REPUBLIC OF SIERRA LEONE

Fifth National Report to the Convention on Biological Diversity

Submitted by Environment Protection Agency Sierra Leone

on behalf of

The Government of Sierra Leone

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GOVERNMENT OF SIERRA LEONE
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FOREWARD

Sierra Leoneans are becoming increasingly aware of the inextricable relationship that exists between our survival and way of life on the one hand and biodiversity on the other. We are aware that our prosperity and economic development, welfare, spirituality, tradition and culture, health and food security can only thrive in a healthy environment. To this end, environmental sustainability and the protection of wildlife, forests and our water, air and land are embedded in our constitution, legislation, policies, political agenda and regulations. It was for this reason that Sierra Leone joined the rest of the world in signing and ratifying the United Nations Convention on Biological Diversity that seeks to conserve species, genes, habitats and ecosystems, ensure the wise use of biological resources and access to benefit sharing of our genetic resources in the first place; and is also committed to providing updates on the status of the nation's implementation of the provisions of the CBD. It was for this reason that national focal points were set up for the CBD secretariat and that the Department of Forestry in the Ministry of Agriculture, Forestry and Food Security (MAFFS), and the Ministry of Fisheries and Marine Resources (MFMR) are charged with the responsibility of implementing the national biodiversity strategy and action plans. The Environment Protection Agency Sierra Leone (EPASL) was also established in 2008 by an Act of Parliament to oversee, manage and protect Sierra Leone's environment. The National Protected Areas Authority (NPAA) and Conservation Trust Fund (CTF) Act was passed in 2012 to manage designated protected areas and forest reserves in order to meet the meet the objectives of the convention.

National reporting and update within the framework of the CBD has always been an important aspect of the assessment of a country's compliance with the CBD. The assessment of the 5th National report to the CBD focuses on mainstreaming of emerging issues and the outcome of the conference of parties (COP) into national policies, agenda and programs. This report, developed in partnership with UNEP, details actions put in place to honour our nation's commitment to achieving the objectives of the convention on biological diversity since the 3rd National Report. This two-faceted partnership includes the revision of the NBSAP and development of the fifth national report, developed *in tandem*.

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The preparation of this document involved a review of literature materials, consultative meetings and workshops with participants as varied as ministries, departments, agencies, NGO's, civil society organizations, the university and research institutions. The agency would therefore like to thank all stakeholders and contributors to the successful completion of the document.

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Acronyms and abbreviations

ACRE	Adaptive Crop Research and Extension
BRACO	Beautification, Rehabilitation and Conservation Organization
CADEM	Community Advocacy and Development Movement
CBR	Centre for Biodiversity Research
CEP	Country Environmental Profile
CHECSIL	Council for Human Ecology in Sierra Leone
CRS	Catholic Relief Services
CSSL	Conservation Society of Sierra Leone
EFA	Environmental Foundation for Africa
ENFORAC	Environmental Forum for Action
EPA	Environmental Protection Agency
FBC	Fourah Bay Collage
FOESL	Friends of Earth Sierra Leone
GEF	Global Environmental Fund
GoSL	Government of Sierra Leone
IAR	Institute of Agricultural Research
IBA	Important Bird Area
ICRISAT	International Crop Research Institute of Semi-Arid Tropics
IIT	International Institute of Tropical Agriculture
KBA	Key Biodiversity Area
NARCC	National Agricultural Research Coordinating Council
NGOs	Non-Government Organisation
NUC	Njala University Collage
OREINT	Organization for Research and Extensive International Technology
RRS	Rice Research Station
SAFRAD	Semi-Arid Food Grain Research
TCS	Tacugama Chimpanzee Sanctuary
UNDP	United Nations Development Program
WAP	Western Area Peninsula
WAPFR	Western Area Peninsula Forest Reserve
WARDA	West African Rice Development Association
WARRI	West African Rice Research Institute
WHH	Welthungerhilfe

Glossary

Afrotropical migrants	These are birds that move across Africa either in a north-south or west-east cycles in response to changes in moisture rhythm or changes in rainfall patterns
Flyways	This is the entire range covered by a migratory bird species. It includes its summer range (where it usually breeds), its winter range (where it spends most of the winter period) and all sites visited and flies over during its migratory activity.
GNP	Gross National Product. This is an index used to assess the economic status and growth of a country.
GOSL	Government of Sierra Leone
IBA	Important Bird Areas: initiated by BirdLife International and sites are identified through surveys and desk studies at country levels.
IUCN	International Union for the Conservation of Nature
KBA	Key Biodiversity Areas: initiated by Conservation International and identified mainly through reviews and desk studies.
NGO	Non-Governmental Organisation
Palaearctic migrants	These are birds that move between Europe and parts of Asia to Africa and back on an regular annual basis, as a result of because of changes in climatic condition.
RSPB	Royal Society for the Protection of Birds. The RSPB is the sponsors and promoters of the Gola forest conservation programme.
RAMSAR Convention	The Convention on Wetlands of International Importance, especially as Waterfowl Habitat) is an international treaty for the conservation and sustainable utilization of wetlands i.e., to stem the progressive encroachment on and loss of wetlands now and in the future, recognising the fundamental ecological functions of wetlands and their economic, cultural, scientific, and recreational value. It is named after the city of RAMSAR in Iran, where the Convention was signed in 1971.

UNDP United Nations Development Programme

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Executive summary

In Sierra Leone, natural resources of all categories determine the pattern of economic growth, depending mostly on how they are used, valued and managed, and on the economic policies and institutions put in place (Blinker, 2006); hence, the need to focus on the institutions managing these resources. With its rich biodiversity, the country has potentials to raise funds through sales of biodiversity resources, ecotourism, genetic modification and other ecosystem services. The nation's biodiversity can also contribute to and promote its health through its diverse natural capacity to mitigate both natural and anthropogenic stresses.

The role of biodiversity conservation in the nation's development is manifested in several forms, including food production/ harvesting, bio-prospecting/biotechnology, eco-tourism, agro-forestry, and essential environmental services. Priorities include developing sustainable use patterns and halting environmental degradation, protecting endangered species, promoting reproductive rights to slow population growth, improving lives and documenting traditional knowledge.

Status and trends in biodiversity, and major threats

Sierra Leone's biodiversity has continued to face immense pressure since the 3rd National report was prepared and submitted in 2008; and since adequate data on the status and trends of species, populations and their ecosystems are difficult to come by, it is nearly impossible to present an accurate picture on the subject. A number of terrestrial and marine environments have been declared protected under the National Protected Areas Act (NPAA), 2012, but this declaration has not been accompanied by reduced pressures, especially from anthropogenic stresses. That said, a few patches of protected forest ecosystems have remained luxuriant and intact, whilst sections in the line of advance of urban settlements and community or rural forests harvested for charcoal and timber production have experienced considerable decline.

Declining trends have been largely reported across various ecosystems, with emphasis on forest cover, marine and coastal ecosystems, brackish and freshwater biodiversity. Many biodiversity components including species of conservation significance, special species or species of interest in these ecosystems have been observed to demonstrate dwindling composition, populations, density, and dispersion throughout the country, but this must be judged in the context of paucity of data.

Threats to biodiversity

Some of the major threats to biodiversity come largely from deforestation, changing land-use patterns, habitat degradation and fragmentation, over-harvest, poaching, pollution and contamination issues, invasive alien species, climate change effects, predator-prey relationships, wild fires etc.

Changing land use patterns take the form of large and small-scale and artisanal mining, commercial agriculture and agro-based industrialization, shortened fallow systems and shifting cultivation, mono-cultural plantations such as oil palm and cane sugar. Habitat degradation is brought about by contamination and pollution from misuse or abuse of chemicals, bushfires, and over-harvesting of genetic resources. Slash and burn agriculture practices and removal of mangroves for fuel, salt and rice production and sand mining along the coastlands also contribute to biodiversity loss.

Over-exploitation involves excessive logging, and harvesting of trees for firewood and charcoal production for domestic use, by-catch and use of inappropriate harvesting techniques such as pair trawling, beach seine and wrong net sizes.

Gradual manifestation of climate change effects include rising sea level and loss of coastal habitat, sea water intrusion into estuarine and inland waters, and erratic weather patterns; gradual fluctuation in hydrological patterns leading to reduced crop yield; pest and disease infestation and deteriorating soil quality.

Impacts of the changes in biodiversity for ecosystem services and the socio-economic and cultural implications of these impacts

The main types of damage/impact to biota and ecosystem from anthropogenic activities can be classified into 5 broad categories: over-exploitation, physical alteration and habitat loss, pollution, the role of invasive alien species and global climatic change.

The implications of biodiversity loss for a developing country like Sierra Leone can be considerable and wide ranging. About 80% of the population is rural and depend heavily on biodiversity resources for their food, fibre, medicine, income and well being. The small land area and vast natural resources is a challenge to the country's sustainable development. Sierra Leone relies heavily on her natural resources derived from agriculture, forestry, ecotourism and mining. As this review reveals, these resources are dwindling and there is an urgent need for careful their stewardship and management.

There is evidence of unsustainable trends, such as the fast encroachment of agriculture on forest land, overexploitation of biodiversity resources, habitat destruction, land degradation, increased squatting, and pollution, poor disposal of wastes and rapid expansion of vehicular traffic that relies heavily on fossil fuel combustion. There is high unemployment amongst the youth, but job opportunities are on the rise due to major investments in the country, especially in the mining sector. Recent developments appear unsustainable, and are based on short term gains for long term losses of goods and services offered by nature's ecosystems.

Other important consequences of deforestation and land degradation on human wellbeing are soil erosion and consequent loss of soil fertility. This in turn leads to reduced agricultural productivity.

Over exploitative and unlawful removal of beach sand is ongoing. These have resulted in erosion and loss of the aesthetic value at beach resorts, depriving them of vital income due to a likely decrease in the number of tourists visiting these resorts. On its own, beach sand has a high economic value from its use in sand-creting and natural protection to land and properties.

Removing mangroves for fuel, salt and rice production makes the coast more vulnerable to erosion leading to siltation.

The biodiversity targets set by Sierra Leone

Sierra Leone has only concluded the 2nd of a 5 component project on the Revision of the NBSAP and development of the 5th National Report to the CBD. Target setting and development of priorities and principles are an integral part of the project, which will be completed by 31st December, 2014.

Actions taken by Sierra Leone to implement the Convention since the 3rd report and the outcome of these actions

The actions taken at the national level can be broadly characterized as thematic, such as the setting up of legislative or regulatory framework, the role of NGOs, institutional and capacity building, etc.

The painstakingly slow process of updating the Forest and wildlife biodiversity policies is underway. Draft documents were released for review in 2010. The Environment Protection Agency Act, formerly the Sierra Leone Environment Protection Agency Act was passed in 2008, leading to the establishment of the EPASL that was charged with the responsibility of regulating environment-related activities in the country. An agriculture policy has also been drafted in 2007 that has as some

of its objectives; the rational and sustainable use of natural resources, enacting or reviewing laws designed to conserve natural resources and the environment, and coordinating the activities or all MDAs involved in the use and management of natural resources.

Educational and research institutes were also established or strengthened with curriculum adapted to reflect environmental ideals and emerging principles. Examples include the National agricultural research coordinating council (NARCC), Agricultural Research (IAR), Rice Research Station (RRS); and the emergency of a number of NGOs, such as *The Environment Forum for Action (ENFORAC), Green scenery, the Tacugama Santuary for the conservation of chimpanzees, etc.*

Mainstreaming of biodiversity into relevant sectoral and cross-sectoral strategies, plans and programmes

There has been tremendous improvement in policy and regulatory framework since the preparation of NBSAP in 2005. The Environmental Protection Agency Act, 2008 is exhaustive in terms of coverage of the policy and legal issues previously negating biodiversity management. The proposed Forestry Act (revision of the 1988 Act) has addressed some of the gaps that allowed illegal logging and exportation of ill- gotten timber. In addition, the separate forestry and wildlife policies are comprehensive and thorough enough to improve biodiversity management if implemented. The Mines and Minerals Act of 2009 has adequate provisions for an Environmental Impact Assessment (EIA) process and the associated mitigating measures coupled with substantially revised fines measured in United States dollars. In all these situations, law enforcement may be found wanting due to limited staffing and funding. Mainstreaming has also taken the form of capacity building, public participation and trans-boundary initiatives. Government has initiated a number of programmes to conserve or protect biodiversity and ecosystems. These are the Bumbuna Hydro Electric Environmental and Social Management Project, Gola Forest Programme, World Bank Project on Protected Areas including Fouta Jallon Programme and Outamba Kilimi, and the Sierra Leone Biodiversity Conservation Programme.

Implementation of the 2003 NBSAP

The implementation process of the 2003 NBSAP (GOSL, 2003) is difficult to assess because of the lack of adequate information on progress that have been made since its adoption. However, some noticeable progress has been made in a number of action plans that were specified in the document. Some of the major achievements of the implementation of the strategy and action plan are in the area of education and awareness-raising on the importance of biodiversity in general to human survival, and the establishment of protected terrestrial and marine areas.

Though, a wide range of projects have been undertaken in diverse areas of biodiversity conservation including habitats and species, some experts rate the overall level of implementation of NBSAP's objectives to be relatively low. One of the assessments put the overall achievement as less than 50%; and that 70% of the objectives had a success rate of less than 25 %. Factors that influenced the results were inadequate coordination amongst project implementing partners, weak to average political will, dated and fairly weak legislations and policies, and funding.

For reptiles, the sea turtles have had much conservation attention and protection than all the other species. They have been assessed and campaigned for their protection by the Sea Turtle Conservation Program at RAP-SL in collaboration with the MFMR and MAFFS.

Though manatees, amphibians and the other reptile species have not been particularly accorded specific species protection status, but the protection of their habitats by MAFFS and MFMRS in collaboration with environmental NGOs in Sierra Leone, has benefited these species. The habitat protection activities included the creation of Marine Protected Areas (MPA) and Protected Areas (PA). The recently established Gola National Park and the Yawri Bay MPA in addition to older PAs and national Parks in Sierra Leone are steps in the right direction. The review of forestry, fisheries and wildlife laws and regulations of Sierra Leone were recommendations from the 2003 NBSAP. The

review actually started in 2000 and has over the years had series of considerations by the MAFFS, Environmental NGOs including USAID PAGE, CSSL and law reform committees. It is presently ongoing under the leadership of MAFFS through the Biodiversity Project.

Evidence of forest restoration activities using tree plantations is quite sparse in recent times although there are a number of good examples in various localities in the country. Most areas where such plots exist were planted over thirty years ago using species such as *Gmelina arborea, Tectona grandis, melia azaderact* and *Acoi bateri*. There are however good examples of fuel wood plantations or afforestation activities using more recently introduced fast growing exotic species such as *Acacia mangium, Acacia auriculiformes, Acacia leptocoma* and *Eucalyptus sp*.

The NBSAP 2003, proposed a national survey of the country's biodiversity but this is yet to happen for other taxa including reptiles, amphibians, arthropods etc. The reasons for the delay in implementation include the unavailability of funds and capacity.

Progress towards the implementation of the Strategic Plan for Biodiversity 2011-2020 and its Aichi Biodiversity Targets

Technically, the Aichi targets have not been adopted by Sierra Leone at this stage, as the NBSAP is currently being revised to incorporate these targets. Nonetheless, an evaluation of the biodiversity-related projects have been done as part of the NBSAP revision process both by the plenary at the first National Workshop, on Stock taking and assessment, and by consultants hired to prepare reports for the workshop. It was generally agreed at the workshop that Sierra Leone is implementing projects and carrying out biodiversity programs that could help the nation meet 6 of the targets. These were the launching of the Poverty reduction strategy paper (PRSP), declaration of protected areas, enacting of the national protected areas, formation of protected area task force, formation of community management authorities and, EPASL taking the lead in biodiversity mapping (NPAA, 2012); all related to targets 2, 6, 14, 17, 18 and 19).

The plenary at the first national workshop on the revision of the NBSAP (Stock taking and assessment) classified the launching of the poverty reduction strategy papers 1, 2 (Agenda for Change), and 3 (Agenda for prosperity) and its accompanied economic and social gains; the declaration of the protected terrestrial and marine areas, and the co-management in fishing communities as 'GOOD' and in line with Target 2 of the Aichi Biodiversity targets. The categories were as follows: No implementation – 0; Poor – 1; Average – 2; Good – 3; Very good – 4; Excellent – 5.

The passing of legislation and the provision of vessels for monitoring commercial and artisanal fishing activities were also classified as 'GOOD' and in line with Target 6 of the Aichi Biodiversity targets.

The establishment of national parks, and protected areas, education and sensitization, the establishment of the Bumbuna Watershed Management Authority (BWMA), the Western Area Protected Forest Reserve, financial assistance to community women by Government and NGOs were also classified as 'GOOD', and in line with Target 14 of the Aichi Biodiversity targets.

The revision of the NBSAP and development of the 5th National report to the CBD were ranked as 'GOOD', and in line with Target 17 of the Aichi Biodiversity targets.

The formation of conservation task forces, the establishment and empowerment of EPASL, the role of NGOs, were ranked as 'GOOD', and in line with Target 18 of the Aichi Biodiversity targets.

On-going research and studies and EPASL taking the lead in the mapping out of Sierra Leone's environment and attempting to establish a GIS database were ranked as 'GOOD', and in line with Target 19 of the Aichi Biodiversity targets.

Environmental organizations including the Conservation Society of Sierra Leone (CSSL), Environmental Foundation for Africa (EFA), Green Scenery (GS), Reptile and Amphibian Program – SL (RAP-SL) to name but a few and government ministries including MAFFS, MFMR, MLCPE, EPA-SL and other collaboration institutions have in diverse ways undertaken education and sensitization, researches, surveys, campaigns and other programs necessary in the implementation of ABT in Sierra Leone.

Contribution of actions to implement the Convention towards the achievement of the relevant 2015 targets of the Millennium Development Goals (MDGs) in Sierra Leone

Due to several constraints, namely, funding, power problems, planning, monitoring constraints, poor infrastructure, weakness of social services, governance and capacity constraints and the effect of the war which robbed the country for 10 years prior to implementation of the MDG, some goals were not likely to be met by Sierra Leone. Gender equality, reduction of hunger and environmental sustainability have posed some challenge to the implementation of the targets. For instance, absolute poverty dropped from 70% after the war to 60% by 2007, but would need to reach 40% by 2015 to achieve target; this may not be likely.

Achieving goal No. 7 is therefore not quite likely in the face of unprecedented deforestation and land degradation and the loss of forest cover to a mere 5% of the total land area. Many sustainable principles have been incorporated into laws and policies but these require medium to long term implementation. Institutions are weak, law enforcement is ineffective, funding is grossly inadequate and the forest estate areas are decreasing due to other competitive land use options.

Lessons learned from the implementation of the Convention in Sierra Leone

The key lessons learnt from the implementation of the CBD in Sierra Leone were as follows:

1. Mainstreaming and integration of the strategy and action plan into national policies and programs is important to the successful implementation of the convention;
2. Stakeholder mapping, identification and consultations should be comprehensive enough to enhance stewardship and sense of responsibility;
3. Incentives such as tax breaks for biodiversity-related projects and programs should be provided to promote project implementation;
4. Enforcement instruments such as adequate and up-to-date legislation, regulations and policies would form the backbone for project implementation;

1. INTRODUCTION

Sierra Leone has a total land surface area of 71,740 Km^2 (27,699 sq miles). The total arable land[1] is 6,026 km^2 or 0.6million hectares (accounting for 8.4% of the total surface area); agricultural land is 28,839.5 Km^2 or 2.9 million hectares, (40.2%); permanent crop land is 789.14 (representing 1.1% of the land surface area); irrigated area stand at 37.1 Km^2 (accounting for 4.7% of permanent crop land); forest land stand at 27,620 Km^2 (38.5% of land surface) while national protected land is 2,941km^2 (this is 4.1% of the total surface area); other land use accounts for 7.7% of the total surface land area (World Bank Sierra Leone Country Profile (2009).

According to the country environmental profile[2], the country lies within the Upper Guinean Lowland Forest Ecosystem with an abundant richness in ecosystem and species biodiversity (lowland rainforests, mountain forests, savannah woodlands, agricultural, freshwater and wetlands). There are 48 forest reserves and conservation areas, representing about 4% of the land area. The total area of government wildlife reserves is estimated at 173,000 ha. There are over 2000 species of plants including 74 endemic species identified in Sierra Leone. A total of 15 species of primate, 18 species of antelopes and duikers, 9 bat species and over 500 bird species have been recorded in the country. An estimated 4,837.8 km^2 of Sierra Leone is covered by wetlands with vegetation which is typically of freshwater swamp forests, riparian and mangroves.

The Country is divided into four main relief regions; coastline, interior lowland plains, interior plateau and mountains, each of which can be subdivided into a number of ecosystems. The coastline or coastal plains is relatively gentle and comprises estuarine swamps, terraces, alluvial plains and beach ridges. The interior lowland plains extend from the coastal terraces in the West to the East of Sierra Leone.

To a large extent, the natural features of the country such as its geography, geology and topography determine its vegetation. The country is divided in to four topographic regions, namely, the coastal lowland, the interior plains, the interior plateau and scattered mountains and hills. The coastal lowlands occupy the West to Southwest of the country, and consist of a narrow strip about 40 km wide that lies below 7m above sea level. The interior plains extend from 50 to 130 km inland, rises to 200 m in the East and cover 43% of the land. The interior plateau emerges as an abrupt escarpment that runs almost parallel to the interior plains, giving rise to higher plateaus in the Eastern sector, which is topped by two mountain ranges, the Loma Mountains (that peak at Mount Bintumani, 1945 m a.m.s.l.) and Tingi Hills (that peaks at Sankan Biriwa, 1709 m a.m.s.l.). Mount Bintimani is the highest peak in West Africa, west of Mount Cameroon). Other mountain ranges include the Western Area Peninsula, the Kangari Hills on the central region and the Kambui Hills on the south of the country.

One of the greatest challenges in Sierra Leone's development arena, is how to achieve sustainable development while at the same time protect the environment which sustains the development. According to the country studies[3], the essence of sustainable development is to ensure that the society meets its present needs without compromising the ability of future generations to meet their needs; this implicitly requires that development should not compromise the ecological integrity of the environment.

[1] Arable land means land under food crop cultivation

[2] B. Leslie Blinker (Sept 2008); Country Environmental Profile (CEP): Sierra Leone

[3]

Part I:

An update on biodiversity status, trends, and threats and implications for human well-being

2. IMPORTANCE OF BIODIVERSITY TO SIERRA LEONE

2.1. Background

According to COHAB Initiative (2010), biodiversity is the foundation for human health. By securing the life-sustaining goods and services which biodiversity provides, the conservation and sustainable use of biodiversity can provide significant benefits to humans. In contrast, the continuing loss of biodiversity on a global scale represents a direct threat to human health and well-being. Without an environment that is healthy and capable of supporting a diversity of life, no human population can exist. The environment provides the life sustaining services and resources without which humans and all other living things can barely survive or cease to exist at all. The services largely include provisioning, regulatory, cultural and supporting.

In Sierra Leone, natural resources of all categories determine the pattern of economic growth, depending mostly on how they are used, valued and managed, and on the economic policies and institutions put in place (Blinker, 2006); hence, the need to focus on the institutions managing these resources. With its rich biodiversity, the country has potentials to raise funds through sales of biodiversity resources, ecotourism, genetic modification and other ecosystem services. The nation's biodiversity can also contribute to and promote its health through its diverse natural capacity to mitigate both natural and anthropogenic stresses.

The role of biodiversity conservation in the nation's development is manifested in several forms, including food production/ harvesting, bio-prospecting/biotechnology, eco-tourism, agro-forestry, and essential environmental services. Priorities include developing sustainable use patterns and halting environmental degradation, protecting endangered species, promoting reproductive rights to slow population growth and improve lives, and documenting traditional knowledge.

Apart from the aforementioned direct benefits, biodiversity provides us a life support system. Recycling of essential elements such as carbon, oxygen and nitrogen; migration of population; protection of watersheds, buffering against excessive variation in weather and climate do require biodiversity. The economic value of biodiversity is well established. Agriculture now depends on new genetic stocks from natural ecological systems; eco-tourism is a $12 billion business world-wide (WRI, 1992); benefit from wild plants and animals contributes to national economics in no small way; drugs rely on plants microbes and animals for their development. Breeders and farmers rely on the genetic diversity of crops and livestock to increase yields and respond to changes in environmental conditions. Food production from wild stocks of fish is the single large source of animal protein for the world's growing population. Some 119 pure chemical substances extracted from 90 species of higher plants are used in pharmaceuticals around the world (WCMC, 1992).

The livelihood of the rural population in Sierra Leone, as in most countries in Africa and Asia, incorporate natural resources and high diversity, regardless of whether the agro ecosystems are based on permanent cropping, predominantly pastoral or mixed. This helps to provide resilience in the face of adverse trends or shocks, and offers a greater choice of livelihood options. Traditional medicine, which relies on species of wild and cultivated plants, is the basis of primary health care for the majority of people in developing countries like Sierra Leone. Recreational opportunities and aesthetic value associated with wild birds, salt-extraction, water/fresh water recreational fishing and parks brings in much needed revenue. Biodiversity, from which all these benefits are derived, is therefore indispensable to socio-economic and cultural development.

From an agricultural standpoint, different types of biodiversity are used at different times and in different parts of the country, and so contribute to livelihood strategies in a complex fashion. Understanding how this use differs according to wealth, gender, age and ecological situation is

essential for understanding of its contribution to the livelihoods of different members of a community. For example, wild resources are particularly important for the food and livelihood security of the rural poor, women and children, especially in times of stress such as the hungry period when food stocks are low or in a period of drought. These groups generally have less access to land, labour and capital and thus need to rely more on the wild diversity available. At least 70% of the country's population depends on agricultural biodiversity for livelihood. The sector continues to be the main contributor to growth in 2012, in terms both of share (45% of value-added) and of added GDP (just under half of real GDP growth) (Agenda for Prosperity, 2012).

Many wild plants and animals have significant economic value by preventing the need for cash expenditure on food, medicines and construction needs as well as providing ready sources of cash to poor households, often yielding a better income than local wage labour (IIED, 1995). The cultural and spiritual values of some elements of agricultural biodiversity are sometimes more highly rated than money.

Some plant species are grown for socio-economic and socio-cultural reasons e.g. snake and mosquito repellants, insecticidal properties like the neem plant, protecting building from de-roofing like *Acacia mangium* and *A.auriculiformis*; shade provision like *Terminalia catapa* while others are believed to habour dead relatives.

The reptile, amphibian and manatee biodiversity is a significant category of biodiversity in Sierra Leone, and they provide pest control services in the food productive cycle of the country. They are part of the culture of Sierra Leone as some people have different life sustaining values for them, such as food and medicine.

Wetlands and Freshwater ecosystems in Sierra Leone are vast (almost 5,000 sq km) and rich in birds, mollusc and crustaceans.

2.2. The Value of the Upper Guinea Forest Biodiversity

The Upper Guinea forests of West Africa encompass a belt of lowland rainforest stretching from Guinea and Sierra Leone eastwards to Ghana. In some places this rainforest belt is up to 350km wide, but becomes as narrow as 100km in Cote d'Ivoire. It is classified as one of the 25 most important biodiversity hotspots in the World, with a total of 2,800 species of vascular plants of which about 650 species (23%) are endemic to the region. Some 15 endemics such as the White-necked Picathartes and White-breasted Guinea fowl are amongst the large number of bird species present. The Gola forests of Sierra Leone have been described as the region's centre of diversity and endemism (Klopp et al, 2008). There are lots of other species of value in conservation.

The Outamba Kilimi National Park (OKNP), the only extensive area of savanna woodlands and grassland savanna with protection in Sierra Leone, and with a high primate population, especially chimpanzees has a potential for education and ecotourism development.

2.3. Value of Benefits from Resource Harvest or Collection

Even before we consider the equitable distribution of resources, we need to consider the quantum or economic value of the resource. Also, of paramount importance is the value of biodiversity in traditional, cultural and religious diversity. The value of the resources may vary in the eyes of the different groups (FAO, 1991). For instance, sacred groves and cemeteries are conserved as points of contact with dead relatives, where deforestation is prohibited. The use of wild plant species in cross breeding research has resulted in hybrids with high productivity, disease resistance and other attributes. NERICA rice is a typical example of a cross between *Oryza sativa* and *Oryza glaberima*.

However, even if the equity conditions are met, it is the quantum of financial and other benefits that is often assessed by the different beneficiaries. However, the Sherman Phamaceuticals of the USA which researches into the production of new therapeutic agents in 1996 referred to reciprocal benefits as immediate, short- and long term benefits while the Columbia University (1999) categorized benefits into monetary and non monetary, as indicated in **Table 1**.

NON MONETARY	**MONETARY**
Acknowledgement in publications	Bio prospecting fees
Joint research and increased scientific capacity	Per sample fees
Participation in planning and decision making	Percentage of research budget
Control over samples and research results	Percentage of royalties
Voucher specimens deposited in national institutions	Alternative income generation
Free access to technology and products	International fund
	Levies and sales

Table 1: Monetary and non-monetary benefits from resource harvest (Source Adapted from Columbia University School of International and Public Affairs, 1999)

According to the WCMC (1992), about 119 pure chemical substances extracted from 90 plant species of higher plants are used in pharmaceuticals around the World.

These benefits serve mankind in general including the source countries but the credit is given to those countries which may not even be aware.

3. THE MAJOR CHANGES IN THE STATUS AND TRENDS OF BIODIVERSITY IN SIERRA LEONE

3.1. Background

Sierra Leone is located within two bio-geographic regions; namely, the humid tropical rain forest belt and the savannah belt of West Africa. The climate is typically showing distinct dry and rainy seasons; annual rainfall varies between 6000 in the wettest areas in the southwest to about 2000 in the driest areas of the northeast to the northwest. According to Birchall et al., (1979), the climate and soil conditions can support rainforest on over 60% of the land area. However rapid deforestation rates have drastically reduced the forest cover and forest regeneration has not kept pace with the rates of deforestation. The vegetation is now a mixture of various types of plant communities ranging from forest to open grassland savannah (Cole, 1976: Panagos et al., 2011).

The main ecozones in Sierra Leone can be divided into two categories: terrestrial and aquatic. Forest, Montane, Savannah and Agricultural ecosystems fall under terrestrial; whilst, wetlands, freshwater, coastal and marine ecosystems are classified under aquatic systems. Of all these ecosystems, there is evidence that the lowland rainforest ecosystem is the most endowed in species richness, diversity and endemism.

There are six main ecosystems in Sierra Leone; namely: Forest, Montane, Savannah, Agricultural, Wetlands and Freshwater, and Coastal and Marine Ecosystems (NBSAP 2003).

3.2. Forest Biodiversity

Tropical moist evergreen forest and moist semideciduous forest form the two types of forests in Sierra Leone and are found in the south-east and north of the country, respectively. The tropical moist evergreen forest is subdivided into lowland rainforest and montane.

It was estimated that by the turn of the century, 60% of the land surface of the country was covered by closed forest, although a number of reports (e.g. Scott-Elliot and Raisin, 1893) and anecdotal evidences indicate that much of the primary forest had been slashed. Phillipson (1978) reported that by 1970 only about 5% of the original forest remained in the country, much of which have lost through slash and burn agriculture. A large proportion of the country's land surface (over 50%) is now occupied by farmbush and forest regrowth at various stages of succession. The changes in forest cover have been under a dynamic state characterized by clearing, cultivation and regeneration. This cycle, which is basically a cultivation- fallowing ecological succession, is the most common agricultural practice in the country. The nation's forest resources have come under serious pressure from urbanization and sprawling, commercial logging and timber production, quest for additional farmlands, fuel wood and charcoal production, mining and monoculture cultivation.

Current levels of deforestation are unknown, but the problem is generally viewed as one of the major environmental challenges faced by Sierra Leone. The total area of government wildlife reserves is slightly less, estimated at 173,000 ha. Some 74 out of the 2000 plant species recorded in the country are endemic.

Bush fallowing provides an opportunity for forest regeneration, but the period of fallow, which determines the quantity of forest cover and soil nutrient replenishment within such agro-ecosystem has declined considerably over the last couple of generation. According to a number of published information (Richards, 1986: Gleave, 1996: Okoni-Williams, 2013) average fallow periods dropped from range of 10-15 years to between 6-8 years in about two generations. A land use map by Surveys

and Land Department in Sierra Leone (SLDSL) in early 1950s, showed a strong inverse correlation between population density and the period of fallow around the country.

The national forest estate was estimated in the 1990s to have an area of 610,122 ha (8.4% of the total land area of Sierra Leone) comprising gazette and proposed forest reserves: proposed (360, 622 ha); strict nature reserves (7,500 ha), proposed game reserves and game sanctuaries (60,100 ha) and gazette and proposed national parks (181,900 ha), (Allan, 1990: Mnzava, 1992). A more recent report puts the forest reserves (48 reserves in total) and conservation areas at about 4% of the land area or 180,250 ha (Blinker, 2006). The Gola forest, which has a total area of 74,000 ha, is the largest tract of forest in Sierra Leone. Much of the original forest in the country has been replaced by farmbush and forest regrowth, mainly as a result of unplanned agricultural activities. This derived vegetation is estimated to extend at ca 52% of the total land area. Tree species common to this vegetation are *carapapocera, musangacercopoides, Anthocleistanobilis, Canthiumglobigorum* and *Parinariexcels* among others. Oil palm, *Elaeis guineensis* is also very common.

According to **Table 2**, plantations which include fuelwood and forest tree establishments form a small proportion of the land cover. As far as current activities on forest are concerned, there is no indication that the status of fuelwood and forest tree plantations have improved since the assessments were done by Karim (1996). The proportion of forest cover has remained in forest restoration programmes, especially with regards to restoration around closed forest formation and reserve forests.

Table 1:

Vegetation type	**Plant community**	**Area (Ha) Of country**	**Percentage of country**
Tropical closed forest	*Rain forest*	*358,700*	*5.0*
	Moist Evergreen forest		*3.6*
	Moist semi- deciduous forest	*258,264*	*52.2*
	Secondary forest	*3,766,350*	
	Forest regrowth		
Swamp forests (wetlands)	*Mangrove swamp*	*172,176*	*2.4*
	Inland valley swamp	*107,610*	*1.5*
	Raphia swamp forest	*28,690*	*0.4*
	Gallery	*35,870*	*0.5*
Savanna Woodland	*Moist, close,Guinea savanna w*	*616,964*	*8.6*
	oodland	*724,574*	*10.1*
	Mixed tree, open, sudan savanna woodland	*265,438*	*3.7*
	Lophira tree savanna	*107,610*	*1.5*
	Coastal park savanna woodland	*251,090*	*3.5*
	Tall grass savanna		
Tropical grassland	Riverine grassland (1-3m tall	179,350	2.5
	Boliland swamp grassland 1m tall	71, 740	0.1
	Montane pan grass (1m)		
	Lateritic pan grassland (very short)		
Plantation(farmland+	Rubber		
Wasteland	Oil palm	71,740	0.1
	Coffee and cacao	165.002	2.3
	Forest tress		

Table 2: Diversity of plant communities within major ecosystems in Sierra Leone and their land coverage

Source: Karim, (1996)

3.2.1. Savanna Ecosystems

Savanna ecosystems are found mostly in the North and North East of the country and they occupy about one-third of the country. Savannas include forest savanna, mixed tree savanna and grassland savanna. Wildlife in the Savanna is characterized by elephants, leopards, hyenas, duikers, genets, civets, warthogs, aardvarks, chimpanzees, baboons and monkeys; six species are recorded as endangered (NBSAP, 2003).

The savannah woodlands support widely spaced trees and tall grass. This habitat supports a more limited variety of wildlife than the forests in Sierra Leone. Common trees in this grassland are *Lophira*, *Parha biglobosa* (Locust beans), and *Piliostigma thennigir* (cow foot). Wild animals found are bush pigs (red rice hog), bush cats and leopards. Other fauna are millipedes, snails, earthworms, millions of termites, army ants and other species of insects.

3.2.2. Riparian Forests

The riparian forest vegetation includes species such as *Piptadeniastrum africanus, Uapaca togonese, Pterocorpus santalinodes, Brachystegia leonensis, Anadelphia spp. Panacium congoeasis and Cyperus pustulata.*

3.2.3. Areas of Designated Reserves in Sierra Leone

The areas of designated reserves (276,800 ha) indicate that they constitute only about 5% of the total land area of the country (**Table 3**). Sadly enough, even these reserves are subjected to deforestation and resource degradation just like off-reserve areas, for satisfying man's insatiable demand for forest products.

Reserve	**Area(Ha)**	**Reserve**	**Area(Ha)**
Gola	77,044	Nimini	15,557
Tonkoli	47,656	Freetown Peninsula F.R.	14,089
Loma	33,200	Sanka Briwa	11,885
Kambui	21,213	Kangari Hills	8,573
Dodo	21,185	Kuru Hills	7,001
Tama	17,094	Kasewe	2,333

Table 3: Designated Reserves and corresponding Areas in Sierra Leone (USAID, 2007)

3.2.4. National Parks

Of the 220 bird species at the OKNP, about 40% are considered to be dependent on Guinea-Sudan savanna biome. Of the 9 primate species present, 4 are threatened: chimpanzee (EN), Red Colobus (VU), Black and White Colobus (NT) and Sooty Mangabay (NT). A small population of western elephants (endangered) could be found in the Outamba section. Other mammals include the leopard

(VU) Pigmy hippopotamus (VU) Water Chevrotain (NT), Maxwell's Duiker (NT) and Savanna Buffalo (NT).

In the Western Area Peninsula Forest Reserve, hunting pressure on the red colobus (*Piliocolobus badius badius*) to the point of extinction and logging pressure (especially during the war) resulted in the over-cutting of *Terminalia ivorensis* and *Heritiera utilis.*

3.3. Agricultural Biodiversity

Sierra Leone, situated at the western most tip of the upper Guinea forest, is a hotspot with abundant Agricultural biodiversity. To date, there are ca. 2000 plant species reportedly recorded of which 74 species and one Genus are endemic to West Africa. Agricultural biodiversity in Sierra Leone, as in the African region, has had a history of unique challenges. The crop cultivars that are currently grown are largely exotic breeds introduced into the farming systems unlike the livestock species and medicinal plants which are largely indigenous and well adapted to the agricultural biodiversity ecological systems. Rice mainly *sativa* species and the interspecific breeds (NERICA varieties), cassava, sweet potatoes, maize are some of the introduced staples. Sorghum and millet are little used cereal staples which together with Tabae beans, cowpea, pigeon pea, bambara ground nut, benniseeds and some vegetables (landraces) are indigenous to Sierra Leone. Fruit trees, namely citrus, mango, cashew and avocado, plantain, pineapple and banana are amongst the most recent introductions to the country. Some introduced commercial perennial crops are coffee, cacao, piassava, rubber, coconut and oil palm. Several indigenous wild tree species producing edible fruits and nuts exist in the agricultural biodiversity system. Also of importance are the numerous medicinal plant species.

The Bolilands and Riverain grasslands comprise two important grassland agro-ecosystems in Sierra Leone. The Bolilands are saucer shaped depressions often located on old riverbeds, which are flooded to varying depth in the rainy season. Drainage is poor and the soils are infertile. The native plant species is mostly the coarse elephant grass. Rice is the main crop grown during the Rainy Season, but invariably subjected to high weed infestations of grasses and sedges. In the dry season, Bolilands may be left to fallow and serve as grazing fields for cattle and wild buffaloes or cropped with cassava, sweet potato or to a limited extent groundnuts, vegetables and maize. Migratory waterfowls and other tiny invertebrates, snails and worms that birds eat are common occurrences in the dry season.

