BIODIVERSITY ACTION PLAN

Ghana Rubber Estates Limited

Biodiversity Action Plan

Prepared for GREL

By

Gregory Mensah
(Land Use Manager)

Ghana Rubber Estates Limited

June, 2016

COMPANY PROFILE

Registered Name of Company	Ghana Estates Rubber Limited
Type of Undertaking	Agro Industrial
Head of the Organization	Managing Director
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Contact Person/s	Mr. Lionel Barre/Kwadwo Wiafe Tenkorang
Position/s	Managing Director/Estates Manager

Locations of Undertaking

a) Plot/House No:

b) Zoning Status:

c) Region: Western, Central and Eastern Region

d) Area Name: Apimenim

c) Town: Apimenim, Awudua, Subri, Agona Abrem, Okurase and Asikasu

e) District(s): Ahanta West, Nzema East and Tarkwa – Nsuaem, Prestea-Huni Valley KEEA and Upper West Akyem

Biodiversity Committee Members

Sn	Names	Designation	Department
1	Kwadwo Wiafe Tenkorang	Estates Manager	Estates
2	Perry Acheampong	Cooperate Affairs Manager	Cooperate Affairs
3	Gregory Mensah	Land Use Manager	Nucleus
4	Benjemin Bentil	Survey Manager	Survey
5	Kwaku Bediako Ansong	Land Preparation Manager	Nucleus
6	Akwasi Apau Boakye	Sustainability Manager	HR
7	James Nii A Adoboye	Nucleus Operations Manager	Nucleus
8	Joseph Adu-Boahen	Nucleus Operations Manager	Nucleus
9	Alihu Issah	Technical Training Manager	DTC

Approved By:

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Designation

_____

Signature, Stamp and Date

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TABLE OF CONTENTS

1.0 RATIONALE AND BACKGROUND INFORMATION

Natural resources are of great importance to millions of people, especially those whose livelihoods largely depend on them. These resources play a key role in protecting the environment and are of tremendous importance to the sustainable development. Recognizing the importance of natural resources and the need for appropriate measures to optimize their management and utilization in Ghana, Ghana Rubber Estates Limited (GREL), into natural rubber development is developing this baseline information for biodiversity conservation and management on its field operational areas that can then be used to guide future planning and development. There is also a growing imperative that all public and private bodies, including companies to plan for and consider biodiversity on their operational areas listed in the latest Sustainable Development Goals (SDGs). SDG 15 seeks to protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss. Hence the target for all private and public bodies to integrate ecosystem and biodiversity values into national and local planning and development processes by 2020.

It is always stated that most of the biodiversity policies developed at the national level by governments have failed to address the fundamental challenges of forest management in the country. Their implementation, with all the associated reforms could not halt the degradation in the forest resource base. Indeed, some forest reserves are well-managed, but others may have been over-harvested and off-reserve forests are often unregulated.

In addition, many managed biodiversity reserves are without management plans. As a result, illegal chainsaw and small-scale mining (G*alamsey*) operations in forest areas have thrived over the years despite conscious national efforts to curb the situation in collaboration with the security agencies. Wood fuel production and Game hunting especially in some fragile areas has remained unsustainable. Though it has significantly reduced in some areas, wildfires continue to be an annual occurrence in most of the ecosystems.

With regards to ecosystem management, GREL seeks to implement the SIFCA rules on biodiversity preservation on its operational areas. The rules are:

- Preserve biodiversity as in the policy (Estate and ROU).
- Preserve at least 10% of new concessions (original ecosystem)
- No conversion on excessive slopes and along water bodies
- Promote the development of fallow lands
- Combat against poaching, illegal logging and forest fires

In line with these directions, Public Agencies, Independent organizations, Consultancies and academic research institutions has supported the company to prepare this management plan for the biodiversity maintenance, enhancement and monitoring.

In light of this management plan, an ecological surveys (High Conservation Value and Biodiversity assessments) were commissioned in 2012 (Nucleus by Takoradi Renewable Energy Limited, TREL – **annex 2**), 2014 (Awodua by Proforest – **annex 3**) and 2016 (Eastern Region by Proforest – **annex 4**) with the aim of documenting the current habitat provision and outlining areas where improvements could be made to enhance biodiversity on the company's operational areas. The ecological survey provided the necessary baseline information for the creation of this Biodiversity Action Plan (BAP). The field BAP demonstrates a commitment on the part of the company to prioritize biodiversity in its plantation management. It provides the basis for a coordinated approach and provides research opportunities and the chance to engage researchers and students with the management of natural resources. The BAP will improve information gathering, recording and monitoring, and ultimately, if recommendations are implemented, enhance the biodiversity values of the company's plantations and its immediate surroundings.

The BAP seeks to fulfill the following objectives:

