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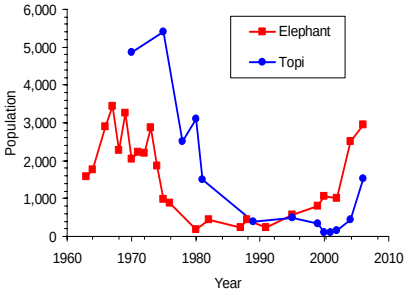

BIODIVERSITY MONITORING IN UGANDA

ASSESSMENT OF MONITORING PROGRAMS

REPORT

By

Gerald Eilu,

Paul Ssegawa

and Concy Olanya

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Cover illustrations: Map of Important Bird Areas of Uganda Integrated with Water Fowl Counts: from Nature Uganda; Graph from NBDB 2006.

LIST OF ACRONYMS

Acronym	Name
AWF	African Wildlife Fund
BCFS	Budongo Conservation Field Station
BD	Biodiversity
CBD	Convention on Biological Diversity
CFM	Collaborative Forest Management
CITES	Convention on International Trade in Endangered Species
COP	Conference of Parties
CoP	Conference of Parties
ECOTRUST	Environmental Conservation Trust of Uganda
GSPC	Global Strategy on Plant Conservation
HIs	Headline Indicators
IGCP	International Gorilla Conservation Project
ITFC	Institute of Tropical Forest Conservation
IUCN	International Union for Conservation of Nature
JGI	Jane Godall Institute
KNP	Kibale National Park
Mak	Makerere University, Kampala
MDGs	Millennium Development Goals
MIST	Management Information System
MUBFS	Makerere University Biological Field Station
MUIENR	Makerere University Institute of Environment and Natural Resources
NaFORRI	National Forestry Resources Research Institute
NARO	National Agricultural Research Organisation
NBDB	National Biodiversity Data Bank
NBSAP	National Biodiversity Strategy and Action Plan
NEMA	National Environment Management Authority
NFA	National Forestry Authority
NGO	Non-Governmental Organization
PAs	Protected Areas
UNEP	United Nations Environment Program
UNFCC	United Nations Forum on Climate Change
USAID	United States Agency for International Development
UWA	Uganda Wildlife Authority
WCMC	World Conservation and Monitoring Centre
WCS	Wildlife Conservation Society
WMD	Wetlands Management Department
WWF	World Wildlife Fund

EXECUTIVE SUMMARY

Countries that are party to the Convention on Biological Diversity (CBD), including Uganda, are obliged to monitor biodiversity (Article 7.b) but many have yet to establish national monitoring programmes. Many animal and plant species have declined in numbers, geographical spread, or both but quantitative monitoring data are not readily available. Human activity has increased the extinction rate of species worldwide by at least 100 times compared to the natural rate. The main factors directly driving biodiversity loss include, but are not limited to, habitat loss, fragmentation of forests, invasive alien species, overexploitation, pollution and climate change.

Biodiversity monitoring data coupled with other environmental data form an important basis for future nature conservation policy and for other policy areas that have a significant impact on biodiversity for example; forestry, agriculture, and wildlife. Biodiversity monitoring can be used to identify negative and positive impacts on biodiversity at an early stage and trigger appropriate action. Distinguishing natural fluctuations from abnormal changes and identifying cause-and-effect relationships between external factors and changes in biodiversity is an important outcome of monitoring.

The unique global status of Uganda in terms of biodiversity necessitates that it is properly managed to prevent unprecedented losses. Uganda has a unique occurrence and distribution of biodiversity, attributed to the country's location within the equatorial belt and the associated physical and climatic features as well as overlap of phytochoria. In Uganda, however, approximately 200 species of plants and animals are red-listed meaning that they are species of global importance for conservation and deserve special attention. However, Uganda lacks a biodiversity monitoring framework through which activities related to biodiversity can be harmonized, and information/data shared to prevent duplication and wastage of scarce resources. Uganda is also obliged to align its biodiversity management goals alongside the 2010 Biodiversity Target and the Millennium Development Goals (MDGs) particularly Goal 7. The CBD recognizes that national participation towards meeting the 2010 Target must be informed and driven by national priorities, but these are unclear for Uganda.

This assessment of biodiversity monitoring programmes was undertaken to meet the requirements of the Terms of Reference (TOR) by accomplishing the following tasks:

(i) To identify the different biodiversity monitoring programmes in Uganda.
(ii) To assess the performance of current monitoring programs in meeting international conventions' targets (focusing on achievements, gaps, challenges and opportunities)
(iii) To document the available resources and strengths of relevant institutions and or individuals.
(iv) To assess the weaknesses and/or gaps within biodiversity monitoring programs.
(v) To explore the linkages between the institutions (institutional collaborations) and within individuals engaged in monitoring.
(vi) To identify opportunities for collaboration, coordination, harmonization and implementation of monitoring programs.
(vii) To assess opportunities for biodiversity monitoring in Uganda

This assessment addresses the general subject of biodiversity monitoring in Uganda. Specifically, the meaning and importance of Biodiversity Monitoring is discussed in the context of relevant policies and legislation as well as International Conventions/Strategies. The International Conventions/Strategies include, for example, the Convention on biological

diversity (CBD), Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), Convention on Wetlands of International Importance (Ramsar), and the Millennium Development Goals (MDGs). A synthesis of Uganda's alignment to the CBD targets is given. The assessment also includes the international institutions relevant for biodiversity monitoring. Those specifically highlighted include the World Conservation Monitoring Centre (WCMC), the International Union for Conservation of Nature (IUCN), World Wide Fund for nature (WWF), Birdlife International and Wetlands International.