In the livestock sector very little success has been recorded in terms of genetic improvement for beef and milk production. Most high yielding introduced breeds of animals intended for use in hybridization programmes across the country perished as a result of disease infestations. The indigenous livestock are N'dama cattle, West African dwarf and Djalonke sheep and Goats that are tolerant /resistant to both Trypanosomiasis and Streptothricosis. Other livestock are pigs (local and exotic), poultry (local and exotic), rabbits and Guinea pigs.

Agro-forestry practice though old in the country have shifted emphasis to integrating some introduced fast growing tree species mainly for firewood into the crop farming systems. The tree introduced species include *Acacia, Leucaena, Gliricidia* and *Albizia spp*., which are distributed all over the country.

It is worthy to note that efforts at species conservation either *in situ* or *ex situ* has not been treated as a priority concern mainly because the introduced crops were domesticated as integral parts of the traditional farming systems that was virtually free from notorious pests and diseases; and lack of capacity in terms of trained personnel, facilities and funding. It was not until the exponential demands from increased populations and other socio-economic pressures threatened the agricultural biodiversity that lip service by way of ratification of International conventions, ineffectual legislatures

and half hearted sensitizations were operationalized. Very little or no effort has been made to regenerate indigenous tree species or to encourage the nursing and planting of indigenous trees. Thus the once beautiful multi storey canopy of the indigenous forest covers has been mostly transformed to homogenous single tree canopies.

Essentially, this review realized that the diversity of plant and animal species other than the major food and fruit crops and livestock species have had little or no attention paid to them in terms of improvement and conservation. As such some of the agricultural biodiversity have been declared critically threatened or extinct.

It should be noted, however, that crop plants that are propagated from seeds tend to increase in genetic diversity. This is a result of many factors including the genetic mutations that normally occurs during flowerings, the ability of seeds to stay dormant for longer periods thus allowing longer distance movements and some level of cultivar selection and breeding. Examples are the rice ROK series and NERICA cultivars, NUCASS, ROCASS, SLICASS, Njala white, Njala wonder and ROPOT, SLIPOT cassava and sweet potato cultivars.

3.4. Aquatic Biodiversity

There are two types of aquatic environments in Sierra Leone: fresh water lakes and rivers. There are 8 major river basins and 11 fresh water lakes in the country. The major river systems in Sierra Leone are the Great Scarcies, Jong (Maboleh) River, Little Scarcies, River Rokel (Seli), Kpamgbai River, Sewa River and Mano River. These rivers are usually bordered by palisade forests. It is designed to protect the water bodies from excessive evaporation and subsequent alteration of the hydrologic cycle including depletion of the water table. Because of the palisade forest, there is a dynamic food chain existing ranging from foragers and larger herbivores as well as carnivores. The rivers and streams themselves are rich in aquatic life such as scaled and non-scaled fish. Some common fish varieties include tilapia, catfish, eel, electric fish, crabs, and shrimps. They are a ready source of the protein component of the diet of the local communities.

The lacustrine environments are rather small. The largest lake in Sierra Leone the Mape in the Pujehun District is less than 30 Km^2 in area. Most of the lakes are fed by fresh water streams.

The others are: Mabesi, Popei, Baiama, Sonfon, Masatoi, Kamason, Tibi, Kenema, Kwako, and the Gambia. Fresh water lakes are surrounded by fringing forests. Wildlife frequent these forests in the afternoons for shelter from the hot burning sun. Egrets and water ducks actively fish in the lake water.

3.4.1. Coastal swamps

About 4,837.8 km^2 of the surface area of Sierra Leone is covered by wetlands with vegetation that is typically of freshwater swamp forests, riparian and mangroves (Blinker 2006). Along the coast where the major river channels meet the sea are usually found thick deposits of clays and silt. They also occur at the foot of coastal terraces in the vicinities of the estuaries of the large rivers and inter-tidal creeks. Mangrove vegetation typifies the vegetation type in these swamps which are subject to tidal flooding. In places, especially along the Scarcies Rivers, the mangrove has been extensively cleared. It is used as a source of energy. They cover an estimated area of 2,347 Km^2 (UNDP/FAO, 1979).

Some 500,000 ha of mangrove swamps fringe the coastline (Fomba, 1994). The drainage system consists of a series of rivers from North to South including the following; Great Scarcies, Little

Scarcies, Rokel, Jong, Sewa, Moa and Mono. Other streams include Ribi, Gbangbaia and Wanji rivers. There are in addition to the four main Estuaries (Scarcies, Rokel, Yawri and Sherbro) numerous small Estuaries and lagoons. Bah (1994) estimated that there are 4,837.8km^2 of Wetlands.

The soil association varies in morphology depending on degree of tidal flooding. The saline content is likewise controlled by seasonality. In the rainy season when there is an abundance of fresh water the saline effect is distinctly less. However in the dry season the water is significantly saltier. In lower tidal flats in the around Mambolo and Kobia in the Kambia, only remnants of mangroves still exist. The rest have been cleared to make way for rice cultivation. The upper tidal flats are covered by sedges such as *Sesuvium sp*, ferns and salt tolerant grasses. Generally, *Rhizophora racemosa* is the species commonly present at the edge of the water while *Rhizophora mangle* and *Rhizophora harrisonii* are dominant upstream at the tidal limits where *Avicennia nitida* is also likely to be found. The dominant fauna in the lower tidal flats are frogs, mud skippers, molluscs and oyesters. 29 species of water birds have been identified in these mud flats.

3.4.2. Freshwater Ecosystems

Fresh water Ecosystem consists of swamps, rivers and other waterways and canals. An estimated 4,838 Km^2 of wetlands exist in Sierra Leone (Bah, 1994). These include 66 wetland areas which have been identified and mapped out. The vegetation characteristically comprise of fresh water swamp forests i.e. riparian type and mangroves. The fresh water swamp forests are ubiquitous in Sierra Leone and consist of *Mitragyna stipulosa, Rophia palma-pinnus, Cala muzdeeratus, Heritiera utilis and Rhychospora corymbosa* as the endemic tree species.

It is estimated that 200,000 ha to 300,000 ha of mangrove swamps exist on the coastline of Sierra Leone (Bah, 1994; Fomba, 1994). These mangrove swamps are subjected to twice daily tidal inundations from the sea that are largely brackish. The vegetation is made up of five species, viz: *Rhizophora racemosa, R. harrisonni, R. mangle, Avecenia nitida, and Laguncularia racemosa*, which are found differentially in various locations along the river beds and coastlines. Intermingled among the mangrove may be other plant species such as *Paspalum vaginatum, Sesuvium sp. and Philoxerus vermicularis.* Mangrove and estuarine sediments have high populations of crabs, fishes, other crustaceans such as shrimps and lobsters and other invertebrate fauna, which includes Molluscs, snails, Bivalves, Polycheates, Protochodates and Echinoderms.

The wetlands have a rich animal life. An estimated 240 species of birds have been spotted in this ecosystem and ca. 200,000 migrant birds are recorded to visit the wetlands annually. Three species of crocodiles are found in this environment. The monitor lizards, V*aramus sp* and Pythoas spp. (*Pythoa sebea, Phthoa regins*) are also common. The important mammals include *Aonyx capeasis*, the carnivores (*Potamogale velox, Atilax paludinosus*), herbivores (*Tricheabus senegalensis*) and the pigmy hippopotamus (*Hexaprotodon liberiensis*).

Sixteen families of fish comprising ca.100 species have been identified in the freshwater ecosystem. The major fish species include Alextes longipinnus, *Epiplatys fasciolatus, Hepsetum odoe, Sarotheodon kingsleyi, Ctenopoma kingsleyi, Polypterus palmos, Hemichromis fasciatus, Tilapia sp., clarias lazera, Clatias laevicps and Mormyrus macrophaalus.* There are also several species of catfish (*Bagrus bayad, Synodontis nigrita, Clarias platycephalas, Clarias lazera* and *Chysichthys furcatus) found in* (Payne, 1986) in lakes, rivers and Lagoons (Payne, 1986 cited in NBSAP, 2003). Although the practice of aquaculture has huge potential as a profitable commercial enterprise, it is limited and fish species such as Tilapia, Mullets (Mugi and Liza), Claris, Chrysichthys, Penacus and Scylla are the commonly used feeder stocks.

The Riverain grasslands are found in the southern province of Sierra Leone. The ecosystem is usually

deeply flooded and may have standing water of up to 1m during the rainy season. Owing to sedimentary deposits from the river, the soil is fairly fertile and rice production can be sustainably undertaken. The high clay content of the soil makes this grassland unsuitable for crop cultivation during the dry season.

3.5. Wildlife

3.5.1. Mammals

A wide variety of mammals also exist in Sierra Leone. Of the 178 species of mammals identified, there are 15 species of primates, among which six species are threatened. These include the black and white Colobus Monkey (*Procolobus polykomus*), Red Colobus Monkey (*Colobus badius polykomos*), Diana Monkey (*Cercopithecus diana*), the Western Chimpanzee (*Pantroglodytes verus*) and other spp. of Colobus Monkey. Similarly, there are 18 species of antelopes of which nine are threatened and six endangered. These include Jentinck (*Cercopithecus jentinki*) and Zebra (*Cephalophus zebra duikers*). Other threatened species of mammals include the Forest elephant (*Loxodonta Africana cyclotis*), believed to have almost gone extinct, the West African Manatee (*Trichechus senegalensis*), the pigmy Hippopotamus (*Hexaprotodon liberiensis*) and the Leopard (*Pantera pardus*) etc.

There are nine species of fruit bats and three species of crocodiles (Nile, Slender-snouted, and Dwarf).

3.5.2. Invertebrates

There are ca.108 species of butterflies and moths and several species of bees and beetles serving as plant pollinators in cultivated farms and in the wild.

3.5.3. Reptiles, Amphibians, Sea Turtles and Manatees

In Sierra Leone, there are 55 amphibian species according to the IUCN Redlist of threatened species and 67 reptile species exist (wikipedia.org). Among the 67 reptiles species are the sea turtles that comprise five species namely green turtles (*Chelonia mydas*), hawksbill (*Eretmochelys imbricate*), olive ridley (*Lepidochelys olivacea*), leatherback (*Dermochelys coriacea)* and loggerhead (*Caretta caretta*). All five species nest on beaches along the coast of Sierra Leone with the highest nesting population on beaches along the Turtle and Sherbro Islands and the Turners Peninsula. The status of reptiles (except sea turtles), amphibians and manatees are not currently known for Sierra Leone though it is widely believed that they are facing decline in populations.

1. *Sea turtles*

Sea turtle population is believed to be improving due to the conservation effort applied on their behalf. Beach and by-catch monitoring have contributed to their population in Sierra Leone coastline. In the late 90s, sea turtles were exploited by locals in the artisanal fisheries and on nesting beaches but since the intervention of the sea turtle conservation in 2000, there has been a dramatic improvement in their population though no population survey or underwater studies have been carried out in the country but their commonness and nesting populations are indications that can be considered (**Table 4**).

By-catch data since 2006

Years	No. of turtles Caught	No. of turtles released	No. of turtles drowned
2006	14	0	14
2007	38	29	9
2008	137	107	30
2009	154	118	36
2010	199	140	59
2011	193	154	39
2012	113	99	14
Total	**848**	**647**	**201**

Nesting data since 2008

Years	Total nests	Extracted	No. hatchlings
2008/9	77	23	561
2009/10	89	1	2790
2010/11	69	4	1305
2011/12	124	3	7290
Total	**359**	**31**	**11,946**

Table 4: results of the conservation effort since 2006

2. Amphibians

Decline and losses of amphibian populations are a global concern with the complex local causes. Local causes in Sierra Leone include predation, habitat modification, environmental acidity and toxicants, diseases, climate changes or weather patterns, and interactions among these factors. Understanding the extent of the problem and its nature requires an understanding of how local factors affect the dynamics of local populations.

The current wave of interest in amphibian population biology and in the possibility that there is a global pattern of decline and loss began in 1989 at the First World Congress of Herpetology (Barinaga, 1990). By 1993 more than 500 populations of frogs and salamanders on five continents were listed as declining or of conservation concern (Vial et al, 1990). There is now a consensus that alarming declines of amphibians have occurred (Blausteinet al 1994, Corn 1994, Kuzmin, 1994, Pechmann et al, 1997, and Waldman et al 1998). Because most amphibians are exposed to terrestrial and aquatic habitats at different stages of their life cycles, and they have highly permeable skins, they may be more sensitive to environmental toxins or to changes in patterns of temperature or rainfall than are other terrestrial vertebrate groups (Blaustein et al 1990, Vitt et al., 1990). It is unfortunate that in Sierra Leone, there are no primary data for analysis of population trend over years since there is no national data base for reptiles and amphibians of Sierra Leone.

Two species of amphibians of specific importance are the endemic frog found in the Tingi Hills (*Bufo cristiglands*) and an endemic toad found in the Western Area Peninsular (*Cardioglossus aureolli*).

3. Manatees

One species of manatees (*Trichechus senegalensis)* occur in Sierra Leone and they inhabit brackish and coastal marine areas in the country. Manatees are among the data deficient species in the country therefore information about their population trend is lacking and thus the need for studies on this species. It is believed that this species is faced with both natural and anthropogenic threats in the country. Its main habitat is wetlands and their roles in the wetlands' ecosystem are vital not only to the health of the wetlands but to humanity also. In Sierra Leone, due to mining, logging, unsustainable farming, erosion and climate change effects most wetlands including coastal areas are degraded or threatened.

The marine habitat/ecosystem in Sierra Leone has also undergone series of modification due partly to human activities and largely to global warming. Coastal erosion has had significant impact on the coastal environment of the country thereby resulting in the loss of nesting beaches, islands and sea weeds that provides food for sea turtles and manatees. Siltation and sipping of fertilizers from farming around some coastal areas are resulting in the overgrowth of wetland plants and seaweeds which in some cases is posing threats to movement of some marine animals including manatees and boats. Wetlands and coastal areas are sensitive areas that need human attention. About 60% of human needs come from wetlands and coastal areas, but yet these places are not accorded the needed attention for the conservation. In Sierra Leone, the line ministries (MAFFS, MFMRS, and MLCPE) are working on protecting these very important areas.

3.5.4. Avifauna

A British Ornithologist G.D. Field was among the first to publish a number of reports on the bird diversity for some key sites including the WAPF and Gola Forest (Field, 1974; Field, 1979). Dowsette and Dowsette-Lemoire (1993) published the first comprehensive birdlist for Sierra Leone, incorporating data from a couple of decades of field studies undertaken by various ecologists. An updated national bird list was published in the national IBA book (Okoni-Williams, 2005), including new encounters for Sierra Leone between 1994 and 2005. A comprehensive review funded by BirdLife International was done in 2006, particularly to ascertain the presence or absence of species whose occurrences were uncertain. The review was part of the world-wide effort to update the status and distribution of avifauna globally.

Since the inception of the NBSAP in 2003, there has been progress in avifauna research and documentation such as the publication of the IBA book in 2005, the 2006 comprehensive review, and several bird-related studies from both local and international experts in various locations and for different purposes. These studies include an extensive survey of the Gola forest birds (Klop et al., 2008), a survey of significant areas at Loma Mountains (Demey and Okoni-Williams, 2008) and a number of ad hoc impact assessment related surveys and monitoring over the last five years. These surveys have together contributed significantly to updating the species list for Sierra Leone. Thus the data provided here are the most recent update of the national birdlist. It includes birds that are considered as residents, migratory species and vagrants.

a. Overview of Sierra Leone's Ornithological Status

Based on the results of several decades of surveys, documentations and reviews, Sierra Leone is now known to hold/support 642 species of birds, among which are 632 permanent or regular occurrences and 10 with uncertain presence, referred to as vagrants. Current status puts Sierra Leone on a fairly good range in terms of the relative standing on avian diversity in Africa, considering the small size of the country. This may be a consequence of the range of habitats and sub-habitats associated with the presence and combination of two biogeographic vegetation types mentioned in previous sub-sections – the Guinea-Congo forest biome and the Sudan-Guinea savanna biome. The species associated with these biogeographic regions are discussed in subsequent sub-sections.

b. Threatened species and species of global conservation concern

Across the different categories of avian species, are 27 species that are of global conservation concern, belonging to various categories of threat status according to IUCN (2013) and BirdLife International (2013a). Two of these species are endangered (En), ten are vulnerable (Vu), 11 are near-threatened (NT), whilst two are data deficient (DD) (**Table 5**). Over the last five years, three near-threatened species Crowned Eagle, Brown-cheeked Hornbill and Yellow-casqued Hornbill were upgraded to vulnerable status, whilst three species that were of least conservation concern, Bateleur, Martial Eagle and Blue-moustached Bee-eater, have been upgraded to near-threatened status. However, the endangered Rufous fishing Owl and the near-threatened Turatis Boubou were downgraded to vulnerable and least concern, respectively (IUCN, 2012; Birdlife International 2013). An upgraded status means that the population of the species has declined to a critical global population or there is a steady global decline in the population within a short period warranting serious conservation action, whereas a downgraded status means that the species' population has improved to a status that does not warrant its previous status anymore (IUCN, 2012).

The forests accounts for the highest proportion of species (70%) that are of global conservation concern (**Figure 1**). This does not only underlie the importance of the forest ecosystem in Sierra Leone to the conservation of birds, but also shows the degree of threat to birds that depend on forest ecosystems. Some of the forest dependent species such as Gola Malimbe and White-necked Picathates among others require delicate and specialised forest habitats for breeding and foraging activities. Many of the forest reserves support at least five of these species of conservation interest, but the Gola forest National Park and Loma Mountains Proposed National Park support the highest assemblages of such species. The former supports a total of 15 species (55.5%), whilst the latter supports 12 species (44.4%) of global conservation concern in Sierra Leone.

English and Scientific names	IUCN/BLS tatus	Review	Main habitat
Lesser Flamingo *Phoenicopterus minor*	NT	Unchanged	Wetland
Bateleur *Terathopius ecaudatus*	NT	New	Savanna
Crowned Eagle *Stephanoaetus coronatus*	En	New	Forest
Martial Eagle *Polemaetus bellicosus*	NT	New	Savanna
Pallid Harrier *Circus macrourus*	NT	Unchanged	Open
Lesser Kestrel *Falco naumanni*	Vu	Unchanged	Open
White-breasted Guineafowl *Agelastes meleagrides*	Vu	Unchanged	Forest
Great Snipe *Gallinago media*	NT	Unchanged	Wetland
Damara Tern *Sterna balaenarum*	NT	Unchanged	Wetland
Rufous Fishing Owl *Scotopelia ussheri*	Vu	Downgraded	Forest
Blue-moustached Bee-eater *Merops mentalis*	NT	New	Forest
Brown-cheeked Hornbill *Ceratogymna cylindricus*	Vu	Upgraded	Forest
Yellow-casqued Hornbill *Ceratogymna elata*	Vu	Upgraded	Forest
Yellow-footed Honeyguide *Melignomon eisentrauti*	DD	Unchanged	Forest
Western Wattled Cuckoo-shrike *Campephaga lobata*	Vu	Unchanged	Forest
Green-tailed Bristlebill *Bleda eximia*	Vu	Unchanged	Forest
Baumann's Greenbul *Phyllastrephus baumanni*	DD	Unchanged	Forest
Yellow-bearded Greenbul *Criniger olivaceus*	Vu	Unchanged	Forest
Lagden's Bush-shrike *Malaconotus lagdeni*	NT	Unchanged	Forest
Rufous-winged Illadopsis *Illadopsis rufescens*	NT	Unchanged	Forest
White-necked Picathartes *Picathartes gymnocephalus*	Vu	Unchanged	Forest
Sierra Leone Prinia *Prinia leontica*	Vu	Unchanged	Forest
Black-capped Rufous Warbler *Bathmocercus cerviniventris*	NT	Unchanged	Forest
Nimba Flycatcher *Melaenornis annamarulae*	Vu	Unchanged	Forest
Gola Malimbe *Malimbus ballmanni*	En	Unchanged	Forest
Copper-tailed Glossy Starling *Lamprotornis cupreocauda*	NT	Unchanged	Forest
Emerald Starling *Lamprotornis iris*	DD	Unchanged	Savanna
Total – 27: En – 2; Vu – 10; NT – 12; DD – 3			

Table 5: Table 2.1 List of species of global conservation concern, their IUCN/BirdLife International status and review

Status: NT - Near threatened; Vu – Vulnerable; En – Endangered; DD – Data deficient; New – recent additions to the list of species of conservation interest; Unchanged – status the same since 2005

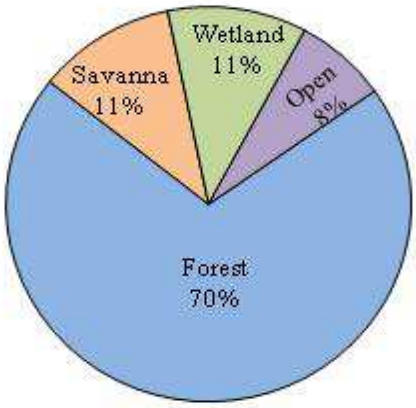

Figure 1: Proportion of threatened species in the main habitat types they occur

c. Resident, Biome Restricted and Upper Guinea Endemic species

Resident species refers to species that are known to spend all or much of their time in Sierra Leone, including its breeding and foraging range. The country holds 489 resident species, representing 76.1% of the total, with 307 (47.8%) is showing proof of breeding, locally. Among the residents are 274 Guinea-Congo forest biome (GCFB) species and 28 Sudan-Guinea Savanna species (SGSB) (**Table 6** and **Table 7**, respectively). Fifteen of the GCFB species are endemic to the Upper Guinea forest (**Table 6**) and these include 13 species with global conservation concern. Two of the Upper Guinea endemics Turati's Boubou and Sharpe's Apalis do not belong to any of the categories of species of conservation concern; the range of the former, though restricted, appears to extend slightly beyond the Upper-Guinea Forest. Sierra Leone's forests supports 14 of the 15 Upper Guinea forest endemics.

The GCFB species constitutes the largest biogeographic avian species representation in the country accounting for 42.7% of the total species recorded. It includes species with very restricted habitat requirements to species that are near-ubiquitous. These species are mostly associated with forest ecosystems, but because of the levels of modifications to their habitats, resulting mainly from human disturbance, many of them have been able to adapt to the changing habitat conditions and so are now found in various degraded forest habitats, forest re-growths and farm bush. The less adaptable species have more or less retreated into the fragments of forest habitats, thus the reason for the higher number of threatened species in forest reserves, where they enjoy some levels of protection. According to the IBA publication (Okoni-Williams et al, 2005), the Gola Forest Reserve (D10), Loma Mountains Forest Reserve (D03), Western Area Peninsula Forest (D07) and Kambui Hills Forest Reserve (D09) still hold the largest number of GCFB species in the country.

English and Scientific names	Status	Main habitat
White-breasted Guineafowl *Agelastes meleagrides*	Vu	Forest
Rufous Fishing Owl *Scotopelia ussheri*	En	Gallery forest
Brown-cheeked Hornbill *Ceratogymna cylindricus*	NT	Forest
Western Wattled Cuckoo-shrike *Campephaga lobata*	Vu	Forest
Green-tailed Bristlebill *Bleda eximia*	Vu	Forest
Yellow-throated Olive Greenbul *Criniger olivaceus*	Vu	Forest
Rufous-winged Illadopsis *Illadopsis rufescens*	NT	Forest
White-necked Picathartes *Picathartes gymnocephalus*	Vu	Forest
Turatis Boubou *Laniarus turatis*	LC	Various
Sierra Leone Prinia *Prinia leontica*	Vu	Forest
Sharpe's Apalis *Apalis sharpie*	LC	Forest
Black-capped Rufous Warbler *Bathmocercus cerviniventris*	NT	Forest stream
Nimba Flycatcher *Melaenornis annamarulae*	Vu	Forest
Gola Malimbe *Malimbus ballmanni*	En	Forest
Copper-tailed Glossy Starling *Lamprotornis cupreocauda*	NT	Forest
Total = 15: En – 2; Vu – 7; NT – 4; LC – 2		

Table 6: Species endemic to the Upper Guinea Forest and their main habitats

Another set of biome restricted species are those found in Sudan-Guinea Savanna Biome (SGSB). Only 28 species are known to be restricted to this biome (**Table 7**), representing about 4.4% of the total number of species; this number has remained unchanged since 2003. Also, only one of these species Emerald Starling is classified as data deficient by BirdLife International and IUCN, and is one of the attractions of many local and international bird enthusiasts. SGSB species are usually found in areas where woodland or grassland or mixed savanna vegetation predominates, normally found in the northern sectors of the country. However, the gradual creeping of derived savanna conditions into areas with closed forest formations associated with the southern sectors makes it possible for species like Oriole Warbler and Splendid Sunbird among others, to be recorded in the savanna-forest transition zone and further south, where they will normally not occur.

English and Scientific names	IUCN/BL status	Main habitat in Savanna
Fox Kestrel *Falco alopex*	LC	Valleys/streams
Senegal Parrot *Poicephalus senegalus*	LC	Woodland
Violet Turaco *Musophaga violacea*	LC	Woodland
Red-throated Bee-eater *Merops bulocki*	LC	Woodland
Blue-bellied Roller *Coracias cyanogaster*	LC	Woodland
Sun Lark *Galerida modesta*	LC	Grassland
Pied-winged Swallow *Hirundo leucosoma*	LC	Woodland/farmbush
Yellow-billed Shrike *Corvinella corvina*	LC	Open woodland
White-crowned Robin Chat *Cossypha albicapilla*	LC	Thickets/riverine scrub
White-fronted Black Chat *Myrmecocichla albifrons*	LC	Open woodland
Black-capped Babbler *Turdiodes reinwardtii*	LC	Thickets
Red-faced Cisticola *Cisticola ruficeps*	LC	Grassland/farmbush
Rufous Cisticola *Cisticola rufus*	LC	Grassland
Oriole Warbler *Hypergerus atriceps*	LC	Thicket/mangroves
Senegal Eremomela *Eremomela pusilla*	LC	Woodland
Splendid Sunbird *Nectarina coccinogastra*	LC	Woodland/thickets
White-cheeked Oliveback *Nesocharis capistrata*	LC	Grassland
Red-winged Pytilia *Pytilia phoenicoptera*	LC	Wooded grassland
Yellow-winged Pytilia *Ptylia hypogrammica*	LC	Wooded grassland
Dybowski Twinspot *Euschistospiza dybowskii*	LC	Wooded grassland
Bar-breasted Firefinch *Lagonostica rufopicta*	LC	Open woodland
Black-bellied Firefinch *Lagonosticta rara*	LC	Wooded grassland
Black-faced Firefinch *Lagonosticta larvata*	LC	Wooded grassland
Exclamatory Paradise Whydah *Vidua interjecta*	LC	Woodland/grassland
Togo Paradise Whydah *Vidua togoensis*	LC	Woodland/grassland
Bush Petronia *Petronia dentate*	LC	Wooded grassland
Emerald Starling *Lamprotornis iris*	DD	Woodland
Piapiac *Ptilostomus afer*	LC	Woodland
Total = 28: DD – 2; LC – 26		

Table 7: List of species found restricted to the Sudan-Guinea Savanna biome in Sierra Leone. LC – Least concern; DD – data dependent

Many of the SGSB species are known to occur in two as IBAs found within the savanna biome – the Outamba-Kilimi National Park (D01) and the Lake Sonfon and environs (D02) (Okoni-Williams,

2005). It is worth noting that these species do not only occur in areas in the north that have IBA designation. For instance, Emerald Starling, Dybowski Twinspoti, Togo Paradise Whydah, Splendid Sunbird, Oriole Warbler and Piapiac, to name a few, have been recorded in the Ferrengbaia Hills within the vicinity of the African Minerals Ltd lease area and the Bumbuna Hydroelectric Project area.

d. Migratory Species (coastal and marine avifauna)

Migratory species constitute a bulk of the coastal and marine avifauna. Of the 642 species of birds that occur in Sierra Leone, 146 species are migratory. Migratory species are a category of birds that spend only part of the year in one region and the remaining part in another region. These are birds that are mainly dependent on coastal and marine ecosystems. Their migratory activity is mainly driven by seasonal and moisture changes between the two locations where the birds stay. In Sierra Leone, two broad categories of migratory species are known among the 146 species – 98 Palaearctic migrants (PM) and 48 Afrotropical migrants (AM).

Palaearctic migrants are species that migrate between Europe and the Mediterranean region (summer range) and Africa (winter range), accounting for 98 (~15.3%) of the total number of avian species in Sierra Leone. According to data collected during the IBA and other surveys, 10 species of Palaearctic migrants visit the country with 1% of their biogeographic population. This is one of the criteria (IBA Criterion A4i) used in assessing wetlands for IBA designation, which qualified the Sierra Leone River Estuary and the Yawri Bay as IBAs. These two coastal wetlands support seven and nine such species, respectively (**Table 8**). The sites also support 20,000 or more individual waterbirds on a regular basis (IBA Criterion A4iii). The Sierra Leone River Estuary is the only designated RAMSAR Site in Sierra Leone, the 1014th RAMSAR site in the world, after Sierra Leone became the 108th member of the RAMSAR Convention in 1999. RAMSAR designations are given to wetland sites that hold significant proportions of the biogeographic population of migratory waterbirds, among other ecological reasons.

Other sites that potentially support significant population of Palaearctic migrants are Scarcies River Estuary in the north and Sherbro River Estuary in the south, both of which are potential IBAs (see Table 3.2). These four major coastal wetlands mentioned so far form a network of congregatory sites that constitute the East-Atlantic flyways for most of the Palaearctic migrants that visit Sierra Leone along their migratory routes. Apart from these major coastal wetlands, there are numerous other sites along the coast and inland that support many populations and congregations of many species of Palaearctic migrants. Palaearctic migrants mainly depend on mangroves, and intertidal mudflats and sandflats for their survival during their migratory activities, which peaks between December and February annually.

English and Scientific names	1% Biog. Pop. Thresholds	Migratory category	SLRE	Yawri Bay
Ringed Plover *Charadrius hiaticular*	3,000	PM	8,600	6,000
Kentish Plover *Charadrius alexandrinus*	1,000	PM	2,100	-
Grey Plover *Pluvialis squatorola*	1,000	PM	2,300	3,500
Sanderling *Calidris alba*	1,000	PM	2,900	-
Curlew Sandpiper *Calidris ferruginea*	7,000	PM	9,500	16,600
Knot Cali*dris canatus*	5,000	PM	-	5,000
Greenshank *Tringa nebularia*	2,300	PM	-	2,500
Redshank *Tringa tetanus*	1,750	PM	4,000	14,000
Western Reef Heron *Egrette gularis*	250	PM	500	-
Great White Egret*Casmerodius albus*	500	PM	-	686
African Spoonbill *Platalea alba*	150	AM	-	150
Royal Tern *Sterna maxima*	150	AM	-	1,100
Totals	**12**		**7**	**9**

Table 8: Species with 1% biogeographic population (IBA Criterion A4i) in Sierra Leone

(Biog. Pop. – Biogeographic population; SLRE – Sierra Leone River Estuary (Data Source – Okoni-Williams et al., 2005); PM – Palaeartic migrants; AM – Afrotropical migrants)

Afro-tropical migrants (also referred to as intra-African migrants) account for 48 (7.5%) of the total number of species in the country. These species normally migrate in response to moisture rhythm, the nature of which depends of the species. In Sierra Leone, the number of Afrotropical migrants increases during the wet season (June to September). Only two species in this category Great White Egret, and African Spoonbill are represented by 1% of their biogeographic population in the country (**Table 8**). Most AM species depend on a diversity of wetland types for their survival, thus they are found in both inland and coastal wetlands. Some of the most important inland wetland habitats for AM species include Mamunta-Mayosso WildLife Santuary, Lake Mape, Lake Mabesi and the Sewa-Wange River system.

In general, the forests constitute the most important ecosystem for bird conservation as it supports the highest proportion of resident species. Forest-dependent species make up the largest component of avian communities, a good number of which are restricted to closed moist forest only. According to Okoni-Williams and Thompson (2013), Guinea-Congo Forest biome assemblages accounts for nearly 45% of the country's avifauna, whilst species found in almost all ecosystems (ubiquitous species) constitutes the second highest group (**Figure 2**). Based on data obtained from some mining areas, ubiquitous species are likely to dominate future avifauna if the current spate of deforestation and habitat degradation continues (J. Wolstencroft and A. Okoni-Williams pers. obs.).

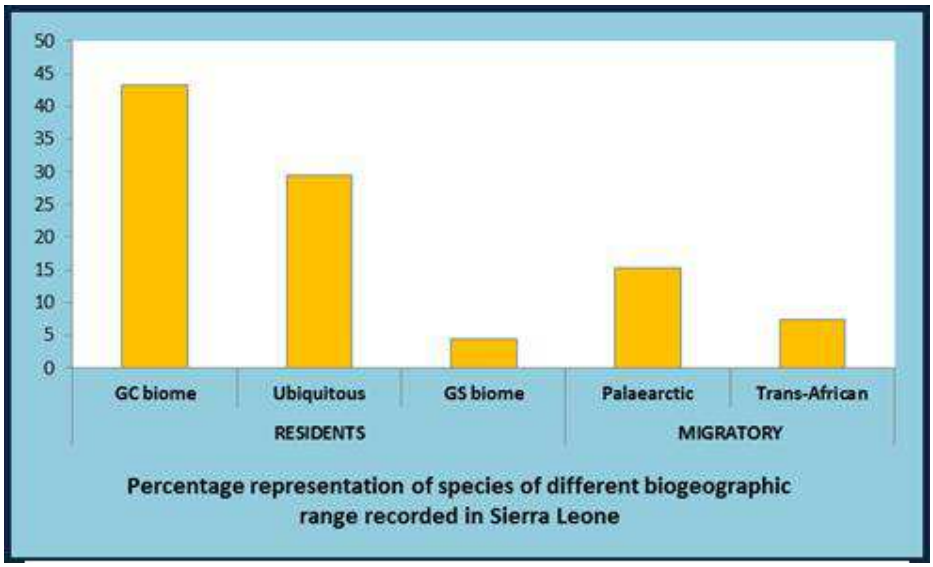

Figure 2: Distribution of Sierra Leone's avifauna based on biogeographic representation (Source: Okoni-Williams and Thompson)

3.5.5. Invasive species and their management in Sierra Leone

1. *Background*

Invasive species are organisms that proliferate beyond their normal natural and capacities because of its introduction in to a new habitat where its natural enemies and natural control mechanisms are absent. Invasive species can either be native or alien and they have the tendency to dominate native plant, animal or microbial communities. In the process, invasive species threatens agriculture and food production, biodiversity and natural ecosystem function, if not controlled. In Sierra Leone, most invasive species are aliens that were introduced either deliberately or accidentally. Deliberate introductions include plant species such as *Acacia spp* used in reforestation purpose and animal species used as biological control of cassava millibug *phenococus mammihoti*. Introduction comes mainly from the importation of goods and organic materials into country; such introductions include a species of cockroach (*Blatta americanus*) that is has been reported in many homes.

2. *Invasive species affecting agricultural ecologies*

a. *Chromolaenadorata*

Chromolaenadorata is a shrub that exists as a noxious weed in many upland ecosystems including farm bush and every other available inch of clearing and preventing the growth of other vegetation. The invasive nature of the weed species was first observed in the mid 1970' In the Eastern and Southern provinces it is known as '' Ndojbohlukpe'' (meaning push bush backwards)

In some parts of the north, especially around the Tama- Tonkoli forest areas, where it is known as ''rebel weed'' several farmbush have been abandoned because of its high level of chromolaena infestation. The plant belongs to the family compositae, producing lots of floral heads and seeds that are easily dispersed by wind, and this allows it to spread rapidly.

Its occurrence and spread is nation- wide. In a recent survey of six areas covering the mid to southern latitudes of the country, the weed was observed have invaded all agro systems and accounted for the largest proportion of plants found in fallow land (figure 4) (Okoni Williams, 2013) Although, in some

Afro tropical agro systems the plant is recognized as a fallow, its usefulness to such ecologies in Sierra Leone has not been proven. Its tendency to suppress the growth of woody plants at the early stages of succession is a potential threat to regeneration of indigenous woody plants, to forest restoration and to plant biodiversity in general. It has been reported that it has allelopathic tendencies. Also, because of the phenolic compounds that it contains, it can be used as herbicides. Claims have also has been made about its manural potentials. In spite of its positive attributes'' its aggressiveness is very worrisome, especially when there seems to no strategy for its eradication.

b. Eichornia crassipes

This plant commonly called water hyacinth is found in swamps and waterways all over the country. It shades out other aquatic plants and reduces the availability of sunlight and oxygen for plant metabolism. Thus its spread potential threatens the survival of variety of plant species and the ecology the stability of riparian ecologies and swamp cultivation.

c. The Acacia species

As indicate in earlier sections *Acacia mangium, Acacia auriculiformes* and *Acacia leptocoma*, As a result of their adaptability, these exotic species which originated from South America are considered invasive and thus their use in forest restoration have been a serious ecological concern, especially among the scientific community. In fact, based on some empirical evidence, it has been suggested that *Acacia spp* have allelopathic properties and have greater water uptake potential than most local species. It has also been observed that the undergrowth vegetation in most *Acacia* plantations is usually sparse and many common herbaceous species do not survive in Acacia dominated ecologies. Thus, the proliferation of *Acacia spp* in the country and its ability to colonise, potentially threatens local biodiversity and water availability.

d. Melalucaleucodendron

Alien spices used as windbreaker especially around Lumley Beach. Unfortunately, all of these planted stands have been cut down for infrastructural developments.

e. Gliricidia sepium and Luucaena leucocephala

These are alien species used in agro-forestry especially alley cropping. These species are also very aggressive and has the potential to become weeds if left unattended. At the moment the species do not seen to have reached their invasive potential probably because of some ecological conditions that may be associated with their establishment in new environments.

However, there is need for investigation into their invasive nature so that the necessary strategy could be put in place to keep the spread of these species in check.

f. Animal alien invasive and non-invasive species in Sierra Leone

According to information from Phyto-sanitary and Pest Control Officials of the Ministry of Agriculture, Forestry and Food Security, there has been no known introduction of alien invasive animal species into the agricultural system over the last thirty years, since an invasion of locust (*Locusta migratoria*).

The import of second hand goods has exposed the local domestic ecology in invasion by one or more species of cockroaches. Many homes are now invaded by these cockroaches and there is possibility that other species of insect and invertebrate may have been introduced into local ecologies. These

alien cockroaches (*Blatta ameracanus)* are smaller than the local cockroaches *(Blatta orientials*) and are said to be aggressive against the local cockroaches and gotten rid of by these aliens. However, there has not been any known work to verify this information.

g. Biological control Agents

In the recent times parasitoids are being released as bio-control agents for the control of cassava mealybug and mango mealybug. These parasitoids are alien into the local agro-ecosystems.

h. Marine Alien Species

There is very little evidence of an introduction of marine alien species. According to Ndomahina (1996), in the mid 1980s there was a sudden increase in the population of invasive fish species, *Ballistes capriscus* which led to a reduction in snapper population. It was believed that invasion of this alien fish species into Sierra Leone waters was as a result in the marine environment was related to an incursion of cold saline bottom water. This change in ocean climate was linked with an overall regional change. This phenomenon reversed in 1988 and the cold front shifted to Guinea Bissau taking with it the *Ballistes* population and there was a subsequent recovery in the snapper population.

The Nile tilapia, *Oreochromis niloticais* an alien fresh water fish species which was introduced into Sierra Leone from Cote d'Ivoire in the 1970s (FAO, 2013). This fish is now widely used in inland fisheries and aquacultures.

Most of these introductions are not invasive or aggressive to cause problems for the local flora or fauna.

4. THE MAIN THREATS TO BIODIVERSITY

4.1. Threats to natural resources and forests

4.1.1. Bio-piracy of our natural resources

This activity entails the surreptitious acquisition of both knowledge and biological material of high commercial value, from the country without benefit to the source country. This basically represents the inequitable distribution of "negative benefits" and has a more negative impact on the economy and sustainable resources management. Unfortunately, there is no legal protection against this practice which continues unabated. However the draft forestry policy (2010) touches this only in passing.