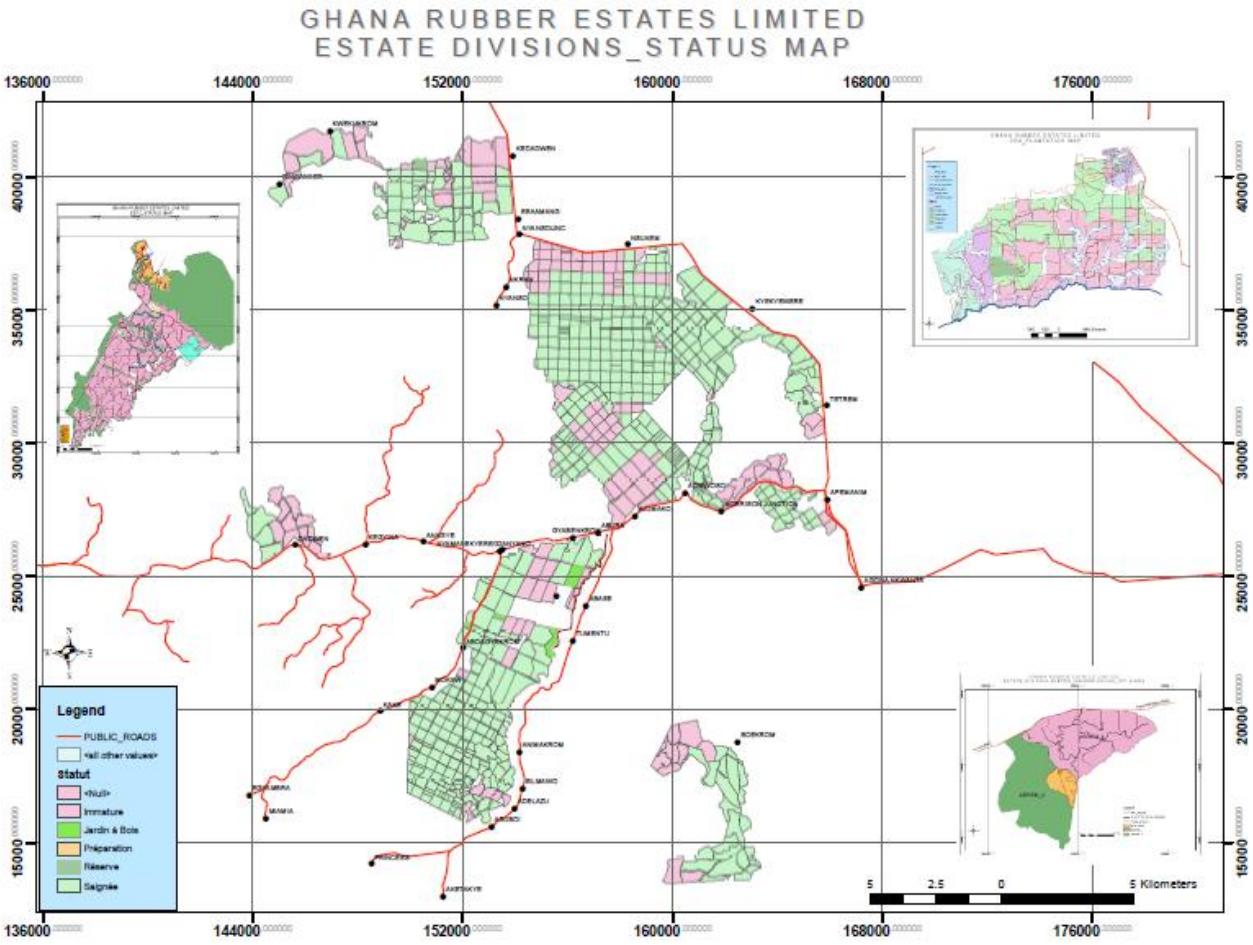
- To raise awareness of biodiversity on GREL's operational areas and the need to maintain and enhance it.
- To maintain and enhance biodiversity on GREL's operational areas through the implementation of the species and habitat action plans.
- To engage GREL staff, consultancies and educational institutions in biodiversity projects and initiatives that will enhance the experience of all.
- To provide a new teaching resource or platform for University departments that deal with biodiversity conservation and wildlife.

1.1 Biodiversity Action Planning

For the purpose of this report we define the term biodiversity as everything that contributes to variety in the living world. This includes variety in habitats (e.g. grassland and forest woodland) as well as diversity in species. Biodiversity is important because of the essential contribution that it makes to the functioning of our planet and because of all the benefits that it provides, from foods and medicine to climate regulation. Contact with biodiversity and the natural world has also been linked to improvements in health and emotional well-being.

Concerns about the loss of biodiversity as a result of human activities have been growing since the 1960s. The first United Nations Earth Summit was held in Rio de Janeiro in 1992 where governments came together to find ways of halting the damage being done. At this summit Ghana signed up to the Convention on Biological Diversity which committed Ghana to develop

plans and programmes for the conservation and sustainable use of biodiversity. In 2002, the Ministry of Environment and Science published the National Biodiversity Strategy for Ghana. The strategy rolls out biodiversity types, biodiversity inventories and challenges for Ghana, and identifies important habitats and species in need of protection. The strategy has since been followed somehow to protect and enhance national biodiversity or forest reserves. A similar strategy is being planned in GREL to identify important habitats and species in need of protection within GREL concessionary lands.



Status map of GREL concessionary lands of ED1 to ED 12

1.2 Ghana Rubber Estates Limited (GREL) Biodiversity Action Plan

GREL's BAP is comprised of a number of species action plans (SAPs) that cover key species groups and a habitat action plan (HAP) that covers key habitats for which biodiversity action is recommended on the field. Species and habitats selected for biodiversity action are those which are included in the IUCN red-list and Ghana Restricted species list or those for which greater provision on the field could considerably enhance their local conservation. Each action plan will

provide background information on the biology and current status of the species and habitats before summarizing proposed objectives and actions.

Biodiverse Swampy and Woodland areas within the Nucleus and the Awodua plantations

2.0 GREL SPECIES ACTON PLAN

The Species Action Plan (SAP) is based on the International Union on Conservation of Nature (IUCN) Redlist of species and the Ghana Wildlife conservation Regulations (1995)

2.1 Ghana Wildlife Conservation Regulations (1995)

The following categories have been developed:

(1) Schedule 1 – the hunting, capturing or destroying of any species listed in this schedule is absolutely prohibited.
(2) Schedule 2 – the hunting, capturing or destroying of any species listed in the schedule is absolutely prohibited between 1 August and 1 December in any year. The hunting, capturing or destroying of any young or adult accompanied by his young of any specie listed in this schedule is absolutely prohibited at all times.
(3) Schedule 3 – the hunting, capturing or destroying of any species listed in the schedule is absolutely prohibited between 1 August and 1 December in any year.