The assessment provides and overview of the stakeholders and biodiversity monitoring programmes in Uganda. The major institutions include the Uganda Wildlife Authority (UWA), National Forestry Authority (NFA), Wetlands Management Department (WMD), Nature Uganda, National Environment Management Authority (NEMA), Jane Goodall institute (JGI), Wildlife Conservation Society (WCS), World Conservation Union (IUCN), National Agricultural Research Organisation (NARO), Makerere University as well as other Universities in Uganda, Environmental Conservation Trust of Uganda (ECOTRUST), Uganda National Council for Science and Technology (UNCST) and Uganda Wildlife Education Centre (UWEC). Involvement of the private sector and individuals is highlighted.

A SWOT analysis of the institutions and current biodiversity monitoring programmes in Uganda is given. The performance and linkages of programmes are discussed leading to identification of options for collaboration, harmonization and coordination. This provides the opportunities for biodiversity monitoring in Uganda. In conclusion, the recommendations for biodiversity monitoring in Uganda are provided highlighting the policy and legal framework, monitoring requirements, institutional arrangements, multi-stakeholder dialogue, monitoring and evaluation as well as human, financial and physical resources.

In the general sense, the alignment between Uganda's biodiversity monitoring programmes and the 2010 Target focal areas and identified indicators from national frameworks is moderate for indicators associated with biodiversity status, trends and threats, and for water ecosystem services. Alignment is moderate for indicators of genetic diversity and sustainable use, weak for the rest.

Assessment of alignment of indicators and for which data have been collated reveals several gaps. While some alignment exists for indicators of biodiversity status, trends and threats, very few indicators have been developed for the focal areas of sustainable use, ecosystem integrity and ecosystem services. There is almost no indication of work in the various biodiversity monitoring programs on socio-cultural themes of indigenous knowledge, access and benefit sharing and resource transfers. These gaps are a result of the historical sectoral focus, but are also strongly influenced by data availability and the resources required to collect new data. This is demonstrated by the comparatively good data on ecosystems and selected species distributions, compared to the general absence of data at the sub-specific level, for example, genetic diversity

There are constraints in achieving the set 2010 Target and MDG goals including (a) Lack of well articulated objectives in the various monitoring programmes (b) Neglect of different sources of error in the estimation of biological diversity (c) inability to contribute to biodiversity conservation because of ineffectiveness in integrating information into decision making. These constraints are particularly acute at a time when there is an urgent need to increase the effectiveness of conservation efforts in Uganda.

Suggestions to ensure the success of the biodiversity monitoring in Uganda and which may inform the process of development of the biodiversity monitoring framework to enable Uganda achieve the 2010 Biodiversity target include: (i) giving serious thought to the question of design, and to 'how", "what" and "why" to monitor. (ii) keeping the methods simple, cost-effective and possible to sustain with limited external support, and ensuring that the time from data sampling to management action is short; (iii) putting in place a proper mechanism for coordination i.e. the National Biodiversity Monitoring Unit and a Clearing House Mechanism to guide access and utilization of data.

If financial support for monitoring is to be provided by government and development agencies, it will be essential that the programmes make a real contribution to arresting the root causes of extinction. Otherwise the biodiversity monitoring programme in Uganda will remain no more than isolated academic exercises hardly making input into policy and legislation.

CHAPTER ONE

1.0. OVERVIEW OF BIODIVERSITY MONITORING IN UGANDA

1.1. Introduction

The term biodiversity refers to the number, variety and variability of living organisms. It includes diversity within and between species, and among ecosystems. Uganda is rich in biodiversity relative to its size. This is attributed, among others, to its unique bio-geographical location, harbouring seven of Africa's 18 phytochoria- more than any other African country- its diversity of species is one of the highest on in Africa (Davenport and Matthews, 1995).

Uganda has more than 18,783 species of fauna and flora recorded (NEMA, 2004). This includes more than half of Africa's bird species. Uganda is second to the Democratic Republic of Congo in terms of number of mammal species. The number of species of various taxa of flora and fauna are summarised in Table 1. These are distributed in various ecosystem types such as forests, woodlands, wetlands, aquatic and modified systems.

Table 1. Numbers of genera and species in major taxonomic groups of Uganda's biota

Group	Genera	Number of species	Percentage of world species represented in Uganda
Acarines	23	133	N/A?
Algae	49	115	0.5
Amphibians	19	67	1.6
Annelids	6	9	0.1
Bacteria	137	N/A	N/A
Birds	347	1007	11.1
Crustacea	18	37	N/A
Dicotyledons	1258	4056	2.4
Ferns	102	386	3.9
Fish	64	350	2.0
Fungi	184	420	1.4
Gymnosperms*	10	40	7.6
Insects	3170	8999	1.2
Lichens	51	296	1.6
Mammals	153	345	7.8
Molluscs	23	81	0.2
Monocotyledons*	323	1238	2.5
Mosses	39	500	2.9
Nematodes	69	126	1.0
Protozoa	27	141	0.4
Reptiles	75	256	4.1
Viruses	58	88	4.4

Source: MUIENR, 1999; **Include exotics; approximate number of species of bacteria is not known. N/A – Not available*

The unique global status of Uganda in terms of biodiversity necessitates that the resource is properly managed to prevent unprecedented losses. About 200 species of plants and animals are red-listed for Uganda, meaning that they are species are of global importance for conservation deserving special attention. Moreover, Uganda has approximately 30 endemic plants including those with limited distribution, such as some Aloes found only on rocky outcrops on rocks in Tororo and Mubende. One endemic species of bird, the Fox's Weaver, is only found around Lake Opeta and Lake Bisina in eastern Uganda outside the PAs. Some of the species are endemic to the Albertine rift region which has received considerable attention partly because of the mountain gorillas. About 600 cichlid fish species are regionally endemic to Lake Victoria and other water bodies in the East and Central African region. Uganda has about 70 species of endemic butterflies (USAID, 1992).