The most unfortunate global problem is that all the biological materials pirated or that were officially exported before the CBD came into being in 1992 are not covered by the CBD's benefit sharing objective. While some transfers are recorded, others are not recorded. There is need for a policy directive to cover this so that proceeds from any research on these materials could benefit the source country as well. The CBD however states that the authority to determine access to genetic resources rests with national governments and the access is "subject to PRIOR INFORMED CONSENT" (PIC) of the country party providing such resources unless otherwise determined by the party. This basically means that it is left to the government whether or not to make access subject to PIC. In the case of traditional Knowledge, however access to traditional knowledge demands PIC from the traditional groups and not from government (Seiler and Dutfield, 2001).

Access is also subject to mutually agreed terms (MAT) and applies to the following:

a. Access to genetic resources;
b. Fair and equitable share of results of research and development and the benefit arising, from commercial and other use of genetic resources;
c. Access to transfer of technology, and;
d. Access to the results and benefits arising from biotechnology.

On the other hand bio prospecting arrangements when effective can generate revenue from the following areas:

a. Fees per sample;
b. Advance payments;
c. Trust fund;
d. Joint research and/or reports on the results of their research;
e. Training for collaboration institutions and indigenous communities;
f. Royalties on any compounds;
g. The option of filing a jointly-owned patent with collaborators (Seiler and Dutfield, 2001).

4.1.2. Poaching of Fauna

Poaching robs the country of biological resources from all ecosystems. These stolen resources deprive the country of the much needed revenue for economic development and the share of financial benefits belonging to the communities. Sadly, there are no benefits to be shared in this case, let alone talk about equitable considerations. Unfortunately, this activity is a source of major biodiversity loss which is still difficult to contain due to limited staff strength and capacity.

According to reports from the OKNP and the Gola national Park management, poaching is happening between the OKNP (Sierra Leone) and Madina Oula and Fore Kaba axis (Guinea) and between the Gola national forests (Liberia) and the Gola national park (Sierra Leone). The poachers normally target elephants for the ivory, chimpanzees for the pet trade and buffalos and others for meat. It is difficult to assess the loss due to access problems and for security reasons, as the poachers are often heavily armed in these remote areas.

4.1.3. Inadequate valuation of resources

Poverty-stricken communities providing biological resources at village level, tend to undervalue these resources. For instance, to these communities redwood and whitewood are sold at the same rate and irrespective of timber volume, due to desperation especially during the lean season. Because of this low market value, one needs to harvest large volumes of the resource to generate substantial income, at the expense of judicious resource management and sustainable development. In addition, collateral damage to economic plantations during the felling and ripping operations could be high and is hardly compensated for.

4.2. Threats to Agricultural biodiversity

The agricultural biodiversity of Sierra Leone continues to face stiff and increased challenges from natural and man-made threats. Natural threats include climate change and related threats. Agro-biodiversity is amongst the thematic areas vaguely defined in the NBSAP as becoming vulnerable to the impacts of climate change. However, the occurrences of natural disasters such as flooding, high wind speed, erratic weather patterns and droughts are directly and indirectly considered as natural threats to the agricultural biodiversity ecosystems in many ways:

- Climate Change contributes towards loss of agricultural biodiversity in crops, resulting from adverse climatic effects such as drought (water stress), flooding, salinity levels and wind damages to crops etc.

- Decline in crop and livestock yields due to fluctuation of water distribution patterns, decline in soil nutrients and lack of fodder etc.

- Decline in soil fertility conditions and structure resulting from heavy use of farm machinery in mono-cropping, unsustainable fallow systems and repeated cropping etc. The impact of climate change on crops and livestock is most severe when several climatic factors occur simultaneously. For instance, prolonged drought coupled with heavy wind causes severe crop losses in cereals as a result of lodging particularly on mono-cultured commercial farms.

4.2.1. Pests and Diseases Infestation

Pest and disease infestations of crops are exacerbated by a combination of poor farming practices and increased adverse effects of climate change. For instance, mono-culture coupled with poor rainfall (drought) contributes towards substandard plant growth, thereby increasing vulnerability to pests and diseases attacks. The increased number of pests and diseases is closely correlated to the increased number of introduced crop varieties.

In this light, the Sierra Leonean traditional farming systems of "sequential" or "relay" and mixed cropping in the uplands has proven to be a more robust system that greatly minimizes pests and diseases infestations. A mixture of several crops in one plot provides a buffer to attack by diseases and pests. For instance, the anthracnose (fungal) disease that affects rice does not affect cassava.

Similarly, the spatial distribution of a mixture of crops in a mixed farm serves as barriers slowing down the spread of pests and diseases among the different plants in the field.

4.2.2. Bush fires

Natural bush fires are caused by lightning and sometimes by sun scorching. Prolonged drought periods often result in natural bush fires because most of the biomass has become very dry. Slash and burn is an old farming practice in Sierra Leone. However, it was previously done on a small scale and used just to kill big trees, shrubs and grasses in a shifting cultivation system whereby farming rotates from one piece of land to another. The problems today are the indiscriminate burning of large tracts of land during the harmattan in preparation for the next season's farming resulting in wild bush fires as well as large scale slash and burn practices to clear grasslands for commercial farming. The problem is not only is the entire ecosystem destroyed, mechanization and repeated cultivation exacerbate the push to shorter fallow periods.

4.2.3. Man Made Threats

Anthropogenic activities constitute the major threat to biodiversity. These activities include Agriculture, Livestock farming, Forest exploitation, Fishing, Energy exploitation, Mining, Transportation, Urbanization (infrastructure development) and Waste disposal. The long civil conflict in Sierra Leone exacerbated the threats (Koker and Kamara, 2002). The forest cover had been reduced from about 70% in 1990 to merely 5% today (Grubb et al., 1998) with forest regrowth constituting 60% of the total area. In addition to population displacement during the civil conflict, the urban population has increased in the areas of refugee putting tremendous pressure on land and habitat for food and fuel thereby endangering biodiversity.

The degradation of habitats through urbanization has impacted strongly on the depletion of Agricultural biodiversity in Sierra Leone. Studies indicate that 85 % of the species on the IUCN Red List is threatened by habitat loss, while clearing land for development and agricultural expansion have dramatically accelerated habitat loss. Agricultural biodiversity ecosystems have been degraded or altered by changes in land use and habitat destruction (development of tourism, deforestation, mining and aquaculture).

Fragmentation of large areas of habitat (owing to flooding, landslides, soil erosion, open pit mining, road construction or other human activities) into smaller patches makes it difficult for isolated species to maintain large enough breeding populations to ensure their survival. It also diminishes the quality of the remaining habitats.

Inland water ecosystems and wetlands (Inland Swamps) can also be altered and destroyed by development of irrigation systems, dams and reservoirs, as well as by introducing water drainages, canal and flood-control systems.

4.2.4. Farming Developments

In the 2003 NBSAP, agricultural development in general was highlighted as one of the major causes of loss of biodiversity. Recent trends in agricultural development such as changing from manual to mechanized farming, the shift from traditional mixed cropping systems to monoculture, changing

from organic (non-chemical) to chemical inorganic fertilizers, and shifting cultivation with shorter fallow periods are the major causes of loss of agricultural biodiversity. Some details are provided below for specific practices.

4.2.5. Commercial Farming

A major threat comes from commercial farming which focuses on maximum utilization of the land in a short period of time. Essentially, commercial farming produces crops that have market value and are in demand. Consequently, crops with lesser market value are left out and are at a risk of extinction due to lack of planting materials and conservation practices. Commercial farming enables farm machinery to over-work the soils through over-tillage, compound the soil structures as well as change the status of the soil conditions. Land tillage during wet conditions makes the soils compact. Tillage along land on slopes increases the risk of soil erosion. Increased use of agro-chemicals such as herbicides decreases the chance for the unwanted crops, but has important bearing on survival of biodiversity.

The Sierra Leonean traditional farming systems as in other parts of Africa is one of the most robust and sustainable systems known world-wide. Planting of crops on a "relay" or "sequential" manner allows for a diversity of crop varieties growing on the same plot of land for a prolonged period of time (up to 5 years) depending on the crop varieties used. Given the longevity of the cropping cycle, short-term and long-term crops are left to grow in harmony. The opportunity for widespread infestation of pest and diseases is kept low because of the high crop diversity, by which each crop acts as a buffer to pests and diseases that prey on other crops.

4.2.6. Slash and burn

Slash and burn is mentioned as a stand-alone farming practice because it is used in both commercial and subsistence farming practices throughout Sierra Leone. It refers to the cutting down of trees and bushes including grasses, and burning them. Repeated slash and burn is detrimental to all living ecosystems on the land and minimizes the opportunities for the indigenous wild plant/crop species rehabilitation and survival.

4.2.7. Short fallow periods

Due to increased population pressure on limited farm lands and increased inaccessibility to lands occupied by non- farming and migrated landowners, the arable farm lands available for farming in Sierra Leone is on the decline. Increasingly, people are now acquiring land for farming through short to medium-term leasing arrangements, at times for as short as one year for crops such as annuals and vegetables. In order to maximize crop returns from the same piece of land, the traditionally longer fallow periods to 10 to 15 years are being cut to as low as 3 to 5 years. This implies that the soils are continually cultivated thus giving no opportunity for rehabilitation of larger trees species, soil fauna and restoration of longer-term stable crops. Short fallow periods also contribute towards downgrading of the structure and other properties of the soil.

4.3. Threats to Biodiversity in the Aquatic, Coastal and Marine Ecosystems of Sierra Leone

Biodiversity in Sierra Leone has been subjected to serious threats, both direct and indirect. The most obvious threats include habitat loss and fragmentation of natural habitats due primarily to deforestation, wetland drainage and infrastructural development, overgrazing, poor mining practices, poor farming practices, inappropriate use of agrochemicals, pollution, bush fires, population pressure,

civil conflict, poverty, illiteracy, lack of resources, limited trained human power, inappropriate policies, institutional weakness as well as socio-economic factors.

The coastal zone as used in this work is as defined by Clark (1990) as "all coastal areas that are subject to storm flooding by the sea, all intertidal areas of mangrove, marsh, deltas, salt flats, tide flats and beaches; all permanent shallow coastal water areas such as bays, lagoons, estuaries, deltaic waterway and near coast waters that include sea grass meadows, coral reefs, shellfish beds submerged bars; the near shore coastal waters and small coastal islands".

Biodiversity refers to the total variety of living organisms and their complex interrelationship. It is often divided into three hierarchical levels: genetic (diversity within species, species (diversity among species), and ecosystem (diversity among ecosystems) (Martens, 1995).

Certain levels of anthropogenic activities do pose serious threats to biodiversity. In 1985, CSO stated that about 43% of the population of Sierra Leone lived within 10 km of the coast. Between 1991 an 2002 (during the rebel war), it is believed that as many as 60% of the population may have fled to safer areas on the coastline occupying more than 500 towns and villages. With the war now over and considering the level of destruction, there is need for reconstruction and the strengthening of those activities that lead to overall poverty reduction and sustainable development.

Along the coast activities such as Fishing, Agriculture, Industrial activities (Textile, Chemical, and Brewing), Mining and Mineral exploitation, Tourism, Marine Transportation, Marine and Coastal Infrastructure, Waste dilution and domestic use water are bound to be on the increase. The activities themselves shall require huge investment and appropriate infrastructure.

Urbanization and development consumes resources heavily and generate huge quantities of waste (Chemical and Solid wastes). Increase in anthropogenic activities and pollutant introduction into the coastal zones affect the complex food web and ecological relationships thus adversely affecting the biodiversity. In addition human health and water quality may be adversely affected. The bulk of pollutants entering the sea are derived from the following sources; Runoff and discharges from the land mainly through rivers (44%), Atmosphere (33%), Marine Transportation; Spills and Operational discharges (12%), Deliberate dumping of wastes (10%), Offshore development of mineral resources (1%).

4.3.1. Over-exploitation

In principle every marine organism could be exploited on a sustainable basis. However when more are taken than could be replaced over-exploitation is the result.
In Sierra Leone, there is evidence of over-exploitation of certain categories of target species and significant reduction in others in response to growing demand and population growth. Out of seven major snapper species, five (*Dentex angolensis, D.congensis, D. Canarensis, Pagellus belloti* and *Sparus caeruloesticus*) have been shown to be declining rapidly (Showers, 1996). There is evidence of over-exploitation of the following species: *Pseudotolithus senegalensis, Drepane africana, Galeoides decadactylus, Dasyatis margarita* (Coutin, 1989; Fomba, 1996). *Ilisha Africana* is the only pelagic species known to have been over-exploited (Ndomahina and Cham 1995, In Press)
The coastal catfish *Arius latiscutatus* is slightly over-exploited (Ndomahina, 2001; Ndomahina and Mamie, 2002; In Press). The shrimps have reached the maximum sustainable Yield levels of 3,000 mt (MFMR, 2002).

Generally gill netting, purse seining and bottom trawling discriminate poorly between target and none target species. Bottom trawling can cause considerable mortalities among benthic organisms such as mollusks, crustacean, hydrozoans, bryozoans and echinoderms. Globally between 5 – 20% and 4.5 – 19 million mt of by catch of finfish are taken by shrimp trawlers (Bricklemeyer et al., 1989).

In Sierra Leone about 70% of the total landings from the shrimping sector consist of finfish by catch. Both shrimp and finfish trawlers discard about 50000 mt and 3000 mt of finfish by catch amounting to 3% and 11% of the total annual catch respectively (Baio, 1999; Cole, 2000; Kanu, 2001; IMBO, 2001).

In the artisanal sector large proportions of juveniles of valuable species such as *Ethmalosa fimbriata*, *Sarda sarda, Caranx and Polydactylus quadrifilis* are landed by gill nets and beach seines (**Figure 3**). In recent times 2002 there are about 150 beach seines compared to some 20 in 1995 in the Western area. There is a risk of recruitment failure. Okera, 1978, recorded 64 species of fish landed at Lumley beach. Today, there are not more than 40 species recorded annually. Poisons and explosives are prohibited by law but are widely used especially in rivers and estuaries. Artisanal fishermen are noticing a drop in their catches.

Mangrove swamps have their unique fauna (gastropods, bivalves, polychaetea, reptiles and mammals). After clearing the scorging sun dries up the mangroves swamps. Trees are replaced by few adventitious grasses. Only a few species are obvious including *Uca tangeri.*

Figure 3: A photograph of beach seine

4.3.2. Agriculture and Forestry

In the coastal areas, mangrove swamps especially in the North are cleared for rice production. Fomba (1997 Per.Com) estimated that 35,000 ha in the North and 5,000 ha in the South are under cultivation. Mangroves are used as fuel wood, for charcoal production, and construction material.

Mangrove swamps and wetlands are bound to be put under further pressure leading to habitat destruction and loss of biodiversity. Pesticides are also used to control of malaria, Schistosomiasis and Orchocerciasis. Pesticides are also used to control pests of rice. Oil palm plantation such as Biopalm Oil Star, West Africa Agriculture, Kingho and Sulphin and Agroforestry Company such as Miro Forestry Limited are all using chemical fertilizers. These fertilizers are dangerous when they reach the Aquatic and Marine Environment. These are washed up through erosion and run-off into rivers and sea. Also, sugar plantation owned by ADDAX Bioenergy Company is also contributing to the level pollution in the Rokel River.

4.3.3. Industrial Activity

About 95% of all industries in the country are located in Freetown. Among these are Oil Refinery, Sierra Leone Brewery, Whitex, Wellington Distilleries, Aureole Tobacco and Paint Factories. Effluents from these factories are discharged directly into the Sierra Leone River Estuary. There are plans to extend the operations of the industries into the hinterland and coastal areas including Pepel and Bonthe.

4.3.4. Coastal Transportation

On the average there are about 50 industrial fishing vessels today. It is estimated that there are 2,000 Artisanal fishing boats of which 950 are motorized. There are an estimated 450 motorised Artisanal cargo boats. The Sierra Leone Ports Authority handles on the average 300 vessels annually. The increased demand on the transport sector has lead to the uncontrolled importation by the private sector of a large number of second hand modes of transportation often fitted with low performance engines. The private sector also continues to import all sorts of grades of fuel and lubricants to service this rather expending but inefficient and poorly managed sector.

Vehicular and coastal marine transport emits gases such as sulphur oxides, nitrogen oxides, carbon monoxide and heavy metals. Power plants of ships and industrial vessels do not only emit noise and thermal energy but also emit significant levels of metals. Burnt oil, bilge and ballast water may be discharged at sea. Garbage including glass and plastics are often thrown overboard by the crew. Anti-fouling paints, lead and acid from batteries and burnt oil from workshops eventually enter the sea. Exhaust pipes emit carbon dioxide and other gases into the atmosphere.

4.3.5. Mining and Mineral Exploitation

The main minerals mined in Sierra Leone are Iron ore, sand gravel, rocks, gold, diamond bauxite Zircom and rutile. Because of the construction industry and coastal infrastructural development sand and other building materials are in great demand. As part of IMBO programmes, Mansaray, (2001), estimated that the quantity of sand removed from Lakka Beach over a 10-day period in August and

September 2001 amounted to 6,420 tons. Mining alters the coastline and discharges silt and mineral water into the coastal zone. Rocks with their rich biota are quarried also for construction.

4.3.6. Power Generation

Because of the large quantities of water required for power generation, hot water or thermal effluent is usually discharged into the sea by coastal stations. Kingtom and Falconbridge stations in Freetown and Nitti and Bonthe stations are found in the Sierra Leone River Estuary and the Sherbro estuaries respectively. Deliberately discharging burnt oil or through accidents involving storage silos could be injurious to the environment.

4.3.7. Tourism

Sierra Leone's coastline is made up mostly beaches and mudflats. Tourism is bound to be on the increase. There are tourist facilities at Lungi, Freetown Peninsula, Shenge, Bonthe and Turtle Island. Tourism requires land based infrastructure and coastal transportation. Tourism can lead to changes in flora and fauna, introduction of pollution, erosion, depletion of natural resources and increase litter. As many as 20,000 tourists are expected annually in the future.

4.3.8. Domestic Waste Disposal

Domestic waste comprises human wastes, laundry waste and solid waste (garbage). About 70% of all households in Freetown and big towns use pit latrines. About 20% have cesspits and 10% use rivers, coastlines and the bush. In the smaller settlements 80% of the inhabitants use the beaches as toilets.
In Freetown sewage from pit latrines and cesspits are only partially treated and discharged into the sea. In addition untreated sewage is discharged directly into the Sierra Leone River Estuary through 4 main sewer lines or outfalls (Murray Town, Kingtom, Government Wharf and Cline Town). Each of these outfalls is found close to certain bays and creeks: Aberdeen, Whiteman's bay, Kroo Bay and Cline bay.

Solid waste collected in Freetown is disposed of at two dumpsites: Granville Brook and Kingtom. At Granville Book, about 66,607kg of solid waste is deposited every month (Nyuma, 2000). Some part of these wastes is eventually washed out to sea. Coastal populations deposit their solid waste on the beaches.

4.3.9. Marine and Coastal Infrastructures

Almost all coastal activities require some amount of infrastructural development. Many tourist concerns have built hotels, guest houses and environment centres close to the coast.

There are possibly more than 50 such centres along the entire coast. Other activities may include construction of silos, pipelines and jetties. There may be channelization, dredging and filling. There are 3 major ports (Queen Elizabeth II Quay, Pepel, and Nitti). The World Bank is to rehabilitate over 30 landing facilities and may construct more.

4.4. Threats to Reptiles, Amphibians, Sea Turtles and Manatee diversity

Although the precise reasons for most reptiles and amphibians declines have not been completely understood and in some cases remain enigmatic, reptiles and amphibians appear to succumb to many of the same problems that affect other wildlife as well as humans. Some of the most important individual factors that are believed to be involved include habitat loss, environmental contamination, desease, climate change and over harvest for human use. However, studies on amphibians have revealed that it is the interaction among some of these factors that may be the ultimate cause of declines (Blaustein and Kiesecker 2002; Collins and Storfer 2003; Stuart et al 2004).

Agricultural activities and trapping are the key threats faced by manatees in Sierra Leone. Other possible threats faced by manatees include environmental contamination and climate change.

4.4.1. Habitat loss/modification

Habitat modification is believed to be the most documented cause of amphibian and reptile population decline in Sierra Leone. Habitat loss certainly reduces amphibians and reptile abundance and diversity in the areas directly affected. Removal or modification of vegetation during forestry operations has a rapid and severe impact on most reptile and amphibian populations. For example, logging, agricultural activities and settlement expansion exposes terrestrial reptiles and amphibians to drastically altered microclimatic regimes, soil compaction and desiccation, and reduction in habitat complexity. The Freetown Long-fingered Frog (*Cardioglossa aureoli*) was first seen in Sierra Leone in 1964 and went unnoticed until 2009; this was probably due to habitat modification since its extent of occurrence was degraded to the extent that it became rare. Though the species are still present within the Western Area peninsula Forest and the Bumbuna area, the extent of habitat modification is likely to result in their rarity once again.

Habitat modification exposes aquatic reptiles and amphibians to stream environments with increased siltation and reduced woody debris. Although populations may recover as regenerating forests mature, recovery to pre-disturbance levels can take many years and may not occur at all if mixed forests are replaced with monocultures. Draining wetlands directly affects frog populations by removing breeding sites, and by fragmenting populations.

Modification of terrestrial and aquatic habitats through urban development can reduce or eliminate reptile and amphibian populations. Populations of some reptiles and amphibians are deemed to decline after degradation of upland, dry season refuges and modification of wetlands used for breeding. Protection of aquatic breeding sites may be of little value if adjacent terrestrial habitats used by amphibians for feeding and shelter are destroyed (Ross et al, 1990)

For sea turtles, beach erosion, fishing, eggs collection, climate change effects, mining, commercial development, pollution and diseases are the key threats. Climate change effects include rising sea levels and submersion of nesting beaches, extreme storms and rainfalls, soaring temperatures, warmer ocean and current, ocean acidification.

4.4.2. Climate / weather

Alterations in local weather conditions caused by global climate change are believed to influence the ecology of reptiles and amphibians in a number of ways. Increased temperatures, extended dry seasons, and increasing inter-year rainfall variability may affect litter species by reducing prey populations and altering reptile and amphibian distributions on increasingly dry soil.

Shifting rainfall patterns is also affecting the reproductive phenology of pond-breeding species. Ponds will fill later and persist for shorter periods, leading to increased competition and predation as

amphibians are concentrated at increasingly limited aquatic sites. Frogs exposed to these stresses may also become more vulnerable to parasites and disease (Donnely et al., 1998).

For the marine species including sea turtles and manatees, climate change effects include coastal erosion, extreme storms, rising sea levels, warmer ocean, current and soaring temperature. Sea turtles are losing their nesting grounds and higher temperature is influencing the increased population of females with lesser population of males.

4.4.3. Acidity and Toxicants

The acidity of aquatic habitats has major impacts on amphibian distribution, reproduction, and egg and larval growth and mortality (Fite et al, 1998, Freda et al 1986). Sensitivity to pH varies among and within species and is influenced by complex chemical interactions among pH and other factors which in most cases may result in incomplete absorption of the yolk plug, arrested development, and deformation of larvae. Sub lethal effects of acidification include delayed or early hatching, reduced larval body size, disturbed swimming behavior, and slower growth rates resulting from reduced response to, and capture of, prey. Indirect sub lethal effects include changes to tadpole food sources through impacts on algal communities, and shifting predator-prey relationships resulting from differential mortality of predatory fish and invertebrates in acidified habitats. The population-level effects of acidity are less well understood. It is possible that the effects of low pH, in combination with other abiotic factors, lead to decreased recruitment into adult populations (Ross et al, 1990).

Some sea turtle species (Hawksbill, loggerhead, and kemp ridleys) survive on crabs and other shellfish. Ocean acidification caused by rising carbon dioxide levels breaks down the shells of preferred turtle prey, such as mollusks and crustaceans, and could alter turtles' food supply. Declining coral reefs due to increases in temperature and ocean acidity would also have negative impacts on sea turtles such as hawksbills that depend on corals for feeding and foraging. Pollutions including plastics, oil spills are threats to marine species including sea turtles are manatees. Sea turtles have been found dead after having choked on plastic bags that are mistaken for jellyfish common food.

4.4.4. Predation

Biotic interactions among reptiles and amphibians, and between amphibians and amphibians and other organisms, can play a significant role in determining their distribution and population dynamics. Larval amphibians are extremely vulnerable to vertebrate and invertebrate predators, and the diversity of aquatic amphibian assemblages is frequently reduced in habitats containing predatory fish (Alford, 1999). Humans have devastated frog populations in several ways for protein.

Sea turtles and manatees are hunted for their meet while turtle eggs are also collected for food. Turtle hatchlings (baby turtles) suffer predation upon their emergence from the nests. No underwater studies have been done to determine the further predators of manatees and sea turtles.

4.4.5. Diseases

It is believed that many disease agents are present in healthy animals, and disease occurs when immune systems are compromised. In Sierra Leone, little or nothing is known about the diseases of wild amphibians, reptiles and manatees. However, a disease known as fibropapillomas, a tumorous growth that kills sea turtles has been noted to affect a small number of sea turtles. It has been hypothesized that this epidemic, which is believed to be linked to toxic ocean pollution, is affecting sea turtles' immune systems.

4.4.6. Interaction among Environmental Factors

Although studies have not been done in Sierra Leone to ascertain the impact of interaction among environmental factors with regards to reptiles, amphibians and manatees, it is widely believed concept that predation may eliminate local populations and have larger-scale effects by altering rates of migration between populations. Outbreaks of disease may only occur when other stresses reduce immune function. Pesticides, pollutants, and environmental acidity may interact to produce unforeseen effects. All local effects may interact with global climate change. Proving the existence of these complex effects in natural populations will require well-planned programs of observation and experimentation. To plan such studies, and to determine how stresses affect population behavior, requires an understanding of the nature of the populations being studied and the limitations of study techniques (Ross et al, 1990).

4.5. Threats to Sierra Leone's Avifauna

4.5.1. Habitat destruction and degradation factors

Habitat destruction and degradation is the most potent threat to bird diversity in Sierra Leone. The following is a description of various forms of threats to birds from habitat destruction and degradation:

4.5.2. Agriculture

The nature of agriculture that has been practiced for centuries in the country is slash and burn, which is considered by the Inter-governmental Panel on Climate Change (IPCC, 2007) as one of the biggest threats to global biodiversity (**Figure 4**). In fact, it has been estimated that slash and burn agriculture is one of the main factors responsible for the depletion of the country's forest ecosystem to less than 5% its 1900 cover. Consequently, closed forest formations only occur as fragments of habitats mainly in forest reserves, a majority of which are found in the east to south-eastern sector of the country. From data, forest-dependent birds constitute the highest proportion of birds in the country and so any significant threat to the forests will affect birds.

Agriculture-related habitat destruction is very widespread in Sierra Leone, restricting the distribution of some birds, which results in limited species dispersal capacity and restricted gene flow that constitute the tools for evolution and speciation. Such ecological process has been worsened by declining fallow periods resulting from the growing rural population, increasing cost of living and lowering crop yield. A recent disturbing phenomenon is the conversion of vast areas of land that support migratory and recent species alike into monocultures for the cultivation of sugar cane and oil palm used for biofuel production. This is mainly driven by investment into multinational companies to satisfy the growing need for environmentally-friendly low-carbon emitting fuels. However, such ventures are counterproductive, as they are creating serious land hunger among local inhabitants, thereby increasing pressure on pristine ecosystems, particularly forests that support a majority of the country's avifauna.

Figure 4: Deforestation for Agriculture on the Hills around Bumbuna

4.5.3. Wood fuel extraction and logging

Wood fuel (wood and charcoal) is estimated to account for a very high proportion of domestic fuel needs in Sierra Leone. In combination with logging and pole extraction, wood-fuel production is now a leading cause of habitat degradation in various ecosystems, including closed forest, woodlands and mangroves. Many species of birds that depend on these ecosystems are threatened because such activities degrade the microclimate and micro-ecological integrity of their habitats, distorting their feeding, foraging and breeding activities. In response, birds tend to retreat into deep areas of closed forests or pristine habitats where they could find suitable alternative habitats for survival. However, for some species such as White-breasted Guinea, White-necked Picathartes, Gola Malimbe and Sierra Leone Prinia the microhabitat requirement could be so delicate and rare, that any distortion could render such species to acute population decline or local extinction.

The rate of wood, charcoal and log production is so high nowadays that the rate of habitat recovery is hardly keeping pace with the rate of depletion. As a result there is always a tendency to extend wood resource extraction into pristine areas and reserves. The recent introduction of the power-saw into wood processing for logs and charcoal is a very potent factor that has accelerated the destruction and degradation. Although logging can sometimes be selective, the increasing demand for building poles and logs is causing indiscriminate extraction nowadays. Forest tree species have been the main target of logging companies and private loggers, but in recent times the extraction of species like *Pterocarpus mildbraedii* and *Lophira lanceolatais* devastating woodland habitats in northern Sierra Leone, including the Outamba-Kilimi National Park.

4.5.4. Unbridled urbanization and development

The accelerated rate of population increase in the country over the last two decades has necessitated the expansion of housing in towns and cities throughout the country. The situation was exacerbated by the 1991 – 2001 civil war during which large numbers of rural inhabitants migrated to safer areas in main towns and cities. Consequently, the numbers and sizes of slums increased, whilst unplanned housing construction in vulnerable areas escalated, putting great pressure on the natural support

systems and resources and almost permanently obliterating the natural ecological systems of these locations. Some of these areas were forests and intertidal coastal systems that use to support a diversity of both terrestrial and aquatic birds, respectively. One typical example is the proliferation of housing on the previously forested hills overlooking Freetown, where some near-threatened birds had been encountered. Another example is the expansion of settlements along the Freetown estuarine coast, where large numbers of migratory waterbirds used to visit.

Bird numbers have declined significantly as a result of changing ecological conditions in these sites, so with many other sites in the country. Both hillside and coastal erosion events are causing serious sedimentation of productive coastal habitats important for bird feeding and roosting activities of migrant birds. Erosion along river banks is clogging river courses and destroying vital riparian habitats thus threatening birds, such as the kingfishers and waterfowls (e.g. ducks, crakes and geese) that depend on rivers streams and water bodies for survival. For instance, over a period of 21 years, the number and abundance of waterbird species and declined significantly. From experience, which has been backed up by data, the Aberdeen Creek has been under serious threats from various sources, including mangrove clearing, sedimentation, unbridled development, noise pollution from helicopters, over-exploitation of fish and molluscs (**Figure 5**).

Figure 5: Destructive settlement expansion at Aberdeen Creek

4.5.5. Mining

The deleterious effect of mining on the environment is glaring and this is evident in many areas in the country. By all estimation, mining constitutes one of the most important threats to birds and biodiversity today. At Ferrengbaia hills, where African Minerals Limited (AML) is mining iron ore, a good number of interesting avifauna, including species of global conservation concern such as Yellow-casqued Hornbill (Vu), Black-faced Rufous Warbler (NT), Emerald Starling (NT), and Rufous-winged Illadopsis (NT) (**Figure 6**). From published information (www.africanminerals.org) these mining activities will go on for the next two or more generations and will affect viable habitats for many of these birds. The destructive nature of the mining and the dumping of mine tailings will definitely render bird habitats redundant, meaning that local populations of these species at Ferrengbaia hills are doom, if their habitats overlap with the mining activities of AML. In fact, the activities of AML and London Mining are threatening the ecological integrity of the Sierra River

Estuary, the country's only designated RAMSAR site. Artisanal diamond, gold and zircon mining is destroying viable habitats and riparian ecology of a number of estuarine, river and streams systems around the country. Observations from various field surveys show that birds that depend on riparian ecologies (such as kingfishers, crakes and ducks) were absent from river systems affected by sedimentation from both artisanal and industrial mining.

Figure 6: Mining destroying bird habitat at Ferrengbaia Hills

4.5.6. Climate Change

According to a report by Karim and Okoni-Williams (2007) produced for the National Adaptation Programme for Action (NAPA), climate change has the potential to distort a range of ecosystem processes that may lead to permanent changes to bird diversity and bird habitat in future. Although the evidences are not immediately apparent, the long dry spells with intense solar heat and the changes in annual precipitation period coupled with irregular strong winds and heavy down pours are enough signs of changing climatic conditions that may affect birds and their habitats. Rising sea levels is depleting bird habitats along sections of the south and north coastlines of the Sierra Leone River Estuary (**Figure 7**). A typical example is provided in a picture shown below, where within a period of four months, rising sea level eroded the sandy beach and background vegetation depleting vital bird habitats. In forest and woodland environments strong winds and wild fires are destroying trees and viable habitats for birds. For example, because of unusual strong winds and heavy down pours, there are direct evidences that fallen trees in the vicinity of White-necked Picathartes colony, has destroyed several breeding habitats of the bird.

Figure 7: Depleting birds' habitats along the coast as a result of sea level rise

4.5.7. Direct off-takes

a) The wild bird trade

The wild bird trade in Sierra Leone has actually declined over the last two decades. The target species included estrilids, hornbills, parrots, orioles and starlings to name a few. However, there are still isolated cases of wild bird trade in the country, especially for Grey Parrots. Currently, the most significant threat from trade in wild bird comes from cross-border activities through the Republic of Guinea, where it appears there is apparently, weak enforcement of international regulations regarding trade in wildlife.

b) Hunting

Many of the birds that are hunted are common and normally congregate in large numbers, including ducks, geese, terns and gulls. Although the activity is widespread, it is not common because the returns are usually limited and is mainly used for food. However, there are isolated incidents of hunting and trapping of critical birds like White-necked Picathartes, White-breasted Guinea fowl and a number of other forest-dependent species.

4.5.8. Analysis of threats to Sierra Leone's avifauna

The short threat analysis given below is based on the application of a simple multi-criteria ranking technique (SMART). The identified threats factors were first ranked in terms of their relative importance using a factor of five as the most important and one as the least importance. A threat is considered most important if its local application is very injurious to both the species and its habitat, whilst considered least important if its effect is limited. For example, agriculture is ranked as 5 because its effect is widespread, and it removes and destroys the habitat and kills or drives away the species. In some cases the potential future destructive effect is considered as in the case of climate change. Thus the following were obtained:

Agriculture (Agric)	-	5
Mining (mng)	-	5
Climate change (Clm chg)	-	4
Woodfuel and logging (Wdfuel)	-	4
Urbanisation (Urbn)	-	3
Hunting (Hntg)	-	2
Wild bird trade (Wb trd)	-	1

These threats were then assessed based on a second level ranking of variables that influence the degree of effect of the threat in question. Thus, the variables include the following, which are sub-ranked in terms of three levels of effect as follows:

(a) How widespread in the country
   i. Widely distributed – 3
   ii. Average distribution – 2
   iii. Sparsely distributed – 1
(b) Deleterious effect in its locality
   i. Highly deleterious – 3
   ii. Averagely deleterious – 2
   iii. Minimally deleterious – 1
(c) Spatial effect in locality
   i. Majority spatial effect – 3
   ii. ~50% spatial – 2
   iii. Limited spatial effect – 1
(d) Temporal effect
   i. Long term
   ii. Medium term
   iii. Short term

1. Explanation of variables

How widespread is a variable depends on the national distribution of the activity. Agriculture and Climate change occur everywhere, whilst wild bird trade only occurs in few locations.

Deleterious effect is the degree to which the activity destroys birds and renders their habitat unproductive. For example agriculture, urbanisation and mining are considered highly deleterious.

Spatial effect in locality looks at the effect of the activity at the locality where it occurs, as oppose to how widespread it is. A threat could be widespread, but only affect small portions of a habitat. Whilst agriculture clears all the vegetation at a locality, woodfuel production and logging only affects certain trees.

Temporal effect is the period over which the threat lasts once applied. Some threats last for only a few years because there is potential for recovery (for e.g. hunting and logging), whilst others last for decades or more (for e.g. mining and climate change).

2. General comments

The application of this threat analysis is considered subjective, although it is based on field observation and experience over the years, and a similar exercise done to assess threat status on the Western Area Peninsula Forest (**Table 9**; Okoni-Williams, 2003). However, it provides a simple and robust approach to assess and prioritise threat to birds and biodiversity in general. To test the robustness of the exercise and reliability of the results, there is need to review the ranking of the threat factors and come up with a number of opinions on the result.

3. Result of threat analysis

Variables	Agric	Mng	Clm chg	Urbn	Wdfuel	Hntg	Wb trd
Multiplicity factor	*X5*	*X5*	*X4*	*X4*	*X3*	*X2*	*X1*
How widespread							
Sparsely distributed	-	-	-	1	-	1	1
Average distribution	-	-	2	-	-	-	-
Widely distributed	3	3	-	-	3	-	-
Deleterious effect							
Minimal effect	-	-	-	-	-	-	-
Average effect	-	3	-	-	2	2	2
Highly destructive	3	-	2	3	-	-	-
Spatial effect in locality							
Limited spatial effect	-	-	-	-	-	-	1
~50% spatial effects	-	2	-	-	2	2	-
Total spatial effect	3	-	3	3	-	-	-
Temporal effect							
Short term	-	-	-	-	-	-	-
Medium term	-	-	-	-	2	-	2
Long term	3	3	3	3	-	3	-
TOTAL	**60**	**55**	**40**	**40**	**36**	**16**	**6**

Table 9: Result of the analysis of threats, based on a local experience, using the SMART technique; Maximum score = 60

The final scores of threat analysis shown in **Table 9**, the reveal three categories of threats in terms of their destructive impacts on avifauna as follows:

(a) Very highly significant threats (score 50 – 60) - Agriculture and Mining.
These are the most important current and long-term threat to national avifauna. These threats need immediate and robust long-term planning and actions to address them, because they a long-lasting and so require sustained and concerted effort from various stakeholders. Lessons learnt from the NAPA programme (GOSL, 2007) should be replicated to create and maximise impact of any mitigation actions.

(b) Highly significant threat (score 40–49)–Climate change and Urbanisation.

These threats also do need robust attention for them to be minimised, because they have the potential to become as potent as the very highly significant threats.

(c) Moderate significant threats (score 20-39) - Woodfuel extraction and Logging.
There is need to design control measure to limit the extent of these threats.

(d) Low significant threats – Hunting and wild bird trade.
These threat need to be regularly monitored in order to sustain the current control measures in place. Some attention needs to be paid on cross-border activities.

4.6. Threats to fisheries biodiversity

4.6.1. Open Access Fisheries

There was a high influx in fishing especially during the civil conflict and probably up to the present time. The worrying competition in this type of fishing is that it disregards any policy restrictions because the illegal operations are carried out offshore and are difficult and even risky to monitor, considering the limited staff capacity; institutional capability and logistical constraints. The unsustainable activities undermine fish availability because the catch levels by far exceed the rate of resource replenishment often under unsuitable environmental conditions. Also, there was an alarming dry monkey trade between Sierra Leone and Liberia during the 80s (Davies, 1987) and probably during the civil conflict when there was a complete breakdown in law and order.

4.6.2. Fish by-catch or discard from industrial fisheries

The target for shrimp fishery is often a low volume high value (convertible currency) resource. In the shrimp fishery process it is estimated that about 50 non-target or by-catch species live on the same fishing ground. The by-catch species are estimated to constitute about 85 % of the total catch of which about 85 % is thrown overboard due to storage limitations. The irony is that while volumes of fishes litter the ocean floor, many potential customers onshore are starved of fish protein and deprived of the much-needed income. The damage inflicted on the artisanal fishermen's nets also result in loss of revenue and the destruction of their catches.

4.7. Threats from alien invasive species

A very potent threat to Sierra Leone is the proliferation of both alien and local exotic species, which are slowly, but surely becoming invasive and destroying local ecologies. Invasive species include plants (such as *chromolaenaodorata, Acacia mangium* and *Acacia auriculiformes*) and animals (particularly invertebrate pests, e.g. cassava mealybug) that are becoming problematic to the natural ecosystems, agricultural systems and crops.