2.2 Species Action Plan: Birds

The Birds SAP seeks to enhance the habitat provision for a wide range of birds that occur on the field in GREL's operational area. Particular attention is paid to the following six species, all the six are classified as Ghana's Wildlife Schedule 1 priority species, meaning their hunting; capturing or destroying is absolutely prohibited, though they are of Least Concern (LC) under the IUCN Red list status. All the 6 species are residence in the Awodua forest and the forest is suited to provide nesting habitat:

- *Great White Egret* (Egretta alba)
- *Long-crested Eagle* (Lophaetus occipitalis)
- *Black Sparrowhawk* (Accipiter melanoleucus)
- *African Goshawk* (Accipiter tachiro)
- *Black Kite* (Milvus migrans)
- *African Hobby* (Falco cuvierii)


African Goshawk


Black Kite

2.2.1 Objectives and actions

2.2.1.1 Objective

To preserve existing species populations and undertake measures to raise numbers within the Awodua forest and surrounding landscape.

2.2.1.2 Actions

1. Baseline survey and subsequent monitoring of bird species in the Awodua forest and surrounding landscape, in particular the six target species

Strategy: Annual bird survey with staff/student from educational institutions (KNUST, UG, UCC etc). The Land Use Manager and team from GREL will be involved in bird survey.

Responsible partners: Land Use Manager and Team to co-ordinate with student groups.
Target date: August/September on yearly basis.

2. Raise awareness of birds and other forest product especially on the Awodua forest and the need for their conservation

Strategy: Advertisement on GREL News, Infoboard and erecting of communication signboards along the forest.

Responsible partners: LUM and Team
Target date: on-going

3. Relaxation of management in appropriate areas of GREL's concessions to allow development of taller trees and scrub.

Strategy: (1) To create and position signs along some forest reserves to raise awareness of conservations and forest management (2) Identify locations during land preparation where taller trees and scrub vegetation could be encouraged by avoiding the cutting of one tall tree within every 25 -50 ha land cleared for planting.

Responsible partners: (1) LUM and Site or Divisional Managers (2) Grounds team (Survey and Land prep.)

Target date: January 2016 for S1 and September to April, yearly for S2

4. Increase the planting of native tree and shrub species to include seed and fruit bearing species in degraded areas of the forest reserve in Awodua.

Strategy: Commence native tree planting schemes, identify and include seed and fruit bearing species for inclusion

Responsible partners: Grounds team (LUM team including survey)

Target date: to be anticipated and budgeted for 2017, to get idea of cost

The above strategies will be very appropriate and significant for these bird species because most of the birds are known to be prey species, there tall tree management within the concessions will enhance bird perching and subsequent relaxation for preying.

2.3 Species Action Plan: Mammals

The Mammals SAP seeks to enhance the habitat provision for a wide range of mammals (large and small) that occur on the GREL's concessions especially within the forest reserves and buffer zones. Particular attention is paid to two Ghana Wildlife Schedule 1 priority species because of their significant numbers within the Awodua concession, and also the Near Threatened and important mammal (Tree Pangolin) according to their status on the IUCN Red-list for which the Awodua concession can provide suitable habitat:

1. Tree Pangolin (NT and WD schedule 1)
2. Demidoff's Galago (LC and WD schedule 1)
3. Maxwell's Duiker (LC and WD schedule 2)

2.3.1 Biology, current status and declines

2.3.1.1 Tree Pangolin *Phataginus tricuspis*

The pangolin is a unique-looking mammal. From the skinny, insect-seeking nose to the end of the scaled tail, the pangolin looks like an anteater from outer space. Pangolins are sometimes called scaly anteaters, but they aren't related to anteaters. They are mammals in a family of their own. Instead of having hair or quills, the pangolin has overlapping scales that feel a bit like our fingernails. The scales are made of keratin, like our fingernails. They grow at the base and wear down at the tip as the animal brushes up against branches and tree trunks. The scales are light and thin, with sharp edges, and are attached at the base to the pangolin's thick skin. These scales cover most of the pangolin's body, except for the belly, snout, eyes, and ears. They can be dark brown to dark olive-brown, pale olive, or yellowish-brown. Flat scales cover the top of the pangolin's head and tail. The pangolin's belly and face has soft, pale hairs. Its head is small and pointed, and its tail is longer than its body. Like other animals that dine on ants and termites, pangolins have no teeth.

The Tree Pangolin (*Phataginus tricuspis)*

There are eight pangolin species. Tree pangolins live in the rain forests of Central and part of West Africa. They are classified **as Near-Threatened (NT) according to the IUCN red-list and belong to the Ghana Wildlife schedule 1.**

Tree pangolins are solitary and nocturnal. As their name suggests, they spend most of their time in trees, using hollow trees for shelter. Tree pangolins have a prehensile tail that helps them hang on to tree branches. The tip of the tail is bare, to give the animal an extra grip.

When strolling along branches or on the ground, pangolins curl their claws underneath their feet and walk on their knuckles, shuffling along. They are slow moving and often walk on the hind legs, using the tail as a brace. Pangolins are often seen standing up on the hind legs to sniff the air, using their keen sense of smell to locate their insect food.

2.3.1.2 Demidoff's Galago *(Galago demidovii)*

The Demidoff's Galago is listed as **Least Concern (LC)** as the species is widespread and common, present in a number of protected areas throughout the range, and there are no major threats

Demidoff's Galago

This species has been recorded from Sierra Leone in the west through southern parts of West Africa and throughout Central Africa, to possibly as far east as north of Lake Victoria in Uganda and Tanzania, west of Lake Victoria. It is found as far south as the southern Congo Basin (Democratic Republic of the Congo) and Lunda District (Angola), and possibly as far south as the Lukuga River in the east.

In terms of habitat and ecology, the species is associated with the understory of secondary forest and forest edge habitats. It is also present in primary tropical moist forest, particularly in tree-fall zones. It sleeps in small groups of up to 10 individuals. It appears to be restricted to dense undergrowth with fine branches. It gives birth to one or two young per year.

This species is presumably locally threatened by habitat loss through deforestation for timber and conversion to agricultural land and they occur in several protected areas such as the Awodua conserved forest.

