDIDAE	Red-cheeked Cordonbleu	*Uraeginthus bengalus*	2		1	LC (S)				
FRINGILLIDAE	West African Seedeater	*Crithagra canicapilla*	3		2	LC (S)				
FRINGILLIDAE	Yellow-fronted Canary	*Crithagra mozambica*	3		1	LC (D)				
HIRUNDINIDAE	Lesser Striped Swallow	*Cecropis abyssinica*	1		2	LC (I)			x	x
HIRUNDINIDAE	Red-rumped Swallow	*Cecropis daurica*	2		2	LC (S)				
HIRUNDINIDAE	Rufous-chested Swallow	*Cecropis semirufa*	1		1	LC (I)			x	x
HIRUNDINIDAE	Common House-Martin	*Delichon urbicum*	1		1	LC (D)			x	x
HIRUNDINIDAE	Pied-winged Swallow	*Hirundo leucosoma*	2	SGSB	1	LC (I)				
HIRUNDINIDAE	White-throated Blue Swallow	*Hirundo nigrita*	4	GCFB	4	LC (I)				

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HIRUNDINIDAE	Barn Swallow	*Hirundo rustica*	1		1	LC (D)			x	x
HIRUNDINIDAE	Wire-tailed Swallow	*Hirundo smithii*	2		2	LC (I)				
HIRUNDINIDAE	Banded Martin	*Neophedina cincta*	2		1	LC (I)				
HIRUNDINIDAE	Preuss's Swallow	*Petrochelidon preussi*	2		2	LC (I)				
HIRUNDINIDAE	Square-tailed Sawwing	*Psalidoprocne nitens*	2	GCFB	3	LC (D)				
HIRUNDINIDAE	Fanti Sawwing	*Psalidoprocne obscura*	2	GCFB	3	LC (S)				
HIRUNDINIDAE	Bank Swallow	*Riparia riparia*	2		2	LC (D)				
HYLIOTIDAE	Yellow-bellied Hyliota	*Hyliota flavigaster*	3		2	LC (D)				
HYLIOTIDAE	Violet-backed Hyliota	*Hyliota violacea*	3	GCFB	4	LC (D)				
LANIIDAE	Yellow-billed Shrike	*Lanius corvinus*	3	SGSB	1	LC (U)				
LANIIDAE	Woodchat Shrike	*Lanius senator*	3		2	LC (D)				
LEIOTRICHIDAE	Brown Babbler	*Turdoides plebejus*	3		2	LC (S)				
LEIOTRICHIDAE	Blackcap Babbler	*Turdoides reinwardtii*	3	SGSB	1	LC (D)				
LOCUSTELLIDAE	Little Rush Warbler	*Bradypterus baboecala*	2		1	LC (S)				
MACROSPHENIDAE	Gray Longbill	*Macrosphenus concolor*	3	GCFB	4	LC (S)				
MACROSPHENIDAE	Kemp's Longbill	*Macrosphenus kempi*	3	GCFB	4	LC (S)				
MACROSPHENIDAE	Moustached Grass-Warbler	*Melocichla mentalis*	3		1	LC (S)				
MACROSPHENIDAE	Northern Crombec	*Sylvietta brachyura*	1p		2	LC (S)	x			x
MACROSPHENIDAE	Lemon-bellied Crombec	*Sylvietta denti*	3	GCFB	4	LC (S)				
MACROSPHENIDAE	Green Crombec	*Sylvietta virens*	2	GCFB	3	LC (S)				
MALACONOTIDAE	Marsh Tchagra	*Tchagra minutus*	2		1	LC (D)				
MALACONOTIDAE	Many-colored Bushshrike	*Telophorus multicolor*	2		2	LC (S)				
MALACONOTIDAE	Sulphur-breasted Bushshrike	*Telophorus sulfureopectus*	2		1	LC (S)				
MALACONOTIDAE	Northern Puffback	*Dryoscopus gambensis*	1		2	LC (S)			x	x
MALACONOTIDAE	Sabine's Puffback	*Dryoscopus sabini*	2	GCFB	3	LC (S)				
MALACONOTIDAE	Yellow-crowned Gonolek	*Laniarius barbarus*	3		3	LC (S)				
MALACONOTIDAE	Lowland Sooty Boubou	*Laniarius leucorhynchus*	3	GCFB	4	LC (S)				
MALACONOTIDAE	Gray-headed Bushshrike	*Malaconotus blanchoti*	2		2	LC (I)				
MALACONOTIDAE	Fiery-breasted Bushshrike	*Malaconotus cruentus*	2	GCFB	3	LC (D)				
MALACONOTIDAE	Lagden's Bushshrike	*Malaconotus lagdeni*	4		4	NT (D)				
MALACONOTIDAE	Brubru	*Nilaus afer*	2		1	LC (S)				
MALACONOTIDAE	Brown-crowned Tchagra	*Tchagra australis*	2		1	LC (S)				
MALACONOTIDAE	Black-crowned Tchagra	*Tchagra senegalus*	1		1	LC (S)			x	x
MONARCHIDAE	Black-headed Paradise-Flycatcher	*Terpsiphone rufiventer*	1	GCFB	4	LC (D)	x	x	x	x

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MONARCHIDAE	African Paradise-Flycatcher	*Terpsiphone viridis*	1		2	LC (S)		x	x	x
MONARCHIDAE	Blue-headed Crested-Flycatcher	*Trochocercus nitens*	2	GCFB	3	LC (D)				
MOTACILLIDAE	Red-throated Pipit	*Anthus cervinus*	3		1	LC (S)				
MOTACILLIDAE	Plain-backed Pipit	*Anthus leucophrys*	3		1	LC (S)				
MOTACILLIDAE	Tree Pipit	*Anthus trivialis*	3		1	LC (D)				
MOTACILLIDAE	Yellow-throated Longclaw	*Macronyx croceus*	2		1	LC (S)				
MOTACILLIDAE	African Pied Wagtail	*Motacilla aguimp*	2		2	LC (S)				
MOTACILLIDAE	Western Yellow Wagtail	*Motacilla flava*	2		2	LC (D)				
MUSCICAPIDAE	Pale Flycatcher	*Agricola pallidus*	1		2	LC (S)		x	x	x
MUSCICAPIDAE	White-tailed Alethe	*Alethe diademata*	2	GCFB	3	LC (D)				
MUSCICAPIDAE	Dusky-blue Flycatcher	*Bradornis comitatus*	2	GCFB	3	LC (S)				
MUSCICAPIDAE	Ussher's Flycatcher	*Bradornis ussheri*	2	GCFB	3	LC (S)				
MUSCICAPIDAE	Brown-chested Alethe	*Chamaetylas poliocephala*	2		3	LC (D)				
MUSCICAPIDAE	White-crowned Robin-Chat	*Cossypha albicapillus*	2	SGSB	1	LC (S)				
MUSCICAPIDAE	Blue-shouldered Robin-Chat	*Cossypha cyanocampter*	2	GCFB	3	LC (D)				
MUSCICAPIDAE	Snowy-crowned Robin-Chat	*Cossypha niveicapilla*	2		3	LC (S)				
MUSCICAPIDAE	European Pied Flycatcher	*Ficedula hypoleuca*	1p		2	LC (D)		x		x
MUSCICAPIDAE	Ashy Flycatcher	*Fraseria caerulescens*	2		1	LC (S)				
MUSCICAPIDAE	White-browed Forest-Flycatcher	*Fraseria cinerascens*	2	GCFB	3	LC (S)				
MUSCICAPIDAE	Gray-throated Tit-Flycatcher	*Fraseria griseigularis*	2	GCFB	3	LC (D)				
MUSCICAPIDAE	African Forest-Flycatcher	*Fraseria ocreata*	2	GCFB	3	LC (S)				
MUSCICAPIDAE	Olivaceous Flycatcher	*Fraseria olivascens*	2	GCFB	3	LC (S)				
MUSCICAPIDAE	Gray Tit-Flycatcher	*Fraseria plumbea*	2		2	LC (S)				
MUSCICAPIDAE	Tessmann's Flycatcher	*Fraseria tessmanni*	2	GCFB	3	LC (U)				
MUSCICAPIDAE	Common Nightingale	*Luscinia megarhynchos*	2		2	LC (S)				
MUSCICAPIDAE	Northern Black-Flycatcher	*Melaenornis edolioides*	1p		2	LC (S)		x		x
MUSCICAPIDAE	Swamp Flycatcher	*Muscicapa aquatica*	2		2	LC (S)				
MUSCICAPIDAE	Cassin's Flycatcher	*Muscicapa cassini*	2	GCFB	3	LC (S)				
MUSCICAPIDAE	Little Flycatcher	*Muscicapa epulata*	2	GCFB	3	LC (S)				
MUSCICAPIDAE	Spotted Flycatcher	*Muscicapa striata*	2		2	LC (D)				
MUSCICAPIDAE	White-fronted Black-Chat	*Oenanthe albifrons*	2	SGSB	1	LC (S)				
MUSCICAPIDAE	Whinchat	*Saxicola rubetra*	4		1	LC (D)				
MUSCICAPIDAE	Forest Robin	*Stiphrornis erythrothorax*	2	GCFB	3	LC (D)				
MUSCICAPIDAE	Forest Scrub Robin	*Tychaedon leucosticta*	2		3	LC (D)				