Biodiversity loss has impacts on several aspects of human well-being, such as food security, vulnerability to natural disasters, energy security, and access to clean water and raw materials. Many animal and plant populations in Uganda have declined in numbers, geographical spread, or both. Human activity is the primary cause of these declines. Overall, the human activities that directly driving biodiversity loss are manifested as: habitat loss and fragmentation; invasive alien species; overexploitation of species; and pollution.

To protect biodiversity and ecosystem services, direct and indirect drivers of loss must be addressed. Possible actions include eliminating harmful subsidies, promoting sustainable intensification of agriculture, adapting to climate change, limiting the increase in nutrient levels in soil and water, assessing the full economic value of ecosystem services, increasing the transparency of decision making processes and effective biodiversity monitoring.

1.2. Meaning and Importance of Biodiversity Monitoring

Monitoring involves the 'intermittent (regular or irregular) series of observations, carried out over time to show the extent of compliance with a formulated standard or degree of deviation from an expected norm; it can be used for basic research, status assessment and measurement of effectiveness. Biodiversity monitoring, therefore, focuses on a series of observations on genes, taxa, and ecosystems/habitats or any combinations of these.

Biodiversity monitoring is a tool for measuring the progress and effectiveness of conservation measures, and to detect biological trends in response to natural and human induced disturbances in the environment. During the monitoring process different approaches can be followed over a certain time period. For example;

- An All Biota Taxonomic Inventory (ABTI) that focuses on a number of key species groups such as birds, fishes, mammals and plants.
- An All Taxa Biodiversity Inventory (ATBI) that focuses on the description of all species present in a certain area
- A Rapid Biodiversity Assessment (RBA) that provides an inventory of selected species giving a quick estimate of the biological richness of an area.

Biodiversity monitoring data coupled with other environmental data form an important basis for nature conservation policy and for other policy areas that have a significant impact on

biodiversity for example in forestry, agriculture, wildlife. Biodiversity monitoring can be used to identify negative and positive developments in biodiversity at an early stage to trigger appropriate action.

The ability to distinguish natural fluctuations from changes caused by human activities is essential for monitoring. To identify cause-and-effect relationships between external developments as well as changes in the biological community is an important requirement of biodiversity monitoring.

1.3. Context of Biodiversity Monitoring in Uganda

The monitoring of biodiversity, like other forms of monitoring, falls under strategic planning. Biodiversity monitoring (i) measures progress towards strategic targets, (ii) ensures attainment of national and international targets, and (iii) provides the scientific basis for identifying the need for further intervention measures. A nationwide strategy that would ensure that these goals are attained is lacking for Uganda.

It is necessary to develop a national strategy for monitoring biodiversity to prevent current and future losses of biodiversity in Uganda. The National Biodiversity Strategy and Action Plan (NBSAP) highlights the need to develop indicators for and subsequently monitor biodiversity. Specific ways of achieving this are, however, not highlighted. The National Important Bird Area Conservation Strategy (NIBACS), however, addresses the issue of conservation efforts (including monitoring) of the IBAs more comprehensively and makes an important foundation for development of national monitoring plan.

The management of biodiversity is a complex matter that needs the involvement of many different partners ranging from governmental organisations to private companies, NGO's and volunteers. National and international commitment, legislation and enforcement offer an essential framework for promoting and maintaining biodiversity. In Uganda, government contribution is still minimal.

Biological resources in Uganda support the livelihoods of many people and yet it is steadily declining, thus the government has to be committed to ensuring their conservation and sustainable use. A study by MUIENR (2006), for example, shows that between 1970 and 2006 there has been a decline of about 10% in species number largely because of the drastic decline in the population of fish in Lake Victoria. Conversion of forest and savanna lands to sugar cane and oil palm plantations between 1970 and 2000 have also led to a loss of about 12% of biodiversity due to habitat loss and destruction. The government has signed several international conventions that require more commitment to conservation. Examples include: Convention on Biological Diversity (CBD); Convention on International Trade in Endangered Species of wild fauna and flora (CITES); Convention on Wetlands of International Importance especially as water fowl habitats (Ramsar) ; United Nations Framework Convention on Climate Change (UNFCCC). In addition to the international conventions the government of Uganda has put in place various laws, policies, statutes and regulations to promote conservation of biodiversity. These include; the constitution of the republic of Uganda; the Uganda Wildlife Act, the National Forestry and Tree Planting Act 2003, the Tourism Policy as well as the Wetlands Policy (1995), among others.

Over the years several institutions and organizations have also been formed to contribute to the conservation of biodiversity in Uganda. Examples include; UWA; NFA; WCS; NEMA; ECOTRUST; WMD, NBDB; *Nature*Uganda among others. These organizations participate in monitoring at different levels, from specific taxonomic groups to a more general coverage of ecosystem types. The various efforts should ideally be guided and supported by the conventions ratified by the government of Uganda as well as the relevant policies/legislation.