2.3.1.3 Maxwell's Duiker *(Cephalophus maxwelli)*

The majority of antelope are native to Africa, but there are some species living in the Middle East and Asia. They are though classified **as Least Concern (LC) according to the IUCN red-list but belong to the Ghana Wildlife schedule 2.** Most live in open grasslands, but the smaller duikers, most sunis, and royal antelope live in Central Africa's rain forests or wooded areas, dik diks live in arid bush country with heavy vegetation, and mountain sunis dwell in the highland

forests of southern Kenya. Waterbuck, as their name suggests, and lechwe are never far from water.

Maxwell's Duiker

Antelope must always be on the lookout for danger, as they make a hearty meal for many predators— leopards, lions, civets, hyenas, wild dogs, cheetahs, and pythons—depending on species and location. Large birds of prey may take young calves. But antelope do have some ways to keep safe. When a Maxwell's duiker sense danger; it freezes, often with one leg off of the ground, so as not to be noticed. Alarm calls: Maxwell's duikers use two vocalizations: an alarm whistle and a loud bleat.

Antelope calves have two survival strategies: hide out to avoid predators or start traveling right after birth to join the protection of the herd. The majority of antelope use the hiding approach, including roan antelope, waterbuck, klipspringer, and duikers. In some species that live in groups, the mother, called a dam, goes away from the herd to give birth, and when the calf is strong enough, she moves it to another location where there are bushes, long grass, rocks, or a thicket to hide the youngster from predators.

2.3.2 Objectives and actions

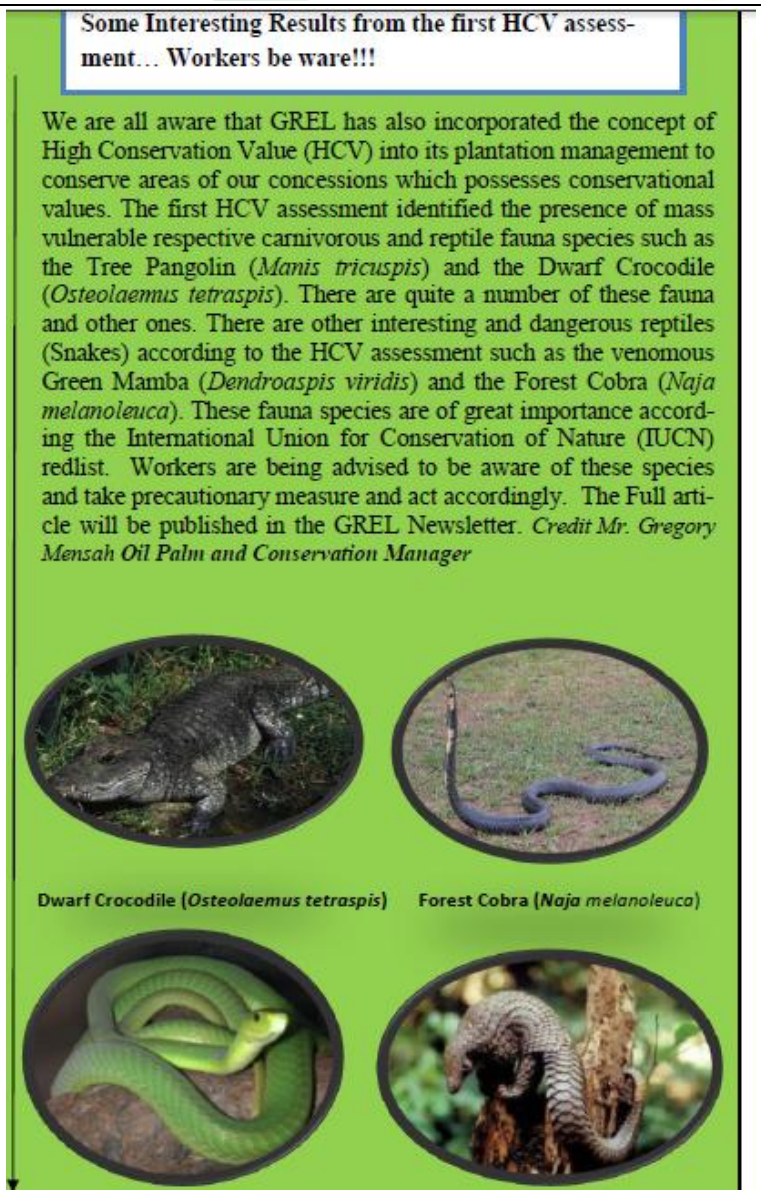
2.3.2.1 Objective

To preserve existing mammal populations and undertake measures to raise numbers within the Awodua Forest and surrounding landscape (Tree Pangolin, Demidoff's Galago and Maxwell's Duiker).

2.3.2.2 Actions

1. Baseline survey and subsequent monitoring of mammal species in Biodiversity plots and other Reserved forest in particular the three target species **Strategy:** (1) Instigate annual surveys in the above habitats with local fauna experts and/or students and volunteers. **Responsible partners:** LUM and Biodiversity committee **Target date:** Annually

2. Raise awareness of especially Threatened and Vulnerable mammals among GREL staff and its stakeholders on the need for the conservation of these mammals. **Strategy:** Advertisement on Fauna conservations in magazines (GREL News and weekly Info-boards) **Responsible partners:** LUM and communication team from the HR department **Target date:** on-going.



An example of awareness creation in GREL's info-board

3. Raise awareness of especially Threatened and other vulnerable mammals within GREL's concessions and surrounding communities on the need for the conservation of these mammals.