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NECTARINIIDAE	Mouse-brown Sunbird	*Anthreptes gabonicus*	4	GCFB	4	LC (S)				
NECTARINIIDAE	Western Violet-backed Sunbird	*Anthreptes longuemarei*	4		3	LC (S)				
NECTARINIIDAE	Green Sunbird	*Anthreptes rectirostris*	3	GCFB	4	LC (S)				
NECTARINIIDAE	Little Green Sunbird	*Anthreptes seimundi*	1p	GCFB	3	LC (S)		x		x
NECTARINIIDAE	Buff-throated Sunbird	*Chalcomitra adelberti*	1p	GCFB	3	LC (S)	x			x
NECTARINIIDAE	Scarlet-chested Sunbird	*Chalcomitra senegalensis*	2		2	LC (S)				
NECTARINIIDAE	Bates's Sunbird	*Cinnyris batesi*	2	GCFB	3	LC (S)				
NECTARINIIDAE	Olive-bellied Sunbird	*Cinnyris chloropygius*	1p		2	LC (S)	x			x
NECTARINIIDAE	Splendid Sunbird	*Cinnyris coccinigastrus*	1p	SGSB	1	LC (S)	x			x
NECTARINIIDAE	Copper Sunbird	*Cinnyris cupreus*	1		2	LC (S)		x	x	x
NECTARINIIDAE	Johanna's Sunbird	*Cinnyris johannae*	2	GCFB	3	LC (D)				
NECTARINIIDAE	Tiny Sunbird	*Cinnyris minullus*	1	GCFB	3	LC (S)			x	x
NECTARINIIDAE	Superb Sunbird	*Cinnyris superbus*	2	GCFB	3	LC (D)				
NECTARINIIDAE	Variable Sunbird	*Cinnyris venustus*	1		2	LC (S)			x	x
NECTARINIIDAE	Blue-throated Brown Sunbird	*Cyanomitra cyanolaema*	2	GCFB	3	LC (S)				
NECTARINIIDAE	Olive Sunbird	*Cyanomitra olivacea*	1		2	LC (S)	x		x	x
NECTARINIIDAE	Green-headed Sunbird	*Cyanomitra verticalis*	2		2	LC (S)				
NECTARINIIDAE	Fraser's Sunbird	*Deleornis fraseri*	2	GCFB	3	LC (D)				
NECTARINIIDAE	Collared Sunbird	*Hedydipna collaris*	1		2	LC (S)	x	x	x	x
NICATORIDAE	Western Nicator	*Nicator chloris*	2	GCFB	3	LC (S)				
ORIOLIDAE	African Golden Oriole	*Oriolus auratus*	3		2	LC (D)				
ORIOLIDAE	Western Black-headed Oriole	*Oriolus brachyrynchus*	2	GCFB	3	LC (S)				
ORIOLIDAE	Black-winged Oriole	*Oriolus nigripennis*	3	GCFB	4	LC (S)				
ORIOLIDAE	Eurasian Golden Oriole	*Oriolus oriolus*	3		2	LC (S)				
PARIDAE	Dusky Tit	*Melaniparus funereus*	2	GCFB	3	LC (D)				
PARIDAE	White-shouldered Black-Tit	*Melaniparus guineensis*	1p		2	LC (S)		x		x
PASSERIDAE	Northern Gray-headed Sparrow	*Passer griseus*	1		1	LC (S)		x	x	x
PELLORNEIDAE	Blackcap Illadopsis	*Illadopsis cleaveri*	3	GCFB	4	LC (D)				
PELLORNEIDAE	Brown Illadopsis	*Illadopsis fulvescens*	3	GCFB	4	LC (S)				
PELLORNEIDAE	Puvel's Illadopsis	*Illadopsis puveli*	3	GCFB	4	LC (S)				
PELLORNEIDAE	Rufous-winged Illadopsis	*Illadopsis rufescens*	3	GCFB	4	NT (D)				
PELLORNEIDAE	Pale-breasted Illadopsis	*Illadopsis rufipennis*	3		2	LC (S)				
PHYLLOSCOPIDAE	Wood Warbler	*Phylloscopus sibilatrix*	3		2	LC (D)				
PHYLLOSCOPIDAE	Willow Warbler	*Phylloscopus trochilus*	2		1	LC (D)				

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PICATHARTIDAE	White-necked Rockfowl	*Picathartes gymnocephalus*	4	GCFB	4	VU (D)				
PITTIDAE	African Pitta	*Pitta angolensis*	3		2	LC (D)				
PLATYSTEIRIDAE	West African Batis	*Batis occulta*	2	GCFB	3	LC (S)				
PLATYSTEIRIDAE	Senegal Batis	*Batis senegalensis*	2		2	LC (D)				
PLATYSTEIRIDAE	Red-cheeked Wattle-eye	*Platysteira blissetti*	2	GCFB	4	LC (D)				
PLATYSTEIRIDAE	West African Wattle-eye	*Platysteira hormophora*	2		3	LC (S)				
PLATYSTEIRIDAE	Brown-throated Wattle-eye	*Platysteira cyanea*	2	GCFB	4	LC (S)				
PLOCEIDAE	Grosbeak Weaver	*Amblyospiza albifrons*	3		2	LC (S)				
PLOCEIDAE	Red-collared Widowbird	*Euplectes ardens*	1p		1	LC (S)		x		x
PLOCEIDAE	Northern Red Bishop	*Euplectes franciscanus*	1		1	LC (S)		x	x	x
PLOCEIDAE	Black-winged Bishop	*Euplectes hordeaceus*	1		1	LC (S)		x	x	x
PLOCEIDAE	Yellow-mantled Widowbird	*Euplectes macroura*	1		1	LC (S)		x	x	x
PLOCEIDAE	Crested Malimbe	*Malimbus malimbicus*	2	GCFB	3	LC (S)				
PLOCEIDAE	Blue-billed Malimbe	*Malimbus nitens*	2	GCFB	3	LC (S)				
PLOCEIDAE	Red-headed Malimbe	*Malimbus rubricollis*	2	GCFB	3	LC (S)				
PLOCEIDAE	Red-vented Malimbe	*Malimbus scutatus*	2	GCFB	3	LC (S)				
PLOCEIDAE	Chestnut-crowned Sparrow-Weaver	*Plocepasser superciliosus*	2		3	LC (S)				
PLOCEIDAE	Maxwell's Black Weaver	*Ploceus albinucha*	2	GCFB	4	LC (S)				
PLOCEIDAE	Black-necked Weaver	*Ploceus brachypterus*	2		2	LC (S)				
PLOCEIDAE	Vieillot's Weaver	*Ploceus nigerrimus*	1	GCFB	3	LC (S)		x	x	x
PLOCEIDAE	Black-headed Weaver	*Ploceus melanocephalus*	1p		2	LC (S)		x		x
PLOCEIDAE	Village Weaver	*Ploceus cucullatus*	1		2	LC (S)	x		x	x
PLOCEIDAE	Heuglin's Masked-Weaver	*Ploceus heuglini*	2	SGSB	1	LC (S)				
PLOCEIDAE	Preuss's Weaver	*Ploceus preussi*	2	GCFB	4	LC (S)				
PLOCEIDAE	Chestnut-crowned Sparrow-Weaver	*Plocepasser superciliosus*	2		2	LC (S)				
PLOCEIDAE	Yellow-mantled Weaver	*Ploceus tricolor*	2	GCFB	3	LC (S)				
PLOCEIDAE	Red-headed Quelea	*Quelea erythrops*	1		1	LC (S)			x	x
PYCNONOTIDAE	Yellow-throated Greenbul	*Atimastillas flavicollis*	2		3	LC (S)				
PYCNONOTIDAE	Honeyguide Greenbul	*Baeopogon indicator*	1p	GCFB	3	LC (S)	x	x		x
PYCNONOTIDAE	Grey-headed Bristlebill	*Bleda canicapillus*	1p	GCFB	3	LC (S)	x	x		x
PYCNONOTIDAE	Green-tailed Bristlebill	*Bleda eximius*	4	GCFB	4	NT (D)				
PYCNONOTIDAE	Red-tailed Bristlebill	*Bleda syndactylus*	2	GCFB	3	LC (S)				
PYCNONOTIDAE	Golden Greenbul	*Calyptocichla serinus*	1		3	LC (S)			x	x
PYCNONOTIDAE	Simple Greenbul	*Chlorocichla simplex*	1p	GCFB	3	LC (S)		x		x

Family	Common Name	Scientific Name	LO	BR	Guild	Status[1]	2008[2]	2012[3]	2021[4]	Total
PYCNONOTIDAE	Western Bearded-Greenbul	*Criniger barbatus*	2	GCFB	3	LC (S)				
PYCNONOTIDAE	Red-tailed Greenbul	*Criniger calurus*	2	GCFB	3	LC (S)				
PYCNONOTIDAE	Yellow-bearded Greenbul	*Criniger olivaceus*	4	GCFB	4	VU (D)				
PYCNONOTIDAE	Ansorge's Greenbul	*Eurillas ansorgei*	2		3	LC (S)				
PYCNONOTIDAE	Plain Greenbul	*Eurillas curvirostris*	3	GCFB	4	LC (S)				
PYCNONOTIDAE	Gray Greenbul	*Eurillas gracilis*	3	GCFB	4	LC (S)				
PYCNONOTIDAE	Yellow-whiskered Greenbul	*Eurillas latirostris*	4		3	LC (S)				
PYCNONOTIDAE	Little Greenbul	*Eurillas virens*	1		3	LC (S)	x	x	x	x
PYCNONOTIDAE	Spotted Greenbul	*Ixonotus guttatus*	2	GCFB	3	LC (S)				
PYCNONOTIDAE	White-throated Greenbul	*Phyllastrephus albigularis*	2	GCFB	3	LC (S)				
PYCNONOTIDAE	Baumann's Greenbul	*Phyllastrephus baumanni*	4	GCFB	4	LC (S)				
PYCNONOTIDAE	Icterine Greenbul	*Phyllastrephus icterinus*	1p	GCFB	4	LC (S)		x		x
PYCNONOTIDAE	Common Bulbul	*Pycnonotus barbatus*	1		2	LC (I)	x	x	x	x
PYCNONOTIDAE	Leaf-love	*Phyllastrephus scandens*	3	GCFB	4	LC (S)				
PYCNONOTIDAE	Slender-billed Greenbul	*Stelgidillas gracilirostris*	1p	GCFB	3	LC (S)	x			x
PYCNONOTIDAE	Swamp Greenbul	*Thescelocichla leucopleura*	2	GCFB	3	LC (S)				
REMIZIDAE	Forest Penduline-Tit	*Anthoscopus flavifrons*	3	GCFB	4	LC (S)				
SCOTOCERCIDAE	Chestnut-capped Flycatcher	*Erythrocercus mccallii*	3	GCFB	4	LC (D)				
SCOTOCERCIDAE	Green Hylia	*Hylia prasina*	1	GCFB	4	LC (S)	x		x	x
SCOTOCERCIDAE	Tit-hylia	*Pholidornis rushiae*	2	GCFB	3	LC (S)				
SITTIDAE	African Spotted Creeper	*Salpornis salvadori*	2		3	LC (D)				
STENOSTIRIDAE	African Blue Flycatcher	*Elminia longicauda*	4		1	LC (S)				
STENOSTIRIDAE	Dusky Crested-Flycatcher	*Elminia nigromitrata*	2	GCFB	3	LC (D)				
STURNIDAE	Violet-backed Starling	*Cinnyricinclus leucogaster*	2		2	LC (D)				
STURNIDAE	Copper-tailed Starling	*Hylopsar cupreocauda*	3	GCFB	4	NT (D)				
STURNIDAE	Bronze-tailed Starling	*Lamprotornis chalcurus*	2	SGSB	1	LC (S)				
STURNIDAE	Lesser Blue-eared Starling	*Lamprotornis chloropterus*	2		2	LC (S)				
STURNIDAE	Purple Starling	*Lamprotornis purpureus*	2	SGSB	1	LC (S)				
STURNIDAE	Splendid Starling	*Lamprotornis splendidus*	2		2	LC (U)				
STURNIDAE	Chestnut-winged Starling	*Onychognathus fulgidus*	2	GCFB	4	LC (D)				
STURNIDAE	Narrow-tailed Starling	*Poeoptera lugubris*	2	GCFB	3	LC (D)				
SYLVIIDAE	Eurasian Blackcap	*Sylvia atricapilla*	4		1	LC (I)				
SYLVIIDAE	Garden Warbler	*Sylvia borin*	3		1	LC (D)				
TURDIDAE	Gray Ground-Thrush	*Geokichla princei*	3	GCFB	4	LC (D)				