1.4. Biodiversity Monitoring and International Conventions/Strategies

1.4.1. Convention on biological diversity (CBD)

The Convention on Biological Diversity is crucial for the monitoring of biodiversity. It was adopted by Uganda in Rio de Janeiro in June 1992. It has three main goals: (i) conservation of biological diversity (or biodiversity); (ii) sustainable use of its components; and (iii) the fair and equitable sharing of benefits arising from genetic resources. The objective of CBD is to develop national strategies for the conservation and sustainable use of biological diversity. Uganda ratified the CBD in 1993. This convention is of direct relevance for biodiversity monitoring.

The target of CBD is to achieve, by 2010, a significant reduction of the current rate of biodiversity loss at the global, regional and national levels. This is a contribution to poverty alleviation and to the benefit of all life on earth. COP 7 identified the following focal areas:

(a) Reducing the rate of loss of the components of biodiversity, including: (a) biomes, habitats and ecosystems; (b) species and populations and; (c) genetic diversity;
(b) Promoting sustainable use of biodiversity;
(c) Addressing the major threats to biodiversity, including those arising from invasive alien species, climate change, pollution, and habitat change;
d) Maintaining ecosystem integrity, and the provision of goods and services provided by biodiversity in ecosystems, in support of human well-being;
(e) Protecting traditional knowledge, innovations and practices;
(f) Ensuring the fair and equitable sharing of benefits arising out of the use of genetic resources;
(g) Mobilizing financial and technical resources, especially for developing countries, in particular least developed countries and small developing island states among them, and countries with economies in transition, for implementing the Convention and the Strategic Plan.

A list of indicators that would identify the extent to which efforts to halt biodiversity loss are working were proposed during the conference of the parties to the CBD in 2004. In its recommendation IX/13, SBSTTA recommended that the following five indicators be tested immediately:
(a) Trends in extent of selected biomes, ecosystems and habitats;
(b) Trends in abundance and distribution of selected species;
(c) Change in status of threatened species;
(d)Trends in genetic diversity of domesticated animals, cultivated plants, and fish species of major socioeconomic importance; and
(e) Coverage of protected areas: It was also recommended that indicators for the following should be developed:

(i) Threats to biodiversity;

(ii) Ecosystem goods and services; and
(iii) Equitable sharing of benefits arising from the use of genetic resources.

Meeting the target of significantly reducing the loss of biodiversity by 2010 is a widely accepted global goal, with an even stronger goal: to stop the loss by 2010. Biodiversity indicators are among the best tools to assess and show the progress towards the 2010 targets. Hence, various efforts are presently undertaken by many national and international organisations to develop and coordinate work on the relevant biodiversity indicators. The Convention on Biological Diversity Secretariat is now the overall global arrangement in this development, working with several organisations to meet these targets.

One of the initiatives developed in line with the CBD is the Global Strategy for Plant Conservation. The main objective of this strategy is to halt the current and continuing loss of plant diversity. The strategy also provides a framework to facilitate harmony between existing initiatives aimed at plant conservation, to identify gaps where new initiatives are required, and to promote mobilization of the necessary resources. It also serves as a tool to enhance the ecosystem approach to the conservation and sustainable use of biodiversity and focus on the vital role of plants in the structure and functioning of ecological systems and assure provision of the goods and services such systems provide. The 2010 CBD targets for the Global Strategy Plant Conservation are relevant for biodiversity monitoring.

Another initiative is the Program of work on Protected Areas (PAs). The overall purpose of the programme is to support the establishment and maintenance (by 2010 for terrestrial and by 2012 for marine ecosystems) of areas of comprehensive, effectively managed, and ecologically representative national and regional systems of PAs. These should collectively, *inter alia* through a global network contribute to achieving the three objectives of the Convention and the 2010 target i.e. to significantly reduce the current rate of biodiversity loss at all levels; contribute to poverty reduction; and pursue sustainable development. This would support the objectives of the Strategic Plan of the Convention.

The goal of this programme was to avoid unnecessary duplication with existing thematic work programmes and other ongoing initiatives of the CBD, and to promote synergy and coordination with relevant programmes of various international organizations. Parties are encouraged to apply, where appropriate, the objectives and activities from these thematic work programmes and the work on cross-cutting issues.

1.4.2. Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)

The aim of CITES is to ensure that international trade in specimens of wild animals and plants does not threaten their survival. Today, CITES accords varying degrees of protection to more than 30,000 species of animals and plants, whether they are traded as live specimens, fur coats or dried herbs. Like CBD, CITES targets to significantly reduce the rate of biodiversity loss by 2010.

The species covered by CITES are listed in three Appendices, according to the degree of protection they need.

- CITES Appendix I include species threatened with extinction. Trade in specimens of these species is permitted only in exceptional circumstances.
- CITES Appendix II includes species not necessarily threatened with extinction, but in which trade must be controlled in order to avoid utilization incompatible with their survival.
- CITES Appendix III contains species that are protected in at least one country, which has asked other CITES Parties for assistance in controlling the trade.

Roughly 5,000 species of animals and 28,000 species of plants are protected by CITES against over-exploitation through international trade. They include groups, such as primates, parrots, and orchids that occur in Uganda.

Uganda ratified this convention in 1987, but no comprehensive regulations are in place although the wildlife act has provisions for the preservation of species of conservation concern. The ministry of Trade, Tourism and Industry with UWA, NFA and UNCST ensure the implementation of this convention to control the trade on endangered flora and fauna.