Strategy: To create and position signs along the company's reserved forest and buffer zones to raise awareness of need for no hunting, mining, illegal tree felling etc;

Responsible partners: LUM Grounds team

Target date: February 2016

Erected Sign boards for awareness creation in GREL's Concession (Awodua)

4. Increase the planting of native tree and shrub species to include seed ad fruit bearing species.

Strategy: Plan on native tree planting schemes with local Timber firms, identify and include seed and fruit bearing species for inclusion

Responsible partners: LUM and Biodiversity committee

Target date: Yet to plan and start

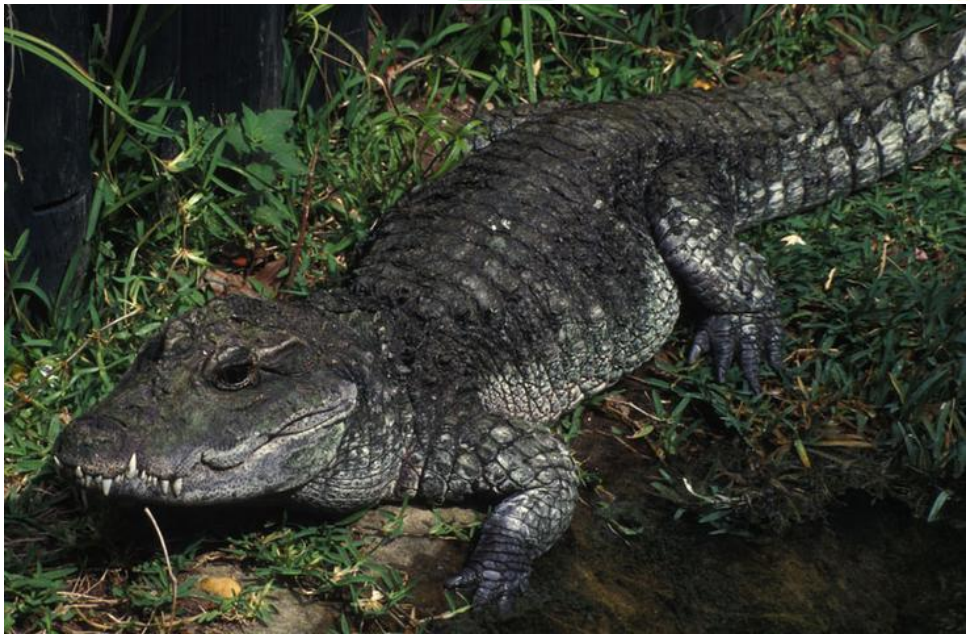
2.4 Species Action Plan: Heptofauna (Amphibians and Reptiles) and Fishes

The Heptofauna SAP seeks to enhance the habitat provision for amphibians and reptiles that occur, or could occur, on GREL's concessions. Particular attention is paid to the following three Ghana Wildlife conservation Schedule 1, 1 and 2 respective species, though are considered Least Concern (LC) when it comes to the IUCN redlist, except the Dwarf crocodile which is classified as Vulnerable (VU).

2.4.1 Biology, current status and declines

2.4.1.1 Dwarf Crocodile *(Osteolaemus tetraspis)*

According to the red list category and criteria, this species is classified as **Vulnerable (Vu).**



This species are natives of and has been recorded in Angola; Benin; Burkina Faso; Cameroon; Central African Republic; The Democratic Republic of Congo, Côte d'Ivoire; Gabon; Gambia; Ghana; Guinea; Guinea-Bissau; Liberia; Nigeria; Senegal; Sierra Leone and Togo. In terms of habitat and ecology, they prefer Terrestial nest sites and basking systems.

2.4.1.2 ***Monitor Lizard*** **(***Varanus niloticus)*

This species has not been assessed yet by the IUCN red list, however, the Nile Monitor lizard is a native of most Western and Eastern and Central African nations.

2.4.1.3 **Rock Python *Python sebae***

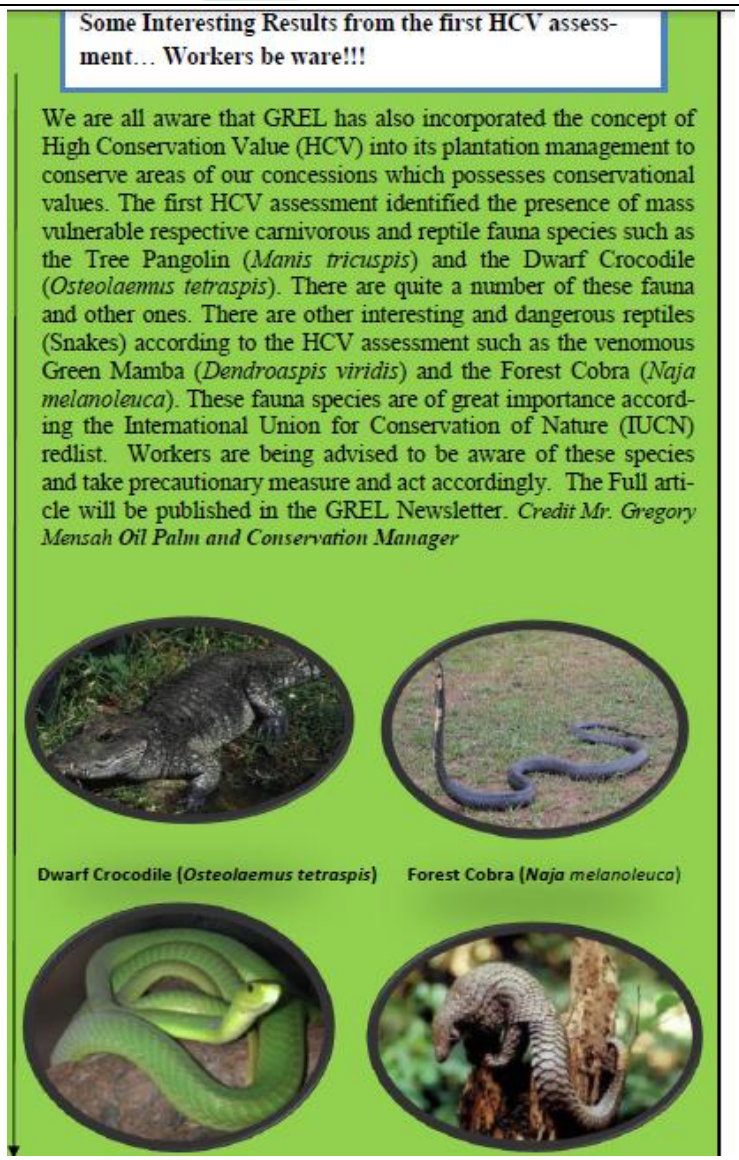
2.4.2 Objectives and actions

2.4.2.1 Objective

To undertake measures to encourage amphibians and reptiles on GREL's concessions

2.4.2.1 Actions

1. Raise awareness of Heptofauna and the need for their conservation **Strategy:** Advertisement on Fauna conservations in magazines (GREL News and weekly Info-boards) **Responsible partners:** LUM **Target date:** On-going



An example of awareness creation in GREL's info-board

2. Maintain and enhance HCV wetlands and Swamps as habitat which is favourable for these species.

Strategy: Seek opportunities for the enhancement of wetland habitat in all concessions particularly new developments; explore potential for integrating surface water management with biodiversity objectives.