Family	Common Name	Scientific Name	LO	BR	Guild	Status[1]	2008[2]	2012[3]	2021[4]	Total
TURDIDAE	White-tailed Ant-Thrush	*Neocossyphus poensis*	3	GCFB	4	LC (U)				
TURDIDAE	Finsch's Flycatcher-Thrush	*Neocossyphus finschi*	3		2	LC (D)				
TURDIDAE	African Thrush	*Turdus pelios*	2		2	LC (U)				
VANGIDAE	Black-and-white Shrike-flycatcher	*Bias musicus*	4		1	LC (D)				
VANGIDAE	African Shrike-flycatcher	*Megabyas flammulatus*	2	GCFB	3	LC (D)				
VANGIDAE	Red-billed Helmetshrike	*Prionops caniceps*	2	GCFB	3	LC (D)				
VIDUIDAE	Pin-tailed Whydah	*Vidua macroura*	1		2	LC (S)		x	x	x
VIDUIDAE	Togo Paradise-Whydah	*Vidua togoensis*	3	SGSB	1	LC (S)				
ZOSTEROPIDAE	Northern Yellow White-eye	*Zosterops senegalensis*	2		3	LC (S)				
ARDEIDAE	Great Egret	*Ardea alba*	2		1	LC (U)				
ARDEIDAE	Intermediate Egret	*Ardea intermedia*	2		2	LC (D)				
ARDEIDAE	Gray Heron	*Ardea cinerea*	2		2	LC (U)				
ARDEIDAE	Goliath Heron	*Ardea goliath*	4		1	LC (S)				
ARDEIDAE	Black-headed Heron	*Ardea melanocephala*	2		2	LC (I)				
ARDEIDAE	Purple Heron	*Ardea purpurea*	2		2	LC (D)				
ARDEIDAE	Squacco Heron	*Ardeola ralloides*	2		2	LC (U)				
ARDEIDAE	Cattle Egret	*Bubulcus ibis*	2		2	LC (I)				
ARDEIDAE	Striated Heron	*Butorides striata*	3		2	LC (D)				
ARDEIDAE	White-backed Night-Heron	*Gorsachius leuconotus*	4		2	LC (D)				
ARDEIDAE	Black Heron	*Egretta ardesiaca*	4		1	LC (S)				
ARDEIDAE	Little Egret	*Egretta garzetta*	3		2	LC (I)				
ARDEIDAE	Little Bittern	*Ixobrychus minutus*	3		2	LC (D)				
ARDEIDAE	Dwarf Bittern	*Ixobrychus sturmii*	3		2	LC (U)				
ARDEIDAE	Black-crowned Night-Heron	*Nycticorax nycticorax*	3		2	LC (D)				
ARDEIDAE	White-crested Bittern	*Tigriornis leucolopha*	4		2	LC (D)				
PELECANIDAE	Great White Pelican	*Pelecanus onocrotalus*	4		1	LC (U)				
SCOPIDAE	Hamerkop	*Scopus umbretta*	2		1	LC (S)				
THRESKIORNITHIDAE	Hadada Ibis	*Bostrychia hagedash*	2		2	LC (I)				
THRESKIORNITHIDAE	Spot-breasted Ibis	*Bostrychia rara*	4	GCFB	4	LC (D)				
THRESKIORNITHIDAE	African Spoonbill	*Platalea alba*	2		2	LC (S)				
THRESKIORNITHIDAE	Glossy Ibis	*Plegadis falcinellus*	2		2	LC (D)				
INDICATORIDAE	Least Honeyguide	*Indicator exilis*	4		2	LC (U)				
INDICATORIDAE	Greater Honeyguide	*Indicator indicator*	2		1	LC (I)				
INDICATORIDAE	Spotted Honeyguide	*Indicator maculatus*	2	GCFB	3	LC (D)				

Family	Common Name	Scientific Name	LO	BR	Guild	Status[1]	2008[2]	2012[3]	2021[4]	Total
INDICATORIDAE	Lesser Honeyguide	*Indicator minor*	2		1	LC (S)				
INDICATORIDAE	Willcocks's Honeyguide	*Indicator willcocksi*	4	GCFB	4	LC (U)				
INDICATORIDAE	Yellow-footed Honeyguide	*Melignomon eisentrauti*	4	GCFB	4	NT (D)				
INDICATORIDAE	Cassin's Honeyguide	*Prodotiscus insignis*	3	GCFB	4	LC (D)				
LYBIIDAE	Yellow-spotted Barbet	*Buccanodon duchaillui*	3	GCFB	4	LC (D)				
LYBIIDAE	Naked-faced Barbet	*Gymnobucco calvus*	2	GCFB	3	LC (D)				
LYBIIDAE	Bristle-nosed Barbet	*Gymnobucco peli*	2	GCFB	3	LC (U)				
LYBIIDAE	Vieillot's Barbet	*Lybius vieilloti*	3		2	LC (U)				
LYBIIDAE	Red-rumped Tinkerbird	*Pogoniulus atroflavus*	1p	GCFB	3	LC (S)		x		x
LYBIIDAE	Yellow-rumped Tinkerbird	*Pogoniulus bilineatus*	1		3	LC (S)	x		x	x
LYBIIDAE	Yellow-fronted Tinkerbird	*Pogoniulus chrysoconus*	2		3	LC (S)				
LYBIIDAE	Speckled Tinkerbird	*Pogoniulus scolopaceus*	1	GCFB	4	LC (D)	x		x	x
LYBIIDAE	Yellow-throated Tinkerbird	*Pogoniulus subsulphureus*	2	GCFB	3	LC (S)				
LYBIIDAE	Double-toothed Barbet	*Lybius bidentatus*	2		2	LC (S)				
LYBIIDAE	Bearded Barbet	*Lybius dubius*	3	SGSB	1	LC (U)				
LYBIIDAE	Yellow-billed Barbet	*Trachyphonus purpuratus*	1p	GCFB	3	LC (D)		x		x
LYBIIDAE	Hairy-breasted Barbet	*Tricholaema hirsuta*	1p	GCFB	3	LC (D)	x			x
PICIDAE	Brown-eared Woodpecker	*Campethera caroli*	3	GCFB	4	LC (D)				
PICIDAE	Little Green Woodpecker	*Campethera maculosa*	3	GCFB	4	LC (I)				
PICIDAE	Buff-spotted Woodpecker	*Campethera nivosa*	1p	GCFB	4	LC (S)	x			x
PICIDAE	Fine-spotted Woodpecker	*Campethera punctuligera*	3		2	LC (S)				
PICIDAE	Cardinal Woodpecker	*Chloropicus fuscescens*	1		2	LC (S)		x	x	x
PICIDAE	African Gray Woodpecker	*Chloropicus goertae*	3		2	LC (S)				
PICIDAE	Melancholy Woodpecker	*Chloropicus lugubris*	3		2	LC (S)				
PICIDAE	Brown-backed Woodpecker	*Chloropicus obsoletus*	3		2	LC (S)				
PICIDAE	Fire-bellied Woodpecker	*Chloropicus pyrrhogaster*	1p	GCFB	4	LC (I)		x		x
PICIDAE	Eurasian Wryneck	*Jynx torquilla*	2		1	LC (D)				
PODICIPEDIDAE	Little Grebe	*Tachybaptus ruficollis*	3		2	LC (D)				
PSITTACIDAE	Red-headed Lovebird	*Agapornis pullarius*	2		2	LC (D)				
PSITTACIDAE	Black-collared Lovebird	*Agapornis swindernianus*	3	GCFB	4	LC (D)				
PSITTACIDAE	Rose-ringed Parakeet	*Psittacula krameri*	3		2	LC (I)				
PSITTACIDAE	Brown-necked Parrot	*Poicephalus fuscicollis*	3		2	LC (D)				
PSITTACIDAE	Red-fronted Parrot	*Poicephalus gulielmi*	3		3	LC (D)				
PSITTACIDAE	Senegal Parrot	*Poicephalus senegalus*	1	SGSB	1	LC (D)			x	x

Family	Common Name	Scientific Name	LO	BR	Guild	Status[1]	2008[2]	2012[3]	2021[4]	Total
PSITTACIDAE	Gray Parrot	*Psittacus erithacus*	3	GCFB	4	EN (D)				
STRIGIDAE	Grayish Eagle-Owl	*Bubo cinerascens*	2		2	LC (S)				
STRIGIDAE	Akun Eagle-Owl	*Bubo leucostictus*	3	GCFB	4	LC (D)				
STRIGIDAE	Fraser's Eagle-Owl	*Bubo poensis*	3	GCFB	4	LC (D)				
STRIGIDAE	Shelley's Eagle-Owl	*Bubo shelleyi*	4	GCFB	4	VU (D)				
STRIGIDAE	Pearl-spotted Owlet	*Glaucidium perlatum*	2		1	LC (S)				
STRIGIDAE	Red-chested Owlet	*Glaucidium tephronotum*	3	GCFB	4	LC (S)				
STRIGIDAE	Maned Owl	*Jubula lettii*	3	GCFB	4	DD (S)				
STRIGIDAE	Sandy Scops-Owl	*Otus icterorhynchus*	2	GCFB	3	LC (S)				
STRIGIDAE	Eurasian Scops-Owl	*Otus scops*	2		1	LC (D)				
STRIGIDAE	African Scops-Owl	*Otus senegalensis*	2		2	LC (S)				
STRIGIDAE	Northern White-faced Owl	*Ptilopsis leucotis*	1		2	LC (S)			x	x
STRIGIDAE	Pel's Fishing-Owl	*Scotopelia peli*	2		2	LC (D)				
STRIGIDAE	Rufous Fishing-Owl	*Scotopelia ussheri*	2	GCFB	4	VU (D)				
STRIGIDAE	African Wood-Owl	*Strix woodfordii*	1		3	LC (S)			x	x
TYTONIDAE	Barn Owl	*Tyto alba*	2		2	LC (S)				
ANHINGIDAE	African Darter	*Anhinga rufa*	4		1	LC (D)				
PHALACROCORACIDAE	Long-tailed Cormorant	*Microcarbo africanus*	4		1	LC (D)				
TROGONIDAE	Narina Trogon	*Apaloderma narina*	2		3	LC (S)				
MEROPIDAE	European Bee-eater	*Merops persicus*	1		1	LC (S)			x	x