1.4.3. Convention on Wetlands of International Importance (Ramsar)

The Ramsar Convention is an international (intergovernmental) treaty for the conservation and sustainable utilization of wetlands. The goal is to protect and ensure sustainable use of wetlands and their resources through national measures and international cooperation. The Ramsar List of Wetlands of International Importance now includes 1,822 designated sites covering around 168,738,934 hectares.

Uganda ratified the Ramsar convention in 1988. A total of 11 sites are presently listed as Ramsar sites for Uganda covering 354,803 hectares. The list includes the following: Lake George, Lutembe Bay and the wetland systems of L. Bisina; L. Mburo-Nakivali; L. Nabugabo; L. Nakuwa; L. Opeta; Mabamba Bay; Murchison Falls-Albert Delta; Nabajjuzi Wetland; and Sango Bay-Musambwa Island-Kagera. Plans are underway to include additional sites such as Rwenzori Mountains. *Nature*Uganda and WMD assisted among others, by UWA, NFA, NBDB and NEMA have played a major role of contributing to the objectives of the Ramsar convention in line with their mandates.

One of the major achievements towards the objectives of Ramsar has been the development of Uganda's National Wetlands Policy in 1995. The process of enacting the accompanying law is in progress. The policy was the first such policy in Africa and the second in the world after Canada's. In Uganda, wetlands are enshrined in the National Constitution as ecosystems of great value to the nation and are held in trust by the government for the benefit of the people.

1.4.4. Millennium Development Goals (MDGs)

The Millennium Development Goals (MDGs) to be achieved by 2015, target the world's main development challenges. Goal 7 “to ensure environmental sustainability” is a major focus of institutions involved in biodiversity monitoring. The target to reduce biodiversity loss,

achieving by 2010, and a significant reduction in the rate of loss is relevant for monitoring. Success of attainment of this goal can be ascertained by monitoring the following indicators: proportion of land area covered by forests; consumption of ozone-depleting substances; proportion of fish stocks within safe biological limits; proportion of total water resources used; proportion of terrestrial and marine areas protected; proportion of species threatened with extinction. The NFA, UWA, *Nature*Uganda, Makerere University, WCS, WMD and NEMA are involved in monitoring activities which are relevant for these indicators.

1.5. International Institutions Relevant for Biodiversity Monitoring

1.5.1. World Conservation Monitoring Centre (WCMC)

The activities of UNEP-WCMC include biodiversity assessment, support to international conventions such as the CBD and CITES, capacity building and management of data on taxa and habitats of conservation concern. UNEP-WCMC has a mandate to facilitate the delivery of the global indicators under the CBD's 2010 biodiversity target on the rate of loss of biological diversity. It also manages the World Database of PAs in collaboration with the IUCN-World Commission on PAs. Data required by this organisation from Uganda are provided by various institutions.

1.5.2. International Union for Conservation of Nature (IUCN)

The International Union for Conservation of Nature, helps the world find solutions to the most pressing environment and development challenges. It supports scientific research, manages field projects in various parts of the world and brings together government, non-government organizations, United Nations agencies, companies and local communities to develop and implement policies, laws and best practices for conservation. IUCN works in more than 160 countries.

Each year, IUCN reports to the World Heritage Centre on the conservation status of certain natural and mixed World Heritage sites, as well as cultural landscapes. The State of Conservation report based on reactive monitoring of specific World Heritage properties includes those inscribed on the List of World Heritage Sites in Danger. In addition, the United Nations (UN) now uses the IUCN Red List to measure success towards attainment of MDG 7.

1.5.3. World Wide Fund for nature (WWF)

The WWF is a non-profit (charity) foundation aimed at stopping the degradation of the planet's natural environment and building a future in which humans live in harmony with nature. The approach is by conserving the world's biological diversity; ensuring that the use of renewable natural resources is sustainable; and promoting the reduction

of pollution and wasteful consumption. WWF works in more than 100 countries world-wide funding efforts aimed at reducing the loss of biodiversity. Many of the programmes are species specific and are relevant for biodiversity monitoring. The WWF has developed methods such as the Living Planet Index for monitoring the impacts of human activities on Biodiversity.

1.5.4. Birdlife International

BirdLife International is a global Partnership of conservation organisations that strives to conserve birds, their habitats and global biodiversity, working with people towards sustainability in the use of natural resources. BirdLife Partners operate in over 100 countries and territories worldwide. The partners collaborate on regional work programmes in every continent. BirdLife's work in Africa, for example, gives high priority to empowering people to manage and benefit from sustainable use of natural resources through livelihoods improvement, achieved through a four-pronged strategic objective of: Species, Sites, Habitats and People. BirdLife's Africa Division is involved in and coordinates a number of regional and national initiatives. Programmes of immediate relevance to biodiversity monitoring include the Africa IBA Monitoring i.e. instituting effective monitoring of Protected Areas (Important Bird Areas) as a contribution to reducing the rate of biodiversity loss in Africa; as well as Monitoring Africa's IBAs through Remote Sensing.

1.5.5. Wetlands International

Wetlands International is a global organisation that works to sustain and restore wetlands and their resources for people and biodiversity. Wetlands International's mission is "to sustain and restore wetlands, their resources and biodiversity for future generations". Wetlands International is a science-based organization that provides ' tools' and information to assist governments in the protection and restoration of wetlands. It works to influence relevant policies, conventions and treaties. Wetlands International is a source of best-informed opinion on key issues affecting wetlands and priority actions for their conservation and wise use, drawing on scientific analyses and its own experience in global and national conservation programmes. It is particularly relevant for the implementation of the Ramsar Convention including the monitoring aspects.