5. THE IMPACTS OF THE CHANGES IN BIODIVERSITY FOR ECOSYSTEM SERVICES AND THE SOCIO-ECONOMIC AND CULTURAL IMPLICATIONS OF THESE IMPACTS

5.1. Impact of biodiversity loss on Agriculture in Sierra Leone

The implications of biodiversity loss for a developing country like Sierra Leone can be considerable and wide ranging. About 80% of the population is rural and depend heavily on biodiversity resources for their food, fibre, medicine, income and well being. The small land area and vast natural resources is a challenge to Sierra Leone's sustainable development. Sierra Leone relies heavily on her natural resources derived from agriculture, forestry, ecotourism and mining. As this review reveals these resources are dwindling and there is an urgent need for careful stewardship and management of these resources.

There is evidence of unsustainable trends, such as the fast encroachment of agriculture on forest land, overexploitation of biodiversity resources, habitat destruction, land degradation, increased squatting, and pollution, poor disposal of wastes and rapid expansion of vehicular traffic that relies heavily on fossil fuel combustion. There is high unemployment amongst the youth, but job opportunities are on the rise due to major investments in the country, especially in the mining sector. Recent developments appear unsustainable, and based on short term gains for long term losses of goods and services offered by nature's ecosystems.

The negative trends mentioned above will be easily reversed as the political will gets stronger. The Millennium Development Goals include concern about environmental sustainability. Government should take their cue from this global goal, and incorporate into appropriate policies in the National Plan, and water this down to sector plans. Target 9 of MDG 7 goal states, "Integrate the principles of sustainable development into country policies and programs and reverse loss of environmental resources". Enforcing this policy with the proper framework in place and with financial support will ensure sustainable development, and offer protection to Sierra Leone's biodiversity. Economically, sustainable development is about forgoing short term gains for long term availability of goods and services. This could be the way forward for Sierra Leone.

Some of the most negative impacts on human well being from adverse changes in biodiversity are presented below as examples from the forest and agricultural systems.

The agriculture sector and fishing collectively contribute ca.46 % of the GDP (SLARI, 2011). This has been in decline over the years. This trend is due to an increase in the amount of export from the mining sector and the rural to urban drift taking able bodied people away from agriculture. Most of the agricultural products except for cacao and coffee are utilized locally with little export to neighbouring countries and the West. Agricultural productivity relies heavily on availability of fertile and arable land. Luckily the usage of chemical fertilizers and pesticides in agriculture in Sierra Leone, which could exacerbate soil degradation and lead to pollution of ground and surface water, is limited. However, the removal of forest cover has invariably resulted in land erosion and removal of surface soils, thus depriving agricultural lands of its natural fertility. This has adversely affected human health and agricultural productivity.

Widespread monoculture, planting of new elite crop varieties and planting only crops of economic value has resulted in a decrease in the diversity of agricultural plant species. This has the tendency of increasing vulnerability of crop species as old landraces resistant/tolerant to pests and diseases are lost. A case in point is the almost disappearance of *O. glabberima* and *O. barthii* rice species from the agricultural landscape.

5.2. Impact of Changes in Forest and related Ecosystem

The high cost and erratic supply/non availability of electricity and gas have led to an increase in the use of charcoal and wood for heating and cooking. This is an important occurrence in both urban and rural areas. Additionally, people rely on forest for medicinal plants, food, construction materials and other wood and non wood requirements. In the rural areas, people as well as animals and birds depend heavily on freshwater from forests streams, rivers and estuaries for their daily domestic requirements. Hence a loss or degradation of these resources result in reduced and irregular flows, dirty water and drying up of natural water bodies which affects the rural communities. However, the sale of firewood, poles and charcoal are sources of income for the rural poor, thus the loss of forest cover will impact seriously on peoples' livelihood. Therefore, there is the need for a balanced approach to exploitation of these natural resources.

Other important consequences of deforestation and land degradation on human wellbeing are soil erosion and consequent loss of soil fertility. This in turn leads to reduced agricultural productivity. Some farmers counter this effect with increased use of fertilizers, which has a detrimental effect on downstream people or low laying areas including lagoons and coastal areas. The recent seaweed bloom in the lagoons and beaches in the Freetown area was attributed to fertilizer use amongst others. This may have had a deleterious effect on species numbers and composition in this area resulting from competition.

Traditional medicine is still popular despite the existence of a largely Westernized health care system in Sierra Leone. The large scale clearing of lands for agriculture and destruction of medicinal plants in the process has raised eyebrows as a cause for concern, due to the fast decline in number of these plant species in the wild. Most of the medicinal plants are now recorded as endangered or vulnerable and would require replanting and propagation programs. The continuing decline in the native plant species may have negative impacts on the health of the rural population.

5.3. Impacts on the Aquatic Coastal and Marine Environment in Sierra Leone

The main type of damages/impacts to the biota and ecosystem from anthropogenic activities can be put into 5 broad categories: over-exploitation, physical alteration and habitat loss, pollutant contamination of alien species and global climatic change.

Dams represent a major cause of disruption in natural river flows which are built to store water, to compensate the water level fluctuation, or to raise the level of water upstream, either to increase hydraulic head or to divert water into a channel. The storage capacity allows dams to generate electricity, to supply water for agriculture, industries and municipalities, to mitigate flooding and to assist river navigation (Rosenberg et al., 2000).

Large dams and river diversions have proven to be primary destroyers of aquatic habitat, contributing substantially to fisheries destruction, the extinction of species and the overall loss of ecosystem services on which human economy depends (Postel, 1998). Some effects after the dam construction

are immediate and obvious, for example dams obstruct migration pathways for fish, and reservoirs act as a sediment trap. Other effects are gradual and subtle, making them difficult to predict (Nilsson and Berggren, 2000).

The biodiversity of aquatic fauna is affected after dam construction because the natural seasonal flow patterns to which it is adapted are altered, normal seasonal migration paths are blocked and populations are therefore fragmented (Dudgen 2000). Although dams with spillways allow the passage of migratory biota, macrofauna abundance upstream of the dams is lower than in river reaches downstream of dams or in comparable reaches without dams (Conception and Nelson, 1999).

Sometimes, low head dams may act as a bottleneck, increasing the density of upstream migrating animals below the dam, attracting a large number of predators and, therefore, resulting in increased mortality among the migratory species (Benstead et al., 1999). As riverine landscapes depend to a high extent of natural disturbances, the seasonal hydrological dynamics are crucial for maintaining ecological integrity (Junkwirth et al. 2002). Flood control by levees, land drainage, river bed dredging, river regulation by dams and various alterations of the natural hydrological regimes isolate rivers from their floodplains and have been the major factors in physical habitat degradation (Petts, 1996). Flood-dependent fishes migrate regularly between the river channel and the inundated floodplain for spawning and feeding (Welcomme, 1979) and some invertebrates also exhibit movements between the channel and floodplain water bodies as part of their life cycles (Sodetstrom, 1987).

Anthropogenic impacts on riverine landscapes such as damming, dredging and channelization, disrupt natural disturbances regimes and truncate environmental gradients will severely affect the migratory species (Ward and Stanford, 1989). Environmental gradients lead to high levels of spatio-temporal heterogeneity such as movements and migration also contribute to high biodiversity levels over an annual cycle (Ward, 1998). Ecosystem management, therefore, becomes a problem of re-establishing the environmental gradients, re-establishing the ecological connectivity between landscape elements and reconstitutes some semblance of natural dynamics (Ward, 1998). Many morphological and hydrological alterations in the river resulted in irreversible damage of riverine ecosystems (Bloesch and Sieber, 2002). Therefore, when evaluating the effects of dams or other anthropogenic disturbances, it is important for managers to have a good understanding of the ecology of the specific rivers they are managing.

Collaboration with biologists, which can provide information about river flora and fauna (e.g. life-cycle, reproduction, feeding patterns, migration, habitat requirements), can offer useful tools for mitigation of negative effects of dams or reservoirs construction. Larinier (2000) discussed that the construction of a dam on a river can block or delay upstream fish migration and thus contribute to the decline and even the extinction of species that depend on longitudinal movements along the stream continuum during certain phases of their life cycle. Mortality resulting from fish passage through hydraulic turbines or over spillways during their downstream migration can be significant. Experience gained shows that problems associated with downstream migration can also be a major factor affecting anadromous or catadromous fish stocks. Habitat loss or alteration, discharge modifications, changes in water quality and temperature, increased predation pressure as well as delays in migration caused by dams are significant issues.

Adams (2000) proposed that dams impact fish in three ways. Firstly, dams can affect the physical stability of river channels. River bed degradation downstream of dams can also lead to the loss of

important in-stream spawning grounds for fish. Secondly, dams can affect fisheries through impacts on water quality. Declines in water quality can have significance for human health, and for the economies dependent on the natural resources of the river. Water released from low outlets in a dam (e.g. turbines) tends to be cold and may be deoxygenated, or rich in hydrogen sulphide. Thirdly, and most importantly, dams affect fishing communities by changing natural flooding patterns, resulting in the fragmentation (i.e. reduced connectivity) of ecosystems (Ward and Stanford, 1995). Dams not only alter the pattern of downstream flow (i.e. intensity, timing and frequency) they also change sediment and nutrient regimes and alter water temperature and chemistry. Dams may be viewed as anthropogenic alterations that disrupt dynamic processes and so they have impact on the ecological integrity of natural systems (McCarthy, 2000). The most common downstream effect of large dams is that variability in water discharge over the year is reduced such as high flows are decreased and low flows are increased. Reduction of flood peaks reduces the frequency, extent and duration of floodplain inundation. Reduction of channel-forming flows reduces channel migration.

Truncated sediment transport (i.e. sedimentation within the reservoir) results in complex changes in degradation and aggregation below the dam. The temporal pattern of flooding is altered by regulation, one effect of which is to desynchronise annual flow and temperature regimes (Sparks et. al., 1990). These changes and others directly or indirectly influence a myriad of dynamic factors that affect habitat heterogeneity and succession trajectories and, ultimately the ecological integrity of river ecosystems (Ward and Stanford, 1995).

Fish are affected directly by physical barrier of migration routes and movement of fish such as inundation of spawning grounds within the reservoirs, irregular releases of dam and periodic inundation or drying out of spawning grounds and refuge area downstream of the dam. Fish are affected indirectly to different level, depending on species, by modification of velocity, temperature and quality of water. The change in habitat caused by construction of a dam modified the fish community, population densities and areas utilized by a particular species (Horvath et. al., 1998).

The impoundments after damming the rivers adversely impact both fish biodiversity and local fishing communities. Ecosystem change destroys feeding as well as breeding grounds, with a resultant loss of fish species. Where the movement of migratory fish up and down river is affected by hydropower development, fish hatcheries near the dam sites or fish ladders for fish movement should be considered as mitigation options. Local user groups and other stakeholders should be involved in decision-making, to keep good relations concerning peoples' livelihoods and the sustainability of aquatic resources. Migratory fish species are vulnerable during their life cycle due to river damming, and about 20 % of the world's fresh water fishes are estimated near extinction or in urgent need of conservation. Therefore, to sustain biodiversity and fisheries in rivers requires sustainable management both of habitats and systems of exploitation.

River systems should be thoroughly studied jointly with concerned agencies (e.g., electricity, irrigation and fisheries authorities; and local authorities) during formulation and application stages of hydroelectric power development projects (Rai, 2008).

5.3.1. Impact of Changes in Freshwater Environment

The fishery sector earns valuable foreign exchange through the export of marine and aquaculture products, and is the main source of dietary protein for many households. It further provides

employment to a large number of people. However, aquaculture development have not taken firm roots in Sierra Leone and prone to pollution by human and industrial wastes. Furthermore, degradation of the lagoons, streams, estuaries and removal of mangroves, sea grass beds and brackish marshes that function as vital breeding grounds and nurseries for numerous species of fish, crustaceans and molluscs have a diminishing effect on the commercial value of inshore fishing, thus affecting the livelihoods of the dependent communities.

Over exploitative and unlawful removal of beach sand is ongoing. These have resulted in erosion and loss of the aesthetic value at beach resorts, depriving them of vital income due to a likely decrease in the number of tourists visiting these resorts. On its own, beach sand has a high economic value from its use in sand-creting and natural protection to land and properties.

5.3.2. **Physical Alteration**

Physical alteration of the coastal and marine environments can lead to changes in the ecosystem and hence the community structure. In some cases some species may be eliminated. Activities such as logging and construction of facilities and agricultures may affect the ecosystem.

Removing mangroves for fuel, salt and rice production makes the coast more vulnerable to erosion leading to siltation. FAO tree planting exercise at Orugu Bridge in 1988 is an attempt to redress that situation. Sustainable utilization of mangrove swamps is possible up to 50 %, of the original area (Fomba, *Pers. Comm.*).

In Sierra Leone, and elsewhere, shoreline structures are often constructed out of necessity without reference to current flow patterns, erosion and siltation. Shoreline structures may alter flow patterns of currents and may cause sediment accumulation. Both the Queen Elizabeth II Quay and Nitti habours have to be constantly dredged to minimize siltation. At Bonthe navigation is only possible at high tide. Siltation can affect ecological productivity of environment and foul the filtration systems of sessile organisms including bivalves thereby causing mass mortalities among the latter.

Sand mining re-suspends sediments and stresses the ecosystem. Digging deep holes on the beach can alter patterns of wave refraction thus contributing toward erosion. Some of the organisms get dislodged or buried. Indiscriminate sand mining at Lakka and Hamilton has been of grave concern to Government. Dredging destroys both topography and the biota especially of suspension feeders and fish.

Trawling disturbs the seabed by churning and resuspending sediments. A shrimp trawler with nets 20 m in width towing at 5km/h scrapes $1km^2$ of seabed in 10h. This loss of seabed integrity has in recent times been termed the desertification of the sea (Riemann and Hoffmana, 1991). Most of the undesirable organisms brought on deck after trawling are already dead before being thrown back overboard.

Foreign companies have prospected for oil and diamonds off the Sierra Leone. Offshore oil development may start soon. Mining at sea causes siltation and in the case of case of oil there is the rock of accidental spills. Mining waste must also be disposed off (Nicolaidu et., al 1989).

Sierra Rutile Mines (Ltd) created artificial lakes by damming nearby water courses thus cutting off the supply of fresh water to the creeks.

Corresponding increase in salinity due to reduction in freshwater flow is harmful to the estuarine life. In the dry season of 1994, the following typically estuarine fishes penetrated up the Jong River in order to avoid the incursion of saline water. *Monodactylu sebae, Pomadasys pereotei, Arius latiscutatus* (Per.Obs).

Large numbers of people visiting coastal areas can cause compaction of sediments, causing increased surface runoff and erosion, harm vegetation and frighten away organisms that use the area for feeding and breeding.

5.3.3. Pollution

In Sierra Leone, very few studies have been undertaken to analyse heavy metals in the sea or sediments. Findlay (1980) found significant quantities of the following heavy metals in sediments and the water column at Murray town, Kingtom, Government Wharf and Cline Town: copper, lead, zinc, chromium and nickel. In the water column, the concentrations of the metals were only about 5 % of the levels found in the sediments.

Trace metals such as lead, cadmium, mercury and arsenic, as well as radionuclide enter the sea from power plant emissions, mining and manufacturing industry (Nicolaidu et al, 1989). The mass mortalities of catfishes in 1992/93 along the entire coast leading to a near extinction strongly suggests a sediment- based heavy metal contamination (Ndomahina, 1994).

The tailings of leucoxene, Kyanite, Monozite and xenotime arising from rutile mining operations were found be radioactive (Tengbeh, *Pers. Comm*.).

There is evidence of oil pollution along our coast in Sierra Leone especially in the Southern region possibly from oil tankers washing their tanks (Ndomahina, 1994; 2000 *Per. Obs*).

Most of the damages by oil animals and plants result from coating, asphyxiation and poisoning through direct contact or ingestion. Various life history stages such as eggs and larvae are vulnerable. Yawri bay is breeding and nursery ground for more than 100 fish species (Yillia, 1996) and the sand and mudflats are rich in biological diversity (this reported, 2002). Chronic low level oil pollution emanating from marine terminals, disposal of drilling muds from offshore oil operations, municipal and industrial wastes, urban runoff into rivers and atmospheric fallout from incomplete combustion of oil in transport engines constitutes the most dangerous source of oil pollution (Clark, 1989). The possibility of oil spills in Sierra Leone is a reality.

The use of pesticides in coastal areas where agriculture is practiced is not very wide spread except in the control (of rice-eating crabs Thompson, 1979; Fomba, *Pers. Comm.*).

The pesticides used in pest control in West Africa include DDT, Lindane methylparathion, carbofuran, endosulphan and diazon (West and Biney). The indiscriminate use of pesticides by local farmers in the Rokupr, Mambolo and Barbara areas causes heavy mortalities among rice-eating crabs and fauna of mangroves and mudflats. Some fatalities have also occurred among the farmers. Some pesticides have also been used in vector control of certain diseases. Faulkner (1985) and Sankoh (1999) found significant levels of pesticides in certain important food fishes of Sierra Leone.

In the sea where factors such as light and grazing are not limiting, the nutrients such as nitrogen, phosphorus, silicon and iron could become limiting. From studies in the Western Area, in the 1980s' and 1990s, it was concluded that nutrient enrichment (nitrate, sulphate, phosphate) posed no threats since no appreciable change in biota was observed (Findley, 1980; Sankoh, 1992; Ngombu, 1993; Rogers 1993).

However, recent studies (Conteh, 2001; Brima, 2001) indicate that at the Government Wharf where untreated human sewage is discharged, the nutrient concentration (phosphates and nitrates) are much higher directly at the discharge point than 200 m away. Some 39 plankton species were recorded.

The mean abundances at discharge site were 1275 individuals/m^3 and 1020 individual/m^3 offshore but the numbers at the offshore station were about twice that at the discharge site (Conteh, 2001). At the offshore station, no single plankton species appeared to have been dominant. At the discharge site three genera of plankton (*Coscinodiscus, Bidulphia* and *Chaetoceros*) were dominant. Similar genera have been observed in some countries in the West African region (Ghana, Nigeria and Cameroon).

The organic input into the bays in Freetown area has also increased to levels above the WHO standards and continues to rise (Findley, 1980; Sankoh, 1992; Brimah, 2001). The Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) has been measured for Whiteman's Bay, Kroo Bay, King Jimmy, Susan's Bay, Cline Bay (**Table 10**).

The high values of COD and BOD is indicative of high organic input that may lead to eutrophication and fouling.

Location	**Mean BOD mg/l STD**		**Mean COM mg/l STD**	
Whiteman's Bay	11.02	±1.83	44.10	±10.53
Kroo Bay	17.55	±3.82	43.20	±12.96
King Jimmy	12.01	±3.47	42.60	±11.54
Susan's Bay	15.16	±3.30	51.30	±10.58
Cline Bay	9.37	±1.77	36.70	±06.08

Table 10: Biological oxygen demand (BOD) and Chemical Oxygen Demand (COD) for the Bay along the Sierra Leone River Estuary (Sankoh, 1992)

5.3.4. **Solid Wastes**

Solid wastes such as glassware, plastic debris and cloth are usually either dumped on the coast or disposed of at sea. Marine mammals, sea turtles seabirds and fishes can get entangled in solid wastes (Fowler, 1987). Lost gill nets and other fishing gears continue to entangle and ensnare animals in what is known as "Ghost Fishing". In Kuwait, Ghost fishing losses was estimated to be between 3.5 – 12.8% of total landings (Mathews et al., 1987).

In the Yawri Bay about 30 km of gill netting is destroyed by trawlers annually. These nets belonging to artisanal fishermen either sink to the bottom or continue to catch marine animals at the surfaces.
At Granville Brook dumpsite two separate studies on macrofauna nearly 20 years apart is a good example of changes due to man's intervention into the environments resulting in biodiversity changes. Granville Book has been used as a dumpsite since 1989.

5.3.5. Alien Species Introduction

There is no evidence at the moment of alien species introduction because no systematic and comprehensive study has been undertaken. About 300 ships discharge Bilge and Ballast water off our coast annually. A proposal for the study of harmful algal blooms in Ballast and Bilge water is being prepared by IMBO.

5.3.6. Global Climate Change

Greenhouse gases especially carbon dioxide and Chlorofluorocarbons are released into the air from factories, transport sector, refrigerators and so on in all countries including Sierra Leone. The greenhouse effect will not only cause an increase in global temperature, but also alter patterns of ocean circulation, precipitation and storm tracks.

The consequent increase in flooding and salinization of coastal areas could have serious effects on coastal biodiversity.

African countries whose livelihoods depend on agriculture and related activities with limited coping strategies shall be much more vulnerable.

In the mid 1980s there was a sudden increase in the population of *Ballistes capriscus* and reduction in the sparid (snapper) population. It is now believed that this change was related to an incursion of cold saline bottom water into the shelf. This change in ocean climate was linked with an overall regional change. This phenomenon changed and reversed in 1988 to the present status. The cold front shifted to Guinea Bissau taking with it the *Ballistes* population. Towards the end of the dry season (March – April, 2002) both industrial and artisanal fishery sector have been constantly reporting a drop in their catches.

5.3.7. Loss of biodiversity

Loss of biodiversity could produce the following:

- Loss of raw materials for consumption as food and in industry.
- Destruction of valuable scientific information and source of materials for study.
- Stagnation of biological evolution and natural selection
- Reduction in number of species
- Change in species composition

A list of anthropogenic activities and their perceived impact significance is shown in **Table 11**.

Activity	Possible impact	Impact significance	Remarks
Fishing	Overexploitation, environmental degradation, pollution impact on marine biology/fisheries	Major impact	The possible impacts are real given the free access regime
Boat building	deforestation	Moderate impact	Planked canoes from timber requires mitigation measures to check deforestation
Handicraft	Environmental and social impact	Minor impact	Receptor of low sensitivity or value
Wildlife hunting	overexploitation	Minor impact	Receptor of low sensitivity value
Forest resource exploitation	Overexploitation	Major	The possible impacts are real if given the free access regime and demand for fuel wood
Oyster farming	Environmental pollution	Negligible impact	On a small-scale-receptor not affected
Agriculture	Coastal erosion, deforestation, land based pollution	Major impact	The possible impacts are real requiring strict mitigation measures
Waste disposal	Pollution and contamination	Major impact	Extensive and possible impact real
Building construction	Environmental degradation for indiscriminate biodiversity exploitation	Major impact	Not extensive at the moment but mitigation measures required.

Table 11: Anthropogenic Activities and their perceive Impact Significance

5.4. Impact of Changes in Biodiversity on Tourism

Tourism generates foreign currencies and contributes significantly to Sierra Leone's Gross Domestic Product. The total number of visitors that arrived in Sierra Leone on holidays in 2000 was 24,067; of which 4,209 came on holidays. By the end of 2012 this number had increased to 59,730; of which 9,464 came on holidays, an increase of ca. 125 % (Anon, 2013). The end of the civil war and speculations in the areas of mining and agriculture were responsible for this surge in the number of tourists in the period 2000-2012.

Eco-tourism is a new trend in this industry and many tourists seem to be attracted to our beaches and natural environment. It is therefore imperative that we preserve the environment and our way of life to cater for this new development. The protection and preservation of Tiwai Island wildlife sanctuary and Outamba kilimi National Park have led to the picking up of the industry. Environmental

protection is a key issue for the National Tourist Board who is now actively promoting eco-tourism.

Tourism as a potential major contributor to the economy should provide us with an incentive to maintain the natural beauty and social structure of the country. It should be encouraged and protected from activities that would tend to lower its value and positive impacts. This requires that unpolluted places of unspoilt aesthetic value and abundant biodiversity to attract tourists and sustain the industry.

5.5. Extent of Agricultural Biodiversity Loss

The rate of biodiversity loss may vary depending on differences in ecological and economic settings. Nonetheless, the threat to livelihoods and environmental processes by the loss of genetic species and agro ecological diversity are increasing. Understanding the forces that have negated or undermined the values and functions of agricultural biodiversity can help identify actions needed to sustain this key resource.

1. Neglect of indigenous knowledge and management systems

Rural people have vast knowledge in managing and enhancing agricultural biodiversity, which has allowed them to adapt to social and ecological changes over centuries. However, many recent interventions have ignored the importance of local knowledge and skills, resulting in an erosion of knowledge and undermining the usefulness of formal and informal institutions that were central to the sustainable management of agricultural biodiversity. The Institutions promulgated rules and regulations on the use of biological resources and distribution of benefits, tenure, conflict resolution mechanisms and methods of the enforcing rules, cultural sanctions and beliefs.

2. Approach to development and policies

A fundamental cause of agricultural biodiversity loss has been the stereotype approach to development. Examples of this are industrial agriculture and Green Revolution farming; as well as commercial plantations that promote monoculture and uniform technologies, including the use of mechanization, high yielding crop varieties and animal breeds, agrochemicals and irrigation. This blueprint approach to agricultural development and consequently the management of agricultural biodiversity is supported and defended by an elaborate Institutional network, including many International donor and development agencies, Research Institutions and MDAs of the National Government, which promote policies and credit schemes that influence Agricultural development and biodiversity in areas such as crop and livestock production, forestry, fisheries and aquaculture as well as other land use practices.

The most influential are policies predicated on incentives, such as subsidies and credits for agrochemical inputs, extension programs, credit policies and marketing standards; that support the adoption of capital and energy intensive inputs and technologies. For example, extension programs in many countries tend towards the adoption of uniform crop varieties for planting and thus the elimination of diversity. Examples are the wide scale adoption of NERICA rice varieties and improved cassava and sweet potato cultivars. Policy directions for large scale clearing of land in various places countrywide for the establishment of commercial farms and mining have increased economic benefits, while inducing biodiversity losses and unsustainable land use.

3. Corporate interests

Companies that produce and market agricultural commodities are beginning to exert influence on the type of agricultural biodiversity used in production. In Sierra Leone, these companies have little or no R&D budgets.

As a result, corporate priorities and industrial strategies are not influenced by local research development in terms of selection of planting materials, livestock breed, fodder utilization and other technologies that directly affect agricultural biodiversity. The available evidence, though scanty, suggests that the drive for commercial profits and control over production has promoted more, rather than less, genetic and ecological uniformity in agro ecosystems. The use of pesticides and more competitive crop varieties has the tendency to suppress or eliminate the native in situ gene banks (Ho, 1997; UNEP-CBD, 1999).

4. Inequitable land tenure and control over resources

The land tenure systems in Sierra Leone is dual principled. There is freehold tenancy in the Western area while in the provinces tenancy is community based under the stewardship of the local Paramount chiefs. Tenancy in the provinces constitutes over 80 % of the agricultural biodiversity ecosystem. The lack of access rights and control by local people over the agricultural biodiversity resources, severely reduce their incentive to conserve these resources and thus undermine local livelihood security. Western concepts of private property ownership do not recognize the intellectual contributions and informal innovations of indigenous and rural peoples who have modified, conserved and managed old landrace species and landscapes. This is also true for the genetic resources of domesticated plants and animals. It is worth noting that although most high technology genetic resources originated from developing countries, transnational companies and northern institutions are those benefitting from the larger share of such resources through breeding and improvement programs and new natural products development. For example the old landrace pisifera oil palm native to Sierra Leone and other West African countries was taken to Malaysia and Indonesia and used as one of the parents to develop the now world famous high yielding low cholesterol Dura oil palm varieties. In cases similar to this legal means such as patents and other intellectual property rights have allowed companies and advanced Institutions to maintain disproportionate control over the knowledge, genetic resources and benefits associated with such agricultural biodiversity (GRAIN-GAIA, 1999). On the contrary, the local communities and farmers who originally nurtured and conserved this genetic diversity have generally not been recognized or compensated for their efforts at conservation.

5. Market pressures and the undervaluation of agricultural biodiversity

Even though agricultural biodiversity is very valuable and multifunctional, it is underestimated or often ignored in conventional economic evaluations, partly because these multiple functions are difficult to value in economic terms (IIED, 1995). This has shifted resource planning and research towards major food crops and species of commercial importance for urban centres.

The increasing demand for global markets for some crops and livestock products and trade liberalization tend to have a homogenizing effect on agricultural biodiversity by standardizing food production and consumption. Global markets usually demand uniform foods that are increasingly processed and sold by transnational corporations, and are geared to meeting the food desires of urban

based consumers. These market pressures are therefore forcing farmers to comply with such demands for uniformity.

6. Demographic factors

Whilst in some contexts population growth *per se* is clearly responsible for agricultural biodiversity loss, there are many situations in which inequitable land tenure, forest concession policies, refugee settlements, land use and fishing policies are the major root causes behind the biodiversity loss induced by growth in human numbers or migrations.

Conversely, more people can mean more care for the environment and enhanced agricultural biodiversity under certain conditions, as shown by research in Sierra Leone (Richards, 1993) and Kenya (Tiffen *et al.*, 1994). Therefore people in agricultural biodiversity rich communities should be encouraged to devote more time and resources to conservation practices.

5.6. Impact of natural phenomena and anthropogenic activities on ecosystems health and stability and on Reptiles, Amphibians, Sea Turtles and Manatee diversity

In Sierra Leone, the impact of natural phenomena and anthropogenic activities on the country's ecosystem is noticeable. There are evidences that many human dominated ecosystems, including various biophysical systems at national level, has become highly stressed and dysfunctional. The 'services' provided by these ecosystems are extremely important to human welfare. As stated, some ecosystems in the country have become so degraded that, they have almost become incapable of supplying services to the same level as in the past. The health and capability of the environment to sustain economic activity and human health is therefore reduced due to the stress posed on it.

Many of Sierra Leone's ecosystems are 'unhealthy'. Their functions, particularly those that are vital to sustaining the human community, have become impaired. An 'ecosystem distress syndrome is widely prevalent in both aquatic and terrestrial ecosystems. Linking ecosystem health to the provision of ecosystem services (those functions that are recognized as satisfying human needs) and determining how ecosystem dysfunction relates to these services are major challenges at the interface of the health, social and natural sciences (Rapport et al, 1998).

The Sierra Leone ecosystem, though unhealthy, is partially stable with most of the instability is in the northern part, where vegetation has been largely reduced to grasslands with tertiary forests and farm bushes. The impact of this situation in the face of reptiles and amphibians is their seasonal movement between temporal and permanent wetlands. The congregation of amphibians and reptiles in permanent wetland areas leads to inter and intra actions that in most cases do not favor species population increase. Predation is always at its highest at those supposed refuges during the dry season. Some species died en-route to searching for permanent wetlands during the dry season. These situations do not only reduce the populations of the species but deplete their diversity as not all are able to withstand adverse conditions.

The south, east and western areas of Sierra Leone are much more stable in terms of healthy ecosystem service than the north for reptiles, amphibians and manatees.

Amphibian and reptile populations respond strongly to changes and variability in air and water temperature, precipitation, and the hydro period of their environments. Over the short-term (e.g. annually), these factors can determine reproductive success rates and survival to metamorphosis. Over

the long term, the frequency and duration of extreme temperature and precipitation events can influence the persistence of populations and the overall structure of meta-populations on the landscape.

From ecological perspective, amphibians and reptiles are regarded as good bio-indicators. For example, due to the high degree of sensitivity of amphibians, either during tadpole stage or as adults, they respond to very slight change in the environment. Such responses have been used to indicate habitat fragmentation/degradation, ecosystem stress, impact of pesticides, and various anthropogenic activities.

Amphibians and reptiles play a pivotal role in ecosystem as secondary consumers in many food chains. Adult amphibians and reptiles are the best biological pest controllers.

Tadpoles for example, have significant impact in nutritional cycling. They are herbivorous to omnivorous and are prey items for both invertebrates and vertebrates.

As amphibians and reptiles are important predators and prey in many ecosystems, declines in their populations may affect many other species that live within the same ecological community. For example, populations of aquatic insects and amphibian predators such as snakes, birds, mammals, and fish may be especially affected by a loss in amphibians. Moreover, the populations of animals that amphibians and reptiles eat may increase as they disappear.

In human cultures, amphibians and reptiles have been featured through ages in the form of poetry, songs or stories. They are good source of protein and are exploited in medical research. Reptiles skins and carapaces have been used in diverse was by man. Therefore, in Sierra Leone, if nothing is done to reverse the current trend of happenings in the ecosystem, all the important values of these species will be lost.

Sea turtles and manatees in particular have ecotourism potentials; a healthy population of these species will generate so much income not only for locals but for Sierra Leone, by encouraging thousands of tourist who would want to see them in their natural settings. Decrease in their population may result in explosion of seaweeds which may affect navigation by some other marine animals and boats. Sea turtles help in the nourishment of beaches through the deposition of eggs whose remains provide the necessary nutrient for plants growth on beaches. Their eggs and meat are a source of protein for most people though banned by the government of Sierra Leone.

The possible future changes in reptiles, amphibians, sea turtles and manatees, if nothing is done to revert the current trend of habitat degradation and poaching, the population of the species will be reduced, some will go locally instinct or become rare, ecosystem function lost and the population of their prey will increase.

It is largely believed that Sierra Leone's biodiversity is facing loss but there are hardly documents to support such loss for most species including reptiles, amphibians and manatees. What is clear is that there is a remarkable reduction in the individual species population across the country. The root causes of reduction in the populations of Reptiles, Amphibians, Sea Turtles and Manatees across the country include; but not limited to; artisanal and industrial mining, slash and burn agriculture, timber harvesting, settlement and population growth, hunting/fishing and poaching, beach erosion and sand mining, commercial agriculture (oil palm, rice, rubber, cocoa, coffee, etc. and use of agrochemicals), over-exploitation, lack of insufficient education in biodiversity; poor land use planning and practices,

inadequate legislative and regulatory instrument, poor law and regulation enforcement, lack of sufficient capacity and infrastructure, and the paucity of data for monitoring of changes over time.

The decade long political instability had both negative and positive impact on Sierra Leone's biodiversity. The positive aspect include areas the increase in population of most species, regrowth and regeneration of degraded areas and the growth of some farm bushes into secondary forests, secondary forests growing into more matured forests in areas abandoned during the war. The negative aspect includes areas that were overpopulated due to the congregation of displaced persons from around the country. These areas suffered the most in terms of biodiversity exploitation. Most displaced had little choice or non in the exploitation of the most immediate resources including fuelwood, meat, medicine, construction materials, food, etc.

In the absence of centralized monitoring of reptiles and amphibians around the country, many research and surveys have been carried out. Among the many actors are Boulenger who in 1905 discovered the *Petropedetesnatator*, commonly known as Sierra Leone Water Frog in Sierra Leone. Following these were other series of work done by herpetologists that visited the country and in 1964, Arne Schiotz discovered the *Cardioglossa aureoli*, commonly known as Freetown long-fingered Frog. Between 1947 and 1962, T.S. Jones (former deputy director of agriculture), staff and J.I. Menzies carried out survey and analysis of snakes of Sierra Leone and recorded 42 snake species. In 1981, Teleki and Baldwin conducted herpetological survey at Outamba Kilimi National Park (OKNP) and result of the work was compiled by a team from the Smithsonian in 1984 after their own work in the park. The analysis indicated the presence of 16 amphibians and 20 reptiles. The current statuses of the species are not known since no recent studies have been done at the site to ascertain changes in species diversity and population over time.

In the recent years, herpetologists from abroad including M-O Rodel (Germany), Annika Hillers (Germany), Nippon Koei UK, Marine Resources Assessment Group (UK), the Natural History Museum (UK) and Zoological Society of London (UK), to name but a few, and local organizations and scientists including the University of Sierra Leone, Njala University, the Reptile and Amphibian Program – Sierra Leone (RAP-SL), Abdulai Barrie, Edward Aruna, Jonathan Johnny and Alhaji Siaka have done remarkable work on documenting reptile and amphibian species of Sierra Leone.

Between 2004 and 2007, A. Hillers and others conducted four herpetological surveys with a focus on amphibians in Sierra Leonean forests and mountain areas (Hillers et al., unpubl. data). Result of the surveys indicated an exceptionally high amphibian diversity (at least 60 species), led to the observation of six new country records (*Afrixalusnigeriensis*, *Cardioglossaoccidentalis*, *Hyperoliuswermuthi*, *Phlyctimantisboulengeri*, *Phrynobatrachusannulatus*, and*Ptychadenaaequiplicata*), and to the discovery of at least two species new to science (*Conrauanov.sp and Ptychadenanov. sp*.). Four areas in particular promised to harbor highherpetofaunal species richness and were identified as priority areas for further research: Loma Mountains, Tingi Hills, Nimini Forest Reserve, and Gola Forest Reserves, including, Tiwai Island (Hillers, 2009). In 2009, A. Hillers also recorded 43 amphibian and 13 reptile species in the Gola and Tiwai Island (see annex ii).

In 2006, the NHM authored a baseline survey that was conducted for the Bumbuna Hydroelectric Project. Result indicates the presence of 22 amphibian and 29 reptile species within the project site (see annex iii). A follow-up survey was conducted in April/May 2013 by Edward Aruna (RAP-SL)

and Jonathan Johnny (Njala University) in collaboration with Annika Hillers (Gola Program). The team recorded 36 species of amphibians and 27 reptiles (see annex iii).

Of the 67 reptile species noted for Sierra Leone, only the sea turtles have had intense conservation concern/effort so far. Before 1998, there were reports of the occurrence of sea turtles in Sierra Leone by researchers (Cansdale, 1955; Loveridge and Williams, 1957; Parson, 1962; Phaff, 1964, 1967; Willmas, F. 1968; Brongersma, 1981; Sternberg, 1981; Groombridge, 1982; Mager, 1985; Groombridge and Luxmoore, 1989; Stuart and Admas, 1989; King and Burke, 1989; Stuart et al, 1990; Fretey and Malaussena, 1991; Groombridge 1993, Gawler and Agardy, 1994;Hirth, 1997, and Dr Domahina, IMBO in series of reports)but none had complete list of species until 1998/2000 when an intern student at the Conservation Society of Sierra Leone (CSSL), undertook a student research that resulted in documenting five species including green turtle, hawksbill, olive ridley, leatherback and loggerhead along a 12 km beach stretch starting from Lumley beach to Sussex (Aruna, 2001).

The study also noted the threats faced by the five species as follow: sand mining, beach erosion, increase in water level, fishing, eggs collection, construction, oil spillage, collisions with boat engines, shells (carapaces) used as ornaments and the inadequate education and sensitization of locals about laws, policies and regulation about wildlife.

Manatees were first recorded in Sierra Leone by Mr. Kakpindi, former staff of the Ministry of Fisheries and Marine Resources and are noted to be faced with threats including targeted and incidental entanglement by fishing nets, traps purposely set around swamp rice farms since they are known to feed on growing swamp rice, siltation and cutting of mangroves (Jalloh et al., 2006).

5.6.1. Extent of Reptiles, Amphibians, Sea Turtles and Manatee biodiversity loss

In the absence of monitoring data (database) on reptiles, amphibians and manatees, it is difficult to ascertain the extent of loss of these species. However, from ecological view point based on habitats, one can judge that Sierra Leone has lost some of its species over the years due to habitat fragmentation, hunting, etc. It can be estimated that due to the threats faced by these species in Sierra Leone, at least hundreds of individuals of reptiles and amphibians are lost every year. Sea turtles, for which an ongoing monitoring is in progress, the Sea Turtle Conservation Program has recorded 201 species to have got drowned from 2006 to 2012 and hundreds of eggs have been excavated by locals in areas not covered by the monitoring program (RAP-SL, 2012).

For manatees, it can be estimated that at least five is killed every year in Sierra Leone (Jalloh et al, 2006).

i. Threatened, endangered and extinct species

The IUCN has information about reptiles and amphibians and amphibians have been fully assessed and categorized per conservation concerns. The reptiles have not been fully assessed. All species of sea turtles and manatees have been assessed and categorized by IUCN (**Table 12**).