Key: IUCN (2021) global status, letters in parentheses indicate population trend, D= Decreasing, S = Stable, U = Uncertain. Endemicity; End = Endemic, N-end = Near Endemic. Likelihood of occurrence (LO): 1 = Present; 1a = Present Anecdotal; 1p = Present Previous Studies Only; 2 = High; 3 = Moderate 4 = Unlikely. BR: Biome Restricted. GCFB = Guinea-Congolese Forest Biome; SGSB: Sahel Grassland Savannah Biome. Source: [1]IUCN (2021); [2]Attuquayefio (2008); [3]Oduro and Danqhua (2012); [4]Current (2021)

Appendix 2: Present and potentially occurring mammal species

Order	Family	Scientific Name	Common Name	LO	Guild	Status	2008[2]	2012[3]	2021[4]	Total
CARNIVORA	CANIDAE	*Canis adustus*	Side-striped Jackal	4	1	LC (S)				
CARNIVORA	FELIDAE	*Caracal aurata*	Golden Cat	4	4	VU (D)				
CARNIVORA	FELIDAE	*Felis silvestris*	Wild Cat	3	2	LC (D)				
CARNIVORA	FELIDAE	*Leptailurus serval*	Serval	3	2	LC (S)				
CARNIVORA	FELIDAE	*Panthera pardus*	Leopard	4	2	VU (D)				
CARNIVORA	HERPESTIDAE	*Atilax paludinosus*	Water Mongoose	1	2	LC (D)		x	x	x
CARNIVORA	HERPESTIDAE	*Crossarchus obscurus*	Cusimanse	1	3	LC (U)		x	x	x
CARNIVORA	HERPESTIDAE	*Herpestes ichneumon*	Large Grey Mongoose	2	1	LC (S)				
CARNIVORA	HERPESTIDAE	*Herpestes sanguineus*	Slender Mongoose	1	1	LC (S)			x	x
CARNIVORA	HERPESTIDAE	*Ichneumia albicauda*	White-tailed Mongoose	2	1	LC (S)				
CARNIVORA	HERPESTIDAE	*Mungos gambianus*	Gambian Mongoose	2	2	LC (S)				
CARNIVORA	HYAENIDAE	*Crocuta crocuta*	Spotted Hyaena	4	1	LC (D)				
CARNIVORA	MUSTELIDAE	*Aonyx capensis*	Cape Clawless Otter	2	2	NT (D)				
CARNIVORA	MUSTELIDAE	*Ictonyx striatus*	Striped Polecat	2	1	LC (S)				
CARNIVORA	MUSTELIDAE	*Mellivora capensis*	Honey Badger	2	1	LC (D)				
CARNIVORA	NANDINIIDAE	*Nandinia binotata*	Palm Civet	2	3	LC (U)				
CARNIVORA	VIVERRIDAE	*Civettictis civetta*	African Civet	1	2	LC (U)		x	x	x
CARNIVORA	VIVERRIDAE	*Genetta pardina*	West African Large-spotted Genet	1p	2	LC (U)		x		
CARNIVORA	VIVERRIDAE	*Genetta poensis*	Royal Genet	4	2	DD (U)				
CARNIVORA	VIVERRIDAE	*Genetta thierryi*	Hausa Genet	4	2	LC (U)				
CETARTIODACTYLA	BOVIDAE	*Alcelaphus buselaphus*	Hartebeest	4	1	LC (D)				
CETARTIODACTYLA	BOVIDAE	*Cephalophus dorsalis*	Bay Duiker	3	3	NT (D)				
CETARTIODACTYLA	BOVIDAE	*Cephalophus niger*	Black Duiker	3	3	LC (D)				
CETARTIODACTYLA	BOVIDAE	*Cephalophus ogilbyi*	Ogilby's Duiker	3	3	LC (D)				
CETARTIODACTYLA	BOVIDAE	*Cephalophus rufilatus*	Red-flanked Duiker	2	3	LC (D)				
CETARTIODACTYLA	BOVIDAE	*Cephalophus silvicultor*	Yellow-backed Duiker	3	4	NT (D)				
CETARTIODACTYLA	BOVIDAE	*Hippotragus equinus*	Roan Antelope	4	1	LC (D)				
CETARTIODACTYLA	BOVIDAE	*Kobus ellipsiprymnus*	Waterbuck	4	1	LC (D)				
CETARTIODACTYLA	BOVIDAE	*Kobus kob*	Kob	4	1	LC (D)				
CETARTIODACTYLA	BOVIDAE	*Neotragus pygmaeus*	Royal Antelope	1p	2	LC (D)		x		
CETARTIODACTYLA	BOVIDAE	*Ourebia ourebi*	Oribi	4	1	LC (D)				

Order	Family	Scientific Name	Common Name	LO	Guild	Status	2008[2]	2012[3]	2021[4]	Total
CETARTIODACTYLA	BOVIDAE	*Philantomba maxwellii*	Maxwell's Duiker	1	2	LC (D)		x	x	x
CETARTIODACTYLA	BOVIDAE	*Redunca redunca*	Bohor Reedbuck	4	1	LC (D)				
CETARTIODACTYLA	BOVIDAE	*Sylvicapra grimmia*	Common Duiker	2	2	LC (D)				
CETARTIODACTYLA	BOVIDAE	*Syncerus caffer nanus*	Forest Buffalo	1a	4	NT (D)			x	x
CETARTIODACTYLA	BOVIDAE	*Tragelaphus eurycerus*	Bongo	2	4	NT (D)				
CETARTIODACTYLA	BOVIDAE	*Tragelaphus scriptus*	Bushbuck	1	2	LC (S)		x	x	x
CETARTIODACTYLA	HIPPOPOTAMIDAE	*Hippopotamus amphibius*	Hippopotamus	4	2	VU (S)				
CETARTIODACTYLA	SUIDAE	*Hylochoerus meinertzhageni*	Giant Forest Hog	4	3	LC (D)				
CETARTIODACTYLA	SUIDAE	*Phacochoerus africanus*	Common Warthog	1	1	LC (D)			x	x
CETARTIODACTYLA	SUIDAE	*Potamochoerus porcus*	Red River Hog	1p	4	LC (D)		x		
CETARTIODACTYLA	TRAGULIDAE	*Hyemoschus aquaticus*	Water Chevrotain	4	4	LC (D)				
CHIROPTERA	EMBALLONURIDAE	*Coleura afra*	African Sheath-tailed Bat	4	2	LC (U)				
CHIROPTERA	EMBALLONURIDAE	*Saccolaimus peli*	Pel's Pouched Bat	3	2	LC (U)				
CHIROPTERA	EMBALLONURIDAE	*Taphozous perforatus*	Egyptian Tomb Bat	2	2	LC (S)				
CHIROPTERA	HIPPOSIDERIDAE	*Hipposideros abae*	Aba Roundleaf Bat	2	3	LC (U)				
CHIROPTERA	HIPPOSIDERIDAE	*Hipposideros beatus*	Benito Roundleaf Bat	2	3	LC (D)				
CHIROPTERA	HIPPOSIDERIDAE	*Hipposideros cyclops*	Cyclops Roundleaf Bat	1	3	LC (D)			x	x
CHIROPTERA	HIPPOSIDERIDAE	*Hipposideros fuliginosus*	Sooty Roundleaf Bat	2	3	LC (D)				
CHIROPTERA	HIPPOSIDERIDAE	*Hipposideros jonesi*	Jones' Roundleaf Bat	2	3	NT (D)				
CHIROPTERA	HIPPOSIDERIDAE	*Hipposideros ruber*	Noack's Roundleaf Bat	3	3	LC (U)				
CHIROPTERA	HIPPOSIDERIDAE	*Macronycteris gigas*	Giant Leaf-nosed Bat	2	3	LC (U)				
CHIROPTERA	MEGADERMATIDAE	*Lavia frons*	Yellow-winged Bat	2	2	LC (S)				
CHIROPTERA	MOLOSSIDAE	*Chaerephon aloysiisabaudiae*	Duke of Abruzzi's Wrinkle-lipped Bat	2	2	LC (D)				
CHIROPTERA	MOLOSSIDAE	*Chaerephon ansorgei*	Ansorge's Wrinkle-lipped Bat	2	2	LC (S)				
CHIROPTERA	MOLOSSIDAE	*Chaerephon major*	Large Wrinkle-lipped Bat	2	2	LC (S)				
CHIROPTERA	MOLOSSIDAE	*Chaerephon nigeriae*	Nigerian Free-tailed Bat	2	2	LC (U)				
CHIROPTERA	MOLOSSIDAE	*Chaerephon pumilus*	Lesser Free-tailed Bat	2	2	LC (U)				
CHIROPTERA	MOLOSSIDAE	*Chaerephon russatus*	Russet Wrinkle-lipped Bat	3	2	DD (U)				
CHIROPTERA	MOLOSSIDAE	*Mops brachypterus*	Short-winged Mops Bat	3	2	LC (U)				
CHIROPTERA	MOLOSSIDAE	*Mops condylurus*	Angolan Free-tailed Bat	2	2	LC (U)				
CHIROPTERA	MOLOSSIDAE	*Mops nanulus*	Dwarf Free-tailed Bat	3	2	LC (U)				
CHIROPTERA	MOLOSSIDAE	*Mops spurrelli*	Spurrell's Free-tailed Bat	3	2	LC (U)				
CHIROPTERA	MOLOSSIDAE	*Mops thersites*	Railer Mops Bat	3	2	LC (S)				