CHAPTER TWO

2.0. STAKEHOLDERS AND BIODIVERSITY MONITORING PROGRAMMES

2.1. Institutions and national monitoring programmes

2.1.1. Uganda Wildlife Authority (UWA)

The Uganda Wildlife Authority (UWA) was established in August 1996 by the Uganda Wildlife Statute, which merged the Uganda National Parks and the Game Department. UWA is in charge of management of National Parks, Wildlife Reserves, and Wildlife Sanctuaries. It provides guidance for five Community Wildlife Areas. It is mandated to manage all wildlife (mainly fauna) in Uganda including those outside PAs. The IBA monitoring project is involved in 10 National Parks and three Wildlife Reserves. This could greatly improve biodiversity monitoring in the UWA estate. UWA is supported primarily by donor funds, the longevity of which are uncertain. The Wildlife Policy and Wildlife Statute give UWA a strong mandate to preserve and manage biodiversity and also provides a framework to enable partnership with communities neighbouring national parks. UWA is expected to become less dependent on external funding and to be partially self-supporting, primarily through tourism receipts.

UWA is committed to the international Conventions and Protocols for which Uganda is a party. These include; CBD, CITES and others that have been ratified. Since it also manages some of the forested protected areas, UWA adheres to the forest management practices consistent with the Forest Stewardship Council (FSC) Principles and Criteria.

The UWA has a Monitoring and Research Unit which receives operational and capital development funds from the Uganda Wildlife Authority and from externally funded projects. In the 1990s the Uganda Institute of Ecology (UIE) played a key role in research and monitoring within the savanna ecosystems that characterised many of the National Parks. The abolition of this role left a gap in the monitoring efforts previously carried out by this institute. Currently UWA carries out monitors threats to biodiversity in the different parks. The threats are divided into those i) that are common to most PAs, ii) that are specific to specific PAs and iii) other parameters not directly linked to threats. Animal populations, climate, habitat changes, use of migration corridors and regeneration of degraded areas where active, restoration is taking place are monitored. UWA has a spatial Management Information System (MIST) to provide managers and planners with up-to-date information for their planning, decision-making and evaluation. MIST is located in an Information Management Unit at UWA. Standardised data sheets have been developed for the recording of (1) ecological data and data on illegal activities, (2) visitor data at park gates and (3) data on resource harvest by local communities. These are essential for biodiversity monitoring and could benefit a national biodiversity monitoring programme. The outputs of MIST include (1) indices for monitoring of wildlife populations; illegal activities and resource harvest by local communities; (2) distribution maps for planning and monitoring; (3) baseline information for patrol deployment planning; (4) information on wildlife population structure; (5) performance indicators to monitor and evaluate the implementation of annual operations plans; and (6) reports for collaborating institutions.

2.1.2. National Forestry Authority (NFA)

The NFA was set-up to achieve specific objectives which include among others: Improving the management of the Central Forest Reserves to provide a sustainable yield of forest products; expanding partnership arrangements so as to substantially increase the size of the Central Forest Reserve area being managed under arrangements with local governments, communities and private investors; and supplying good quality products and services such as timber, technical advice, seeds, seedlings and forestry-related services to both public and private consumers on a contractual basis.

Biodiversity monitoring does not feature prominently among the objectives for which the NFA was established, however the NFA (or the then Forest Department) conducted a biomass assessment covering the whole of the country. Some of the sample plots have been maintained as Permanent Sample Plots and are monitored regularly. The new forestry policy entrusts ownership of natural resources on private and customary with the landowners which is relevant to any national framework for biodiversity monitoring but is difficult to implement. Within the Central Forest Reserves, the NFA has a number of Permanent Sample Plots (PSPs) which have been maintained irregularly but not recently re-measured. These have in the past been used to monitor regeneration, growth and recruitment with the goal of calculating yield increments. The database containing the PSP data are housed at the Biomass Unit of the NFA while other data are held by NaFFORI and could form the basis of a new national monitoring programme. Continuity of datasets from the 1930s is unclear as new PSPs were established in the late 1990s.

2.1.3. The Wetlands Management Department (WMD)

The department administers the National Policy for the Conservation and Management of Wetland Resources and is implementing the Wetland Sector Strategic Plan 2001-2010 (WSSP). This plan integrates closely with the Poverty Eradication Action Plan by promoting increased income and improved quality of life of the poor. The department provides oversight, monitoring, and technical support for district wetlands programs/ activities. It recognizes the Plan for Modernization of Agriculture (PMA) mandate to use wetlands wisely in a way compatible with the vital functions and natural properties of the ecosystem. It is also mandated to monitor biodiversity in wetlands.