Amphibians

	Species	Conservation Status
1	*Cardioglossa aureoli*	Endangered
2	*Amietophrynustogoensis*	Near threatened
3	*Hyperoliuschlorosteus*	Near Threatened
4	*Hyperoliuszonatus*	Near Threatened
5	*Kassinacochranae*	Near Threatened
6	*Leptopelismacrotis*	Near Threatened
7	*Petropedetesnatator*	Near Threatened
8	*Phrynobatrachusalleni*	Near Threatened
9	*Phrynobatrachusguineensis*	Near Threatened
10	*Phrynobatrachusliberiensis*	Near Threatened
11	*Phrynobatrachusphyllophilus*	Near Threatened
12	*Ptychadenasuperciliaris*	Near Threatened
13	*Conrauaalleni*	Vulnerable
14	*Amietophrynuscristiglans*	Data Deficient
15	*Ptychadenasuperciliaris*	Data Deficient
16	*Ptychadenasubmascareniensis*	Data Deficient
17	*Ptychadenapujoli*	Data Deficient
18	*Ptychadenaretropunctata*	Data Deficient
19	*Ptychadenaarnei*	Data Deficient
20	*Geotrypetesangeli*	Data Deficient

Reptiles

	Species	Conservation Status
1	*Dermochelys coriacea*	Critically Endangered
2	*Eretmochelys imbricata*	Critically Endangered
3	*Caretta caretta*	Endangered
4	*Lepidochelys olivacea*	Endangered
5	*Chelonian mydas*	Endangered
6	*Cyclanorbissenegalensis*	Near Threatened
	Chamaeleo gracilis	Protected by CITES
	Chamaeleosenegalensis	Protected by CITES
	Kinixysbelliena	Protected by CITES
	Crocodyluscataphractus	Data deficient
	Osteolaemustetraspis	Vulnerable

Table 12: List of threatened and endangered species

5.7. **Impact of/on climate change**

According to UNEP – WCMC, Climate change is already having noticeable impacts on biodiversity. This is quite clear for Sierra Leone where it is likely that if the current trend of unsustainable utilization of the country's biodiversity is not checked future changes are likely to result in changes in the distribution of species and ecosystems, and overall biodiversity loss. Individual species respond differently, according to their climate tolerances and their ability to disperse into a new location, alter their phenology (e.g. breeding date) or adapt to shifting food sources. This means that it is difficult to predict how communities will change or how current interactions between species will be affected (UNEP-WCMC).

In Sierra Leone, though there are attempt to understudy the rate and extent of species or ecosystem responses to climate change, it is difficult to tell how exactly the future will look like. But on general terms, terrestrial species are typically expected to move towards higher latitudes or higher altitudes, where temperature will be favorable. Marine ecosystems will be affected not only by an increase in sea temperature and changes in ocean circulation, but also by ocean acidification, which increases the vulnerability of fragile ecosystems.

Climate change has other effects on biodiversity including disease outbreaks, food shortages and habitat destruction/alteration.
The impact of a healthy biodiversity on climate change is the reverse of its mayhem. A rich and healthy biodiversity has the capacity of controlling some of the impacts of climate change including temperature, food, habitat restoration etc. as biodiversity is the centre of ecosystem functioning.

Part II:

The national biodiversity strategy and action plan, its implementation, and the mainstreaming of biodiversity

6. THE BIODIVERSITY TARGETS SET BY SIERRA LEONE

Sierra Leone has just concluded the 2nd of a 5 component project on the Revision of the NBSAP and development of the 5th National Report to the CBD. Target setting and development of priorities and principles are an integral part of the project, which will be concluded by 31st December, 2014.

7. UPDATING OF NATIONAL BIODIVERSITY STRATEGY AND ACTION PLAN TO INCORPORATE THESE TARGETS AND TO SERVE AS AN EFFECTIVE INSTRUMENT TO MAINSTREAM BIODIVERSITY

(See question 5 above)

8. ACTIONS TAKEN BY SIERRA LEONE TO IMPLEMENT THE CONVENTION SINCE THE 3RD REPORT AND THE OUTCOME OF THESE ACTIONS

The actions taken at the national level can be classified into Legislative or regulatory, the role of NGOs, institutional and capacity building.

8.1. Policies and Regulatory Framework

Since biodiversity is governed in a changing social, political and economic environment, even the best of policies may be affected by trends in these factors, thereby necessitating policy review, amendment and even full scale repeal in order to ensure the relevance of the new policy. Forest biodiversity policy should therefore consider future economic changes; changes in taste; availability of alternative products; technological changes as they affect demand and supply of products and therefore economic benefits derived there-from.

8.1.1. The Wildlife Policy (2010)

The wildlife section of the Forestry sector too had no policy document prior to the 2010 draft Wildlife Policy. The 1972 Act itself had no regulations to facilitate implementation. The development of separate forestry and wildlife policies in 2010 was borne out of a workshop organized by (GOSL) represented by the Forestry Division) with support from European Union and USAID, in Freetown from 3-5 February 2009. The objective was to review the existing policies, laws and regulations which efficacy was questionable. The emerging Advisory Committee established, had representation from Agriculture, Forestry and Environmental Sectors; National, international and local NGOs, civil society organizations and local communities. In addition to the Act, the workshop also recommended the preparation of separate Forestry and Wildlife policies.

The AC, during the review process, identified and analyzed gaps and limitations or weaknesses of the old policies, recommending inputs based on lessons learned from other countries. The two draft policies benefited from both intensive and extensive visibility through radio/TV discussion programs, public notices, phone-in radio programs, meetings etc. The lingua franca – creole was used in the visibility process, in order to involve the wider public, especially the local illiterate communities. A national validation workshop concluded the preparatory process.

Some of the policy statements include:

1. Maintenance of viable population of indigenous species of flora and fauna in their natural habitats;
2. Maintenance of viable population of migratory species;
3. Control of these species of flora and fauna that have detrimental impacts.
4. Control collection and trade in indigenous flora, fauna as per CITES regulation;
5. strategic land use planning;
6. Judicious management of flora and fauna;
7. Incorporation of an understanding of biodiversity conservation and wildlife management into schools and other curricula.

The guiding principles include: sustainable wildlife management. Rights – based governance economic or social benefits integrated wildlife conservation' culturally insensitive knowledge based wildlife conservation and effective policy implementation through capacity building (GOSL, 2010).

i. The Forest Policy (2010)

The Forestry sector had been operating on policy ideas, not actually compiled as a comprehensive policy document. The Morgan draft policy proposal of 2003, though circulated had never been fully adopted but used in preparation of related documents. This draft however considered the role of allied sectors in shaping forest policy; human capacity development, the role of allied sectors and other issues. The current cry for sect oral policies harmonization in the interest of especially forest conservation probably stems from the fact that previous policy ideas had a narrow focus and therefore failed to foresee potential challenges from other land use sectors. With increasing population and the associated increasing demand for land, these challenges will only increase in depth.

This draft document comprises of 19 policy statements and 9 guiding principles. Some of the policy statements focus on forest land management, forest reserve management, community forest management, industry and products; benefit sharing, development of ecologically sustainable eco-tourism enterprises, wildlife management and conservation, ecosystems conservation and management, and watershed management.

The guiding principles indicated focused on sustainability of forests and benefits there from; rights-based governance including benefit sharing and enforcement of international natural local rule of law; economic benefits and livelihoods as they influence community participation; integration of sectoral plans to indicate rights and limitations; capacity development for resources management. Research/science –based resources management; public awareness; adaptive management and consideration of cultural heritage.

ii. Environmental Protection Agency Act (2008), formally Sierra Leone Environment Protection Agency Act, and amended in 2010

Act No.1 of 2008 created the Environmental Protection Agency and describes the functions of the Environmental Protection Agency as contained in Regulation 1990 as follows:

'To coordinate the activities of all bodies, which activities could affect the environment, ensure control of discharge into the environment; issue environmental permits and pollutant abatement; provide notices for controlling the volume, types and effects of waste discharges; prescribe standards and guidelines relating to ambient air, water and soil quantity; ensure compliance with EIA procedure; liaise with central/local government and other bodies in pollution control; develop a comprehensive database on the environment, amongst others.'

Generally the agency develops laws and regulations governing local government land use rights, land use planning and terrestrial and aquatic natural resources use and the need to be consistent with laws and regulations governing wildlife development.

Both the policy and legislative framework, if implemented to the letter, should guarantee biodiversity conservation and sustainable development in Sierra Leone.

iii. Agricultural Policy 2007 (draft)

Section 8.9 of the 2007 Agricultural Policy concerning natural resources management, is based on the following policy objectives, amongst others:

- To promote the rational and sustainable use of natural resources''.
- Sensitize the public on the importance of effective use of natural resources; the current state of their management and appropriate measures to control environment degradation.

- Ensure the continuous inventory and assessment of natural resources is carried out to monitor changes in their status.
- Ensure training of all stakeholders in the judicious use of natural resources such as timber, fire wood and appropriate measures to monitor and control mining operations to conserve biodiversity
- Enact or review laws designed to conserve natural resources and the environment and regulate the development and exploitation of natural resources.
- Coordinate the activities or all MDAs involved in the use and management of natural resources.
- Adopt and implement element of international treaties, conventions and protocols relating to sound environmental management.
- Also in section 9.32 of the Agriculture policy, one of the policy objectives state as follows, 'To encourage the sustainable exploitation of land and water resources in various agro-ecologies.'

Older pieces of legislation relating to biodiversity include the Forestry Act (1988) and regulation (1990), and the wildlife Act (1972); *Natural Environmental Policy (1995)*

b. Establishment and strengthening of Institutions

i. Agricultural Research and Support Institutions

There are strong research and technical support from allied institutions such as National Agricultural Research Coordinating Council (NARCC), Institute of Agricultural Research (IAR), Rice Research Station (RRS), and Njala University (NU) (from the University of Sierra Leone. GoSL support to Agricultural institutions for 2003 amounts to Le 963.8 million.

a) National Agricultural Research Co-coordinating Council (NARCC)

Conflicting and overlapping mandates, duplication of resources among government agencies and support institution led to the establishment in 1985 of the NARCC by the Government of Sierra Leone (GoSL) in 1985.

NARCC formulates polices, set research priorities and makes recommendations to GoSL. It also co-ordinates research activities and maintains a documentation centre. It has only two senior officers and a finance department.

b) Sierra Leone Agricultural Research Institute (SLARI)

Formerly known as Institute of Agricultural Research (IAR), SLARI was established after the termination of the American funded Adaptive Crop Research and Extension (ACRE) Project in 1988. SLARI conducts research on major crops other than rice. It adapts a farming systems Research/Extension approach. While they do not have a mandate to work on forestry or wildlife related issues, SLARI is important in spreading high quality seeds and germ plasm which famers around the forests and parks could use to enhance food security and reduce pressure on the existing fragile forest. Their activities (directly and indirectly) support livelihood and food security initiatives for inhabitants and people living around the protected forests. SLARI has collaborative links with NUC, Fourah Bay College (FBC), International Institute of Tropical Agriculture (IITA), Semi-Arid

Food Grain Research and Development (SAFGRAD), West African Rice Development Association (WARDA), and the International Crop Research Institute of Semi -Arid Tropics (ICRISAT). SLARI as an institution has a decentralized research team in each of six zones (Rokupr, Kabala, Makeni, Magbossi, Njala and Kenema).

There are seven constituent departments: Crop improvement; Resource Management; Training and Information; Crop Management; Socio-economic Research; Food and Nutrition; Technology Transfer The core staff of IAR comprises a Director, 13 Research Officers and 10 Research Assistants. During the war the infrastructure was devastated necessitating a massive rehabilitation program. Funding remains the greatest problem.

ii. Educational Institutions

a) Fourah Bay College-Department of Biological Sciences

This is an institute of higher learning and promotes biodiversity through training future technocrats in biological sciences including ecology management, botany zoology, geography and environmental disciplines. The department oversees the botanical garden and has been very active in carbon credit activities.

b) Njala University (NU), formerly, Njala University College

NUC was established in 1964 and has three faculties and several academic departments. These three faculties are Agriculture, Education and Environmental Sciences. NUC carries out basic and applied research with strong collaboration with IAR and RRS. Most of the research personnel at IAR and RRS were recruited from NUC. The department of biological sciences is mainly focused on conservations issues are operates the research station on Tiwai Island. The department has merged with the institute of Biological Research and conservation focused NGO and they are both an active member of ENFORAC.

iii. Non-governmental Organizations (NGOs)

There are over 631 NGOs operating in Sierra Leone. Many of these have either national or international status (Source: SLANGO 2013). However, only a handful is directly involved in ecology and biodiversity conservation work while a vast majority we understand are involve in food security that has Agricultural intervention as a component. Amongst this, the most prominent are the Conservation Society of Sierra Leone (CSSL), Tacugama Chimpanzee Sanctuary, Amphibian and Reptile Programme Sierra Leone, Council for Human Ecology of Sierra Leone (CHECSIL), Welthungerhilfe (WHH) work around Gola Forest and in Western Area Peninsula Forest, the Environmental Foundation for Africa (EFA) and Sustainable and Thriving Environment for Western Africa Regional Development (STEWARD) prioritizing trans boundary zones Outanmba Kilimi National Park in Sierra Leone, and in Guinea (Madina Oula and Oure subperfectures) and Liberia (Wonegizi).

Among the many NGOs spread across the country actively implementing poverty reduction and socio-economic development programmes such as food security their activities include work on Inland Valley Swamp (IVS), upland farming and promote agro-forestry interventions. Through these they participate in agro biodiversity activities in their operational areas. Among these organizations

are Concern Worldwide, Community Action for Rural Development, World Vision International, Sustainable Nutrition and Agriculture Programme (SNAP), Catholic Relief Services (CRS), Action Contre la Faim (ACF), Care International, Community Animation and Development Organization (CADO), HELP Sierra Leone and many more.

a) Role of Non-Governmental Organizations in Sierra Leone

Since the civil war, civil society has flourished in the country, with the formation of organizations providing a wide range of services. As a result, civil society organizations (CSOs) have gained "performance legitimacy" in the socio-political arena of the country (*International Journal of Not-for-Profit Law)*.

Non-Governmental Organizations is crucial in many ways and has mostly complimented the effort of the government. In Sierra Leone, NGOs and civil Societies have supported government institutions in raising awareness on environmental and conservation issues around the protected forest and across the country.

Together with MAFFS, non-governmental organizations are contributing to the *Strategic Goal B of the Bio diversity convention on Reduce the direct pressure on biodiversity and promote sustainable use.*

Activities undertaken and initiatives supported by non-governmental organizations are considered important to the socio economic development of the country. A case is made that many NGOs targeting supports very poor and marginalised households. The activities on NGOs in Sierra Leone include; research, awareness raising and community –based programs. Below is the profile of prominent not-for-profit organizations working to protect forest and biodiversity followed by NGOs involved in agriculture and food security in Sierra Leone.

b) NGO Intervention type and changing role

Apart from the traditional international NGOs (such as Care International, Plan International, Concern Worldwide) and UN Agencies implementing development projects in the country sometime immediately after independence, most the flurry of NGOs in the country became active and started operations during the war operating Relief and Welfare type intervention. Over the years the country have seen NGOs (both National and International) come and go. According to Korten's classification of NGOs strategies and development from first to the fourth generation, NGO roles will evolve and change as country stabilises. **Table 13** illustrates the different roles of NGO from the stage of relief and welfare to People's movement through the community development and sustainable systems development stages.

	First ***Relief and Welfare***	**Second** ***Community Development***	**Third** ***Sustainable Systems Development***	**Fourth** ***People's Movements***
Problem Definition	Shortage	Local Inertia	Institutional and Policy Constraints	Inadequate Mobilising Vision
Time Frame	Immediate	Project Life	Ten to Twenty Years	Indefinite Future
Scope	Individual or Family	Neighbourhood or Village	Region or Nation	National or Global
Chief Actors	NGO	NGO plus Community	All Relevant Public and Private Institutions	Loosely Defined Networks of People and Organizations
NGO Role	Doer	Mobilizer	Catalyst	Activist/ Educator
Management Orientation	Logistics Management	Project Management	Strategic Management	Coalescing and Energizing Self-Managing Networks

Table 13: Korten's Strategies of Development-Oriented NGOs: Four Generations

c) NGOs implement Conservation programmes

The Environment Forum for Action (ENFORAC)

ENFORAC is a coalition of environmental non-governmental organizations, community groups and academic institutions working together towards advocating for environmental policy reforms; influencing positive policy impact, management and behaviour change for the health environment. The organization advocates for: Biodiversity management research; Natural Resource management; policy reforms and enforcement and Land use planning; water management, water management catchment and Waste management. Other programs of focus include: sustainable development; mass environmental education and information campaign.

Beautification, Rehabilitation and Conservation Organization (BRACO)

BRACO is a member of ENFORAC. The organization started in 1992, with a major aim of protecting and conserving the biodiversity through: identification of ecological hazards, conduct research, environmental advocacy and providing biodiversity education as well as creating biodiversity awareness; the organization is operating in Western Area.
Since its inception, the organization has had four major projects on biodiversity protection and conservation:

1. Green Belt program which was implemented together with the Ministry of Agriculture, Forestry and Food security (MAFFS);
2. Advocacy on disaster Management which was implemented with funding from Plan International Sierra Leone;
3. Fuel Wood Project Mountain Area;
4. Biodiversity protection and conservation education and awareness.

Their activities include the following:

- Addressing Biodiversity conservation through Livelihoods activities
- Biodiversity education and awareness, training workshops on biodiversity protection and conservation.

Budget

The organization has received funding from different donor organizations as follows:

Period	**Budget**	**Project**	**Donor**
1993-1996	Budget was controlled by MAFFS	Green Belt program (MAFFS)	European Union
2007	$ 1,000	Advocacy on disaster Management	Plan Sierra Leone
2007-2008	Le 89,000,000	Fuel Wood Project Mountain Area	UNDP
2011-2012	Euro 30,000	Biodiversity protection and conservation education and awareness	UNDP and CRS

Achievements

- Protection of 61 Water points of the Western Area
- An estimated 5,000 people have acquired knowledge about biodiversity protection and conservation of which 40% are women.

Challenges

- Access to finance has hinders the organizations from carrying out its objectives.
- Lack of good governance affects the implementation of government policies of biodiversity protection and awareness.
- Lack of harmonized policies negatively hampers progress in biodiversity protection and conservations interventions.

Projected budget

The Organizations projects Euro 70,000-80,000 for the next 3 years.

Conservation Society of Sierra Leone (CSSL)

The Conservation Society of Sierra Leone (CSSL) is a national, non-profit, non-governmental organization. It is a membership organization for a wider community with interest in promoting biodiversity protection and conservation in Sierra Leone. The membership is open to every individual from every background both scientific and non-scientific backgrounds.

The Society started in 1986 and it has operational programs in the following districts: Bombali, the Outamba Kilimi National Park- Kailahun-Pujehun/ (Gora Rainforest) districts, Tonkolili and Western Area. The chiefdoms in which CSSL include: Kholifa Mabang/Yoni (Bombali chiefdom); Barri, Koya, Nomo, Gaura, Tambahka (kailahun district); and in Western Area District, CSSL is operating in Aberdeen.

Activities

- Lobbying and advocacy: CSSL work with government and other non-governmental organization to raise awareness of the need for sustainable policies and legislation for the protecting, management and sustainable use of Sierra Leone's natural Resources.

- Conservation work: CSSL works in collaboration with communities and national and International NGOs and partners for biodiversity protection and conservation by enhancing the understanding of key species, building local support for conservation of biodiversity and ecosystem as well as strengthening understanding the socio-economic needs that threaten biodiversity.

Budget

Period	Budget	Program	Donor
2010-2011	US$ 130,000	All projects activities	RSPB Birdlife, Bio life International, MAVA foundation, GEF/UNDP
2011-2012	US$ 130,000	All projects activities	RSPB Birdlife, Bio life International, MAVA foundation, GEF/UNDP
2012-2013	US$ 130,000	All projects activities	RSPB Birdlife, Bio life International, MAVA foundation, GEF/UNDP
2013-2014	US$ 130,000	All projects activities	RSPB Birdlife, Bio life International, MAVA foundation, GEF/UNDP
2014-2015	US$ 180,000	All projects activities	Projection
2015-2016	US$ 180,000	All projects activities	Projection

Achievements

- The society initiated and contributed to the transformation of Gora forest into a National Park; CSSL contributed about 70% to the transformation work.
- Provided technical support in the development of the Biodiversity Strategy Action Plan
- Undertook and identified Important Bird Areas (IBAs) and Key Biodiversity Areas (KBAs)
- Planned and conducted trainings of field conservationists
- Identified RAMSAR Site as Sierra Leone's river estuary
- Providing environmental education activities and events
- Produced environmental education and awareness as well as biodiversity protection and conservation awareness.
- The Society is undertaking the monitoring of water birds particularly at Aberdeen creek
- The society has undertaken the planting of Mangrove, a total of 8600 both red and white mangrove have been planted.

Challenges

- Mining companies imposes a great threat to the protection of environment due to mining activities

- Lack of unified approaches and collaboration with other green actors and MAFFS
- Low salary/motivations for staff
- Poor public engagement
- Low staff capacity resulting in poor quality services

Green Scenery

Green Scenery is a national NGO involved in wider activities aimed at promoting the protection of environment as well as Biodiversity protection and conservation. Through its many activities, Green Scenery builds capacity of communities and institutions in natural resource management, community development and peace building. The organization is operation in Western Area and other districts. Green Scenery is very active in advocacy and has championed the issues of deforestation across the country.

Projects implemented by Green Scenery: The Conservation of the Western Area Peninsula Forest Reserve (WAPFoR) and its Watersheds

Conservation of the Western Area Peninsula Forest Reserve (WAPFoR) and its Watersheds focused on tree planting and awareness raising campaigns on the protection and management of the environment and natural resources.

This project was implemented by Green Scenery in collaboration with: Welthungerhilfe (WHH), Environmental Forum for Action (ENFORAC), in collaboration with the Forestry Division within Ministry of Agriculture, Forestry and Food Security (MAFFS) and Environmental Protection Agency Sierra Leone (EPA-SL).

The overall objective of the project was to introduce participatory processes in decision making on the sustainable use of natural resources that contribute to the reduction of rural poverty in the Western Area Peninsula (WAP) and to conserve and sustainably manage the Sierra Leonean Western Area Peninsula Forest Reserve (WAPFoR) and its watershed.

Green Scenery works with Community Based Youth Groups living in proximity to the forest. The community lives by the coast and depends on fishing for livelihood. Fish smoking accounts for large consumption of firewood, the bulk of which is obtained from the forest.

Tacugama Chimpanzee Sanctuary (TCS)

The Government of Sierra Leone, through the help of a conservationist, Bala Amarasekaran, and the Conservation Society of Sierra Leone, created the Tacugama Chimpanzee Sanctuary. The sanctuary is part of a larger program, the Sierra Leone Chimpanzee Rehabilitation Program, playing a vital role in stopping the trade and preserving chimpanzees in the wild; it is located in the Western Rural Area.
The overall aim of the Sierra Leone Chimpanzee Rehabilitation Program is to provide a safe home for orphaned & endangered chimpanzees. Tacugama also endeavours to help protect and conserve the species in the wild by engaging with the public through environmental sensitization & training programs.

The social implications of the Tacugama Chimpanzee Sanctuary

In Sierra Leone, the chimpanzee pet trade, until recently was flourishing as over 50 pets were found in the capital Freetown, alone. Whilst young they are playful and cute, but as they grow up, they become difficult to handle. Thus many are killed and abandoned. Those that do survive live a life of cruelty in confinement, denied their most basic social needs. Although Sierra Leone prohibits the capture and sale of chimpanzees, enforcing this law means confiscating pets. Authorities are then faced with the dilemma of what to do with so many chimpanzees. Once captive they cannot simply be returned to the wild, they would be attacked by wild chimps and without their naturally learned skills, may perish.

Achievements

Tacugama Chimpanzee Sanctuary (TCS) has taken a wider range of activities for biodiversity protection and conservation and the ecosystem. The TCS has documented the following achievements:

Some 614 bird species have been recorded in Sierra Leone of which six are threatened. The white-breasted guinea fowl (*Agelastes meleagrides*), which was recently rediscovered in Sierra Leone and is considered as one of the most threatened birds in continental Africa. A total of 15 species of primates of which 11 are forest species were identified in the country. Six species of the primates are threatened and they include: western Chimpanzee (*Pantroglodytes verus*), the Black and White Colobus Monkey (*Procolobus polykomus*), Red Colobus Monkey (*Colobus badius polykomos*), Diana Monkey (*Cercopithecus diana*), and Olive Colobus Monkey.

Tacugama identified a total of 18 species of antelopes of which 9 species are threatened and 16 endangered. These include: the Jentincks (*Cephalophus jentinki*) and Zebra duikers (*Cephalophus zebra*). Other threatened species of mammals include 1 species of forest elephants (*Loxodonta africana cyclotis*) which is believed to have almost gone extinct, West African Manatee (Trichechus senegalensis), pigmy hippopotamus (*Hexaprotodon liberiensis*), leopard (*Pantera pardus*), an endemic frog found in the Tingi Hills (*Bufo cristiglands*) and an endemic toad found in the Western Area Peninsula Forest (*Cardioglossus aureolli*).

WELT HUNGER HILFE Cocoa Development project

Welt hunger hilfe is a German based international NGO operating in Sierra Leone. The Cocoa development project started in 2004, operating in three districts: Kenema, Kailahun and Kono. In Kenema district, the organization is operating in two chiefdoms: Nongwa and Lower Bambara; while in Kono district, the organization operates in seven chiefdoms: Gorama Kono, Nimikoro, Gbeneh, Fiama, Lei, Soa and Sandor Chiefdoms. The project is being implemented in a total of fifteen chiefdoms, one hundred and thirty eight villages with 5,000 cocoa/coffee producing households. The objective of the project is to improve the income and wellbeing of cocoa/coffee farm families through improved production, processing and Marketing of quality cocoa and coffee in the Eastern Province.

The project is working towards archiving the following results:

1. Farmers are supported to (i) increase the area of cocoa/coffee through new plantations, and (ii) increase yield through rehabilitation.
2. Cocoa/coffee quality improvement on farm level is promoted; youth/women are actively involved in the process.

3. The private sector is enabled to conclude certifications
4. The cocoa summit follow-up is supported and close relations to relevant sector organizations are maintained, especially the District Councils to strengthen the cocoa/coffee sector.

The Biodiversity protection and conservation, which started in 2008, is not a stand-alone project, rather it is embedded in other programs, particularly in cocoa and coffee value chain. The aim is to develop livelihood initiatives for farmers that will mimic the natural forest covers and protect the forest at the same time.

Budget: Data showed that there was no specific budget for Biodiversity protection and conservation but for the project period 2013-2015 the overall budget is Euros 7 million; financed by the European Union and Welt hunger hilfe. Staff capacity is 25.

Achievements

Since the inception of the project in 2008, Welt hunger hilfe has registered the following achievements:
The establishment and replication of Agro-forestry demonstration plots:

- Support the establishment of Cocoa Block Farms
- More famers rehabilitate cocoa/coffee farms (pruning)
- Expansion and Gap filling of cocoa/coffee farms
- Cocoa quality in SL has improved (Ref. buyer)
- Buyers pay for cocoa/coffee according to quality
- Awareness in farmers on the use of quality control equipment (moisture meter, G motive)
- Two farmer organizations were certified
- Linkage to external market
- Export of cocoa/coffee by farmer organizations
- Functioning cocoa working group
- Functioning coordination meetings with MAFFS and District councils

Challenges

The organization reported the following challenges during the implementation of biodiversity activities:

- Farmers lack adequate technical knowhow
- Difficulty In sourcing and affording of planting materials
- Slashing and burning of upland farms affects the establishments of biodiversity
- Land agreement was reported as a major problem for establishment of cocoa block farms.
- Pruning of cocoa tree/farms has is also a major challenge in biodiversity protection and conservation.

Welt hunger hilfe Food Security and Economic Development Project (FoSED)

The result three of the EU funded project FoSED centres on developing and promoting mechanism for sustainable management of Natural Resources. Implemented by Welt hunger hilfe and Environmental Foundation for Africa (EFA), FoSED Project activities are mainly in Bo, Kenema and Pujehun Districts. Funded by the European Union and Welt hunger hilfe, the project is for a period of five years.

The project started in March 2009. It was designed to work in 59 different communities and expected to initiate a positive change in current agricultural practices, in processing and marketing of agricultural products, in attitudes to environment protection and natural resource management which will also include provision of service delivery capacity of community based organization and strengthening of local government institutions.

A significant focus of the project is on developing ecotourism on Tiwai Island Wildlife Sanctuary as a way of protecting the forest and fauna on the Island along with providing support for research. Through this the FoSED project aim to protect the existing biodiversity on the Island and raise awareness of the owning communities living in the forest edge and non-forest edge alike on sustainable forest use, land use planning and alternative livelihood. As part of developing an alternative livelihood, the FoSED Project is involved in promoting the Non Timber Forest Products around Tiwai Island and the Gola Forest. They have funded Food Security and livelihood initiatives to improve the living condition of owning communities.

Total budget is 1.5million Euro among which 206,000 Euro is for Natural Resource Management and 352,750 Euro for Agriculture: Others are for Institutional Building, Marketing and Processing including support to Agricultural Business Centres (ABC) and overheads.

Reptile and Amphibian Program (RAP) Sierra Leone

This organization was started in Septembers 2012, with an aim of biodiversity protection and conservation with focus on Sea turtles and protection and conservations. Other than protection and conservation of sea turtles, the organization also undertakes Natural Resources Management and Environmental awareness activities.

Operation area:

The organization operates in Moyamba district, Kargboro chiefdom. It also operates in Bonthe district in Deima and Settia as well as in the Western Area Rural and Urban.

Budget

Period	Budget	Project	Donor
2012-2013	$ 67,445	Sea turtles conservation	
2013-2014	$ 160,000	National Survey of reptiles and amphibians	
2014-2015	$ 200,000	National Survey of reptiles and amphibians	
2015-2016	$ 240,000	National Survey of reptiles and amphibians	

Major sources of budget include grants, membership subscriptions and consultancies.

Achievements

- Able to set up a database on sea turtles
- Undertaking community development programs have led to the community response to release turtles
- Documented a total of 45 species of Amphibians and 28 species of reptiles

Challenges

- Funding is one of the constraints affecting the implementation of the project.
- The second problem is lack of equipment
- Lack of awareness on biodiversity protection and awareness by the local community

Sustainable and Thriving Environments for West African Regional Development (STEWARD)

Sustainable and Thriving Environments for West African Regional Development (STEWARD) is a USAID supported program. The motivation for the program came out of the realization that the Upper Guinean Forest Ecosystem, extending from southern Guinea into Sierra Leone, though Liberia and southern Cote d'Ivoire and into Ghana is a high global priority for biodiversity conservation.
The program has three goals: to build capacity for increased regional collaboration; to foster regional policy innovation and harmonization; and to pilot trans-boundary conservation and natural resource management at selected sites.

Programs focus

- Harmonizing forest, wildlife and conservation policies to mitigate illegal movement and unsustainable use of natural resources
- Promoting improved markets and management for high value tree crops that provide benefits to smallholders and help governments diversify extractive-industry based economies
- Developing a regional presence in global fora for conservation, sustainable development and trade
- Assisting the region to more effectively manage and capitalize on influxes of investment and trade in natural resources
- Developing regional strategies for coastal and fisheries management, and (6) accelerating the flow of knowledge and experiences about best practices.

In Sierra Leone, STEWARD is focusing on: natural resources Management and environment awareness, Livelihoods and income generation and Biodiversity protection and conservation. The program operation area is Bombali district Northern Province in Tambahko chiefdom; it is a 5 years program which started in 2010 and is ending in September 2015.

Activities

Major activities include organizing community sensitization meetings on management of natural resources and as well as environmental protection.

Advocate for policy reform to foster sustainable natural resources and environmental management.
Conduct activities aiming at protecting forests as well as establishing forest management committees.
Support the harmonization of trans-boundary environmental policies; as well as supporting for their implementation.

Environmental Foundation for Africa (EFA)

EFA is one of the oldest institutions to begin promoting environmental awareness, conservation and protection in Sierra Leone. It was active throughout the conflict period in Sierra Leone working in the refugee camps and in communities' adjacent to the refugee camps with funding from UNHCR. There were active tree planting activities and domestic energy and lately rural solar electrification projects.

Following an initial assessment towards the end of the war in Sierra Leone, EFA with funding from USA based Conservation International (CA) and International Union for Conservation of Nature (IUCN) in Netherlands, EFA began active restoration and conservation work on Tiwai Wildlife Sanctuary. The mission of (EFA) in Sierra Leone is to rehabilitate and protect the environment and its natural resources.

EFA activities also include environmental restoration and protection work operation in conflict zones, humanitarian and refugee operations, post-conflict reconstruction and rehabilitation. EFA is a principal partner of Welt hunger hilfe and it implements the environmental awareness and conservation element of the European Union funded Food Security and Economic Development (FoSED) Project. The FoSED project is in Bo, Kenema, and Pujehun District.

Other active NGOs in biodiversity conservation and environmental intervention are:

Union of Environmental Journalists (UEJ)

Protect biodiversity through mass media, theatrical and artistic practitioners to educate civil society about the true status of the environment in order to promote sustainable natural resource management and aesthetic human existence. Membership is drawn from all print and electronics member houses in Sierra Leone.

The Commonwealth Human Ecology Council (CHEC-SIL)

This council promotes conservation of the ecology through education and disseminates environmental information through the mass media. It also supports the Government of Sierra Leone (GOSL) in promoting, through education, policy implementation and project execution.

Biotechnology Association of Sierra Leone (BioSalone)

Promote the use of Biotechnology by: Biotechnology education; bio-business development and advocating for biodiversity standards and policies.

Community Advocacy and Development Movement (CADEM)

Promoting the protection of human ecosystem

Council for Human Ecology in Sierra Leone (CHEC-SL)

Promote human ecology through education, policy implementation and the extension of the science of ecology to foster sustainable human well-being and quality of life.

3. MAINSTREAMING OF BIODIVERSITY INTO RELEVANT SECTORAL AND CROSS-SECTORAL STRATEGIES, PLANS AND PROGRAMMES

a. Capacity Building

Staff capacity building of line ministries mandated to conserve and manage biodiversity is often done either locally (with the respective MDA) or in groups represented by respective MDAs. This is infrequent due to costs and technical limitations and could be very selective excluding majority of staff who should benefit from it. Institutional capability enhancement entails technical, logistic and material support to facilitate conservation.

However, Multilateral agencies like the UNDP and FAO often support staff capacity building programmes in the Crops Forestry, Livestock, Fisheries and the land and water development sub-sectors either conducted locally or support external training programmes. Other areas involved in staff and institutional capacity building includes sensitization and awareness raising ventures organized by the CBD, CCD, UNFCCC, CITES and RAMSAR convention amongst others. In addition to the dispatch of volumes of documentations on the implantation of these Conventions, to state parties' projects such as the RAMSAR small grants projects build the capacities of MDAs and NGOs involves in the implementation of the RAMSAR convention on wetlands. All conventions support both staff and institutional capacity building as a strategy to facilitate the implementation of the respective conventions.

In addition, in-country donor agencies, embassies and international NGOs, support training in biodiversity conservation but the number of beneficiaries is often limited by funding. Also, staff retirement, retrenchment, attrition, death in service etc. undermine the impact of these trainings.

Generally trainings are infrequent and cover an insignificant number of staff. Research in biodiversity management weak because financial and logistics support internet facility, equipment and experts in surveying are limited. The major constraint is often that of low staff strength, due to the de facto ban on staff recruitment, owing to funding constraints in the case of Sierra Leone in particular.

For instance in 1990 the following numbers by staff category were managing 507,700 ha, of national forests:

177 forestry staff (90% in the junior cadre and 33 wildlife staff (85%) in the junior cadre) giving a protected area: staff ration of 2418:1. By that time about 28 senior staff vacancies and 63 middle staff vacancies were to be filled. The situation is even worse now (FAO, 1990).

Recent capacity building efforts including 30 Sierra Leones (mostly students) was undertaken by the multi-donor project entitled: Strengthening initiative for Biodiversity Conservation in West Africa (Ngeh and Fishpool, 2008) Institutions covered by the training in biodiversity identification and survey technology were: Government (Wildlife) Forest Agencies, National NGOs, Academia (Universities) in Ghana, Gambia, Sierra Leone and Liberia (West Africa). In addition the following materials were added:

- 15,000 pound sterling worth of books,
- 75 pairs of Viking binoculars,
- 75 copies of birds of West and Central Africa and
- 15 CDs of bird sounds were distributed.

b. Public Participation

Public participation in biodiversity management is often ensured in the following areas:

- Ordinary Meetings (planning meetings, disclosure of studies, field visits by authorities etc)
- Radio/TV Programmes (Involvement in discussion programmes; Public notices; meet the peoples tours; visits to Forestry offices in Freetown and district offices; responses to direct interviews and through administered questionnaires.
- Workshops (Sensitization/ Awareness-raising workshops; Planning workshops, Introduction of projects, Project inception workshops, steering committee meetings etc).
- National tree planting day exercises and other tree planting ceremonies organized by development projects.
- Management of sacred grooves and the conservation of secret society bushes, places of worship and burial grounds (cemeteries).

However, in practice, these involvement of stakeholders (local communities, civil society, NGOs in policy development and implementation in biodiversity management is often inadequate. Lack of strategies on civil society involvement and lack of incentives to promote public participation in biodiversity conservation are issues yet to be addressed.

c. Progress made in Biodiversity Management

The following developments could enhance biodiversity management:

- The recent recruitment of 100 field staff by the Forestry Division, now awaiting training, though already in post, is a commendable step.
- In addition to the revised 1988 Act, the 2007 bill has been passed through cabinet and probably awaits parliamentary ratification. This Act introduced the following novelties supportive of resource conservation.
- Introduction of a land lease rent payment of 5.0 USD/ha/yr irrespective of the harvest of products from the piece of forest or PA.
- Introduction of a chain of custody strategy, to monitor the movement of timber from source to final destination.
- The re-introduction of the protected tree clause relating to *Pterocarpus erinaceous* as as one of the only hardly tree species in the north that was indiscriminately harvested for export to Asian countries before the log export ban.
- The progress of implementation of the Biodiversity Conservation project covering 3 PAs – Loma Mountain, Kangari Hills and the OKNP started in 2012 and the implementation of the Western Area Peninsula Forests Conservation project which started in 2008?
- The Forest Research station formally located at Bambawo, was revived under the Kenema Forestry and Tree Crops Station which activities include: indigenous tree species growth performance trials; germplasm collection; survey of threatened timber species and agro forestry tree species trials.
- The return of most of the refugees and internally displaced persons to their original locations has now been completed. However, a few others about (2-4%) have applied for naturalization but such a small number may not pose significant threat.

- Tran boundary natural resources management in the Mano River Union had probably come to the limelight about 5 years ago. This was initiated by the MRU earlier in her strategic plan of 2010. Even during the establishment of the Mano River Union there were 2 pillars supporting biodiversity conservation namely:

d. Trans-boundary Initiatives

In 2012 STEWARD, initiated the natural resources management policy drive in the Mano River Union capital cities and later supported the Mano River Union secretariat in convening workshops in a few trans-boundary areas. The Mano River Forest management project prepared in 2010, started implementation in 2012 with the following objectives:

i) Provide institutional support to MRU and partners;

ii) Improve livelihood through rural and community development in the target areas

iii) Improve biodiversity conservation and management and

iv) Provide project management and coordination support as part of MRU strategic plan (2010-2020)

The EC supported Forest Law Effective Governance and Trade (FLEGT) concept was introduced in 2011 and FD staff capacity has been raised in this area at FD headquarters and in the Gola Forest Peace Park project launched in 2012.

A log export ban was promulgated in 2011, in an effort to curb the then alarming round wood export which was declared 'as other items' quite unrelated to forest products. The process was heavily corrupt and surreptitious, depriving the country of the much needed foreign exchange to service the huge balance of payment deficits.