Order	Family	Scientific Name	Common Name	LO	Guild	Status	2008[2]	2012[3]	2021[4]	Total
CHIROPTERA	MOLOSSIDAE	*Mops trevori*	Trevor's Mops Map	3	2	DD (D)				
CHIROPTERA	MOLOSSIDAE	*Otomops martiensseni*	Large-eared Free-tailed Bat	2	2	NT (D)				
CHIROPTERA	NYCTERIDAE	*Nycteris arge*	Bate's Slit-faced Bat	2	2	LC (S)				
CHIROPTERA	NYCTERIDAE	*Nycteris gambiensis*	Gambian Slit-faced Bat	2	2	LC (U)				
CHIROPTERA	NYCTERIDAE	*Nycteris grandis*	Large Slit-faced Bat	2	2	LC (D)				
CHIROPTERA	NYCTERIDAE	*Nycteris hispida*	Hairy Long-eared Bat	2	2	LC (S)				
CHIROPTERA	NYCTERIDAE	*Nycteris intermedia*	Intermediate Slit-faced Bat	2	2	LC (D)				
CHIROPTERA	NYCTERIDAE	*Nycteris macrotis*	Large-eared Slit-faced Bat	2	2	LC (U)				
CHIROPTERA	NYCTERIDAE	*Nycteris nana*	Dwarf Slit-faced Bat	2	2	LC (U)				
CHIROPTERA	NYCTERIDAE	*Nycteris thebaica*	Egyptian Slit-faced Bat	1	2	LC (U)			x	x
CHIROPTERA	PTEROPODIDAE	*Eidolon helvum*	African Straw-coloured Fruit Bat	1	3	NT (D)			x	x
CHIROPTERA	PTEROPODIDAE	*Epomophorus gambianus*	Gambian Epauletted Fruit Bat	2	2	LC (U)				
CHIROPTERA	PTEROPODIDAE	*Epomops buettikoferi*	Buettikofer's Epauletted Fruit Bat	2	2	LC (D)				
CHIROPTERA	PTEROPODIDAE	*Epomops franqueti*	Franquet's Fruit Bat	2	3	LC (S)				
CHIROPTERA	PTEROPODIDAE	*Hypsignathus monstrosus*	Hammer-headed Fruit Bat	2	3	LC (U)				
CHIROPTERA	PTEROPODIDAE	*Lissonycteris angolensis*	Angolan Fruit Bat	3	2	LC (D)				
CHIROPTERA	PTEROPODIDAE	*Megaloglossus azagnyi*	Azagnyi Fruit Bat	3	2	LC (U)				
CHIROPTERA	PTEROPODIDAE	*Micropteropus pusillus*	Peter's Dwarf Epauletted Fruit Bat	2	2	LC (S)				
CHIROPTERA	PTEROPODIDAE	*Myonycteris leptodon*	Sierra Leone Collared Fruit Bat	3	3	LC (U)				
CHIROPTERA	PTEROPODIDAE	*Nanonycteris veldkampii*	Veldkamp's Bat	3	2	LC (U)				
CHIROPTERA	PTEROPODIDAE	*Rousettus aegyptiacus*	Egyptian Fruit Bat	2	2	LC (S)				
CHIROPTERA	PTEROPODIDAE	*Scotonycteris occidentalis*	Hayman’s Tear-drop Fruit Bat	2	2	LC (U)				
CHIROPTERA	PTEROPODIDAE	*Scotonycteris ophiodon*	Pohle's Fruit Bat	3	3	NT (D)				
CHIROPTERA	RHINOLOPHIDAE	*Rhinolophus alcyone*	Halcyon Horseshoe Bat	3	3	LC (U)				
CHIROPTERA	RHINOLOPHIDAE	*Rhinolophus fumigatus*	Rüppell's horseshoe bat	3	2	LC (U)				
CHIROPTERA	RHINOLOPHIDAE	*Rhinolophus landeri*	Lander's Horseshoe Bat	3	2	LC (U)				
CHIROPTERA	VESPERTILIONIDAE	*Glauconycteris beatrix*	Beatrix's bat	3	2	LC (U)				
CHIROPTERA	VESPERTILIONIDAE	*Glauconycteris poensis*	Abo Bat	3	2	LC (U)				
CHIROPTERA	VESPERTILIONIDAE	*Glauconycteris variegata*	Variegated butterfly bat	3	2	LC (U)				
CHIROPTERA	VESPERTILIONIDAE	*Hypsugo musciculus*	Mouselike pipistrelle	2	2	DD (U)				
CHIROPTERA	VESPERTILIONIDAE	*Kerivoula lanosa*	Lesser Woolly Bat	2	2	LC (U)				
CHIROPTERA	VESPERTILIONIDAE	*Kerivoula phalaena*	Spurrell's Woolly Bat	3	2	LC (U)				
CHIROPTERA	VESPERTILIONIDAE	*Mimetillus moloneyi*	Moloney's Flat-headed Bat	3	2	LC (U)				

Order	Family	Scientific Name	Common Name	LO	Guild	Status	2008[2]	2012[3]	2021[4]	Total
CHIROPTERA	VESPERTILIONIDAE	*Myotis bocagii*	Bocage's Banana Bat	2	2	LC (U)				
CHIROPTERA	VESPERTILIONIDAE	*Neoromicia brunnea*	Brown Pipistrelle	1	4	NT (D)			x	x
CHIROPTERA	VESPERTILIONIDAE	*Neoromicia capensis*	Cape Serotine	1	2	LC (S)			x	x
CHIROPTERA	VESPERTILIONIDAE	*Neoromicia guineensis*	Guinean Pipistrelle Bat	2	2	LC (U)				
CHIROPTERA	VESPERTILIONIDAE	*Neoromicia nana*	Banana Bat	2	2	LC (U)				
CHIROPTERA	VESPERTILIONIDAE	*Neoromicia rendalli*	Rendall's Serotine	2	2	LC (U)				
CHIROPTERA	VESPERTILIONIDAE	*Neoromicia tenuipinnis*	White-winged Bat	2	2	LC (U)				
CHIROPTERA	VESPERTILIONIDAE	*Pipistrellus inexspectatus*	Aellen's Pipistrelle	2	2	DD (U)				
CHIROPTERA	VESPERTILIONIDAE	*Pipistrellus nanulus*	Tiny Pipistrelle	2	2	LC (U)				
CHIROPTERA	VESPERTILIONIDAE	*Scotoecus albofuscus*	Light-winged Lesser House Bat	2	2	DD (U)				
CHIROPTERA	VESPERTILIONIDAE	*Scotoecus hirundo*	Dark-winged Lesser House Bat	2	2	LC (U)				
CHIROPTERA	VESPERTILIONIDAE	*Scotophilus dinganii*	Yellow-bellied House Bat	2	1	LC (U)				
CHIROPTERA	VESPERTILIONIDAE	*Scotophilus nigrita*	Giant House Bat	2	2	LC (D)				
CHIROPTERA	VESPERTILIONIDAE	*Scotophilus nucella*	Robbins's House Bat	2	2	DD (U)				
CHIROPTERA	VESPERTILIONIDAE	*Scotophilus nux*	Nut-coloured House Bat	2	2	LC (U)				
CHIROPTERA	VESPERTILIONIDAE	*Scotophilus viridis*	Green House Bat	2	2	LC (U)				
EULIPOTYPHLA	ERINACEIDAE	*Atelerix albiventris*	Four-toed Hedgehog	2	2	LC (S)				
EULIPOTYPHLA	SORICIDAE	*Crocidura buettikoferi*	Buettikofer's Shrew	2	2	LC (U)				
EULIPOTYPHLA	SORICIDAE	*Crocidura crossei*	Crosse's Shrew	2	2	LC (U)				
EULIPOTYPHLA	SORICIDAE	*Crocidura foxi*	Fox's Shrew	2	3	LC (U)				
EULIPOTYPHLA	SORICIDAE	*Crocidura grandiceps*	Large-headed Forest Shrew	1p	3	NT (U)				
EULIPOTYPHLA	SORICIDAE	*Crocidura lamottei*	Lamotte's Shrew	2	2	LC (U)				
EULIPOTYPHLA	SORICIDAE	*Crocidura muricauda*	Mouse-tailed Shrew	2	2	LC (U)				
EULIPOTYPHLA	SORICIDAE	*Crocidura cf. obscurior*	West African Pygmy Shrew	1	3	LC (U)			x	x
EULIPOTYPHLA	SORICIDAE	*Crocidura olivieri*	African Giant Shrew	2	2	LC (U)				
EULIPOTYPHLA	SORICIDAE	*Crocidura poensis*	Fraser's Musk Shrew	2	2	LC (U)				
EULIPOTYPHLA	SORICIDAE	*Crocidura theresae*	Therese's Shrew	2	2	LC (U)				
EULIPOTYPHLA	SORICIDAE	*Suncus megalura*	Climbing Shrew	2	2	LC (U)				
HYRACOIDEA	PROCAVIIDAE	*Dendrohyrax dorsalis*	Western Tree Hyrax	2	4	LC (U)				
HYRACOIDEA	PROCAVIIDAE	*Procavia capensis*	Rock Hyrax	4	1	LC (S)				
LAGOMORPHA	LEPORIDAE	*Lepus victoriae*	African Savanna Hare	2	1	LC (S)				