2.1.4. The National Environment Management Authority (NEMA)

The National Environment Management Authority is the principal government agency for the management of the environment. Provisions of the CBD are included in the National Environmental Statute (1995) which mandates NEMA to: undertake research and disseminate information about the environment; and to prepare and disseminate the state of environment report (SOER) once every two years (each lead agency charged with the management of a section of the environment is required to submit a report of its operations for inclusion into the SOER). NEMA is mandated to coordinate biodiversity monitoring and provide a framework through which monitoring can be carried out. NEMA should play a coordination role and guide biodiversity monitoring in Uganda. NEMA, for example, is the Secretariat for the Technical Committee on Biodiversity Conservation. Recently, UWA, NEMA, WMD and NFA formed a

Biodiversity Conservation Coordination Initiative (BCCI) to further strength co-ordination and networking between these institutions in the management and conservation of biodiversity in the country. This should provide a framework within which the biodiversity monitoring plan will be developed and coordinated. In terms of biodiversity, NEMA is the CBD national focal point for Uganda and hosts the desk officer coordinating the implementation of the Convention in the country. The National Environment Act gives NEMA, among others, the mandate to coordinate activities in biodiversity conservation and management including development of NBSAP and coordinating its implementation, development of regulations on ABS and enforcing the regulations. NEMA has worked with the National Council for Science and Technology (UNCST) and other partners to draft regulations on access to genetic resources.

NEMA oversees the National Environment Management Plan and the implementation of the National Environment Action Plan (NEAP). NEMA is expected to encourage, supervise, monitor and co-ordinate environmental actions among and between sectors, provide technical and training input and provide policy level assistance to other agencies. NEMA is working to develop and implement district environmental action plans.

2.1.5. *Nature*Uganda

*Nature*Uganda is the operational name of the East Africa Natural History Society (EANHS) in Uganda. *Nature*Uganda has made a major contribution on the status of Uganda's birds and their habitats. *Nature*Uganda is involved in gathering atlas data on Uganda's biodiversity. The Society operates through a number of working groups with special interests. The working groups are: BirdLife Uganda (birds); Plants Working Group (plants); Mammals Working Group (mammals); Herps Working Group (amphibians and reptiles); Microbial Working Group (microbes); and Friends of the Dudus (Arthropods).

The activities of *Nature*Uganda include: identification of areas important for conservation, biodiversity research; monitoring and development of appropriate action plans management of species, sites and habitats among others. Implementation of these plans is done with all the stakeholders' including the local communities. In partnership with the Wetlands Management Department, *Nature*Uganda led the process of identifying and gazetting sites that qualify for Ramsar listing. A total of 11 Ramsar sites have been gazetted through this initiative.

The research and monitoring programmes of *Nature*Uganda are conducted through: research by technical groups; project level research and monitoring programmes; Site support Groups (SSG); African Waterfowl censuses; land birds monitoring programmes; raptor monitoring programmes; Vulture censuses; MSc and PhD students; and Consultancies related to monitoring

The society has published a book titled "Important Bird Areas of Uganda". *Nature*Uganda is implementing the Important Bird Area Monitoring Project which is a regional project in eight African countries namely Zambia, Zimbabwe, Botswana, Tunisia, Burkina Faso, Burundi, Kenya and Uganda. Instituting effective monitoring of Protected Areas (Important Bird Areas) is necessary as a contribution to reducing the rate of biodiversity loss in Africa. The various *Nature*Uganda programmes involve efforts of various collaborators offering opportunity for a national monitoring programme.

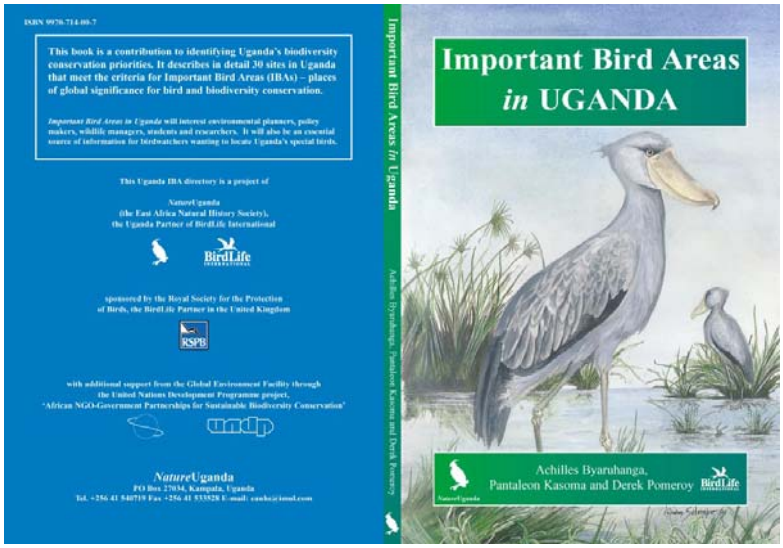


Figure 1. NatureUganda played a major role leading to the publication of the book titled: Important Bird Areas in Uganda

The major monitoring programmes are: the IBA monitoring Programme; Water bird Monitoring (bi-annual) - jointly with staff from Makerere University where the data are kept at the National Biodiversity Data Bank (NBDB); Conservation of Biodiversity in Agricultural Landscapes (COBA) project; Additional linkages that *Nature*Uganda is involved in include the following:

- MUIENR/WCS/*Nature*Uganda on the COBA project;
- *Nature*Uganda/MUWRP/Mak-Veterinary Department/Institute of Public Health on the AIPI (African Influenza Pandemic Initiative) Project
- *Nature*Uganda and the Site Support Groups (e.g. in Mabamba, Musambwa, Nyamuriro and others)
- *Nature*Uganda/IUCN/WMD in relation to the Ramsar sites, IBAs, and work with local communities.
- WCS/UWA/local communities and local governments.

*Nature*Uganda is keen to consolidate the different programmes, involve different stakeholders and improve implementation.