New policy interventions in March 2007, were out of the need to contain the mad rush of loggers and saw millers from other countries, through stringent measures instituted to regulate forest exploitation in that country. These loggers entered the country by dubious means and went into direct timber sales agreements with local chiefs, most of whom had very little experience in timber business, and hurriedly harvested trees especially in the Northern Province. The concealed logs were exported under different consignment labels. This situation attracted the attention of the authorities and a log export ban was imposed; and the local communities sensitized on the matter Also, the following remedial measures received cabinet clearance:

i) The introduction of a land lease rent in addition to the payment of fees and royalties for harvest products. Communities were to recommend potential entrepreneurs for logging and saw milling to Central Government as a pre-condition for the award of timber licenses, forest exploitation concession agreements etc, to the applicants;

ii) To institute a chain of custody system to monitor transported timber from source to destination, at check points along the route, a checking system was instituted;

iii) Declare any tree threaten with extinction due to excessive harvesting pressure 'as protected' in the interest of sustainability of timber supplies;

iv) OKNP and Gola National Parks carbon stock assessment studies and trainings conducted on a few occasions;

v) Loma mountain Forest Reserve and the Gola National Park Management plans prepared. Chimpanzee population survey at the OKNP and environs was conducted in 2010;

vi) Separate forestry and wildlife policies developed through a fully participatory process. Documents endorsed by cabinet are now available for comments prior to ratification;

According to Kiran *et al.*, (2008) the GEP biodiversity index for Sierra Leone dropped from 1.52 (2005) to 1.29 (2008) on a scale where '0' means no biodiversity are 100 means maximum biodiversity potential Increases in costs of permits, licenses and fees was instituted (**Table 14**).

From 1989 to 2008 there have been significant changes in the cost prices of forest products. Although they are still low, compared to other countries, they are likely to reflect the true value of the resources in future increases.

No.	Forest Produce	1989 Rate Le	1999 Rate Le	2004 Rate Le	2008 Rate Le	Rate USD
1	Class 1 timber	3175.00	8000.00	28000.00	48000.00	10.6
	Class II	2850.00	7000.00	26000.00	46000.00	10.2
	Class lll	2225.00	6000.00	24000.00	44000.00	9.70
2	Poles van load	100.00	200.00	1500.00	15000.00	3.33
3	Poles truckload		150.00	1200.00	50000.00	11.11
4	Poles-trailer load	50.00	100.00	1000.00	100000.00	22.22
5	Timber licence/year	60000.00	600000.00	1200000.00	5000000.00	1111.1
6	Charcoal prod./month	5000.00	5000.00	50000.00	200000.00	44.44
7	Clearance licence/acre	5000.00	20000.00	100000.00	2000000.00	444.44
8	Fuel wood-cord	4000.00	6000.00	10000.00	20000.00	4.444
9	Export permit/m3					75.00
10	Reg. power saw/year#					1000000.00
11	Property mark(concession)					1000.00/yr
12	Exporter reg. fees					2000000/yr
13	Retailer reg. fees					500000/yr.

Table 14: Changes in the costs of licences, permits and fees for forest products and operations (MAFFS)

The registration of power saws may encourage illegal logging except there is evidence of acquisition of timber license or allocation of forest to the individual.

e. Constraints in the Development and Implementation of Biodiversity Conservation

Constraints in the implementation of policies and legislations in support of sustainable management of biodiversity are varied but interrelated and are mostly influenced by financial, technical, capacity and logistical problems. The following are the major current constraints:

i) There are still some weaknesses in conservation policy and legislation, coupled with acute staff and institutional constraints and weak law enforcement. Staff involved in biodiversity management are often very thin on the ground giving the most outrageous staff: Protected area ratio imaginable (see section 4.7) In addition, the job environment hardly provides any incentives for staff motivation and dedication to

duty. Training is restricted to a few individuals as selection may be subjective sometimes and therefore counterproductive.

ii) Lack of effective partnership in biodiversity management and low funding which in turn is affected by absorptive capacity. Late release of the low funds is partially responsible for the low absorptive capacity. Forest co-management arrangements could help the situation to some extent. Other options include debt-for-nature swaps as it applies in other countries.

iii) There is insufficient visibility on sustainable biodiversity management issues to bring on board local communities, NGO, other MDAs, Civil Society, the media etc. to underscore the importance of biodiversity and the negative impacts of their degradation on society.

iv) Lack of effective data collection, information management and retrieval for development planning on employment and livelihood improvement opportunities. There are hardly any reliable assessment of biodiversity losses, simply because biodiversity surveys are very expensive and even the technical knowhow may be limiting.

v) Major deforestation drivers are the activities of other MDAs, which seriously negate biodiversity conservation and management. For instance road and building construction; mining of minerals, sand and stone; urbanization, construction of rail tracks, jetties and landings, which are subject to EIA processes still continue to destroy biodiversity. MDAs polices harmonization has been recommended in several fora but it is yet to be implemented.

vi) There is a lack of mechanism to ensure that environmental and natural resources management issues are incorporated into other sectoral ministries and line agencies.

vii) Effective private sector involvement in biodiversity management could generate funds for conservation. For instance the Tacugama Chimpanzee Rehabilitation project cooperated with the Sierra Leone National Airlines in 2004 – 2006 in promoting the project. The beer and soft drink companies could be encouraged to pay some conservation levy, in order to guarantee high water yield from Guma. This will ensure sustainability of these businesses which are highly dependent on sustained water supplies.

viii) Unfortunately for the country, biodiversity management hardly benefits from research data indicating the value of lessons learned is the case for well known protected areas. Effective Coordination with research and academia could identify better management options for biodiversity conservation under our situations.

ix) The new PRSP probably excluded natural resources management thereby undermining sustainable development.

x) There is limited or no support for local community conservation efforts despite their global significance. Communities conserve and manage natural resources through the use of by-laws, respect for authority, peer pressure etc. developed through the bottom-up development process. This could be explored so that the communities could augment the efforts of the very small staff on the ground for forest biodiversity management.

xi) Poor funding to the forestry sectors.

xii) The distribution of the annual budget (Other charges) from 2011 to date indicates an appalling allocation to the sector (Table **15**). The FDs share of the total annual budget ranges from 1.5% to 3.0%) from 2011 to the 2015 projection.

Division	FY2011 Actual Le,m	% of Total budget	FY2012 Estimate Le'm	% of Total Budget	FY2013 Budget Le'm	% of total	FY 14 Indicative Le'm	% of total budget	FY 15 Indicative Le'm	% of Total Le'm
Crops	516.2	2.4	445.0	1.94	920.0	3.7	1012.0	75.0	1194.0	3.75
Food security	15941.7	75.0	18669.1	81.48	17660.0	72.0	19426.0	72.0	22922.7	72.08
Forestry	218.3	1.0	281.1	1.2	620.0	2.5	682.0	2.53	804.3	2.52
Livestock	102.3	0.49	168.4	0.730	360.0	1.46	396.0	1.46	467.3	1.46
LWDD & Eng	117.1	0.55	172.5	0.75	440.0	1.79	484.0	1.79	571.1	1.79
PEMSD	1051.3	4.9	712.9	3.11	1180.0	4.81	1298.0	4.81	1531.6	4.75
Agric Ext. Services	2066.4	9.7	1593.8	6.9	1520.0	6.20	1672.0	6.20	1973.0	6.20
Total	21264.2	100	22911.6	100	24500.0	100	26050.0	163.9	31801.0	100

Table 15: Breakdown of MAFFs Budgetary allocations (2011-2015)

f. Sustainable use of biodiversity Components

There are now near-adequate policies and legislative frameworks within the Forestry sector and the EPASL, for the sustainable management of the component of biodiversity. However, the following constraints continue to militate against successful enforcement of these instruments and eventually the limited success in the implementations of the CBD.

g. Sharing of benefits from the use of biodiversity

Benefits often shared from the use of forest biodiversity in particular include:

- Fees and royalties derived from the harvest of forest products and services.
- Land lease rent for forest land and PA sites (yet to be implemented)
- Provision of wood off cuts from sawmills for community development.
- Concession price charged to the communities for forest products i.e. timber, construction poles, charcoal etc.
- Right to collect minor forest products i.e. ropes, wrapping leaves, dead wood (firewood)
- Right of entry and passage through forest estates.
- Provision of agricultural development grants by forest exploitation concessionaires as an incentive for cultivating lowlands after displacement from forests to be exploited.

h. Sharing of benefits arising from genetic resources

In Sierra Leone, benefits arising from genetics resources are limited and little or no efforts are made by the revenue generating institutions to monitor the sharing process. The value of benefits are

generally low, due to under-invoicing, unnecessary loss of resources; wastage; limited processing and value – adding facilities, bio-piracy, corruption, influence of the middle man and so on.

Biodiversity governance in developing countries like Sierra Leone is sometimes undermined by the following issues:

- Lack of political will, resulting in low funding and low prioritization of the resource management sector;
- Funding, technical and logistical constraints affecting the institution;
- Corruption and nepotism which makes the culprit in resource depletion, get off the hook;
- Poor visibility and environmental education on policy and legislative matters, relating to biodiversity management;
- Inadequate involvement of local forest-dependent communities in policy and legislative formulation;
- Inconsistency in policy implementation due to donor and/or development project influences e.g. fertilizer usage policies in the country have been mostly donor or project influenced in the past;

War impact on forests and wildlife due to the then breakdown in law and order as in the case of the 11 years long war, in the country from 1991-2002.

Since policy implementation falls under the purview of the respective relevant institutions, the capacity of such institutions is critical to successful resource management. Common problems with such government institutions including Sierra Leone, are as follows:

- Low staff strength and capacity, due to very limited staff capacity building and enhancement efforts;
- Poor staff remuneration translating into low staff morale, low motivation and low dedication to service;
- Limited operational funds means very little, if any, output. This questions the payment of salaries to staff who are not allowed to work.
- Low absorptive capacity of the meager funds allocated, for charges other than salary, which accounts for the bulk of total funds to the sector.
- Institutions managing the Agriculture, Forestry. Wildlife Fisheries and Livestock sub-sectors are subjected to the above biodiversity management implementation constraints in the country.

i. Benefit Sharing as Incentive for Judicious Biodiversity Management

Benefit sharing which forms pillar 3 of the Convention on Biological Diversity (CBD), is critical to the successful implementation of this convention. Therefore member nations of CBD should have this included in natural resources management policies This is because biological resources provide sustenance and cash benefits to land-owning communities, most of whom unfortunately, are below the poverty line. In the circumstances, they could take pittance for these resources virtually out of desperation. These communities are often not capable of evaluating these natural resources due to lack of the know-how. However, if benefits derived from these resources are appreciated by them, they are likely to support resource managers in resource protection. However, in most instances the true value

of these resources are not paid for and the people who have the expertise in resource evaluation may even be the vendors.

In Sierra Leone, most of the benefits from biological resources are from terrestrial and aquatic resources. While the terrestrial resources are often located in virtually inaccessible remote areas, making their monitoring and management difficult, in the aquatic environment logistical limitations make surveillance difficult and even risky, with the resulting poaching of the resources and therefore reduced value of benefits to stakeholders.

Unfortunately, both policy and legislative frameworks in the resource management sectors, have not treated the equitable distribution of resources, with the seriousness it deserves. While illegal harvest and collection of resources are on the increase, even the meager funds distributed are not monitored to ensure equitability in distribution. For instance the local community's share of logging revenue is in the following proportions:

- 50% to the land-owning communities
- 40% to the chiefdom administration and
- 10% to the Paramount chief of the chiefdom in which the resource was harvested (MAFFS, 1990).

The following scenarios are likely to undermine any equity considerations in the distribution at the chiefdom level:

The paramount chief is also part of the chiefdom administration and is therefore likely to influence the distribution. He may also belong to the land-owning family, further complicating the matter. At the land owner's level, the section chiefs, town chiefs and tribal authorities are likely to be favoured due to their positions in the system. The common man, who is actually fully resource-dependent, may only receive pittance or nothing at all, especially in situations where corruption and nepotism prevail.

At the community level, animal carcasses up to the size of a buffalo are normally distributed as follows:

The head and fore-limbs go to the paramount chief and in the case of an elephant, the tusk is added to the paramount chief's quota, while the rest is shared with the rest of the community including the hunter. If the hunter is cheated, he may have to hide the next kill and sell it under the cover of darkness. The women and children in society may or may not get shares except the husband's share.

Also, the rates of fees and royalties established by the Forestry Regulations (1990) were up to 2009 very small, and did not reflect the true value of the timber at the time.

These rates are in fact only paid when a forest product is harvested from a forest estate irrespective of the duration of the lease. Until the review of the Forestry Act in 2007 this was s frustrating factor which urged the communities to illegally re-take the Government reservation lands at Makeni, Bo and Kenema in addition to leased research lands at Pendembu and Kpuwabu.

j. Institutional Framework

i. Government Lead Programmes

Prominent among initiatives and programmes implement directly by Government of Sierra Leone through the ministries are:

- Bumbuna Hydro Electric Environmental and Social Management Project
- Gola Forest Programme
- World Bank Project on Protected Area covering Fouta Jallon Programme and Outamba Kilimi
- Sierra Leone Biodiversity Conservation Programme

ii. Policy and Legislative Framework, Capacity and Support

Policy & Law

There has been a tremendous improvement in policy and regulatory framework since the preparation of NBSAP in 2005. The Environmental Protection Act, 2008 is exhaustive in terms of coverage of the policy and legal issues previously negating biodiversity management. The proposed Forestry Act (revision of the 1988 Act) has addressed some of the gaps that allowed illegal logging and exportation of ill- gotten timber. In addition, the separate forestry and wildlife policies are comprehensive and thorough enough to improve biodiversity management if implemented. Even the Mines and Minerals Act of 2009 has adequate provisions for EIA process and the associated mitigating measures coupled with substantial fines in United States dollars. In all these situations law enforcement may be found wanting due to staffing situation and limited funding.

Capacity enforcement and logistical support

Staff capacity and institutional capability, and the financial and technical support for law enforcement, monitoring and evaluation are still lacking. Surveys and inventories required for the provision of necessary information and data for planning, are expensive and therefore grossly inadequate. Logistical support for staff movement and good road infrastructure to easily access biodiversity hot spots still remains a major constraint. Biodiversity value itself is undermined by distance and the lack of quality access roads leading to these resources. When majority of the communities residing within close proximity to these resources wallow in extreme poverty, they can '' appreciate'' even pittance for these resources as a survival strategy. For instance, the road leading to the OKNP from Makeni (about 250Km.) is a disincentive for tourism development, not to mention the ferry which is hardly functional during the rainy season. If returns to investment in tourism are substantial, benefits realized by communities could motivate them to support the development of park resources. Monitoring biodiversity loss could be difficult where access is restricted by bad road conditions. However, some schools of thought believe that bad road to major tourist attractions is a challenge for young tourists look forward to, especially considering the improved road network they are used to back home.

Law enforcement and litigation process

Cases involving biodiversity loss like poaching of elephants, chimpanzees, leopards etc. could be expensive to monitor and until the communities' mind-set is changed in favour of conservation it may be even difficult to apprehend offenders. Hence, there is the need to sensitize the local communities, the police and the judiciary in effecting expeditious trials and the handing down of commensurate punitive measures. In case of trans-boundary poaching activities, national neighboring governments should take a common decision in at least minimizing the spate of these illegal operations as it obtains between OKNP – Madina oula/Oure kasb axis and between the Gola National Park (Sierra Leone) and the Gola Forests (Liberia). Harmonization of legislations between the sister countries (cemetery pursued by the Mano River Union) could deprive the culprits of any safe haven. The cooperation and

support of the local community will be mostly in fleeced by the quantum of benefit they realize from conserving of these natural resources.

4. IMPLEMENTATION OF THE NATIONAL BIODIVERSITY STRATEGY AND ACTION PLAN

For an assessment of the degree of implementation of the 2003 NBSAP, experts and consultants were requested to evaluate implemented programs in line with the proposed strategies and action plans. Additional assessments were also done at the 2-day first National Workshop on Stock taking and Assessment held in August, 2013. The findings of both approach is tabulated below:

No.	Recommended strategy/action	Timeframe	Implementation category (NA, 0-5)	Comments on specific cases where applicable (location, dates, etc)
1.	Post-conflict reconstruction and management of protected areas in sierra Leone	2004-2014	1	funding and staffing limitations; Projects/programmes include conservation programs like Gola Forest Program, WAPF, Loma mountains, Outamba Kilimi National Park, Kangari Hills
2.	Medicinal plant conservation in Sierra Leone	2005-2007	**3**	**Some awareness raising; e.g., nutritional value of moringa,aloe vera, (small scale lemon grass use; efforts by grassroot people to return to gara dying and gardening;**
3.	Development and implementation of a biodiversity database system (Bioinformatics)	5 years	2	No centralized database as yet; individual (isolated) data management systems are in place; no gene bank
4.	Environmental education and awareness raising program	2004-2008	**3**	**Proliferation of local community radios at district level; EPASL nationwide campaigns; more involvement of CSO in environmental campaigns; there has been tremendous progress, university curriculum includes environmental science and management**
5.	Resuscitation of the National Herbarium of Sierra Leone	2004-2008	2	The National Herbarium at Njala has been rehabilitated; Fourah Bay College is now affialted with international specimen;
6.	Mapping and documentation of the flora and fauna of sacred groves	2005-2007	1	So far, mapping has covered few areas such as the Bumbuna watershed area in Northern Sierra Leone
7.	Inventorying the non-timber forest products (NTFPs of Sierra Leone)	2005-2009	1	Expensive and therefore slow; NTFP inventory is being done at the Gola Forest and Tiwai area (by Njala University);
8.	Post-conflict rapid biodiversity assessment of large mammals in Sierra Leone	2004-2005	**3**	**Ongoing and require additional funding; significant work done; chimpanzee assessment, WAPF, Gola mammals; BWMA, Tacugama Chimpanzees and other mammals**
9.	National reforestation and rehabilitation of degraded forest resources	2004-2008	2	Ongoing, but requires more funds, WAPFOR, limited efforts; not implemented
10.	Nationwide forest inventory to restore and redefine the forest estate after the civil conflict	2004-2005	1	Lack of funds
11.	Small holder domestication of *Thryonomys swinderianus* (Grass cutter) as a preferred bush meat species in Sierra Leone	2004-2008	1	Little efforts have been made; there is one private farm at Kenema i
12.	Co-management and rehabilitation of mangrove ecosystem in Southwestern Sierra Leone	2005-2009	2	some effort is in place by govt to protect and manage mangroves an
13.	Control of forest fires in the Northern Savannah region of Sierra Leone	2004-2005	2	No Forest/bush fire' is part fo OKNP, STEWARD transboundary projects and CARE programs
14.	Capacity building for biodiversity conservation in Sierra Leone	2004-2005	**3**	**Ongoing; the commissioning of short courses at the university; NGOs and the Department of Forestry are the main employers**
15.	National marine biodiversity and museum for Sierra Leone	2004-2008	**3**	**Marine specimens stored at the Institute of Marine Biology and Oceanography (IMBO); there is no national museum for marine life**
16.	Assessment of the marine finfish and shellfish stocks of the inshore coastal waters of the continental shelf of Sierra Leone	2004-2008	**3**	**Ongoing at IMBO**
17.	Studies on the biodiversity of major estuarine systems of Sierra Leone	2004-2008	**3**	**Ongoing; there is some reporting and documentation**
18.	Small ruminants restocking program	1 year	**3**	**Ruminants restocking project in Northern Sierra Leone supported by NaCSA**
19.	Gola conservation concession development project	2004-2006	**4**	**Declaration and protection of Gola national park**

Implementation categories are as follows: No implementation – 0; Poor – 1; Average - 2
Good – 3; Very good – 4; Excellent - 5

a. Status of Implementation of NBSAP

The NBSAP implementation schedule used a thematic sectoral action plan covering the following sub-components:

- Wildlife biodiversity
- Forest Biodiversity
- Policy legislative and Institutional Review
- Capacity building
- Identification and monitoring
- Sustainable use of biodiversity components
- Incentive measures
- Public education and Awareness-raising.

b. National self capacity assessment study

In 2006, a National Self-Assessment for Global Environmental Management in Sierra Leone was undertaken with the following objectives:

- To identify, review and update priority issues for capacity building for the themes of biodiversity, climate change and land degradation
- To identify constraints and capacity building activity needs
- To link country action to the broader framework of national environmental management etc.

The following priority issues were identified for the successful implementation of the CBD in particular:

- Inventory, database on ecosystems, species and habitats
- Expansion of protected areas
- Forest inventory and conservation
- Institutional and financial system for biodiversity conservation and environmental management
- Legislation for biodiversity conservation
- Environmental awareness and education on biodiversity.

Efforts at addressing the 6 issues indicated above will now be explained in the following lines:

Inventory and Database build-up:

There seems to be very little improvement for forest inventory in particular. There had been some wildlife surveys like the elephant survey in the OKNP and environs; also the following surveys were carried out in the Golas in 2008-mammals, reptiles, birds, butterflies, dragon flies and damsels. There are other species-specific surveys like the hippopotamus survey currently on-going.

Expansion of protected areas:

This issue is constrained by two factors namely, the huge areas of land lease payments to land-owning communities covering a period of 5 decades and the apparent demand for farmland close to trunk roads to facilitate the sale of farm products especially firewood. Population dynamics will eventually worsen the land hunger situation in the future.

Forest inventory and conservation:

The most recent full scale forest inventory was done in parts of the Gola forests in 1976 by White. However, pre-investment timber assessment for potential concessionaires in various forests had been carried out but not for resource management. Effective forest conservation had been carried out initially by the Gola Rain Forest Conservation concession project and now by the Gola National Park Management from 2006 to date. Other protected areas undergoing conservation include the OKNP, Loma Mountains, Kambui Hills albeit at varying scales.

Institutions involved:

Institutions involved in biodiversity management have serious staff strength and capacity problems, exhibiting an alarmingly high protected area: staff ratio. Unfortunately there is no specific financial system just for conservation and environmental management but for all other charges. This budget line ranges between1.5% to 3% of the total MAFFS budget which is largely inadequate for the growing conservation challenges of the sector.

Legislation for biodiversity conservation:

Policy and legislative framework for biodiversity conservation is by now nearly adequate especially considering the separate Forestry and Wildlife policies; the Forestry Act 2007, the Environmental Protection Act 2003 and the new mining Act 2009 which has provisions for EIA enforcement with the associated heavy USD fines (section 131 to 136).

Environmental awareness and education on Biodiversity:

Visibility of biodiversity conservation, though inadequate due to financial constraints, is now better than before the NBSAP formulation. The district radios have been supportive in this process although there is room for improvement and contact with people without access to radios.

c. Perspectives of Some Consultants

Perspective 1: Agricultural perspective

The overall level of implementation of NBSAP's objectives is fairly low. None of the NBSAP objectives recorded an achievement of over 50% of the desired indicators. Some 30% of the objectives achieved between 25% and 50% of the indicators; the remaining 70% of the objectives achieved less than 25 % of the indicators.

Factors that influence the results were lack of (1) coordination, (2) National direction, (3) holistic legislations and policies, and (4) funding. Improvement in these factors is crucial for progress towards achieving national objectives and contribution to global AICHI targets.

Perspective 2: Reptiles, Amphibians, Manatees etc

Since 2003, the NBSAP has had attention across the line ministries and environmental NGOs in the country. Wide ranges of projects have been undertaken in diverse areas of biodiversity conservation including habitats and species. For reptiles, the sea turtles have had much conservation attention and protection than all the other species. They have been assessed and campaigned for their protection by the Sea Turtle Conservation Program at RAP-SL in collaboration with the MFMR and MAFFS.

Though manatees, amphibians and the other reptile species have not been particularly accorded specific species protection status, but the protection of their habitats by MAFFS and MFMRS in collaboration with environmental NGOs in Sierra Leone, has benefited these species. The habitat protection activities included the creation of Marine Protected and Protected Areas. The recently established Gola National Park and the Yawri Bay MPA in addition to older Pas and national Park in Sierra Leone are steps in the right direction. The review of forestry, fisheries and wildlife laws and regulations of Sierra Leone are recommendations from the 2003 NBSAP. The review actually started in 2000 and has over the years had series of consideration by the MAFFS, Environmental NGOs including USAID PAGE, CSSL etc. etc. and law reform committees. It is presently ongoing under the leadership of MAFFS through the Biodiversity Project.

The NBSAP 2003, proposed a national survey of the country's biodiversity but this is yet to happen for other taxa including reptiles, amphibians, arthropods etc. reasons for not achieving this goal largely include the unavailability of funds and capacity.

Perspective 3: Avifauna

The implementation process of the 2003 NBSAP (GOSL, 2003) is difficult to assess because of the lack of information on progress that have been made since its inception. However, some progress has been made in a number of action plans that were specified in the document. One of the biggest achievements of the implementation of the strategy and action plan is in the area of education and awareness raising on the importance of biodiversity in general to human survival. Since 2003 a lot of radio programmes, newspaper articles, community meetings and workshops have been held by various stakeholders to promote wise use and management of biological resources and habitats. Also various biodiversity-related study programmes have been introduced in the universities and colleges to address the education and technical needs of natural biological resource management in the country.

Notwithstanding, biodiversity is still under serious threats and since NBSAP 2003, the threat levels and variety has increased dramatically, mainly due to increased mining activities, new bio-fuel related agricultural schemes and climate change. The trends in threat levels have not been equally matched by the pace of interventions, and so the pressure on biodiversity has continued to increase. However, there have been major strides in promoting both *in situ* and *ex situ* conservation, especially for areas that fall within the protected area system in the country. Conservation actions outside protected areas have either been *ad hoc* or virtually non-existent. No new areas in terrestrial ecosystems have been given any protected area status since 2003, nor has there been any improvement in the status of inland wetlands. Nevertheless, progress is being made in the process of designating marine protected areas for the four main estuarine systems in the country – Scarcies River Estuary, Sierra Leone River Estuary, Yawri Bay and Sherbro River Estuary. Below is a tabulated conservation achievements made since NBSAP 2003, which have had direct or indirect impact on bird conservation:

Activity	Year	Sites affected	Key Stakeholders
Gola Forest Conservation Concession Project	2003 - 2009	Gola Forest	Forestry Division (MAFFS), Conservation Society, RSPB, the local communities
Establishment of the National Commission on the Environment and Forestry (NaCEF) (now defunct)	2004		Forestry Division, Environment Division, GoSL.
Publication of the Important Bird Areas directory for Sierra Leone	2005	11 sites	Conservation Society and Forestry Division
Picathartes Conservation project	2006	WAPF	Conservation Society, the local communities
National survey of chimpanzee population	2007 – 2008	Nationwide	Tacugama Chimpanzee Rehabilitation Centre, Forestry Division and …..
Implementation of the Sierra Leone Biodiversity Conservation Project (SLBCP)	2009 – 2014	Loma Mountains, Kambui Hills and Mamunta-Mayosso	Forestry Division, Global Environmental Facility and World Bank
Western Area Peninsula Forest Reserve Project	2009 – 2013	WAPF	Welthungerhilfe (WHH), European Union, ENFORAC and Forestry Division.
Review of the Forestry of Wildlife Policies	2010		Forestry Division and PAGE
Establishment of the Gola Forest National Park	2010	Gola forest	Forestry Division, RSPB, European Union, the local communities
The implementation of the Wetlands Conservation Project	2012	Mamunta-Mayosso, Yawri Bay	Forestry Division, World Bank
Proposal for Loma Mountains to be upgraded to a national park	2012	Loma Mountains forest reserve	Forestry Division, SLBCP
Establishment of the WAPF National Park	2013	WAPF	Forestry Division, WHH

d. The status of vegetation restoration programmes in Sierra Leone

The drive to restore the forests in the country can be dated as far back as the colonial era when it became apparent that the country was losing its forests. Various reforestation and even afforestation programmes and strategies have tried some of which have been quite successful and their outcome are still evident today. However, some other efforts were futile because policies were out of phase with practice, especially in situations where local communities were involved. Most of the unsuccessful reforestation programmes had no management plans, the forestry officers did not involve the local communities on the management of the plots Thus there are many reforested plots wood lots around the country with virtually no management systems.

Reforestation programmes was in most cases carried out during the colonial era using *Gmelina arborea*, mainly as a way of addressing the fuel wood situation and forestalling the rapid deforestation using fast growing tree species. Later Acacia species, *A. mangium* and *A. auriculiformes* were used, which because of their aggressive growth and proliferation potentials have spread widely all over the country. The *Acacia spp*, among a few other species, are extensively used during national tree planting days on 5th June each year. Millions of seedlings have been produced and planted in various locations in the country, especially in the western area such reforestation activities are normally coordinated by the forestry division and supported by a number of environmental NGOs,

In the report on Assistance for forestry planned (Karim, 1993), 5, 910 ha of farmland were targeted for tree planting interventions over a period of five years methods to be used by then included woodlots establishment, intercropping with fruit trees, alley cropping and planted fallows. Various species were proposed for use, particularly *Acacia spp, Gmelina arborea* and *Terminali avorense*. Planted fallows as the report stated are not only beneficial for plant nutrient regeneration, but can economically and biological enrich degraded farm plots. Economically enriched, fallows increase the economic value of the fallows vegetation with trees values for their cash or subsistence values, whilst biologically enriched fallows vegetation with trees values for their cash or subsistence values whilst biologically enriched fallow is designed to enhance and accelerate the vegetative regeneration of soil fertility and control of weeds in short fallow periods.

Evidence of forest restoration activities using tree plantations are quite sparse in recent times although there are a number of good examples in various localities in the country most areas where such plots exist were planted over thirty years ago using species such as *Gmelina arborea, Tectona grandis, melia azaderact* and *Acoi bateri*. There are however good examples of fuel wood plantations or afforestation activities using more relatively recent introduced fast growing exotics species such as *Acacia mangium, Acacia auriculiformes, Acacia leptocoma* and *Eucalyptus sp.*

e. Forest vegetation restoration through fuel wood establishment

Fuel wood has been considered by many environmental actors and conservationist as one of the main cause of deforestation in Sierra Leone. Several efforts have been made to address the fuel wood situation in the country, particularly through the establishment of wood lots or plantations using fast-growing species mentioned earlier but these have generally been badly managed at the local level. The primary purpose of the establishments of wood lots was to reduce the dependence on the natural forest wood resources. Unfortunately, as a consequence of the lack of appropriate adaptive management approaches, no impact has been made in that direction and only a small proportion of fuel wood is extract from wood lots.

The following are description of species that have used locally as fuel wood.

<u>Preferred indigenous fuel wood species</u>

The use of local fuel wood species in the establishment of wood lot has been difficult because of lack of knowledge on their phenology and silviculture. The preferred fuel wood species include *Ochthocosmusafricana, Tetrapleuramacrophyllum, Harungamadgascariensis, Phyllanthusdiscoideus* and *pentadesmabutyracea*. According to Karim(1993 farmers have a fair knowledge of the growth potential of three locally common species that can used in home gardens and farmlands and as fuel wood. These are *Gmelinaarborea, Terminali ivorensis and Terminalia superb. G arborea* can grow either from seeds/wildings or cuttings while Terminalia spp germinate easily from seeds.

The Acacia species

As stated in previous section, *A Auriculiformes, A. Mangium* and *Acacia leptocomat* were introduced in the 1970s to accelerate the restoration process. They are ecologically well adapted, generally outcompete local flora. And have popular throughout the country in their use for wood lot establishments and even in home and office gardens. *A. auriculiformes* is said to be more tolerant to degraded and difficult terrains than its counterpart.

The Neem tree (*Azadiracter indica)*

As part of the package of the Ecological promotion project by SLADEA, the GTZ proposed the introduction of *Azadiracter indica* (Neem tree) as a multipurpose tree, The purpose was to popularize the planting of neem trees not only as a fuel wood species, but as multipurpose tree that can be used for ecological restoration and medicinal purposed. Trials and experimental plots and ad hoc plantation of the species were carried out in various areas in Sierra Leone, but this was not promoted beyond its experimental stage. However, the tree is now well known among traditional healers as having vast medicinal properties that can cure many ailments and diseases.

Gliricidia sepium

Gliricidia sepium has been introduced for a very time, probably in the earlier 1950s.It was used mainly as hedge and boundary demarcation to been purposes. The species is widely observed in various locations particularly in waterloo and Njala. It is also one of the most important multipurpose tree species in the country, particularly for alley cropping/ farming.

Cassia siamea

This species is indigenous and is widely known for its medicinal value and is also being used for various agroforestry interventions. However, its trial in plantations for fuel wood purposes has not been popularized.

f. Mangrove forest restoration

A number of trials for mangrove vegetation have been done in different localities along the coastal regions but the success rate has been minimal. These trials were done by the forestry Division in the early to mid- 1990. One successful mangrove planting was carried out along the Jui Creek, in east Freetown, where the mangrove vegetation is now reaching over five meters in height and dbh is 10 cm in most stands The planting that was done in the northern part of the Yawri bay (Tissaa area) was unsuccessful, so were many other mangrove planting trials many other locations. There was a recent mangrove restoration activity carried out at the Aberdeen creek by the conservation society of Sierra Leone, but assessment of success would depend upon the result of a monitoring process over course of time

In general, the success of mangrove planting is dependent on the species used and the salinity range of the location where it is planted. There is need to understand the species – salinity relationship in mangrove vegetation planting to assess the level of success in such restoration programmes. However, mangrove vegetation restoration could best achieved by natural regeneration process, which unfortunately is disrupted by the persistent cutting and poor management activities.

g. Restoration of land degraded by mining

Forest and land degradation by mining has been one of the most destructive activities in the environment. Huge areas of land are being deforested and degraded in various parts of the country,

resulting from various mining operations. In mokanji and Rutile, huge areas of land and vegetation are degraded through bauxite and rutile mining, respectively whilst in Ferrengbaia and Lunsar, similarly destruction are happening as a consequence of iron ore mining. Despite the huge damage to land and vegetation, very little restoration activities are going on However, good examples of restoration using *Acacia spp* and *Gmelina arborea* are evident in Mokanji and other areas around the country. An experimental vegetation restoration programme was undertaken in Rutile funded by Darwin Initiative and implanted by centre for Ecology and Hydrology (CEH) in collaboration with fourah Bay College (FBC) and Njala University: The experiment showed positive results of the potential for the restoration of rutile mine tailings through the use of compost manure. *Gmelina arborea* was the most adapted species in terms of growth among the five tree species that were used. The significance of the growth of the hereby layer is the potential that it has to enhanced nutrient build up in the soil that can be for the cultivation of annuals/biannual crops like groundnut, pepper, garden eggs and tomato.

h. **Exotic/ Introduced species**

A good number of plant species now growing in the country were introduced long ago, some as early as the 15th century. Most of the forest plantations along road sides and in various communities were established using exotic species, example, *Gmelina arborea*, have now been indigenized. The new entrants include Acacia *auriculi formis* and *Acacia mangium* which are fast growing leguminous species which are now widely used in reforestation and rehabilitation programmes. Other fast growing leguminous trees are *leucaena species*, *Gliricidia sepium* and some *Albizia species*. These were introduced several decades ago and like the *Acacias* they are now found nearly everywhere in the country. Non leguminous species include various species of Eucalyptus, *melia azederach* and *Azederacter indica* (Neem tree) and more recently *moringa oleifea* is being popularized. Very little or no effort has made to encourage natural regeneration of indigenous species let alone encourage their use in plantation of reforestation and rehabilitation programmes.

Part III:

Progress towards the 2020 Aichi Biodiversity Targets and contributions to the relevant 2015 Targets of the Millennium Development Goals

5. PROGRESS MADE BY SIERRA LEONE TOWARDS THE IMPLEMENTATION OF THE STRATEGIC PLAN FOR BIODIVERSITY 2011-2020 AND ITS AICHI BIODIVERSITY TARGETS

a. Input from Stakeholders at the Workshop

Technically, the Aichi targets have not been adopted by Sierra Leone at this stage, as the NBSAP is currently being revised to incorporate these targets. Nonetheless, an evaluation of the biodiversity-related projects have been done as part of the NBSAP revision process both by the plenary at the first National Workshop, on Stock taking and assessment, and by consultants hired to prepare reports for the workshop. The plenary was asked to break up into groups, numbering up to 7, and assess biodiversity projects with targets identical to the Aichi targets based on the success of their implementation. The outcome of the evaluation is displayed in the table below:

No.	Recommended strategy/action	Implementation category (NA, 0-5)	Comments on specific cases where applicable (location, dates, etc)
1.	**Target 1:** people are aware of the values of biodiversity and the steps they can take to conserve and use it sustainably.	2	awareness raising by conservation societies, Ministry of Fisheries and Marine Resources, Ministry of Agriculture, Forestry and Food Security and NGOs
2.	**Target 2:** biodiversity values have been integrated into national and local development and poverty reduction strategies and planning processes and are being incorporated into national accounting, as appropriate, and reporting systems	**3**	**Launching of Poverty Reduction Strategy Program (PRSP) 1; declaration of protected areas (Pas), marine protected areas (MPAs) and co-management in fishing communities**
3.	**Target 3:** incentives, including subsidies, harmful to biodiversity are eliminated, phased out or reformed in order to minimize or avoid negative impacts, and positive incentives for the conservation and sustainable use of biodiversity are developed and applied, consistent and in harmony with the Convention and other relevant international obligations, taking into account national socio economic conditions	1	incentives are adopted in the Western Area Protected Forest Reserve (WAPFOR)
4.	**Target 4:** Governments, business and stakeholders at all levels have taken steps to achieve or have implemented plans for sustainable production and consumption and have kept the impacts of use of natural resources well within safe ecological limits	2	Law reviews; formulation of by-laws for management at community levels
5.	**Target 5:** the rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced.	2	Gola Forest Conservation Project; passing of legislations and regulations; however, much of the country's farmland are given out for plantation establishment;
6.	**Target 6:** all fish and invertebrate stocks and aquatic plants are managed and harvested sustainably, legally and applying ecosystem based approaches, so that overfishing is avoided, recovery plans and measures are in place for all depleted species, fisheries have no significant adverse impacts on threatened species and vulnerable ecosystems and the impacts of fisheries on stocks, species and	**3**	**There is legislation in place, and vessels for monitoring the sea**
7.	**Target 7:** areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity	2	Minimal work is being done in conservation, EIAs are enforced by the EPASL to safeguard environment;
8.	**Target 8:** pollution, including from excess nutrients, has been brought to levels that are not detrimental to ecosystem function and biodiversity	2	EIA enforcement; monitoring by EPASL; legislation in place
9.	**Target 9:** invasive alien species and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment.	1	Some education and sensitization has been done,
10.	**Target 10:** the multiple anthropogenic pressures on coral reefs, and other vulnerable ecosystems impacted by climate change or ocean acidification are minimized, so as to maintain their integrity and functioning.	1	Some scientific study and reporting on the impact of climate change is done; a climate change secretariat established;
11.	**Target 11:** at least 17 per cent of terrestrial and inland water, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes	1	There are declared MPAs and PAs;
12.	**Target 12:** the extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained.	2	There are efforts to protect sea turtles, manatees and some endangered species, but these are few and far between ; protection of sea turtles and manatees
13.	**Target 13:** the genetic diversity of cultivated plants and farmed and domesticated animals and of wild relatives, including other socio-economically as well as culturally valuable species, is maintained, and strategies have been developed and implemented for minimizing genetic erosion and safeguarding their genetic	2	Little work has been done in this area
14.	**Target 14:** ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and well-being, are restored and safeguarded, taking into account the needs of women, indigenous and local communities, and the poor and vulnerable.	**3**	**Creation of national parks, protected areas and education and sensitization; Bumbuna Watershed Management Authority, WAPFOR; NGOs and govt are providing loan to community women in form of microcredits**
15.	**Target 15:** ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification.	2	There is some effort in conservation by MAFFS, MFMR, EPASL
16.	Target 16: the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization is in force and operational, consistent with national legislation.	1	No noticeable implementation to date
17.	**Target 17:** each Party has developed, adopted as a policy instrument, and has commenced implementing an effective, participatory and updated national biodiversity strategy and action plan.	**3**	**Development of an action plan (NBSAP) is on course**
18.	**Target 18:** the traditional knowledge, innovations and practices of indigenous and local communities relevant for the conservation and sustainable use of biodiversity, and their customary use of biological resources, are respected, subject to national legislation and relevant international obligations, and fully integrated and reflected in the implementation of the Convention with the full and effective participation of indigenous and local communities, at all relevant levels.	**3**	**Formation of task forces, CMA's protected areas, full MFMR, universities, EPA and NGOs; several people opposed to traditional beliefs; formulation of Community Management Association**
19.	**Target 19:** knowledge, the science base and technologies relating to biodiversity, its values, functioning, status and trends, and the consequences of its loss, are improved, widely shared and transferred, and applied.	**3**	**ongoing studies; EPASL taking the lead in mapping out Sierra Leone's environment and establishing GIS database; There is input from other institutions and collaborating partners**
20.	**Target 20:** at the latest, the mobilization of financial resources for effectively implementing the Strategic Plan for Biodiversity 2011-2020 from all sources, and in accordance with the consolidated and agreed process in the Strategy for Resource Mobilization, should increase substantially from the current levels. This target will be subject to changes contingent to resource needs assessments to be developed and	2	Review of the NBSAP ongoing

Implementation categories are as follows: No implementation – 0; Poor – 1; Average - 2
Good – 3; Very good – 4; Excellent - 5

b. Perspectives of Consultants

Perspective 1: Reptiles, Amphibians, Manatees

Since the preparation of the NBSAP document, Sierra Leone has made progress in its implementation. Progress includes the implementation of activities related to those under the Aichi Biodiversity Targets (ABT), starting from Strategic Goal A to E. Environmental organizations including the Conservation Society of Sierra Leone (CSSL), Environmental Foundation for Africa (EFA), Green Scenery (GS), Reptile and Amphibian Program – SL (RAP-SL) to name but a few and government ministries including MAFFS, MFMR, MELCP EPA-SL and other collaboration institutions have in diverse ways undertaken education and sensitization, researches, surveys, campaigns and other programs necessary in the implementation of ABT in Sierra Leone. A breakdown of the consultant's personal assessment in shown in the table below (% refers to % implementation):

Strategic Goal A: Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society		
Target 1 By 2020, at the latest, people are aware of the values of biodiversity and the steps they can take to conserve and use it sustainably.	40%	Some considerable work has been done in this direction at various levels. There is hope that a considerable proportion will be achieved by 2020.
Target 2 By 2020, at the latest, biodiversity values have been integrated into national and local development and poverty reduction strategies and planning processes and are being incorporated into national accounting, as appropriate, and reporting systems.	50%	Sierra Leone has developed a number of development strategies and almost all of them, biodiversity conservation had formed a significant component of poverty reduction strategies at a national scale
Target 3 By 2020, at the latest, incentives, including subsidies, harmful to biodiversity are eliminated, phased out or reformed in order to minimize or avoid negative impacts, and positive incentives for the conservation and sustainable use of biodiversity are developed and applied, consistent and in harmony with the Convention and other relevant international obligations, taking into account national socio economic conditions.	30%	It is difficult to assess the steps that have been taken to incorporate incentives to reduce harmful practice and encourage beneficial ones. However, there are steps being taken at Gola, WAPF and Loma forest reserves to develop carbon trading potentials into biodiversity conservation that will benefit local communities.
Target 4 By 2020, at the latest, Governments, business and stakeholders at all levels have taken steps to achieve or have implemented plans for sustainable production and consumption and have kept the impacts of use of natural resources well within safe ecological limits.	30%	With the exception of Gola forest, no other conservation area has a functional ecotourism programme in the country. However, actions are being taken in several conservation areas to develop ecotourism programmes that could attract investors, including Loma mountains, WAPF, Outamba-Kilimi National Park and Mamunta-Mayosso Wildlife Sanctuary.