Order	Family	Scientific Name	Common Name	LO	Guild	Status	2008[2]	2012[3]	2021[4]	Total
PHOLIDOTA	MANIDAE	*Phataginus tetradactyla*	Black-bellied Pangolin	2	4	VU (D)				
PHOLIDOTA	MANIDAE	*Phataginus tricuspis*	African White-bellied Pangolin	1	4	EN (D)			x	x
PHOLIDOTA	MANIDAE	*Smutsia gigantea*	Giant Pangolin	4	1	EN (D)				
PRIMATES	CERCOPITHECIDAE	*Cercocebus lunulatus*	White-naped Mangabey	4	4	EN (D)				
PRIMATES	CERCOPITHECIDAE	*Cercopithecus lowei*	Lowe's Monkey	2	3	VU (D)				
PRIMATES	CERCOPITHECIDAE	*Cercopithecus petaurista*	Lesser Spot-nosed Guenon	3	4	NT (D)				
PRIMATES	CERCOPITHECIDAE	*Cercopithecus roloway*	Roloway Monkey	4	4	CR (D)				
PRIMATES	CERCOPITHECIDAE	*Chlorocebus sabaeus*	Green Monkey	2	3	LC (D)				
PRIMATES	CERCOPITHECIDAE	*Colobus vellerosus*	White-thighed Colobus	4	4	CR (D)				
PRIMATES	CERCOPITHECIDAE	*Erythrocebus patas*	Patas Monkey	1p	3	NT (D)				
PRIMATES	CERCOPITHECIDAE	*Papio anubis*	Olive Baboon	3	2	LC (S)				
PRIMATES	CERCOPITHECIDAE	*Piliocolobus waldroni*	Miss Waldron’s Red Colobus	4	4	CR (D)				
PRIMATES	CERCOPITHECIDAE	*Procolobus verus*	Van Beneden's Colobus	2	3	VU (D)				
PRIMATES	GALAGIDAE	*Galago senegalensis*	Northern Lesser Galago	2	2	LC (D)				
PRIMATES	GALAGIDAE	*Galagoides demidoff*	Demidoff's Galago	4	3	LC (S)				
PRIMATES	GALAGIDAE	*Galagoides thomasi*	Thomas's Bushbaby	1	3	LC (S)			x	x
PRIMATES	HOMINIDAE	*Pan troglodytes*	Chimpanzee	2	2	EN (D)				
PRIMATES	LORISIDAE	*Perodicticus potto*	Western Potto	1	3	NT (D)			x	x
PROBOSCIDEA	ELEPHANTIDAE	*Loxodonta cyclotis*	Forest Elephant	4	4	CR (D)				
RODENTIA	ANOMALURIDAE	*Anomalurus beecrofti*	Beecroft's Flying Squirrel	4	2	LC (U)				
RODENTIA	ANOMALURIDAE	*Anomalurus derbianus*	Derby's Flying Squirrel	4	4	LC (U)				
RODENTIA	ANOMALURIDAE	*Anomalurus pelii*	Pel's Scaly-tailed Squirrel	4	4	DD (U)				
RODENTIA	ANOMALURIDAE	*Idiurus macrotis*	Long-eared Flying Squirrel	4	4	LC (U)				
RODENTIA	GLIRIDAE	*Graphiurus lorraineus*	Lorrain Dormouse	3	2	LC (U)				
RODENTIA	GLIRIDAE	*Graphiurus nagtglasii*	Nagtglas's African Dormouse	3	2	LC (U)				
RODENTIA	HYSTRICIDAE	*Atherurus africanus*	African Brush-tailed Porcupine	1p	3	LC (U)		x		
RODENTIA	HYSTRICIDAE	*Hystrix cristata*	Crested Porcupine	1	3	LC (U)				
RODENTIA	MURIDAE	*Arvicanthis rufinus*	Guinean Grass Rat	2	2	LC (U)				
RODENTIA	MURIDAE	*Dasymys rufulus*	West African Shaggy Rat	1p	2	LC (U)	x			x
RODENTIA	MURIDAE	*Dephomys defua*	Defua Rat	1p	2	LC (U)	x			x
RODENTIA	MURIDAE	*Gerbilliscus guineae*	Guinean Gerbil	2	2	LC (S)				
RODENTIA	MURIDAE	*Gerbilliscus kempi*	Kemp's Gerbil	2	2	LC (U)				
RODENTIA	MURIDAE	*Grammomys kuru*	Eastern Rainforest Grammomys	4	4	LC (U)				

Order	Family	Scientific Name	Common Name	LO	Guild	Status	2008[2]	2012[3]	2021[4]	Total
RODENTIA	MURIDAE	*Hybomys trivirgatus*	Temminck's Striped Mouse	2	2	LC (S)				
RODENTIA	MURIDAE	*Hylomyscus alleni*	Allen's Hylomyscus	1p	2	LC (S)	x			x
RODENTIA	MURIDAE	*Hylomyscus baeri*	Baer's Wood Mouse	2	2	EN (D)				
RODENTIA	MURIDAE	*Lemniscomys bellieri*	Bellier's Striped Grass Mouse	2	2	LC (S)				
RODENTIA	MURIDAE	*Lemniscomys striatus*	Typical Lemniscomys	2	2	LC (I)				
RODENTIA	MURIDAE	*Lemniscomys zebra*	Heuglin's Striped Grass Mouse	2	2	LC (S)				
RODENTIA	MURIDAE	*Lophuromys sikapusi*	Rusty-bellied Brush-furred Rat	2	3	LC (U)				
RODENTIA	MURIDAE	*Malacomys cansdalei*	Cansdale's Swamp Rat	2	2	LC (U)				
RODENTIA	MURIDAE	*Malacomys edwardsi*	Edward's Swamp Rat	2	2	LC (U)				
RODENTIA	MURIDAE	*Mastomys erythroleucus*	Reddish-white Mastomys	1p	2	LC (S)	x			x
RODENTIA	MURIDAE	*Mastomys natalensis*	Natal Mastomys	2	2	LC (S)				
RODENTIA	MURIDAE	*Mus baoulei*	Baoule's Mouse	2	2	LC (S)				
RODENTIA	MURIDAE	*Mus mattheyi*	Matthey's Mouse	2	2	LC (S)				
RODENTIA	MURIDAE	*Mus musculoides*	Temminck's Mouse	1	1	LC (U)	x		x	x
RODENTIA	MURIDAE	*Mus setulosus*	Peter's Mouse	2	2	LC (S)				
RODENTIA	MURIDAE	*Mylomys dybowskii*	African Groove-toothed Rat	2	2	LC (U)				
RODENTIA	MURIDAE	*Oenomys ornatus*	Ghana Rufous-nosed Rat	3	2	DD (U)				
RODENTIA	MURIDAE	*Praomys daltoni*	Dalton's Mouse	2	2	LC (S)				
RODENTIA	MURIDAE	*Praomys rostratus*	Forest Soft-furred Mouse	3	2	LC (U)				
RODENTIA	MURIDAE	*Praomys tullbergi*	Tullberg's Praomys	1p	2	LC (S)	x			x
RODENTIA	MURIDAE	*Rattus rattus*	Black Rat	1	2	LC (S)			x	x
RODENTIA	MURIDAE	*Taterillus gracilis*	Gracile Taterile	3	2	LC (S)				
RODENTIA	MURIDAE	*Uranomys ruddi*	Rudd's Mouse	3	2	LC (D)				
RODENTIA	NESOMYIDAE	*Cricetomys emini*	Forest Giant Pouched Rat	4	2	LC (S)				
RODENTIA	NESOMYIDAE	*Cricetomys gambianus*	Giant Gambian Pouched Rat	1	2	LC (S)		x	x	x
RODENTIA	NESOMYIDAE	*Steatomys jacksoni*	Jackson's Fat Mouse	3	2	DD (U)				
RODENTIA	SCIURIDAE	*Epixerus ebii*	Ebian's Palm Squirrel	3	2	LC (U)				
RODENTIA	SCIURIDAE	*Funisciurus pyrropus*	Fire-footed Rope Squirrel	4	2	LC (S)				
RODENTIA	SCIURIDAE	*Heliosciurus gambianus*	Gambian Sun Squirrel	3	2	LC (U)				
RODENTIA	SCIURIDAE	*Heliosciurus punctatus*	Small Sun Squirrel	3	2	DD (U)				
RODENTIA	SCIURIDAE	*Heliosciurus rufobrachium*	Crab-eating Mongoose	2	2	LC (U)				

Order	Family	Scientific Name	Common Name	LO	Guild	Status	2008[2]	2012[3]	2021[4]	Total
RODENTIA	SCIURIDAE	*Paraxerus poensis*	Green Bush Squirrel	1	3	LC (U)			x	x
RODENTIA	SCIURIDAE	*Protoxerus aubinnii*	Slender-tailed Squirrel	3	4	NT (U)				
RODENTIA	SCIURIDAE	*Protoxerus stangeri*	African Giant Squirrel	3	2	LC (U)				
RODENTIA	SCIURIDAE	*Xerus erythropus*	Striped Ground Squirrel	1	1	LC (S)		x	x	x
RODENTIA	THRYONOMYIDAE	*Thryonomys swinderianus*	Greater Cane Rat	1	2	LC (U)		x	x	x
TUBULIDENTATA	ORYCTEROPODIDAE	*Orycteropus afer*	Aardvark	4	1	LC (U)				

Key: IUCN (2021) global status, letters in parentheses indicate population trend, D= Decreasing, S = Stable, U = Uncertain. Endemicity; End = Endemic, N-end = Near Endemic. Likelihood of occurrence (LO): 1 = Present; 1a = Present Anecdotal; 1p = Present Previous Studies Only; 2 = High; 3 = Moderate 4 = Unlikely. BR: Biome Restricted. GCFB = Guinea-Congolese Forest Biome; SGSB: Sahel Grassland Savannah Biome. Source: [1]IUCN (2021); [2]Attuquayefio (2008); [3]Oduro and Danqhua (2012); [4]Current (2021)