Responsible Partners: LUM and Biodiversity committee

Target date: on-going

3. Prevent the spraying and application of respective chemical pesticide and fertiliser into water bodies and/or swamps to prevent the reduction of fish populations in the company's water bodies.

Strategy: Continued to implement the Buffer zone width demarcations along all water bodies during land conversion.

Responsible partners: LUM and Biodiversity Committee

Target date: On-going

4. Encourage the planting natural snake repellants such Marigold, Rosemary, wormwood, garlic etc around all workers camps and bungalows to prevent the threat of snakes in workers residences.

Strategy: Search and buy some of the plants and distribute to workers camps and bungalows for planting (to be budgeted in 2017 conservation budget).

Responsible partners: LUM and Biodiversity Committee

Target date: December 2017

2.5 Species Action Plan: Invertebrates

The invertebrates SAP aims to enhance the habitat provision for a wide range of invertebrate species on the field especially the oil palm planting areas. Invertebrates are often underrepresented within the biodiversity planning process in Ghana.

Invertebrates are the most numerous and diverse species on Earth, making up at least 65% of all species on the planet. They include insects, spiders, snails, woodlice, worms, millipedes and centipedes, false scorpions, mites and earthworms. They perform a range of vital functions within ecosystems such as pollination and decomposition, and are also essential prey for many bird, mammal and amphibian species. Invertebrates can be encouraged by the provision of an array of microhabitats on including ponds, compost heaps, rockeries, flower borders and shrubberies.

Many invertebrates feed and shelter on plant stems and leaves and it is important to maximize the complexity of vegetation structure by ensuring a range of vegetation cover at different heights, from ground cover through to tall tree canopies. They will also benefit from a variety of plant growth forms such as grasses, herbs, shrubs and trees. Planting native species is likely to encourage a greater range of herbivorous invertebrates. For pollinating insects such as bees, hoverflies and butterflies, it is ideal to maximize the provision of flowers throughout the season, and many exotic species are important sources of pollen and nectar early and late in the season.

Although little is known about the population status of many invertebrates, surveys of the more charismatic groups such as butterflies and bees suggest that they are experiencing declines. The plight of the honey bee *Apis mellifera* has been particularly well documented in recent years, but many of the lesser known wild bees, including bumblebees and solitary bees, have also declined. Overall, in GREL it is estimated that at least 33 butterfly species representing about 4% of the number of species in Ghana and none was identified to be part of the 23 endemic species in Ghana. However, bee species were rarely recorded during the biodiversity inventory assessment.

2.5.1 Objective and actions

2.5.1.1 Objective

To preserve existing invertebrate populations and undertake measures to raise numbers within GREL's concessionary landscape.

2.5.1.2 Actions

1. Give preference to native and flowering plants in planting schemes to maximise their value to plant-feeding invertebrates especially in the buffer zones and wetlands.

2. Manage well the complexity of vegetation structure that exists within the forest patches and buffer zones.

Strategy: Training for biodiversity Grounds team to prevent the destruction of buffer zones; adapt planting plan (restoration plant) to incorporate the above actions especially in the degraded forest areas.

Responsible partners: Grounds team (with input from external Biodiversity experts)

Target date: on-going and must continue in every clearing for development

Papilio butterfly feeding on Pueraria (cover crop) in the plantation

3. Install invertebrate nest sites at suitable locations especially areas close to oil palm plantation on the field, e.g. 'bee hives'

Strategy: Identify suitable locations and install invertebrate nest eg bee hives

Responsible partners: LUM and ground team

Target date: Site identification in March 2016 and installation in May 2016 and beyond.

A Beehive sited in a Biodiversity plot in Awodua

4. Continue promoting sustainable management practices and manage pesticide and fertiliser use especially at the interface between the plantation and original ecosystems. This is to increase the number of invertebrate.

Strategy: Continued use of recommended buffer zones during chemical spraying; continued low use of Environmental Protection Agency (EPA) recommended agro-chemicals

Responsible partners: LUM team and Plantation Managers

Target date: On-going

5. Manage well all mapped out wetland habitat on the field, including ponds and dams, to provide habitat for aquatic invertebrates such as dragonflies, damselflies, water beetles and pond/dam snails.

Strategy: Seek opportunities for the creation of new wetland habitat on the field particularly as part of new developments; explore potential for integrating the surface water (nursery dams) management with biodiversity objectives.

Responsible Partners: Plantation staff including the Nursery staff

Target date: on-going

2.6 Habitat Action Plan (HAP)

GREL HAP seeks to enhance the management of existing habitats on the field for biodiversity and to encourage the creation of new habitats to maximize their wildlife provision. Four broad habitats have been included in the action plan:

1. Forest Patches
2. Buffer Zones
3. Wetland
4. Other Biodiversity Plots including Sanctuary grooves, totems, etc

The current distribution and condition of each of the habitats mentioned above will be summarized below including their biodiversity objectives and actions.

2.6.1 Forest Patches

Forest patches that contain very biodiverse characteristics are conserved after consensus among the biodiversity committee during lad preparation to serve as habitat for the surrounding mammals and other fauna spp.

Reserved Forest patch within the Awodua (ED12) plantation

Actions

1. Identify all suitable forest within land prep demarcated areas, especially those that can serve an ecological function to nearby flora and fauna spp.