Strategic Goal B: Reduce the direct pressures on biodiversity and promote sustainable use		
Target 5	10	This target is ranked low because there is

By 2020, the rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced.		currently no prospect that rate of natural habitat loss will be reduced. The increase population coupled with current development in agricultural sector are the main threat to achieving this target by 2020.
Target 6 By 2020 all fish and invertebrate stocks and aquatic plants are managed and harvested sustainably, legally and applying ecosystem based approaches, so that overfishing is avoided, recovery plans and measures are in place for all depleted species, fisheries have no significant adverse impacts on threatened species and vulnerable ecosystems and the impacts of fisheries on stocks, species and ecosystems are within safe ecological limits	30%	The foraging and breeding activities of some migratory birds depend on the fish and invertebrate stock, and aquatic plants. Thus, conserving these aquatic resources contributes to conserving migratory birds. The move towards establishment of marine protected areas including their huge mangrove resources is a vital step towards achieving this target.
Target 7 By 2020 areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity.	30%	There are good indicators and prospects that areas under forestry will be well managed by 2020. However, there is no indication yet that other areas, particularly those under agriculture will be under sustainable management.
Target 8 By 2020, pollution, including from excess nutrients, has been brought to levels that are not detrimental to ecosystem function and biodiversity.	10%	Although the issue of industrial pollution is not widespread, there are serious concerns over recent happenings in Pujehun district, where river pollution from industrial agriculture resulted in the death of fish along the river. Such pollution events could enter into the food chain and serious deplete bird diversity. There is yet no concrete plan on how such issues could be addressed in the long-term .
Target 9 By 2020, invasive alien species and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment.	25%	Alien plant species use in reforestation programmes in Sierra Leone is rampant, especially using *Acacia* spp. The invasiveness of these species are yet to be determined, but *adhoc* research indicate that they possess some allopathic and competitive exclusion tendencies for other plant species. With respect to animal invasive, not much is known about their injuriousness to local biodiversity. However some concerned ecologists have highlighted the possible dangers from alien invasive species on local indigenous flora and fauna.
Target 10 By 2015, the multiple anthropogenic pressures on coral reefs, and other vulnerable ecosystems impacted by climate change or ocean acidification are minimized, so as to maintain their integrity and functioning.	10%	Currently, there is no information on the location, extent and status of the coral reefs in Sierra Leone continental shelves. There is however, a potential for these areas to be identified and relevant policy developed for their conservation.
Strategic Goal C: To improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity.		

Target 11 By 2020, at least 17 per cent of terrestrial and inland water, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well-connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes.	50%	With the current progress made on the NBSAP, and the progress on conservation projects in Gola, Loma, WAPF and OKNP, there is hope that a significant proportion of this target will be delivered by 2020. Gola forest is now a national park, Loma mountain forest is proposed for national park status, whilst the four estuarine systems of the Scarcies River, the Sierra Leone River, the Yawri Bay and the Sherbro River have been proposed for marine protected area status. The interest of birds and habitat conservation is well addressed within these frameworks
Target 12 By 2020 the extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained.	70%	Considerable efforts have been made in this direction and Sierra Leone as a country has contributed immensely to preventing the extinction to threatened species in the West African sub-region. Work on threatened species are going on at Gola, WAPF, Loma and OKNP
Target 13 By 2020, the genetic diversity of cultivated plants and farmed and domesticated animals and of wild relatives, including other socio-economically as well as culturally valuable species, is maintained, and strategies have been developed and implemented for minimizing genetic erosion and safeguarding their genetic diversity.	60%	As far as bird species are concerned the various conservation efforts made so far, as well as the strategies and actions planned for the next decade, will certainly ensure that all forms of avian genetic diversity is maintained and any potential erosion prevented.
Strategic Goal E: Enhance implementation through participatory planning, knowledge management and capacity building.		

Strategic Goal D: Enhance the benefits to all from biodiversity and ecosystem services.		
Target 14 By 2020, ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and well-being, are restored and safeguarded, taking into account the needs of women, indigenous and local communities, and the poor and vulnerable.	60%	The progress on water and water resources conservation, especially in catchment areas that lie with forest reserves and other conservation areas is significant in Gola, WAPF and Kambui Hills.
Target 15 By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification.	30%	There is a number of background work on the potential contribution of biodiversity to carbon stock and the potential to attract trade in carbon credits. Initial assessments are ongoing out at Gola, WAPF and Loma mountains forest reserves. More work is needed to enhance these potentials.
Target 16 By 2015, the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization is in force and operational, consistent with national legislation.	40%	Although no concrete action has been initiated, there is a good chance that this target will be partly met by 2020, based on current reviews of policies that point in that direction.

Target 17 By 2015 each Party has developed, adopted as a policy instrument, and has commenced implementing an effective, participatory and updated national biodiversity strategy and action plan.	60%	It is now certain that the NBSAP review process will be completed in a participatory way. However, there is a bit of doubt how far the implementation of the plan will go
Target 18 By 2020, the traditional knowledge, innovations and practices of indigenous and local communities relevant for the conservation and sustainable use of biodiversity, and their customary use of biological resources, are respected, subject to national legislation and relevant international obligations, and fully integrated and reflected in the implementation of the Convention with the full and effective participation of indigenous and local communities, at all relevant levels.	50%	A lot of effort is ongoing in this direction. Traditional conservation efforts have been proposed for incorporation into national legislations
Target 19. By 2020, knowledge, the science base and technologies relating to biodiversity, its values, functioning, status and trends, and the consequences of its loss, are improved, widely shared and transferred, and applied	20%	Only some aspects of this target is being achieved, but progress is slow and not much will be expected by 2020. Some science is being generated for Gola, Loma and WAPF
Target 20 By 2020, at the latest, the mobilization of financial resources for effectively implementing the Strategic Plan for Biodiversity 2011-2020 from all sources, and in accordance with the consolidated and agreed process in the Strategy for Resource Mobilization, should increase substantially from the current levels. This target will be subject to changes contingent to resource needs assessments to be developed and reported by Parties.	30%	There is some hope of obtaining donor funding, the likelihood for national budget to be increased substantially to cater for the required financial resources is limited.

Perspective 2: Avifauna

The assessment of Aichi Targets as outlined below has been based on a percentage assessment of the progress that has been made on the target activities. The assessment has been done with the focus on the conservation birds and their habitats, which has been based on some key considerations as follows:

- The achievements made since 2011, which is the time when the review process of the NBSAP was effective. This also takes into cognisance progress made, the experiences and lessons learnt on the implementation of the NBSAP 2003.

- Assessment of the potential for the implementation of the NBSAP 2013 with focus on the achievement of the Aichi Targets 2011 – 2013, which will be based on the prospects and readiness of the stakeholdersfor the implementation of these plans and targets.

- Some of the targets may not necessarily apply directly to birds, but have been assessed because they indirectly impact bird activities and the conservation of bird habitats. For instance the management of fish and invertebrate diversity is directly or indirectly related to habitat functionality for birds.

The table presented below is interpreted as follows: for each strategic goal, the targets as stated in the Aichi Targets 2011 – 2020, are given on the left column; the perceived proportion of the target to be achieved over the period 2011 – 2020 is given as a percentage in the middle column; and the comments given on the right column justifies the assessment based on real evidence and the prospects of achieving the target.

Perspective 3: Aquatic and Marine Consultant

Strategic Goal A: Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society

Aichi Target	Percentage	Comments
Target 1: By 2020, people would aware of the values of biodiversity and steps they can take to conserve and use it sustainably.	60%	If there is proper education and sensitization about biodiversity put in place. At least some work has been done towards this direction.
Target 2: By 2020, at the latest, biodiversity values have been integrated into national and local development and poverty reduction strategies and planning processes and are being incorporated into national accounting, as appropriate, and reporting system.	30%	Biodiversity is contributing little to national accounting but some companies like ADDAX and West Africa agriculture are helping in the biodiversity restoration.
Target 3: By 2020, at the latest, incentives, including subsidies, harmful to biodiversity are eliminated, phased out or reformed in order to minimize or avoid negative impacts, and positive incentives for the conservation and sustainable use of biodiversity are developed and applied, consistent and in harmony with the convention and other relevant international obligations taking into account national socio-economic conditions.	40%	Although little incentives are provided for biodiversity, there are however measures put in place for carbon stocking. That is reservation of the Gola forest, the Freetown Peninsula Forest and the Sugar Loaf mountain.
Target 4: By 2020, at the latest, Governments, business and stakeholders at all levels have taken steps to achieve or have implemented plans for sustainable production and consumption and have kept the impacts of use of natural resources well within safe ecological limits.	30%	Few steps are been taking towards that direction. e.g., The establishment of the MPA's, the Gola Forest reserves, EIA's before mining.

Strategic Goal B: Reduce the direct pressure on Biodiversity and promote sustainable use

Aichi Target	Percentage	Comments
Target 5: By 2020, the rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly	30%	Almost all the mining companies are removing mass area of forest reserved for mining activities.
Target 6: By 2020, all fish and invertebrate stocks and aquatic plants are managed and harvested sustainably, legally and applying ecosystem based approaches, so that overfishing is avoided, recovery plans and measures are in place for all depleted species, fisheries have no significant adverse impacts on threatened species and vulnerable ecosystems and the impacts of fisheries on stocks, species and ecosystems are within safe ecological limits.	55%	This is done through the establishment of the Marine Protected Areas in Four major Estuaries. The banded on illegal nets for fishing activities by MFMR.
Target 7: By 2020 areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity.	30%	Some work has been done by EPA-SL for the creation of buffer zone for large scale agricultural farms, the Gola forest reserved, and West Area Forest.
Target 8: By 2020, pollution, including from excess nutrients, has been brought to levels that are not detrimental to ecosystem function and biodiversity.	10%	Little effort has been done by EPA-SL and related organizations towards pollution rate, e.g., closing done of the agricultural company (SUCPHIN) in Pujehun District
Target 9: By 2020, invasive alien species and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment.	15%	Some work has been put in place by the Sierra Leone Maritime Administration for the management of Ballast water which brought in invasive Alien Species when the waters are discharged in our territorial water.
Target 10: By 2015, the multiple anthropogenic pressures on coral reefs, and other vulnerable ecosystems impacted by climate change or ocean acidification are minimized, so as to maintain their integrity and functioning	12%	Although the MFMR is working to towards that, e.g., the banding of twin fishing which destroy the bottom sediment, completely.

Strategic Goal C: To improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity

Aichi Target	Percentage	Comments
Target 11: By 2020, at latest 17% of terrestrial and inland water, and 10% of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation	75%	Through the esblishment of the Marine Protected Areas (MPA) in the various Estuaries along the coast of Sierra Leone. This would be effective if there are laws in place passed through parliament. Also mining companies to stop discharging their waste water into various rivers. They need to be dimacated by bouy.

measures, intergrated into the wider landscapes and seascapes.		
Target 12: By 2020 the extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained.	35%	At the moment, there is no record of extinction of known threatened species. But some species population are threaten
Target 13: By 2020, the genetic diversity of cultivated plants and farmed and domesticated animals and wild relatives, including other socio-economically as well as culturally valuable species, is maintained, and strategies have been developed and implemented for minimizing genetic erosion and safeguarding their genetic diversity.	35%	At least some work is been done the EPA-SL by launching of the West African Coastal Observation Mission project

Strategic Goal D: Enhance the benefits to all from biodiversity and ecosystem services

Aichi Target	Percentage	Comments
Target 14 By 2020, ecosystems that provide essential services, including services related to water and contribute to health, livelihood and well-being, are restored and safeguarded, taking into account the need of women, indigenous and local communities, and the poor and vulnerable	70%	Environment Protection Agency-Sierra Leone and other Environmental Institutions are working hard to put this in place. The establishment of the Environmental courses at Njala, FBC, Ministry Health etc.
Target 15: By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15% of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification	20%	Little are done by EPA-SL and other NGO's for carbon stocking. Like WAPFR, the Gola Forest Reserved etc.
Target 16: By 2020, the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable sharing of Benefits Arising from their Utilization is in force and operational consistent with national legislation	20%	This is little work done towards that direction.

Strategic Goal E. Enhance implementation through participatory planning, knowledge management and capacity building

Aichi Target	Percentage	Comments
Target 17: By 2020 each party has developed, adopted as a policy instrument, and has commenced implementing an effective, participatory and updated national biodiversity strategy and action plan	50%	Legislation in place
Target 18: By 2020, the traditional knowledge, innovations and practices of indigenous and local communities relevant for the conservation and sustainable use of biodiversity, and their customary use of	40%	At least some work has been done towards that direction that is the establishment of the MPA's. This would be achieved through proper education of the communities.

biological resources, are respected, subject to national legislation and relevant international obligations, and fully integrated and reflected in the implementation of the Convention with the full and effective participation of indigenous and local communities, at all relevant levels.		
Target 19: By 2020, knowledge, the science base and technologies relating to biodiversity, its values, functioning status and trends, and the consequences of its loss, are improved, widely shared and transferred, and applied	10%	There is no data-based for biodiversity except the NBSAP which is in progressed
Target 20: By 2020, at the latest, the mobilization of financial resources for effectively implementing the Strategic Plan for Biodiversity 2011 – 2020 from all sources, and in accordance with the consolidation and agreed process in the Strategy for Resource Mobilization, should increase substantially from the current levels. This target will be subject to changes contingent to resource needs assessments to be developed and reported by Parties	60%	At least, there is financial resources for the implementation of the NBSAP

Perspective 4: Restoration Ecology

Strategic Goal B: Reduce the direct pressure on biodiversity and promote sustainable use

Target 1 By 2020, at the latest, people are aware of the values of biodiversity and the steps they can take to conserve and use it sustainable	40%	Awareness programs are ongoing and will achieve significant proportion by 2020
Target 2 By 2020, at the latest, biodiversity values have been integrated into national and local development and poverty reduction strategies and planning processes and are being incorporated into national accounting, as appropriate, and reporting systems	30%	Poverty reduction strategy paper (now called agenda for prosperit) is an important component of vegetation restoration because it affect agricultural activities and livelihoods. There is much room for improvement
Target 3 By 2020, at the latest, incentives, including subsidies, harmful to biodiversity are eliminated, phased out or reformed in order to minimize or avoid negative impacts, and positive incentives for the conservation and sustainable use of biodiversity are developed and applied, consistent and in harmony with the convention and other relevant international obligations, taking into account national socio economic conditions.	20%	Reduce harmful practice should include limiting the use of invasive species in restoration programs and being careful about the use of alien species in biological control programs. The use of indigenous species should be encouraged in such programs, e.g. the use of fruit trees and plantations in reforestation.
Targets 5 By 2020, the rate of loss of all natural habitats, including forests, is at least halved and where	10%	This target is very important and crucial for Sierra Leone. Very little has been done in this direction especially in

feasible brought close to zero and degradation and fragmentation is significantly reduced.		the restoration of land degraded by agriculture and mining.
Target 6 By 2020, all fish and invertebrate stocks and aquatic plants are manage and harvested sustainable, legally and applying ecosystem based approaches, so that overfishing is avoiding, recovery plans and measures are in place for all depleted species, fisheries have no significant adverse impacts on threatened species and vulnerable ecosystems and the impacts of fisheries on stock, species and ecosystems are within safe ecological limits	15%	The conservation of mangroves and restoration of degraded mangroves is vital in contributing to achieving this target.
Target 7 By 2020, areas under agriculture, aquaculture and forestry are managed sustainable ensuring conservation of biodiversity.	20%	Restoration of degraded areas contiguous with these ecologies is vital in their sustainable management. This includes controlling the use of invasive species.
Target 9 By 2020, invasive alien species and pathways are identified and priotized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment.	25%	The use of alien plant species especially Acacia species ecological reforestration programs in Sierra Leone is rampant. It is believe that these species have some allopathic properties that exclude indigenous in local plant communities where they occur. There is also serious concern over the spread of *Chromolaena odorata* in agro-ecosystem in the country. Much research and trials are needed to ascertain the invasiveness of these species in order to draw up strategies for their control and/ or eradication.
Target 10 By 2015, the multiple anthropogenic pressures on coral reefs, and other vulnerable ecosystems impacted by climate change or ocean acidification are minimized, so as to maintain their integrity and functioning.	0	This is very difficult to assess because there is little or no data on the current status of coral reefs in our continental shelf.

Strategic Goal C: To improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity

Target 11 By 2020, at least 17 percent of terrestrial and inland water, and 10 percent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitable managed, ecologically representative and well-connected system of protected areas and other effective area-based conservation measures, and integrated into the wider landscape and seascapes.	40%	The restoration of degraded areas contiguous with these ecological systems is very important for their conservation. This should include the establishment and management of buffer zones around reserve areas.

Target 12 By 2020, the extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained.	70%	There is no known species extinction from Sierra Leone based on current scientific knowledge. However it is possible that local abundance of some may have declined, particularly in some ecology such as coastal savanna.

Strategic Goal D: Enhance the benefits to all from biodiversity and ecosystem services

Target 14 By 2020, ecosystem that provide essential services, including services related to water, and contribute to health, livelihoods and well-being, are restored and safeguarding, taking nto account the needs of women, indigenous and local communities, and poor and vulnerable.	50%	Vegetation restoration, especially reforestation programs are vital to the enhancement of ecological services to local communities and the country as a whole.
Target 15 By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhance, through conservation and restoration, including restoration of at least 15 percent of degraded ecosystems, thereby contributing to climate change mitigation and adaption and to combating desertification.	30%	Baseline carbon stock assessment are being carried out at Gola, WAPE and Loma mountains forest reserves. Further potential for carbon sequestration could be realized from reforestation programs. There is need to collaborate with the REED initiative implementation by the Forestry Division
Target 16 By 2015, the Nagoya Protocol on Access to Genetic Resources and their Fair and Equitable sharing of benefits arising from their utilization is in force and operational, constituent with national legislation.	50%	There is need to get more information on this protocol. However, at present legislation on the benefits sharing on genetic resources is being incorporated into national legislation.

Strategic Goal E: Enhance implementation through participatory planning, knowledge management and capacity building

Target 17 By 2015 each party has developed, adopted as a policy instrument, and has commenced implementing an effective, participatory and updated national biodiversity strategy and action plan.	60%	The NBSAP review is part of this process.
Target 18 By 2020, the traditional knowledge, innovations and practices of indigenous and local communities relevant for the conservation and sustainable use of biodiversity and their customary use of biological resources, are respected subject to national legislation and relevant international obligations, and fully integrated and reflected in the implementation of the convention with	50%	There is need to incorporated traditional conservation into restoration programs. For examples using alley cropping and planted fallows in traditional fallow agriculture.

the full and effective participation of indigenous and local communities, at all relevant levels.		
Target 19 By 2020, knowledge, the science base and technologies relating to biodiversity, its values, function, status and trends, and the consequences of its loss, are improved, widely share and transferred, and applied	20%	This study of and application of the result of trial for reforestation programs using indigenous tree species is relevant to achieving this target. The rutile experimental restoration experiences need to be applied and shared**.**
Target 20 By 2020, at the latest, the mobilization of financial resources for effectively implementing the strategic plan for Biodiversity 2011-1020 from all sources, and in accordance with the consolidated and agreed process in the strategy for resources Mobilization, should increase substantially from the current levels. This target will be subject to changes contingent to resource needs assessment to be developed and reported by parties.	30%	The REED scheme is a potential for funding as far as ecological restoration of degraded forests is concerned.

c. Projects from Ministry of Agriculture, Forestry and Food security (MAFFS) assessed in line with the Strategic Plan for Biodiversity (2011-2020)

Below are projects executed by the MAFFS along with partners and funding organizations that could be identical to certain aspects of the Aichi strategic plan for biodiversity 2011-2020:

No.	Aichi	Specific projects (Title of project, implementing MDA and partner, contact details)	Project Implementation Period
1.	**Target 1:** By 2020, people are aware of the values of biodiversity and the steps they can take to conserve and use it sustainably.	Sierra Leone Biodiversity Conservation Project (SLBCP) Sierra Leone Wetlands Conservation Project (SLWCP) REDD+ and Capacity Building Project in Sierra Leone	21/4/2010-1/12/2014 1/6/2011-19/3/2015 20/3/2012-19/32016
2.	**Target 2:** By 2020, biodiversity values have been integrated into national and local development and poverty reduction strategies and planning processes and are being incorporated into national accounting, as appropriate, and reporting systems	Approval of the National Protected Area Authority (NPAA) and Conservation Trust Fund (CTF) Act 2012. Establishment of the Authority is in Progress. The NPAA and CTF Act 2012 make provision for the establishment of the NPAA and CTF to promote biodiversity conservation, wildlife management, research, provide the sale of ecosystems services in the protected areas and provide for other related matters; Other projects include SLBCP; SLWCP (above)	
3.	**Target 5:** By 2020, the rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced.	The establishment of the NPAA and CTF will boost the creation of a network of protected areas and solicit interventions in the Protected areas that need urgent attention	
4.	**Target 7:** By 2020, areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity	Integrating adaptation to climate change into agricultural production and food security: *Component 1:* sustainable development of inland valley swamps for rice and other food crop production; *Outcome 1.1:* participatory mapping and monitoring of vulnerability to climate change; *Outcome 1.2:* climate-resilient rice production systems; *Outcome 1.3:* training of local rice producers on best adaptation practices; *Component 2:* Integrated water and natural resource management for adaptation; *Outcome 2.1:* Ecosystem-based adaptation in the wetlands; *Outcome 2.2:* Irrigation efficiency and drainage systems	1/10/2012-30/6/2014

No.	Aichi	Specific projects (Title of project, implementing MDA and partner, contact details)	Project Implementation Period
5.	**Target 11:** By 2020, at least 17 per cent of terrestrial and inland water, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes.	See target 5.	
6.	**Target 12:** By 2020, the extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained.	SLBCP and SLWCP; Some threatened species have been considered but scope will be extended when funds are available	
7.	**Target 14:** By 2020, ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and well-being, are restored and safeguarded, taking into account the needs of women, indigenous and local communities, and the poor and vulnerable.	SLBCP, SLWCP Development of community action plans for the prioritized conservation sites	
8.	**Target 15:** By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification.	Gola Rainforest National Park REDD+ Project	
9.	**Target 17:** By 2015, each Party has developed, adopted as a policy instrument, and has commenced implementing an effective, participatory and updated national biodiversity strategy and action plan.	Review of the Forestry and Wildlife Acts and Regulations to incorporate emerging issues. Also, the inclusion of by-laws on biodiversity conservation into the district council by-laws	
10.	**Target 18:** By 2020, the traditional knowledge, innovations and practices of indigenous and local communities relevant for the conservation and sustainable use of biodiversity, and their customary use of biological resources, are respected, subject to national legislation and relevant international obligations, and fully integrated and reflected in the implementation of the Convention with the full and effective participation of indigenous and local communities, at all relevant levels.	SLBCP and SLWCP	

Integration of biodiversity into poverty eradication and development by key ministries (excluding projects listed above)

d. Ministry of Agriculture, Forestry and Food security

No.	Ministry targets, (1) MDG, (2) Agenda for Prosperity, (3) Agenda for Change, (4) Spatial planning processes as appropriate	Related Ministry targets, principles and priorities (please rank priorities)	Specific projects (Title of project, implementing MDA and partner, contact details)	Project Implementation Period
1.	MDG Target 1.C: Halve, between 1990 and 2015, the proportion of people who suffer from hunger; Goal 8: Develop a global partnership for development Target 8B	None	IFAD financial support and strategy for the eradication of rural poverty and hunger, which is a goal in line with the MDGs, will continue into 2015. The program targets agriculture as the 'engine' of socio-economic development. The portfolio covers 2 projects and a program, namely; (i) Rehabilitation and Community-based poverty reduction Project (RCPRP); (ii) the Rural Finance and Community Improvement Project (RFCIP) that was approved in 2007, and (iii) the Smallholder Commercialization Program – under the Global Agricultural Food security Program (SCP-GAFSP), launched in 2007.	
2.	MDG Goal 7: Ensure Environmental sustainability; Targets 7A and B.		See Table above	

e. Projects from Ministry of Lands, Country Planning and the Environment (MLCPE) assessed in line with the Strategic Plan for Biodiversity (2011-2020)

No.	Aichi	Related Ministry targets, principles and priorities (please rank priorities)	Specific projects (Title of project, implementing MDA and partner, contact details)	Project Implementation Period	Comments, concerns, issues
1.	**Target 1:** By 2020, people are aware of the values of biodiversity and the steps they can take to conserve and use it sustainably.	In our Strategic Plan for 2014 – 2016, the Ministry of Lands, Country Planning and the Environment has a component on Environmental Education and Awareness Raising on Natural Resources Management	Western Area Peninsular Forest Project (WAPFOR) funded by European Union and implemented by ENFORAC Partnering with MLCPE	2014 – 2016	WAPFOR to end this year and expected to graduate to another phase
2.	**Target 2:** By 2020, biodiversity values have been integrated into national and local development and poverty reduction strategies and planning processes and are being incorporated into national accounting, as appropriate, and reporting systems	National Land Policy Implementation. (a well loaded policy document) To be approved by cabinet and would become an open-ended national document And the National Environment Policy (1994)	National Land Policy Coastal Profile and Coastal Zone Management Plan (under development)	Open – Ended Open – Ended	Can be reviewed when necessary To be reviewed
3.	**Target 3:** By 2020, incentives, including subsidies, harmful to biodiversity are eliminated, phased out or reformed in order to minimize or avoid negative impacts, and positive incentives for the conservation and sustainable use of biodiversity are developed and applied, consistent and in harmony with the Convention and other relevant international obligations, taking into account national socio economic	National Land Policy Implementation.. (a well loaded policy document) To be approved by cabinet and would become an open-ended national document	National Land Policy	Open – Ended	Can be reviewed when necessary

No.	Aichi	Related Ministry targets, principles and priorities (please rank priorities)	Specific projects (Title of project, implementing MDA and partner, contact details)	Project Implementation Period	Comments, concerns, issues
	conditions				
4.	**Target 4:** By 2020, Governments, business and stakeholders at all levels have taken steps to achieve or have implemented plans for sustainable production and consumption and have kept the impacts of use of natural resources well within safe ecological limits	National Land Policy Implementation. (a well loaded policy document) To be approved by cabinet and would become an open-ended national document	National Land Policy	Open - Ended	Can be reviewed when necessary
5.	**Target 5:** By 2020, the rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced.	National Land Policy Implementation. (a well loaded policy document) To be approved by cabinet and would become an open-ended national document	National Land Policy	Open - Ended	Can be reviewed when necessary
6.	**Target 6:** By 2020, all fish and invertebrate stocks and aquatic plants are managed and harvested sustainably, legally and applying ecosystem based approaches, so that overfishing is avoided, recovery plans and measures are in place for all depleted species, fisheries have no significant adverse impacts on threatened species and vulnerable ecosystems and the impacts of fisheries on stocks, species and ecosystems are within safe ecological limits.	National Land Policy Implementation. (a well loaded policy document) To be approved by cabinet and would become an open-ended national document And the National Environment Policy (1994)	National Land Policy Coastal Profile and Coastal Zone Management Plan (under development)	Open – Ended Open - Ended	Can be reviewed when necessary To be reviewed
7.	**Target 7:** By 2020, areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity	National Land Policy Implementation. (a well loaded policy document) To be approved by cabinet and would become an open-ended national document And the National Environment Policy (1994)	National Land Policy Coastal Profile and Coastal Zone Management Plan (under development)	Open – Ended Open - Ended	Can be reviewed when necessary To be reviewed

No.	Aichi	Related Ministry targets, principles and priorities (please rank priorities)	Specific projects (Title of project, implementing MDA and partner, contact details)	Project Implementation Period	Comments, concerns, issues
8.	**Target 8:** By 2020, pollution, including from excess nutrients, has been brought to levels that are not detrimental to ecosystem function and biodiversity	National Land Policy Implementation. (a well loaded policy document) To be approved by cabinet and would become an open-ended national document	National Land Policy	Open – Ended	Can be reviewed when necessary
		And the National Environment Policy (1994)	Coastal Profile and Coastal Zone Management Plan (under development)	Open - Ended	To be reviewed
9.	**Target 9:** By 2020, invasive alien species and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment.	SLMA, MARPOL Convention			
10.	**Target 11:** By 2020, at least 17 per cent of terrestrial and inland water, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes.	National Land Policy Implementation. (a well loaded policy document) To be approved by cabinet and would become an open-ended national document	National Land Policy	Open – Ended	Can be reviewed when necessary
		And the National Environment Policy (1994)	Coastal Profile and Coastal Zone Management Plan (under development)	Open - Ended	To be reviewed
11.	**Target 12:** By 2020, the extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained.	National Land Policy Implementation. (a well loaded policy document) To be approved by cabinet and would become an open-ended national document	National Land Policy	Open – Ended	Can be reviewed when necessary
		And the National Environment Policy (1994)	Coastal Profile and Coastal Zone Management Plan	Open - Ended	To be reviewed

No.	Aichi	Related Ministry targets, principles and priorities (please rank priorities)	Specific projects (Title of project, implementing MDA and partner, contact details)	Project Implementation Period	Comments, concerns, issues
			(under development)		
12.	**Target 13:** By 2020, the genetic diversity of cultivated plants and farmed and domesticated animals and of wild relatives, including other socio-economically as well as culturally valuable species, is maintained, and strategies have been developed and implemented for minimizing genetic erosion and safeguarding their genetic diversity.	National Land Policy Implementation. (a well loaded policy document) To be approved by cabinet and would become an open-ended national document And the National Environment Policy (1994)	National Land Policy Coastal Profile and Coastal Zone Management Plan (under development)	Open – Ended Open - Ended	Can be reviewed when necessary To be reviewed
13.	**Target 14:** By 2020, ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and well-being, are restored and safeguarded, taking into account the needs of women, indigenous and local communities, and the poor and vulnerable.	National Land Policy Implementation. (a well loaded policy document) To be approved by cabinet and would become an open-ended national document And the National Environment Policy (1994)	National Land Policy Coastal Profile and Coastal Zone Management Plan (under development)	Open – Ended Open - Ended	Can be reviewed when necessary To be reviewed
14.	**Target 15:** By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification.	National Land Policy Implementation. (a well loaded policy document) To be approved by cabinet and would become an open-ended national document And the National Environment Policy (1994)	National Land Policy Coastal Profile and Coastal Zone Management Plan (under development)	Open – Ended Open - Ended	Can be reviewed when necessary To be reviewed

6. CONTRIBUTIONS OF ACTIONS TO IMPLEMENT THE CONVENTION TOWARDS THE ACHIEVEMENT OF THE RELEVANT 2015 TARGETS OF THE MILLENNIUM DEVELOPMENT GOALS

Due to some due several constraints, namely, funding, power problems, planning, monitoring constraints, poor infrastructure, weakness of social services, governance and capacity constraints and the effect of the war which robbed the country of 10 years prior to the start of implementation some MDG goals were not likely to be met by Sierra Leone. Gender equality, reduction of hunger, and environmental sustainability posed some challenge to the implementation of the targets. For instance, absolute poverty dropped from 70% after the war to 60% by 2007, but needed to reach 40% by 2015 to achieve target, which may not be likely.

Achieving goal No. 7 is not likely either in the face of unprecedented deforestation and land degradation and the loss of forest cover to a mere 5% of the total land area. Many sustainable principles have been incorporated into laws and policies but these require medium to long term implementation. Institutions are weak, law enforcement is ineffective, funding is grossly inadequate and the forest estate areas are decreasing due to other competitive land use options.

Perspective 1: Forestry

These actions have been in the form of projects, studies, policies and legislations, dialogues, visibility and activities of other sectors in conservation or even deforestation and land degradation as highlighted below:

- Most of the sectors have made progress in activities related to the MDGs goals related to their respective areas albeit to varying degrees
- The recent increase in staff strength in MAFFS is commendable but the recruits need at least crash programmes on introduction to forestry in the local University before overseas courses can be arranged for diplomas or degree programmes.
- The new policies and legislations promulgated will at least help the courts in litigation processes provided law enforcement is improved.
- The Sierra Leone Biodiversity Conservation project, the Wetlands Biodiversity conservation project and the Western Area Peninsula forestry project all have biodiversity conservation components and contribute towards goal no.7 on environmental sustainability.
- The Sierra Leone Forest Dialogue was concluded in a validation workshop held at the Lagonda Hotel in June 2012 with representatives of FAO, ECOWAS, African Union etc.
- Forest research (silviculture) has been revived and is now part of the Kenema Forestry and Tree Crops Center in Kenema(see?
- The Mano River Forest Ecosystems management project(MARFOP) had started in 2012.
- The Carbon content of the 87/ Important Bird Areas(IBAs) has been assessed in terms of soil carbon and biomass carbon. Carbon assessment and community training workshops have been carried out at the Gola forests and the OKNP. This underscores the need for the conservation of these IBAs.
- The 2002 log export ban encourages saw milling and value addition thereby maximizing returns to investment in forestry and also the creation of jobs in the rural areas possibly curbing rural-urban migration.

- The 2007 forest policy and legislation underscores forest conservation and management;
- Gola forests and the Loma mountains management plans have been completed and are now in operation.

Perspective 2: Reptiles, Amphibians, Manatees etc

Though reptiles (except sea turtles), amphibians and manatees are not particularly given conservation attention in Sierra Leone but these species are believed to be benefiting from the efforts of environmentally minded institutions around the country. The education/sensitization, research, surveys, monitoring and law reform/review processes in the country are believed to be contributing to the targets of CBD and the MDG in Sierra Leone. The creation of protected areas, reserves and protection of some fauna and flora species across the country are crucial for the conservation of Sierra Leone's biodiversity in totality. Working with communities around critical and fragile ecosystems is not only important for the conservation of Sierra Leone's biodiversity but to the locals as well. The natural resources are invaluable to humans therefore these resources deserves all the efforts for their protection. This, over the years has been made known to the locals around the country though some are in the habit of taking chances which has resulted in the loss of forests and wetlands across the country.

7. LESSONS LEARNED FROM THE IMPLEMENTATION OF THE CONVENTION

The key lessons learnt from the implementation of the CBD in Sierra Leone were as follows:

1. Mainstreaming and integration of the strategy and action plan into national policies and programs is important to the successful implementation of the convention;
2. Stakeholder mapping, identification and consultations should be comprehensive enough to enhance stewardship and sense of responsibility;
3. Incentives such as tax breaks for biodiversity-related projects and programs should be provided to promote project implementation;
4. Enforcement instruments such as adequate and up-to-date legislation, regulations and policies would form the backbone for project implementation;

Going forward the following should be taken into consideration:

1. Sierra Leone has a rich terrestrial and aquatic biodiversity and the Gola forest in particular has high species diversity and endemism.
2. Sierra Leone biodiversity is seriously threatened by life-sustaining activities such as mining; infrastructural development; agricultural expansion and practices(overuse of chemicals, shifting cultivation); wildfires etc.
3. Human resource capacity and strength to cope with the several resource management challenges is very low.
4. Law enforcement for offenders in biodiversity misuse is very weak and even after apprehension of offenders the litigation process too slow to serve as deterrent for would-be offenders.
5. Policies and legislative frameworks are nearly adequate but exclude issues such as bio piracy, trans boundary poaching of wildlife, intellectual property rights etc.
6. Visibility on the value of biodiversity and the negative impacts of their degradation is on-going taking advantage of the community radios in all the districts, but there is much room for improvement in order to include those without access to radio.
7. Funding to biodiversity management is appalling and necessary delays in the sourcing of the meagre funds are frustrating often resulting in the utilization of up to 30% of the allocated funds.
8. There has been little or no frantic effort at community forestry development despite the fact that most of the forest lands are communally owned.
9. Partnership arrangements are very rare, except for the Gola trust fund arrangement managed by Birdlife International and the Royal Society for the Preservation of Birds.
10. Political will for resource conservation is virtually non-existent translating into low prioritization of the sectors involved in biodiversity management.
11. Local forest-dependent and forest-dwelling communities are often excluded in policy and legislative development or are often informed at the end of the process.
12. Parliamentarians and ministers may not be properly sensitized on the value of biodiversity and the negative impacts of resource depletion.
13. Remunerations and logistical support to resource conservation is too low to motivate even the loyalist staff to be dedicated to the service and the rate of staff attrition for greener pastures is fairly high.