Appendix 3: Present and potentially occurring reptile species

Family	Scientific Name	Common Name	LO	Guild	Status[1]	2012[2]	2021[3]	Total
CROCODYLIDAE	*Mecistops cataphractus*	West African Slender-snouted Crocodile	1a	4	CR (D)		x	x
CROCODYLIDAE	*Osteolaemus tetraspis*	African Dwarf Crocodile	4	4	VU (0)			
AGAMIDAE	*Agama africana*	Red-headed Agama	3	2	LC (S)			
AGAMIDAE	*Agama agama*	Common Agama	1	2	LC (S)		x	x
AGAMIDAE	*Agama picticauda*	Peter's Rock Agama	4	1	LC (I)			
AGAMIDAE	*Agama sankaranica*	Senegal Agama	4	2	LC (U)			
AMPHISBAENIDAE	*Cynisca leucura*	Coast Worm Lizard	3	2	LC (S)			
AMPHISBAENIDAE	*Cynisca williamsi*		3	2	DD (U)			
ATRACTASPIDIDAE	*Amblyodipsas unicolor*	Dull Purple-glossed Snake	2	3	LC (U)			
ATRACTASPIDIDAE	*Aparallactus lineatus*	Lined Centipede-eater	3	2	NT (U)			
ATRACTASPIDIDAE	*Aparallactus lunulatus*	Reticulated Centipede-eater	3	2	LC (U)			
ATRACTASPIDIDAE	*Aparallactus modestus*	Western Forest Centipede-eater	3	3	LC (U)			
ATRACTASPIDIDAE	*Atractaspis aterrima*	Slender Burrowing Asp	2	2	LC (U)			
ATRACTASPIDIDAE	*Atractaspis corpulenta*	Fat Burrowing Asp	2	2	LC (U)			
ATRACTASPIDIDAE	*Atractaspis dahomeyensis*	Dahomey Burrowing Asp	2	2	LC (U)			
ATRACTASPIDIDAE	*Atractaspis irregularis*	Variable Stiletto Asp	2	2	LC (D)			
ATRACTASPIDIDAE	*Polemon acanthias*	Reinhardt's Snake-eater	3	2	LC (U)			
ATRACTASPIDIDAE	*Polemon barthii*	Guinea Snake-eater	3	2	LC (U)			
ATRACTASPIDIDAE	*Polemon neuwiedi*	Ivory Coast Snake-eater	3	2	LC (U)			
BOIDAE	*Calabaria reinhardtii*	Calabar Ground Python	3	2	LC (D)			
CHAMAELEONIDAE	*Chamaeleo africanus*	African Chameleon	3	1	LC (S)			
CHAMAELEONIDAE	*Chamaeleo gracilis*	Slender Chameleon	2	1	LC (S)			
CHAMAELEONIDAE	*Chamaeleo senegalensis*	Senegal Chamaeleon	3	1	LC (U)			
COLUBRIDAE	*Crotaphopeltis hippocrepis*		3	2	LC (U)			
COLUBRIDAE	*Crotaphopeltis hotamboeia*	Red-lipped Snake	2	2	LC (S)			
COLUBRIDAE	*Dasypeltis fasciata*	Western Forest Egg Eater	3	2	LC (S)			
COLUBRIDAE	*Dasypeltis parascabra*		3	2	LC (S)			
COLUBRIDAE	*Dipsadoboa brevirostris*		3	2	LC (U)			
COLUBRIDAE	*Dipsadoboa underwoodi*		3	2	LC (S)			
COLUBRIDAE	*Dipsadoboa unicolor*	Günther's Green Tree Snake	3	2	LC (S)			
COLUBRIDAE	*Dispholidus typus*	Boomslang	2	2	LC (S)			
COLUBRIDAE	*Hapsidophrys lineatus*	Black-lined Green Snake	3	2	LC (U)			

Family	Scientific Name	Common Name	LO	Guild	Status[1]	2012[2]	2021[3]	Total
COLUBRIDAE	*Hapsidophrys smaragdinus*	Emerald Snake	2	3	LC (U)			
COLUBRIDAE	*Meizodon coronatus*	Western Crowned Snake	3	2	LC (U)			
COLUBRIDAE	*Meizodon regularis*	Eastern Crowned Smooth Snake	3	2	LC (U)			
COLUBRIDAE	*Philothamnus carinatus*	Thirteen-scaled Green Snake	3	2	LC (U)			
COLUBRIDAE	*Philothamnus heterodermus*	Emerald Green Snake	3	2	LC (U)			
COLUBRIDAE	*Philothamnus irregularis*	Northern Green Bush Snake	3	2	LC (U)			
COLUBRIDAE	*Philothamnus nitidus*	Green Bush Snake	3	2	LC (U)			
COLUBRIDAE	*Philothamnus semivariegatus*	Spotted Bush Snake	2	2	LC (U)			
COLUBRIDAE	*Rhamnophis aethiopissa*	Large-eyed Green Treesnake	3	2	LC (U)			
COLUBRIDAE	*Scaphiophis albopunctatus*	African Shovel-nosed Snake	4	1	LC (U)			
COLUBRIDAE	*Telescopus variegatus*	Variable Cat Snake	3	2	LC (U)			
COLUBRIDAE	*Thelotornis kirtlandii*	Forest Vine Snake	3	4	LC (U)			
COLUBRIDAE	*Thrasops occidentalis*	Black Tree Snake	2	4	LC (U)			
COLUBRIDAE	*Toxicodryas blandingii*	Blandings Tree Snake	2	4	LC (U)			
COLUBRIDAE	*Toxicodryas pulverulenta*	Fischer's Cat Snake	2	4	LC (U)			
ELAPIDAE	*Dendroaspis viridis*	Western Green Mamba	1p	2	LC (S)	x		x
ELAPIDAE	*Naja katiensis*	Mali Cobra	4	1	LC (S)			
ELAPIDAE	*Naja melanoleuca*	Forest Cobra	1p	3	LC (D)	x		x
ELAPIDAE	*Naja nigricollis*	Black-necked Spitting Cobra	2	2	LC (U)			
ELAPIDAE	*Naja savannula*	West African Banded Cobra	3	1	LC (S)			
ELAPIDAE	*Pseudohaje goldii*	Goldies Tree Cobra	3	4	LC (U)			
ELAPIDAE	*Pseudohaje nigra*	Black Tree Cobra	3	4	LC (U)			
EUBLEPHARIDAE	*Hemitheconyx caudicinctus*	Fat-tail Gecko	3	1	LC (U)			
GEKKONIDAE	*Hemidactylus mabouia*	Tropical House Gecko	1	2	LC (U)		x	x
GEKKONIDAE	*Hemidactylus albituberculatus*		3	2	LC (U)			
GEKKONIDAE	*Hemidactylus angulatus*	House Gecko	2	2	LC (S)		x	x
GEKKONIDAE	*Hemidactylus ansorgii*	Nigeria Leaf-toed Gecko	3	3	LC (U)			
GEKKONIDAE	*Hemidactylus fasciatus*	Banded Leaf-toed Gecko	3	4	LC (U)			
GEKKONIDAE	*Hemidactylus muriceus*	Guinea Leaf-toed Gecko	1	3	LC (U)		x	x
GEKKONIDAE	*Lygodactylus conraui*	Cameroon Dwarf Gecko	3	4	LC (U)			
GEKKONIDAE	*Lygodactylus gutturalis*	Chevron-throated Dwarf Gecko	3	3	LC (S)			
GERRHOSAURIDAE	*Broadleysaurus major*	Rough-scaled Plated Lizard	3	1	LC (U)			
GRAYIIDAE	*Grayia smithii*	Smith's African Water Snake	1	3	LC (S)		x	x
LACERTIDAE	*Acanthodactylus boueti*	Chabanaud's Fringe-fingered Lizard	3	3	DD (U)			

Family	Scientific Name	Common Name	LO	Guild	Status[1]	2012[2]	2021[3]	Total
LACERTIDAE	*Gastropholis echinata*		3	3	LC (U)			
LACERTIDAE	*Heliobolus nitidus*	Glittering Sand Lizard	3	1	LC (U)			
LACERTIDAE	*Holaspis guentheri*	Sawtail Lizard	3	4	LC (U)			
LAMPROPHIIDAE	*Boaedon fuliginosus*	African House Snake	2	2	LC (S)			
LAMPROPHIIDAE	*Boaedon lineatus*	Striped House Snake	3	2	LC (S)			
LAMPROPHIIDAE	*Boaedon virgatus*	Hallowell's House Snake	2	2	LC (U)			
LAMPROPHIIDAE	*Bothrophthalmus lineatus*		3	2	LC (U)			
LAMPROPHIIDAE	*Chamaelycus fasciatus*	African Banded Snake	3	2	LC (U)			
LAMPROPHIIDAE	*Gonionotophis grantii*	Grant's File Snake	3	2	LC (U)			
LAMPROPHIIDAE	*Hormonotus modestus*	Uganda House Snake	2	2	LC (U)			
LAMPROPHIIDAE	*Limaformosa crossi*	Crosse's File Snake	3	2	LC (U)			
LAMPROPHIIDAE	*Limaformosa guirali*	Guiral's File Snake	3	2	LC (U)			
LAMPROPHIIDAE	*Lycophidion irroratum*	Leach's Wolf Snake	3	2	LC (U)			
LAMPROPHIIDAE	*Lycophidion laterale*	Flat Wolf Snake	3	2	LC (U)			
LAMPROPHIIDAE	*Lycophidion nigromaculatum*	Black-spotted Wolf Snake	3	2	LC (U)			
LAMPROPHIIDAE	*Lycophidion semicinctum*	Semi-annulated Wolf Snake	3	2	LC (U)			
LAMPROPHIIDAE	*Mehelya poensis*	Western Forest Filesnake	3	2	LC (U)			
LEPTOTYPHLOPIDAE	*Myriopholis narirostris*	Boulenger's Blind Snake	3	2	LC (S)			
NATRICIDAE	*Afronatrix anoscopus*	African Brown Water Snake	3	2	LC (S)			
NATRICIDAE	*Natriciteres fuliginoides*	Collared Marsh-Snake	3	2	LC (S)			
NATRICIDAE	*Natriciteres olivacea*	Olive Marsh Snake	3	2	LC (U)			
NATRICIDAE	*Natriciteres variegata*	Variable Marsh Snake	3	2	LC (U)			
PHYLLODACTYLIDAE	*Tarentola ephippiata*	African Wall Gecko	3	2	LC (S)			
PROSYMNIDAE	*Prosymna meleagris*	Ghana Shovel-snout	3	1	LC (U)			
PSAMMOPHIIDAE	*Kladirostratus togoensis*	Northern Sharp-nosed Skaapsteker	3	1	LC (U)			
PSAMMOPHIIDAE	*Psammophis elegans*	Elegant Sand Racer	3	1	LC (S)			
PSAMMOPHIIDAE	*Psammophis lineatus*	Lined Olympic Snake	3	1	LC (S)			
PSAMMOPHIIDAE	*Psammophis phillipsi*	Olive Grass Racer	3	1	LC (U)			
PSAMMOPHIIDAE	*Rhamphiophis oxyrhynchus*	Western Beaked Snake	3	1	LC (U)			
PYTHONIDAE	*Python regius*	Ball Python	1	2	NT (D)	x		x
PYTHONIDAE	*Python sebae*	African Rock Python	1	2	NT (D)	x		x
SCINCIDAE	*Mochlus brevicaudis*	Short-tailed Writhing Skink	2	2	LC (U)			
SCINCIDAE	*Mochlus fernandi*	Fire Skink	2	1	LC (U)			
SCINCIDAE	*Mochlus guineensis*	Guinean Forest Skink	2	3	LC (U)			