2. Demarcate forested areas in the form of a corridor to maximize their connectivity and value to fauna spp.

Strategy: Seek opportunities for demarcating biodiverse habitats as part of new developments; explore potential for integrating with biodiversity objectives.

Responsible Partners: Biodiversity committee and Plantation staff

Target date: Yearly, during land conversion and during HCV assessments

2.6.2 Buffer Zones

Buffer zones are areas created to enhance the protection of a specific conservation area usually water bodies in GREL, often peripheral to the water body. Within buffer zones, resource use may be legally or customarily restricted, often to a lesser degree than in the adjacent protected area so as to form a transition zone. A buffer zone can also be designated as a protected area and be assigned an IUCN Management Categories depending on the conservation objective.

The technique of surrounding a protected area with other protected and non-protected areas allows for the creation of a gradient of protection around the core site. Buffer zones are therefore an important part of conservation strategies for a wide variety of sites of biodiversity importance in particular water bodies running through GREL's concessions. Furthermore, buffer zones have been suggested as a particularly suitable practice for climate change mitigation, as they may facilitate the shifting of populations from reserves to adjacent lands according to the climatic needs of species.

Buffer zone demarcated and reserved in the Awodua Plantation

A buffer zone can also be managed as an area for research to develop approaches for sustainable use of resources, for ecosystem restoration, education and training, as well as carefully designed tourism and recreation activities.

Buffer zones may not be sites of active biodiversity conservation, but their establishment provides an additional layer of protection to existing areas of biodiversity importance, and they are often fundamental to achieving conservation of those areas.

Actions

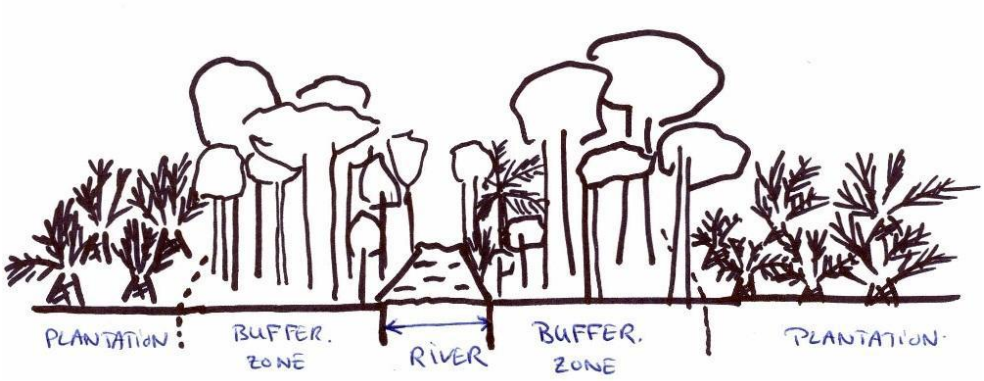
1. Identify all water bodies, especially those that can serve an ecological function to nearby Rivers and streams

2. Demarcate buffer zones in the form of a natural corridor to maximize their connectivity and value to mammals and other fauna spp.

A minimum distance of recommended buffer zone is to be maintained between plantation operations and water bodies including all water bodies and the dams as shown in the table below and also in the biodiversity conservation measures in **annex 5**.

These recommendations are based on an HCV assessment carried out by PROFOREST in collaboration with the buffer zone policy for managing fresh water in Ghana.

Water body Type	Width of River body	Recommended Buffer zone width
Major perennial rivers	>20m	60 m
Minor perennial rivers	5<w<20	20 m
Seasonal streams/ small streams	<5	10 m



Strategy: Seek opportunities for the demarcating buffer zones along all water bodies as part of new developments and during replanting; explore potential for integrating surface water management with biodiversity objectives.

Responsible Partners: Biodiversity committee and Plantation staff

Target date: Yearly, during land conversion

2.6.3 Wetland

Wetland is currently one of the predominant reserved habitats on GREL's concessions. Wetland ecosystems promote and host enormous amount of organisms ranging from heptofauna to invertebrates to fishes.

Actions

1. Identify all suitable wetlands and reserve them, especially those that can serve an ecological function to nearby Rivers and streams

2. Demarcate wetlands in the form of a corridor to maximize their connectivity and value to amphibians and other organisms

3. Integrate biodiversity requirements into a surface water management.

Strategy: Seek opportunities for demarcating wetland habitat as part of new developments; explore potential for integrating surface water management with biodiversity objectives.

Responsible Partners: Biodiversity committee and Plantation staff

Target date: Yearly, during land conversion

Wetland located within the Awodua Plantation

2.6.4 Other Biodiversity Plots for Cultural heritages

These are sites usually classified to be among the World Heritage List as determined by its outstanding cultural or traditional value. Cultural values are obtained for a site when the site both i) contains necessary attributes which will contribute to meeting the High Conservation Value (HCV) criteria six (on cultural heritages), and ii) meets conditions of integrity (and a condition of

authenticity in relation to cultural sites). These sites are usually identified and mapped out during HCV assessments by a third party (normally Proforest for GREL).

The condition of integrity is a measure of the wholeness and intactness of the site's heritage and its attributes that is established when an adequate and long term protection and management system are in place to ensure its safeguarding.

Mapped out sacred Grove located at Estates Division 4 near Tetrem

Actions

1. Identify all suitable areas that meet HCV 6, especially those that can serve as a cultural or traditional function to nearby communities.

2. Demarcate and map out these areas from conversion during land development.

Strategy: Seek opportunities for the demarcating cultural sites as part of new developments; explore potential for integrating these areas with biodiversity objectives.

Responsible Partners: Land Use Manage and HCV Assessors

Target date: During HCV assessments

3.0 BENEFITTING FROM BIODIVERSITY

Managing biodiversity within plantation development will bring a wide range of benefits beyond those for wildlife *per se*. In addition to enhancing the diversity of habitats and species, an attractive natural environment can contribute to human physical and mental well-being. Engaging staff and institutions in biodiversity projects on the field can encourage a sense of ownership and belonging, and provide opportunities for partnerships with the local community. From a financial perspective, managing land for biodiversity rather than intensive agriculture can result in considerable cost savings.