14. Staff replacement after retirement, death, invalidity and attrition is painfully slow resulting in a very high protected area: staff ratio being a recipe for inefficiency and underperformance.

8. CONCLUSION

The review of the NBSAP is a very significant step in the direction that would take Sierra Leone into a decade of progress in and the recognition of the importance of biodiversity to national development. The Aichi Targets 2011 – 2020 that incorporates very important aspects of biodiversity, especially on emerging issues of climate change, carbon sequestration and benefit sharing are key component of this review. If these targets constitute the key focus implementation of the NBSAP 2013, then there is certainty that the biodiversity conservation issues, in the country particularly for birds, will be holistically addressed. This will also contribute to the achieving various national and international development agendas including Vision 2025, the Poverty Reduction Strategy Paper (Agenda for Prosperity) and the Millennium Development Goals.

Despite the many problems facing the conservation of biodiversity there is a growing awareness of its importance, through community programs and media reportage and sensitization. Economic development and human well being are heavily dependent on a healthy environment and abundant bio-resources. At present agricultural biodiversity are being lost through removal of forest cover, large scale commercial agriculture, indiscriminate open pit mining with no regard for environmental degradation and inappropriate land use practices. These trends are dangerous and need to be reversed urgently. These would require changes in lifestyle, attitudes of people towards the environment and its limited resources and having effective and appropriate laws and policies in place. The Government can further assist in reversing these trends by including biodiversity in its work plan and encouraging cross sectoral collaboration with appropriate policies and financial support in place. This will facilitate the full implementation of the NBSAP objectives which in turn will act to improve the economic development of Sierra Leone and the well being of its people. In doing so, Sierra Leone will contribute more to its global commitment to conserve the environment and save the planet Earth.

Sierra Leone is, in general, undertaking conservation actions that are benefiting the biodiversity of the country though the actions are faced with lot of challenges from the resource users due to poverty and the quest for survival and or wealth. Though these conservation actions are somehow benefiting reptiles, amphibians and manatees, but they are not particularly given national protection except the sea turtles. Worst of it is that there are no national databases for all reptiles and amphibians in the country as there are for birds, mammals and plants.

As for birds, their importance in biodiversity conservation and environmental monitoring cannot be overemphasized. It is no doubt that Sierra Leone's avifauna is good and is a unique combination of birds of various biomes and ecological systems, ranging from forest to grassland savanna. As far as bird conservation is concern a lot of work has been done over the years to bring into focus the status of the country's avifauna and importance of birds to biodiversity conservation. Through work on birds in Sierra Leone, the country has benefited immensely from conservation planning and priority setting processes and has achieved significant milestones in the country's biodiversity programme. These include the publication of the IBA book, the designation of the Sierra Leone River estuary as a Ramsar sites, the establishment of the Gola National Park and the proposed establishment of the Loma Mountains National Park. However, there should never be room for complacency and therefore more effort is needed to generate more data on birds and design new ways of tackling issues and challenges that border of their conservation.

9. RECOMMENDATIONS

The following recommendations if taken into good faith and implemented could ameliorate the above conclusions.

- Funding to the natural resources sectors like the Environmental Protection Agency, the Forestry Division, Fisheries ministry and livestock Division need to be increased significantly in view of the fact that a good environment supports food security. Funding food security at the expense of forestry development could aggravate climate change which undermines agricultural productivity.
- Staff strength and capacity for the forestry sector, Wildlife conservation branch and the EPA need to be increased in consonance with the scope of their mandates. In addition the EPA's presence in all chiefdoms is necessary because they need to sensitize the grassroots level people who are yet to be fully involved in this new paradigm change. Staff replacement in these sectors should be given top priority.
- Every effort should be made to maximize benefits to land-owning communities who continue to sacrifice their lands to the country, depriving them of some indigenous rights.
- Government should design a realistic and equity-based benefit sharing formular and monitor the actual distribution at community level.
- Logistics for monitoring biodiversity status should be available to keep the authorities alert and speedily response to the causative factor(s) in time. Training in biodiversity surveys and monitoring technologies and the provision on necessary tools and equipment, video clips etc will be essential.
- Government should pay near-attractive salaries and provide the cash and logistics for monitoring biodiversity status.
- Review policies and legislations in tune with emerging challenges and problems in biodiversity management
- Legislate laws to contain bio piracy, intellectual property rights, biological material export and conditions of export and benefit and knowledge sharing, co-authorship arrangements etc.
- Establish more Pas on communal lands especially in areas currently managed by communities through traditional by-laws.
- Encourage communities to continue the conservation of sacred groves, cemeteries , places of worship, secret society bushes etc. and devise incentives for the best kept groves.
- Properly demarcate the boundaries of all PAs to reduce the rate of encroachment due to poor boundary demarcation.
- Involve the local communities in policy and legislative formulation.
- Establish natural resource co-management conditions for existing and future forest estates.
- Partner with international environmental conservation institutions to make trust fund, debt-for-nature-swap arrangements to fund conservation.
- Engage in robust visibility programmes covering all Pas and dialogue with communities on natural resource conservation as often as possible.
- Engage ministers, Parliamentarians, local government authorities etc. in sensitization programmes on the value of biodiversity

Recommendations from various consultants

The following recommendations are based on the experiences and lessons learnt on biodiversity conservation processes and programmes over the years and what must be done to sustain the successes and address the challenges.

Reptiles, amphibians and manatees Specialist

- National reptile and amphibian survey should be carried out as soon as possible
- All amphibian species of Sierra Leone origin should be given much conservation priority and used as flagship species in the conservation campaigns of reptiles and amphibians
- A national survey should be conducted and further work/studies be done on manatees
- Database should be set for all species in categories
- Environmental NGOs should be locally granted funds for conservation campaigns of Sierra Leone biodiversity
- Local laws protection reptiles, amphibians and manatees should be enacted and enforced.
- National education/sensitization about the amphibians, reptiles and manatees should be conducted.

Avifauna Specialist

- Synchronise and establish synergies between the NBSAP review and the review of 1988 Forestry Act and the 1972 Wildlife Conservation Act. One issue of concern to highlight the conservation needs for globally threated avifauna and facilitate the inclusion of all threatened and near threatened species, and species that are under serious threats nationally in the "Special Protection" category of the Wildlife Conservation Act. Another issue is to include protection for mangrove forest within the framework of marine protected areas.

- Establish a baseline for the assessment of the local status of birds in Sierra Leone. Although there are standard criteria used globally to allocate the threatened status of birds, there needs to be a system of assessing the national status of birds. Birds that are of least conservation concern globally may be threatened locally; the converse also holds for that birds threatened globally, may not necessarily be rare or under the same suite of threats locally.

- In collaboration with the relevant research institutions and experts, establish a monitoring team of birds and other fauna. A twitter account can be open where interesting findings of birds can be sent to inform other in the monitoring team, which could help in providing more data on the identification and distribution status of birds. In fact, other non-experts, who are interested in birds, can access this twitter account, thereby encouraging greater public interest in birding and bird conservation.

- There is need to carry out a more comprehensive assessment of the effect of climate change on biodiversity, especially birds, based on experiences and lessons learnt from other countries within tropical environments. The NBSAP review process should consult the National Adaptation Programme of Action (NAPA) document that was developed in 2008/2009.

- A strategy and plan of action should be incorporated into the NBSAP that addresses the issue of carbon sequestration and carbon-trading related concepts. This is a potential for forest conservation in the country, which will also be beneficial to the living standards of local communities and biodiversity including the protection of critical habitats for birds.

Restoration Ecologist

- Undertake a comprehensive up-to-date status survey of invasive species in the country, including the different ecosystems/ecologies where they occur.
- Review and strengthen existing policies and legislation and where necessary develop new ones on alien species (importation and use)
- Develop and implement identification and monitoring system for invasive species including the extent and intensity of their invasion.
- Empower and involved the local communities in surveillance and control of invasive species. There is recent empirical evidence that *chromoleana odorata* for example, can be a useful fallow plant and do enhance soil fertility. This and other possibilities should be experimented to help in reducing the burden of fallow agriculture on the land.
- Develop and implement a comprehensive awareness programme incorporating traditional methods and mechanisms in invasive species management, especially among local farming communities.
- Improve the human and material resources capacities and indigenous knowledge for government staff, local communities and researchers.
- Timelines should be put on the issue of rehabilitation of mined areas- encourage use of indigenous species. Mining companies should be impressed upon to implement their restoration programs in their EIAs and pay for such restoration programs.
- A comprehensive policy should be developed to control artisanal mining, which is creating serious ecological destruction to ecosystem including forest, wetlands and riparian ecologies.

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APPENDICES

Appendix 1: Background to the preparation of the 5th National report

Sierra Leone ratified the Convention on Biological Diversity (CBD) in 1996 following the Earth Summit in Rio de Janeiro, Brazil in 1992, and is therefore committed to the implementation of the Convention. The Conference of the Parties (COP) to the CBD has declared national biodiversity strategies and action plans (NBSAPs) as the primary mechanisms for the implementation of the Convention and its Strategic Plan. In addition to preparing her first NBSAP in 2003, Sierra Leone has also submitted two national reports to the CBD, namely, the first and the third.

The Environment Protection Agency, Sierra Leone (EPASL), acting on behalf of the Government of Sierra Leone, entered into an agreement with United Nations Environment Program in March 2012 to revise the National Biodiversity Strategy and Action Plan (NBSAP) prepared in 2003, and develop the 5th National Report to the CBD. Subsequently, Sierra Leone, along with 26 other Least Developed Countries (LDCs) received small grants for the execution of the project. The project is in response to the Strategic Plan for Biodiversity 2011-2020 and the Aichi Biodiversity Targets adopted by the 10th Conference of the Parties (COP) to the Convention on Biological Diversity (CBD) (Decision X). All parties committed to promoting effective implementation of the Convention through a strategic approach based on shared vision, a mission, and strategic goals and targets (the Aichi Biodiversity Targets).

The project consists of the following five components:

COMPONENT 1: Stocktaking and Assessment: This component will entail (a) Rapid stocktaking and review of relevant plans, policies and reports; (b)Identification of stakeholders and raising awareness and (c) Rapid assessment of the causes and consequences of biodiversity loss highlighting the value of biodiversity and ecosystem services and their contribution to Human well-being. Part (a) will be done by national consultants before it is discussed by the stakeholders while parts (b) and (c) will be done in a consultative manner in multi-sectoral meetings.

COMPONENT 2: National Targets, Principles, & Priorities of the Strategy
Prior to developing the NBSAP, national targets and priorities will be determined first, taking into account the guiding results from Component 1. Small multi-sectoral committees will do the ground work, which will then be discussed by all stakeholders. This component will be further guided by the instructions given by the CBD COP, based on the many emerging issues which will be updated in the NBSAPs and which will add different dimensions to the consultations. These issues include:

i. The recently adopted the Strategic Plan for Biodiversity (2011-2020) and its associated goals, the Aichi Targets, and indicators require fresh consultations by countries;

ii. Integration of biodiversity into poverty eradication and development: It will be necessary to include ways of integrating the NBSAPs into national development and poverty reduction policies and strategies, national accounting, economic sectors and spatial planning processes, MDGs

iii. Human Rights and Indigenous peoples: The LDCs and SIDs have many indigenous groups and so it will be necessary to factor issues on the United Nations Declaration on the Rights of Indigenous Peoples,3: .

iv. Gender considerations: -the initial NBSAPs had ignored mainstreaming of gender perspectives into the implementation of the Convention and promote gender equality in achieving its three objectives. This aspect will now be included.

COMPONENT 3: Strategy and action plan development: Components 3 will entail developing the strategy and actions to implement the agreed targets through national consultations and application of

the resultant NBSAP to sub-national entities through sub-national and local consultations. Based on results from stakeholder consultations (including sub national levels) national experts will be used to draft the final Strategy and Action Plan, which will later be moderated and validated by the stakeholders.

COMPONENT 4: Development of Implementation plans: Once there is a revised draft strategy and action plans – further consultations will be required to develop implementation plans and related activities. Component 4 addresses the supporting systems for the NBSAP process and will have several areas including:

i. Development of a plan for capacity development for NBSAP implementation;
ii. Technology needs assessment;
iii. Development of a communication and outreach strategy for the NBSAP; and;
iv. Development of a plan for resource mobilization for NBSAP implementation.

COMPONENT 5: Institutional, monitoring, reporting and exchange: This component will address establishment/ strengthening of national coordination structures such as Biodiversity Units, CHM development and Development of indicators and monitoring approach. The component will also develop the Fifth National Reports which will be prepared following the guidelines given by the COP and the SCBD. Using the framework for goals and targets adopted by the CBD COP in its Decision 10 and the Guidelines for the Fifth National Report4 to the CBD, the development of the report will use the data already gathered during consultations for the NBSAP process and from data gathered by various experts. This means the development of the National Report and the revision of the NBSAP is one process but with 2 different products. A portal to assist the preparation of the 5th National Report and revision of the NBSAP will be developed by the SCBD and will be constantly updated, permitting also on-line status reporting in real-time to the CBD, the implementing agencies, the GEF, countries and interested audience, as well as allowing countries to exchange experiences. UNEP will assist in facilitating this inter-country knowledge exchange.

With the EPASL serving as the Executing partner and CBD focal point, a number of actions were immediately taken to implement the project; namely, the appointment of a Project Manager, and selection of a Steering Committee and National Consultants.

Persons and Institutions involved in the execution of the Project

1. *Project Implementation Agency*

UNEP, as the GEF implementing agency is responsible for project oversight to ensure that GEF policies and criteria are adhered to and that the project meets its objectives and achieves expected outcomes in an efficient and effective manner.

2. *Project Executing Agency*

EPASL is the Project Executing Agency, and is responsible for oversight and implementation of the project preparation. The Executing Agency will work closely with the Steering Committee.

3. *Project Coordinator*

The Executive Chairperson of EPASL, Mrs Haddijatou Jallow is the Project Coordinator. She will be responsible for the coordination of project activities, and to provide overall project management and supervision. She will also serve as the Chairperson of the Steering Committee.

4. *Project Manager*

[4] www.cbd.int/doc/meetings/cop/cop-10/official/cop-10-11-en.doc

The Project Manager, Dr Ralph Bona is responsible for the implementation of the project activities.

5. Stakeholders

Stakeholders included:

a) National Stakeholders: Government Ministries (multi sectoral), local authorities, local communities , Civil Society Organizations (CSOs) local NGOs and Universities - all of which will be active in consultations and working teams;

b) private sector entities;

c) local communities and indigenous groups;

d) International NGOs related to Biodiversity conservation and which operate at country level, and;

e) Multi laterals such as FAO, UNDP, World Bank and others will be invited to attend the consultations.

The detailed list of participating stakeholders is given in the table below:

No.	Ministries Departments and Agencies	
1.		Minister of Finance and Economic Development
2.		Minister of Agriculture, Forestry and Food Security
3.		Minister of Fisheries and Marine Resources
4.		Minister of Lands, Country Planning and the Environment
5.		Minister of Mines and Mineral Resources
6.		MAFFS – Forestry Division
7.		Crop Division
8.		Livestock Division
9.		MLCPE
10.		Ministry of Trade and Industrial Relations
11.		Ministry of Mines and Mineral Resources
12.		Ministry of Fisheries and Marine Resources
13.		Ministry of Tourism and Culture
14.		Ministry of works housing and infrastructure
15.		Ministry of Water Resources
16.		Ministry of Education, Science and Technology
17.		Ministry of Finance and Economic Development
18.		Ministry of social welfare, children and gender affairs
19.		Ministry of Local government
20.		EPA-SL
21.		Office of National Security (Disaster Management Dept)
22.		Chairman Oversight committee (Agriculture)
23.		Chairman Oversight committee (Environment)
24.	University and research	NU – Agriculture Faculty
25.		NU- Environmental Sciences/Biological Sciences
26.		FBC – IMBO
27.		FBC – Biological Sciences
28.		Rokupr Rice Research Station
29.		SLARI
30.	NGOs, civil societies, private	CSSL

	sector	
31.		EFA
32.		Green Scenery
33.		STEWARD
34.		RAP-SL
35.		Gola Forest Conservation Project
36.		Tacugama Sanctuary
37.		Loma Offset Project
38.		Wetlands Conservation Project
39.		Western Area Peninsula Forest Reserve and its Catchment Project (WAPFOR)
40.		Bumbuna Watershed Management Program
41.		Sustainable Nutrition and Agricultural Program
42.		National Minerals Agency
43.		National farmers association (SLFA)
44.		50/50 Group
45.	International organizations	UNDP
46.		EU
47.		World Bank
48.	Consultants	Kate Garnett
49.		Prof Alghali
50.		Prof Ndomahina
51.		Mohamed Mansaray
52.		Alhaji Siaka
53.		E.K. Alieu
54.		Prof Karim
55.		Okoni Williams
56.		Edward Aruna
57.		David Suale
58.		Akintayo Alabi
59.		Charles Dickson

6. Steering Committee

The steering committee consisted of the following MDAs:

i. Ministry of Agriculture, Forestry and Food Security (MAFFS),
ii. Ministry of Fisheries and Marine Resources (MFMR),
iii. Ministry of Lands, Country Planning and Environment (MLCPE),
iv. Ministry of Trade and Industry (MTI),
v. Ministry of Finance and Economic Development (MFED),
vi. Conservation Society of Sierra Leone (CSSL),
vii. Njala University (NU);
viii. Fourah Bay College (FBC);
ix. Civil society
x. EPASL

7. National Consultants

Short-term consultant(s) were contracted to assist in facilitating the review of data and consultations for revision of NBSAP and development of 5th National Report to the CBD. A list of the consultants involved in the study is given below:

No.	Expert	Institution	Category	Study/discipline
1	Kate Garnett	MAFFS	Element	Forest Biodiversity & Wild life, game reserves, parks and sanctuaries; mountain biodiversity;
	Kate Garnett		Theme	Conservation (*in situ and ex situ*); in and outside of protected areas;
2	Prof Alghali	Former Vice Chancellor, NU	Element	Agricultural Biodiversity (Plant resources; Livestock resources; Land resources; pastoral and farming land; Aquaculture; Agro-forestry and tree planting; Gene banks);
3	Prof E. Ndomahina	Director, Institute of Marine Biology and Oceanography, FBC	Element	Aquatic Biodiversity, Coastal and Marine Biodiversity including fisheries;
4	Emmanuel K. Alieu	Forestry Department, NU	Theme	Policy, Legislative and Institutional; Capacity Building and Public Participation Measures; incentives
	Sheku A. Mansaray	Director, MAFFS	Theme	Sustainable use of biodiversity components; Sharing of Benefits arising from the use of genetic resources
5	Prof A. B. Karim	Dean, Pure and Applied Sciences, FBC	Theme	Ecological Restoration and Species Recovery; Control of Alien Species; biodiversity planning;
6	David Suale	MAFFS	Theme	Research and Training, Public Education and Awareness; Indigenous Knowledge and Intellectual Property Rights
	David Suale		Theme	Access to Technology and Handling of Biotechnology; Information Exchange and Technical/Scientific Cooperation;
7	Mohamed Mansaray	MAFFS	Theme	Relationship between the CBD and other conventions, Identification and Monitoring;
8	Omotayo Alabi	Agcrest, Sierra Leone	Theme	Organizations, programs, budgets and human capacity (NGOs, civil societies, companies)
9	Arnold Okoni Willliams	Lecturer, FBC	Element	Terrestrial, Coastal and Marine Avifauna
10	Edward Aruna	Reptile and Amphibian Project, Sierra Leone	Element	Reptiles, Amphibians, Manatees, Sea turtles
11	Alhaji Shiaka	Gola Forest Conservation Program	Element	Mammals and wildlife

For the entire project, the National Consultants were tasked to carry out the following tasks in revising the NBSAP and developing the 5th National Report to the CBD:

i. stocktaking and assessment to reflect current data and information on biodiversity threats and priority areas for conservation;

ii. Biodiversity loss;

iii. mainstreaming the Aichi Targets and gender issues in the NBSAP,

iv. Identifying national targets and strategies to promote conservation and development of an action plan for inclusion into the NBSAP,

v. The national consultants will also identify strategies for integration of the Aichi targets and NBSAP into the National Agenda for Prosperity which is the PRSP document of Sierra Leone.

The TOR and SoW contained in this document cover points i. and ii. above, which were the main objectives of Component 1.

National workshops

So far, two national workshops have been held on the project in the city, Freetown:

1. *First National Workshop*

The 2-day first national workshop on 'Stock taking and assessment' was held on 22nd and 23rd August, 2013. The objective of the workshop was to review sections of the reports on the revision of the NBSAP and development of the 5th National Report to the CBD that were being developed by national consultants. The consultants had done their tasks through Stocktaking and assessment to reflect current data and information on biodiversity threats and priority areas for conservation; they

had also examined the mainstreaming of the Aichi Targets and gender issues into biodiversity-related projects. They had completed the draft reports of their study, the crux of which was presented at the workshop.

The main output of the workshop was a comprehensive input into consultants' reports on i) baseline data and ii) causes and consequences of biodiversity loss, and; (iii) the value of biodiversity to human being wellbeing.

2. *Second National Workshop*

The 2-day second national workshop was on Component 2 of the project 'Setting national targets, principles and priorities of the strategy'. It was held on 10th and 11th June, 2014, with the objective of reviewing the national targets and policies as presented by the line ministries, departments and agencies.

The workshop was conducted in the following manner:

- Top Ministry representatives were requested to make policy statements on their contribution to the implementation of the CBD;
- Consultants were requested to obtain information and data from Key Ministries and make presentations on their respective biodiversity-related targets at the workshop.
- The plenary would then hold discussions on biodiversity issues and make contributions to or comment on the targets presented by the ministries;

Main Outputs of Component 2 or 2nd national workshop was the preparation and submission of the 5th National Report to UNEP and CBD and discussions on items to be taken into consideration in the setting of the national targets.

The key aspects examined at the workshop were:

a) *Proposed updates to Sierra Leone's biodiversity strategy and action plan (Appendix A);*
b) *Use of updates to incorporate the targets and to serve as an effective instrument to mainstream biodiversity;*
c) *Actions taken by Sierra Leone to implement the Convention since the 3rd National report and the outcomes of these actions;*
d) *How effectively has biodiversity been mainstreamed into relevant sectoral and cross-sectoral strategies, plans and programmes?*
e) *How fully has Sierra Leone's biodiversity strategy and action plan been implemented?*
f) *Progress made by Sierra Leone towards the implementation of the Strategic Plan for Biodiversity 2011-2020 and its Aichi Biodiversity Targets (Appendix B)?*
a) *The contribution of actions to implement the Convention towards the achievement of the relevant 2015 targets of the Millennium Development Goals in Sierra Leone;*
b) *Lessons learned from the implementation of the Convention in Sierra Leone.*

Appendix II: Wetland Conservation Projects in Sierra Leone

The Wetlands Conservation Project (WCP) is designed to complement the terrestrial focus of the Biodiversity Conservation Project (BCP). The WCP is implemented to build a coherent national wetland conservation program.

Österreichische Bundesforste AG (ÖBf) has been contracted by MAFFS to provide a Project Management Team (PMT) to assist the Forestry Division in the efficient planning, implementation as well as monitoring and evaluation of project activities. Overall project administration and management is built on established processes of the Biodiversity Conservation Project.

WCP-PMT started in June with an inception period of 3 months (June to August 2013). During this period, the Project Management Team (PMT) is expected to develop partnership and design project implementation strategy. The initial project was designed for three years; however in the inception phase a two years project planning was considered.

PROJECT COMPONENTS

The proposed project has three components and will pilot activities in two wetland areas, the Sierra Leone River Estuary (coastal wetland) and the Mamunta Mayosso Wildlife Sanctuary (inland wetland).

Component 1: Strategic Planning for Wetland Conservation: This component will provide technical assistance to support:

(i) Reviewing and updating as appropriate the existing policy and strategy for wetland conservation in Sierra Leone;

(ii) Updating the inventory and prioritizing conservation needs of key wetland ecosystems throughout Sierra Leone;

(iii) Preparing a prioritized and phased strategic plan for wetland conservation nationwide.

Component 2: Wetland Conservation Site Planning and Management: The project will provide services to support: planning and management; goods (e.g. motorbikes, small boats, global positioning systems (GPS), radios, lap tops); minor infrastructure improvements; training, including workshops and study tours; and some operational costs in order to develop and implement effective conservation management at the selected priority wetland conservation sites. Best practice will be shared with managers and stakeholders at other wetland sites around the country in the context of implementing a national strategic plan for wetland conservation. The component will include three sub-components:

2.1. Pilot Site Management Planning and Implementation, which will entail:
(i) Establishing conservation management teams (CSMTs) at each of the selected sites, and building partnerships among government, non-government organizations, community-based organizations, traditional village leaders and the private sector;

(ii) Developing site specific conservation management plans (CMPs) that are endorsed by traditional and local authorities;
(iii) Implementing conservation management plans (including minor infrastructure improvements for staff and visitors such as observation posts, water supply, road access, research facilities, trails and camp sites); boundary demarcation; working with local communities to improve resources management, implementing monitoring systems, exploring financing options;

(iv) Building capacity of field staff and key stakeholders to undertake conservation planning, management, and enforcement through joint training programs.

2.2 Community Mobilization and Outreach and Conservation-linked Development, which will entail provision of consultant services, goods, and training for:
(i) Community outreach and awareness through strategic local and national communication programs that will include contributing to schools curricula, preparing information materials, extension by field staff, and developing nature clubs;

(ii)Conservation-linked community development through the preparation and implementation of Community Action Plans (CAPs), which will, jointly with local stakeholders, identify priority threats to conservation in each site and explore options for addressing them.

Activities under the CAPs may include:
(a) Providing training for developing income-generating activities;
(b) Supporting potential small-scale entrepreneurs to develop business plans and partnerships in support of conservation-linked investment initiatives;
(c) Supporting local practices for sustainable land use;
(d) Strengthening linkages with government programs and service providers (such as Farmer Field Schools);
(e) Possible introduction of energy-saving technologies to reduce unsustainable dependency on natural resources.

2.3. Mainstreaming Conservation in District Development Planning, which will entail supporting the Government's decentralization process by training conservation staff and local officials to work with District Councils and Ward Development Committees to ensure that conservation and sustainable natural resource management is incorporated in district and regional planning for development and service delivery.

Component 3: Project Management: The Project will primarily finance services and some goods to support the existing BCP Project Management Team (PMT) within the Forestry Division of MAFFS, to ensure that the team has the necessary resources to effectively expand the scope of work to include the wetland sites and wetland conservation strategy development.

Activities will include:

(i) Ongoing operation of the National Steering Committee (NSC) and Project Management Team,

(ii) Developing and supervising annual and quarterly work plans and budgets,

(iii) Overseeing procurement and financial management and conducting annual audits, (iv) Establishing baselines, and developing planning, monitoring and evaluation systems for wetlands in the context of the national conservation program.

INSTITUTIONAL AND IMPLEMENTATION ARRANGEMENTS

The project will be implemented at two levels: (i) the national level for overall project coordination, planning, monitoring and evaluation, as well as implementation of Component 1 in support of a strategic plan for wetland conservation; and, (ii) the conservation site level for implementation of Component 2 in support of conservation site planning and management. Implementation arrangements respond to existing capacity of Government structures at central, district and site levels, and will contribute to building management processes for long-term sustainability beyond the project's lifespan.

1. *Project Management at the National Level:* The Ministry of Agriculture, Forestry and Food Security (MAFFS), through its Forestry Division, will be the *Executing Agency.* Under the BCP, the Forestry Division has established a *Project Management Team (PMT)* responsible for the day-to-day project management, coordination, supervision and monitoring of project activities at all levels. Scope of the PMT responsibilities will be enhanced to include management of the WCP. The PMT, based in Makeni, consists of a Project Manager, and specialist staff with skills in biodiversity conservation site planning and management, information technology and GIS, social and rural development, biodiversity surveys, and monitoring policy and regulatory aspects of conservation, and communications and outreach. The PMT will directly supervise the Conservation Site Managers (CSMs) at the priority conservation sites.

2. *Project Oversight at the National Level:* Under the BCP, a National Steering Committee (NSC) was established and chaired by the Director of Forestry. Membership of the NSC includes the Forestry Division's Assistant Director of Conservation and Wildlife Management Unit, the Project Manager from the Project Management Team, representatives of the Ministry of Finance and Development (MFD); the Ministry of Internal Affairs, Local Government and Rural Development (MIALGRD); the Ministry of Lands, Country Planning and Environment (MLCPE); the Ministry of Fisheries and Marine Resources (MFMR); the Ministry of Mineral Resources (MMR); the Ministry of Tourism and Cultural Affairs (MTCA); the Sierra Leone Environmental Protection Agency (SLEPA); a representative of local NGOs; and a community representative from each conservation site. Representatives of other Ministries, Departments and Agencies may be invited to participate on an ad hoc basis as needs arise. The NSC will provide strategic and advisory guidance and assistance in resolving inter-sectoral challenges to project implementation.

3. *Project Management at Conservation Site Level:* Each site will have a *Conservation Site Management Team (CSMT)* composed of Forestry Division staff, including a Conservation Site manager, an office manager/administrator, two technical-level staff and at least six guards. With the support of the PMT, each CSMT will contribute to the preparation and take lead responsibility for implementing site management plans in collaboration with the Conservation Site Management Committee.

4. *Project Oversight at Conservation Site Level*: A Conservation Site Management Committee (CSMC) will be established for each of the priority conservation sites, chaired by the District Council Chairman, with the Conservation Site Manager as Member and Secretary. The CSMC will consist of representatives of local communities, NGOs, other local stakeholders, such as mining or logging concessionaires, traditional leaders (e.g. Paramount Chiefs), and village committees. The CSMC will provide guidance, advice and assistance in addressing inter-sectoral challenges to project implementation at each of the priority conservation sites.

Measures to address capacity constraints

As established under the BCP, the PMT will undertake a training needs assessment to identify weaknesses in implementation and M&E capacity and to strengthen institutional capacity of the Forestry Division, centralized staff, decentralized staff, and other relevant authorities and stakeholders. Based on the results of the assessment, relevant trainings, workshops, exposure visits and other capacity building activities will be organized and conducted throughout the duration of project implementation.

Achievements (May – December 2013)

- Inception report produced.
- Management plan format produced.
- Development of the legal framework on wetland conservation in Sierra Leone. . Evaluation of the Technical and Financial Proposal. Contract with the Legal Consultant to be signed in December.
- GIS equipment in place (hard and software) and thematic maps are being produced for field activities and planning.
- Temporary accommodation facilities secured for both sites.
- 26 members of the Conservation Site Management Team (CSMT) have been deployed at 2 Conservation Sites and have received training in the use of basic field equipment (GPS, Compass, Maps and Data sheet).
- CSMTs have commenced regular patrols, monitoring human and wildlife activities.
- Meeting with District Councils, Local authorities and MAFFS district representatives held to introduce the project.
- Consultative meetings with the communities have been conducted for management effectiveness tracking tools for both sites. MMWS=14.9%, SLRE=12.64%. (PAD Baseline=20%).
- Project management team in place at the Makeni Biodiversity Conservation Project office.
- 2 Monthly meeting with CSMT to monitor progress and provide on the job training.
- Procurement of office and field equipments done and supplied to CSMT.
- Procurement of mobility (vehicles, motorbikes and bicycles) for field staff done.

Appendix III: Sierra Leone Biodiversity Conservation Project

Achievements (January – December 2013)

- METT has been applied for the second year, and management effectiveness increase for all sites. Project Baseline: OKNP=41.4%, LMNP=21.8%, KHFR=18.4%, Second year: OKNP=54.4%, LMNP=57.5%, KHFR=46.7 (PAD: baseline OKNP=49%, LMNP=22%, KHFR=25%, Second year: OKNP=52%, LMNP=24%, KHFR=27
- The Forestry and the Wildlife Conservation Acts reviewed by Advisory Committee and draft document produced. Evaluation of the Technical and Financial Proposal. Contract with the Legal Consultant to be signed in December.
- GIS equipment in place (hard and software) and thematic maps are being produced for field activities and planning. Field staffs have acquired skills in using GPS and field data collected are geo-referenced using GPS. Standardized data sheets are used in all the sites for the collection of data and monitoring
- Two National Steering Committee meetings held in May and December. Work plan and Budget were approved. Different agencies are now aware of the relevance of biodiversity conservation
- Management Plan finalized and disclosed for LMNP, Draft management plan produced for OKNP and circulated for comments. Stakeholder workshop to be organized to inform the community about the final outcome of the document. Kangari Hills management plan process is ongoing
- Community Action Plan (CAP) prepared for Loma, CAP for OKNP and Kangari hills are under preparation. Some component of CAP e.g. establishment of Pineapple, groundnut and cashew farms
- Annual and quarterly work plans are being developed by Project Management Team (PMT) and Conservation Site Management Team (CSMT). Annual work plan for 2014 available. All conservation sites have monthly work plan. Conservation Site Management Committee (CSMC) established for all conservation sites with the District Council Chairman/Representative as Chairman.
- LMNP administrative building, staff accommodation at headquarter, ranger outposts and research base camp under construction. Architectural design for KHNFR and OKNP infrastructures prepared. Site selection done. Bidding Documents prepared and ready for adverts.
- Economic trees like cashew nursery established and seedling supplied to farmers.30, 000 suckers of pineapple supplied to famers in OKNP that received training on pineapple farm establishment. Exchange visit of farmers to Felix Fruit Juice Factory at Mile 6
- District Councils participate in management planning process. Conservation Site managers attend District Council meeting and provide updates on site activities.
- Discussion with Paramount Chiefs on bye-laws publication initiated; with the revised Wildlife and Forestry Acts, bye-laws will be updated.

- Biodiversity Research Consulting firm hired to undertake studies for key taxonomic groups, their distribution and populations in all three conservation sites.
- More effective law enforcement ongoing. Arrest has been made and some defaulters warned and others prosecuted.
- Most of the land lease for mining exploration in KHNFR has been revoked.
- Conservation site managers and their assistants acquired training in computer software packages.
- Temporary accommodation facilities maintained in all sites administration.
- Boundary demarcation for LMNP completed, procurement process for boundary retracing at OKNP initiated, and discussion for KHFR boundary is nearly completed.
- Procurement of additional camera traps to enhance biodiversity monitoring.
- Procurement of firm to undertake training needs assessment for the Forestry Division.
- Procurement of firm to carryout wildfire studies in LMNP and OKNP
- A successful mid-term review exercise carried out

Appendix IV: Bumbuna Watershed Management Authority (BWMA)

The Bumbuna Watershed Management Authority (BWMA) was established by Act of Parliament (the Bumbuna Watershed Management Authority and the Bumbuna Conservation Act, 2008) to manage the watershed of the reservoir created following the commissioning of the Bumbuna Hydroelectric Project (BHP). The main objective of the BWMA as stated in the legislation was to promote sustainable land use practices and environmental management in the Bumbuna Watershed and to exercise control in the Bumbuna Conservation Area, in order to protect the fauna and flora in its natural state and address environmental and social needs associated with the operation of the BHP, including the physical protection and sustainability of the Bumbuna reservoir.

The BWMA is a semi-autonomous Government Authority setup under the Ministry of Energy and Water Resources with the responsibility of facilitating the delivery of the Bumbuna Watershed Management and Conservation Strategy and Action Plan (BWMCSAP) which was prepared as part of the Environmental Impact Assessment (EIA) for the BHP.

As part of the its catchment management remit, the BWMA is responsible for supporting the Bumbuna Conservation Area (BCA) a 3,532 ha protected area to the northwest of the BHP that has been created by the same Act of Parliament. The BCA is managed by staff of the BWMA. There are a lot of consultative meetings going on with communities around the BCA and watershed communities. Demarcation of the north western boundary is currently going on and tree species will be planted with the support and full participation of the communities.

The watershed management plan is designed to protect the Bumbuna Reservoir and to maintain the land and water processes, which sustain both the communities and the flora and fauna of the watershed including fisheries.

The BWMA will, from time to time issue Regulations on, for example, land use practices and conservation actions in the watershed. The BWMA operations cover the area of the watershed that lies between Yiben in the north and Bumbuna Falls in the south.

The BWMA is now fully operational at the Bumbuna campsite with the full complement of staff. The funding for the established and operations for its first year is from grant funds from the World Bank / International Development Association (IDA). Thereafter, it will be funded by the Bumbuna Trust (BT) which will receive funds from, *inter alia*, a portion of the electricity tariff. The Fund will be operated by the Bumbuna Trust Company (BTC), a private company being established under the Companies Act.

Functions

In summary, the BWMA will be responsible for co-coordinating and implementing the following key activities:

i. Prepare a detailed inventory and mapping of fauna and flora
ii. Establish a detailed biodiversity monitoring programme
iii. Manage the Bumbuna Conservation Area
iv. Sensitise local communities on conservation needs and socioeconomic issues
v. Further develop the WLMSAP into a Bumbuna Watershed Management and Conservation Strategy and Action Plan.
vi. Implement the Bumbuna Watershed Management and Conservation Strategy and Action Plan
vii. Set up and administer community liaison committees
viii. Formulate and implement awareness activities for local communities, schools, and the local administration
ix. Monitor community participation and assess the implementation of the Bumbuna Watershed Management and Conservation Strategy and Action Plan

x. Ensure the adoption of safeguards to minimise water pollution and inform the community on water quality issues

xi. Establish local health information programmes

xii. Carry out other functions necessary for the attainment of the objectives

In addition, the BWMA is also responsible for conducting a number of programmes / studies that were defined in the EIA and which are funded from the IDA grant, e.g. reservoir fisheries management, ecotourism survey, water quality monitoring, health assessments etc. The BWMA in some cases is conducting such development, implementation and monitoring activities using its own staff, but also contracting out some of the work to service providers such as suitably qualified NGOs and/or academic institutions. The first phase of a four phase year log monitoring of fisheries has been completed and this will be used as a new baseline following full impoundment. Health assessment, biodiversity monitoring and biomass clearing are being contracted out.

Organizational Structure

The two institutional elements of the BMWA are its governing body and its executive body, as follows:

The Board of the Authority, which will consist of a Chairman appointed by the President and the following members:

i. a representative of the Ministry responsible for energy;

ii. a representative of the Ministry, department or commission responsible for environment and forestry;

iii. a representative of the Ministry responsible for local government;

iv. a representative of the Ministry responsible for tourism;

v. the Paramount Chiefs of Diang, Kasunku, and Kalansogoaia Chiefdoms or their representatives;

vi. a representative each, of the District Councils representing the Diang, Kasunku, and Kalansogoaia Chiefdoms;

vii. The Executive Director, as *ex-officio*.

However, it is worth noting that the board is still not in place 9 months after the BWMA became operational. This is a serious challenge to not only the implementation of the activities but also the sustainability.

Funding and Sustainability of the BWMA

The current funding by the World Bank / International Development Association (IDA) has continued into 2014, whilst the Government in principle is committed to providing a small percentage of the tariff money to environmental and social management programs. The Bumbuna Trust Deed is still being finalised and legalised to ensure that a method of sustaining the BWMA is in place.

The objectives of the Bumbuna Trust Company are:

i. community development activities targeted to communities in the Bumbuna Watershed Area;

ii. financing the operations of the Bumbuna Watershed Management Authority (BWMA);

iii. financing the operation of the Bumbuna Conservation Area;

iv. financing the operation of the national park declared for the Loma Mountains region;

v. Financing the operations of the Emergency Action Unit in the implementation of the Emergency Preparedness Plan

vi. Implementation of other measures which may be identified as required for the environmentally and socially sustainable management of the Bumbuna Watershed.