Family	Scientific Name	Common Name	LO	Guild	Status[1]	2012[2]	2021[3]	Total
SCINCIDAE	*Panaspis tristaoi*	Tristoi's Snake-eyed Skink	3	3	LC (U)			
SCINCIDAE	*Panaspis cf. togoensis*	Togo Snake-eyed Skink	1	3	-		x	x
SCINCIDAE	*Trachylepis affinis*	Senegal Skink	1	2	LC (S)		x	x
SCINCIDAE	*Trachylepis aureogularis*	Orange-throated Skink	2	2	LC (U)			
SCINCIDAE	*Trachylepis buettneri*		3	2	LC (U)			
SCINCIDAE	*Trachylepis maculilabris*	Speckled Lip Skink	2	2	LC (S)			
SCINCIDAE	*Trachylepis paucisquamis*		4	2	LC (U)			
SCINCIDAE	*Trachylepis perrotetii*	Teita Mabuya	3	2	LC (S)			
SCINCIDAE	*Trachylepis quinquetaeniata*	Five-lined Skink	3	2	LC (S)			
TYPHLOPIDAE	*Afrotyphlops lineolatus*	Common Lined Worm Snake	3	2	LC (U)			
TYPHLOPIDAE	*Afrotyphlops punctatus*	Spotted Blind Snake	3	2	LC (U)			
VARANIDAE	*Varanus exanthematicus*	Savannah Monitor	3	1	LC (U)			
VARANIDAE	*Varanus niloticus*	Nile Monitor	1p	2	LC (S)	x		x
VIPERIDAE	*Atheris chlorechis*	Green Bush Viper	2	4	LC (U)			
VIPERIDAE	*Bitis rhinoceros*	Rhinoceros Viper	3	4	LC (U)			
VIPERIDAE	*Bitis arietans*	Puff Adder	1p	1	-	x		x
TESTUDINIDAE	*Kinixys homeana*	Home's Hinge-back Tortoise	1a	4	CR (D)		x	x
PELOMEDUSIDAE	*Pelomedusa subrufa*	Marsh Terrapin	1	2	-		x	x
PELOMEDUSIDAE	*Pelusios castaneus*	West African Mud Turtle	2	2	-			
PELOMEDUSIDAE	*Pelusios gabonensis*	Gabon Terrapin	3	3	-			
PELOMEDUSIDAE	*Pelusios niger*		3	3	-			
TRIONYCHIDAE	*Cyclanorbis elegans*	Nubian Flapshell Turtle	4	2	CR (D)			
TRIONYCHIDAE	*Cyclanorbis senegalensis*	Senegal Flapshell Turtle	2	2	VU (D)			
TRIONYCHIDAE	*Trionyx triunguis*	African Softshell Turtle	2	2	VU (D)			

Key: IUCN (2021) global status, letters in parentheses indicate population trend, D= Decreasing, S = Stable, U = Uncertain. Endemicity; End = Endemic, N-end = Near Endemic. Likelihood of occurrence (LO): 1 = Present; 1a = Present Anecdotal; 1p = Present Previous Studies Only; 2 = High; 3 = Moderate 4 = Unlikely. BR: Biome Restricted. GCFB = Guinea-Congolese Forest Biome; SGSB: Sahel Grassland Savannah Biome. Source: [1]IUCN (2021); [2]Oduro and Danqhua (2012); [3]Current (2021)

Appendix 4: Present and potentially occurring amphibian species

Family	Scientific Name	Common Name	LO	Guild	Status[1]	2012[2]	2021[3]	Total
ARTHROLEPTIDAE	*Arthroleptis poecilonotus*	Mottled squeaker	1	3	LC (S)		x	x
ARTHROLEPTIDAE	*Cardioglossa occidentalis*	Western Long-fingered Frog	4	4	LC (D)			
ARTHROLEPTIDAE	*Leptopelis occidentalis*	Tai Forest Treefrog	3	4	NT (D)			
ARTHROLEPTIDAE	*Leptopelis spiritusnoctis*	Ghostly Tree Frog	1p	3	LC (U)	x		x
ARTHROLEPTIDAE	*Leptopelis viridis*	Green Tree Frog	1	2	LC (U)		x	x
BUFONIDAE	*Sclerophrys maculata*	Northern Flat-backed Toad	1	2	LC (S)		x	x
BUFONIDAE	*Sclerophrys regularis*	Common Toad	1	2	LC (S)		x	x
BUFONIDAE	*Sclerophrys superciliaris*	Cameroon Toad	2	4	LC (U)			
BUFONIDAE	*Sclerophrys togoensis*	Togo Toad	3	4	LC (D)			
DICROGLOSSIDAE	*Hoplobatrachus occipitalis*	Crowned Bullfrog	1	2	LC (S)	x	x	x
HEMISOTIDAE	*Hemisus guineensis*	Guinea Piglet Frog	2	2	LC (U)			
HEMISOTIDAE	*Hemisus marmoratus*	Marbled Piglet Frog	1	2	LC (U)		x	x
HYPEROLIIDAE	*Afrixalus dorsalis*	Striped Spiny Reed Frog	1	2	LC (I)	x	x	x
HYPEROLIIDAE	*Afrixalus nigeriensis*	Nigeria Banana Frog	2	3	LC (D)			
HYPEROLIIDAE	*Afrixalus vibekensis*	Vibeke's Spiny Reed Frog	2	3	LC (D)			
HYPEROLIIDAE	*Afrixalus vittiger*	Savanna Spiny Reed Frog	2	1	LC (U)			
HYPEROLIIDAE	*Afrixalus weidholzi*	Weidholz's Banana Frog	2	3	LC (U)			
HYPEROLIIDAE	*Hyperolius concolor*	Uniform Reed Frog	1p	3	LC (I)	x		x
HYPEROLIIDAE	*Hyperolius fusciventris*	Lime Reed Frog	1	2	LC (U)	x	x	x
HYPEROLIIDAE	*Hyperolius guttulatus*	Dotted Reed Frog	1	2	LC (U)	x	x	x
HYPEROLIIDAE	*Hyperolius igbettensis*	Igbetti Long Reed Frog	2	2	LC (U)			
HYPEROLIIDAE	*Hyperolius laurenti*	Laurent's Reed Frog	4	4	NT (D)			
HYPEROLIIDAE	*Hyperolius nitidulus*	Plain Reed Frog	1p	2	LC (S)	x		x
HYPEROLIIDAE	*Hyperolius picturatus*	Painted Reed Frog	1p	2	LC (U)	x		x
HYPEROLIIDAE	*Hyperolius sylvaticus*	Forest reed Frog	3	2	LC (U)			
HYPEROLIIDAE	*Hyperolius viridigulosus*	Green-throated Reed Frog	4	4	NT (D)			
HYPEROLIIDAE	*Kassina arboricola*	Forest Running Frog	4	4	VU (D)			
HYPEROLIIDAE	*Kassina senegalensis*	Senegal Running Frog	1p	1	LC (U)	x		x
HYPEROLIIDAE	*Phlyctimantis boulengeri*	Boulengers Wot Wot	4	4	LC (U)			
MICROHYLIDAE	*Phrynomantis microps*	West African Rubber Frog	2	1	LC (U)			
PHRYNOBATRACHIDAE	*Phrynobatrachus alleni*	Allen's Puddle Frog	2	4	LC (D)			
PHRYNOBATRACHIDAE	*Phrynobatrachus calcaratus*	Boutry Puddle Frog	1p	3	LC (D)	x		x

Family	Scientific Name	Common Name	LO	Guild	Status[1]	2012[2]	2021[3]	Total
PHRYNOBATRACHIDAE	*Phrynobatrachus ghanensis*	Ghana Puddle Frog	2	4	NT (D)			
PHRYNOBATRACHIDAE	*Phrynobatrachus gutturosus*	Chabanaud's Puddle Frog	1p	2	LC (U)	x		x
PHRYNOBATRACHIDAE	*Phrynobatrachus latifrons*	Ahl's Puddle Frog	2	2	LC (S)			
PHRYNOBATRACHIDAE	*Phrynobatrachus liberiensis*	Liberia Puddle Frog	2	2	LC (D)			
PHRYNOBATRACHIDAE	*Phrynobatrachus natalensis*	Snoring Puddle Frog	1	1	LC (S)		x	x
PHRYNOBATRACHIDAE	*Phrynobatrachus phyllophilus*	Leaf-loving Puddle Frog	2	2	LC (D)			
PHRYNOBATRACHIDAE	*Phrynobatrachus plicatus*	Ridged Puddle Frog	1	3	LC (U)	x	x	x
PHRYNOBATRACHIDAE	*Phrynobatrachus villiersi*	Villier's Puddle Frog	3	3	LC (D)			
PIPIDAE	*Xenopus tropicalis*	Tropical Clawed Frog	2	3	LC (S)			
PTYCHADENIDAE	*Ptychadena aequiplicata*	Victoria Grassland Frog	2	1	LC (D)			
PTYCHADENIDAE	*Ptychadena bibroni*	Broad-banded Grass Frog	1	2	LC (U)		x	x
PTYCHADENIDAE	*Ptychadena longirostris*	Snouted Grass Frog	2	1	LC (U)			
PTYCHADENIDAE	*Ptychadena mascareniensis*	Mascarene Grass Frog	2	1	LC (U)			
PTYCHADENIDAE	*Ptychadena oxyrhynchus*	Sharp-nosed Grass Frog	2	1	LC (S)			
PTYCHADENIDAE	*Ptychadena pumilio*	Western Dwarf Grass Frog	2	2	LC (U)			
PTYCHADENIDAE	*Ptychadena tellinii*	Tellini's Puddle Frog	2	2	LC (U)			
PTYCHADENIDAE	*Ptychadena tournieri*	Tournier's Grass Frog	2	2	LC (U)			
PYXICEPHALIDAE	*Aubria occidentalis*	West African Brown Frog	3	4	LC (U)			
RANIDAE	*Amnirana albolabris*	White-lipped Frog	1	3	LC (U)		x	x
RANIDAE	*Amnirana galamensis*	Galam White-lipped Frog	3	1	LC (U)			
RANIDAE	*Amnirana occidentalis*	Western White-lipped Frog	3	3	LC (D)			
RHACOPHORIDAE	*Chiromantis rufescens*	African Foam-nest Treefrog	3	1	LC (U)			
DERMOPHIIDAE	*Geotrypetes seraphini*	Gaboon Caecilian	2	3	LC (D)			

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