3.1 Health and well-being

There is a wealth of scientific research that links the quality of the environment to human health and well-being (e.g. Tzoulas *et al* 2007). Physically, human health can be improved by the presence of trees that provide urban ecosystem services such as a reduction in air pollution. Moreover, physical exercise can be encouraged through participation in practical conservation tasks such as tree planting. Mentally, exposure to natural environments can promote emotional well-being by reducing stress and increasing attention.

3.2 Educational opportunities

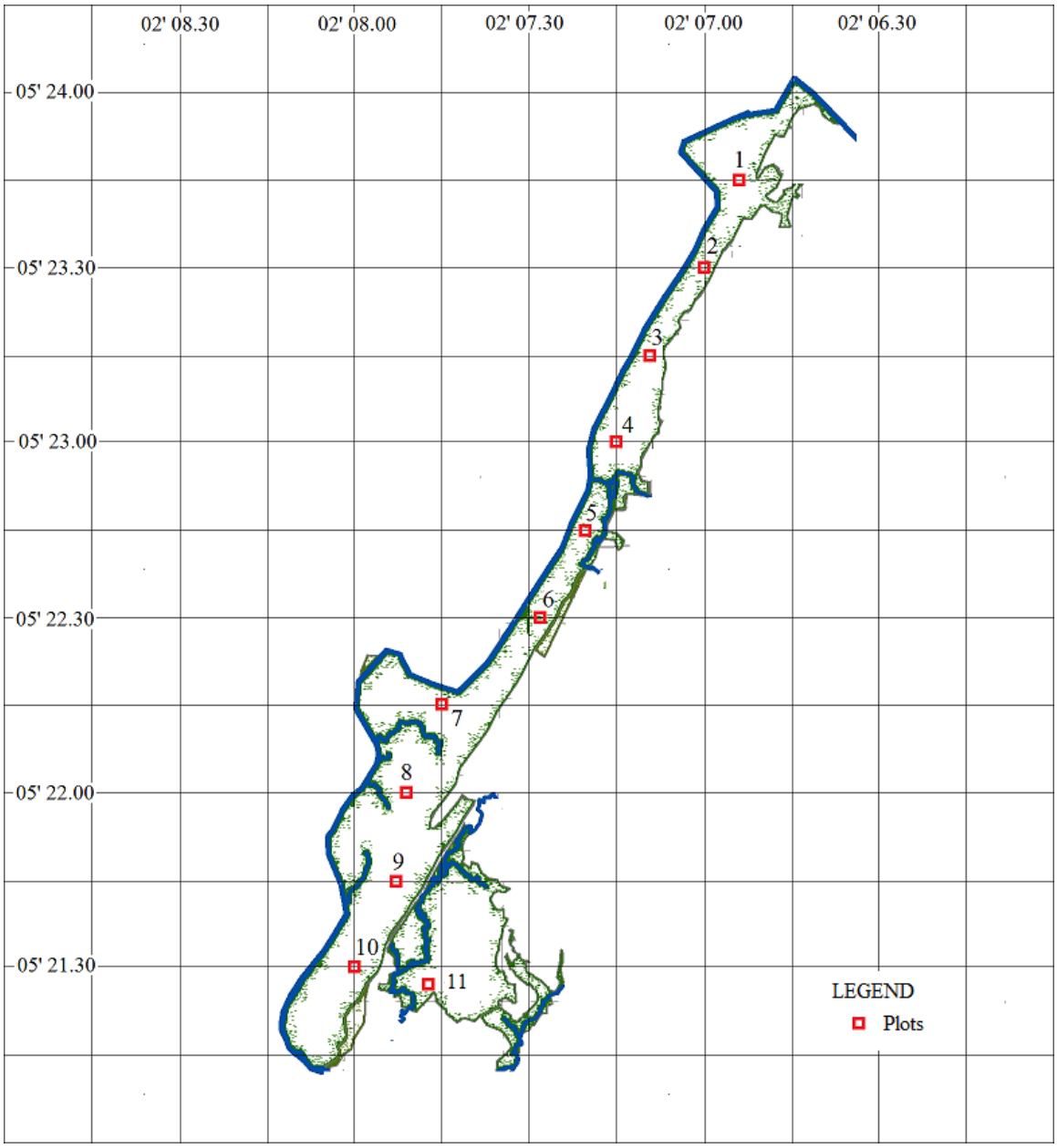
The BAP is an ideal opportunity for GREL to become both an interactive learning environment for students and a superb teaching resource for students studying on Biodiversity, Ecosystems, Wildlife and Rangeland. The need for continued ecological survey and monitoring of target species could be met by incorporating BAP objectives into the plantation development plan. Engaging educational institutions with the BAP process would help them develop fieldwork skills in surveying and assessment techniques, and also provide experience of nature conservation planning. Biodiversity initiatives can also play an important role in emphasizing broader environmental and sustainability issues, and will enhance environmental awareness and personal responsibility amongst students. The BAP will also offer opportunities for informal learning for both GREL staff via habitat interpretation panels and conspicuous features such as mammal footprints.

4.0 BIBLIOGRAPHY

Tzoulas K, Korpela K, Venn S, Yli-Pelkonen V, Kazmierczak A, Niemela, J. and James P (2007) *Promoting ecosystem and human health in urban areas using Green Infrastructure: A literature review*. Landscape and Urban Planning 81, 167-178

5.0 ANNEX

Annex 1. Map of the Awodua Reserved Forest



Annex 2 HCV Assessment Report of the Nucleus Plantations

Annex 3 HCV Assessment Report of Awudua Concession

Annex 4 HCV Assessment Report of the Easter Region Concessions

Annex 5 The SIFCA Group Biodiversity Conservation Measures

Annex 6 Awodua Biodiversity Study Report