2.1.6. Wildlife Conservation Society (WCS)

The Wildlife Conservation Society is involved in various efforts to save wildlife and wild lands. It is implementing the Albertine Rift Program whose goal is to improve conservation in this biologically rich region by focusing on providing information for managers of PAs, building capacity to better manage these areas, and encouraging collaboration across national boundaries. Biological surveys are being completed to identify the priority areas for conservation. Socioeconomic surveys will be used to make better plans to alleviate poverty in the communities that border the PAs. A national action plan is being produced for chimpanzees in Uganda, and a regional action plan for an endangered endemic bird, Grauer's rush warbler, is being implemented in collaboration with *Nature*Uganda and RSPB. Using the latest satellite imagery and analysis techniques, WCS is involved in assessing the rate of forest loss in the Albertine Rift. These analyses highlight the areas that are most threatened by habitat destruction.

The WCS has worked with the Uganda Wildlife Authority (UWA) over the last two years, to develope a monitoring and research plan for every national park and wildlife reserve in Uganda. This project links the monitoring of PAs to strategies being used to address the threats to them. Wardens assess the effectiveness of their actions and how they can adapt to changes as they appear. WCS has also been undertaking surveys of all the forested PAs in western Uganda to determine baseline numbers of species for future monitoring. Such a survey led to a complete census of chimpanzees in Uganda and the development of an action plan for their conservation with UWA. A census of the mountain gorilla populations in Bwindi and the Virungas, was done recently giving a clearer picture of their population. Surveys have also been carried out to develop zoning plans for the forests based on biological criteria to ensure that few valuable areas can be accessed by local people for utilization purposes.

Other projects that WCS has undertaken or is currently involved in include the following: Production of National monitoring and research plan with UWA and NFA; nationwide census of chimpanzee and gorilla populations; training of wardens in UWA and Forest Officers in NFA in adaptive management; training of monitoring wardens in ground census methods and employing them to survey species in PAs; assessment of impacts of tourism on mountain gorillas; and development of a mammal conservation group within *Nature*Uganda. These are directly relevant for biodiversity monitoring. WCS plans to undertake an economic valuation of forests to show their importance in poverty alleviation; and to undertake landscape species research in the Greater Virunga Landscape to ensure their long-term survival. This will be achieved by supporting cross border collaboration between Uganda (UWA) and conservation organizations in the Democratic Republic of Congo.

WCS is developing and implementing training programs with its partners who manage the PAs to improve the monitoring and research capacity of these institutions so that they will be better able to adapt their management to the changing threats to parks and reserves. WCS is targeting those areas identified as having the greatest threats or needs. In the future WCS will: continue to develop a program of cross-border collaboration among Uganda, Rwanda, and the DRC; develop a training program for wardens to establish better management in PAs; conduct surveys on impacts of the war in Uganda, Rwanda, and DRC; and Continue to monitor the biodiversity in the region and use remote-sensing to investigate changes in habitat on a large scale.

2.1.7. The World Conservation Union (IUCN)

The IUCN seeks to influence, encourage and assist societies throughout the world to conserve the integrity and diversity of nature and to ensure that any use of natural resources is equitable and ecologically sustainable. IUCN-Uganda has been particularly active in the wetlands program and Integrated Conservation and Development projects around Mt Elgon National Park as well as Kibale/Semliki National Parks. The goal of this international organization is to support organizations and individuals throughout the world who are interested in the environment. IUCN is vital in the monitoring of Protected Areas (PAs) and Red list species.

2.1.8. National Agricultural Research Organisation (NARO)

The National Agricultural Research Organisation (NARO) is the apex body for guidance and coordination of all agricultural research activities in the national agricultural research system in Uganda. NARO is a Public Institution established by an act of Parliament, which was enacted in

November 2005. NARO operates within the National Agricultural Research System (NARS) provided for by the National Agricultural Research ACT. The purpose of the NARS is of improving agricultural research services delivery, financing and management. The NARS means a cross section of stakeholders (in the public or private sectors); and comprises of the public agricultural research institutes, universities and other tertiary institutions, farmer groups, civil society organisations, private sector and any other entity engaged in the provision of agricultural research services. The NARS institutional framework promotes vertical and horizontal linkages with other national, regional and international institutions. This is important for biodiversity monitoring within the agricultural context.

The national agricultural research institutes under NARO have the objective to manage and carry out agricultural research of a strategic nature and of national importance. Examples include the National Crops Resources Research Institute which is the administrative home of the National Horticulture Research Unit among others.

Other national agricultural research institutes include the fisheries resources; livestock resources; semi arid resources; and the national agricultural research laboratories (which includes the agricultural research information service; agro-meteorological unit; biological control research unit; national agricultural biotechnology laboratory; plant genetic resources research and Entebbe Botanical Gardens; and the soils and soil research unit. The National Forestry Resources Research Institute (NaFORRI) is involved in forestry related research. NaFoRRI is mandated to carry out long term research in the Central Forest Reserves. This is important for monitoring the permanent sample plots in some of the reserves (e.g. Budongo).

NARO also has Zonal Agricultural Research and Development Institutes (ZARDIs) whose objectives are to manage and carry out agricultural research (applied or adaptive) for a specific agro-ecological zone. The ZARDIs which are currently operational are: Abi; Bulindi; Kachwekano; Mbarara; Mukono; Ngetta; and Nabuin.

Currently NARO is coordinating the GEF funded project on removing barriers to the control of Invasive Alien Species (IAS). This role could be strengthened with the mandate taken on by the National as well as the zonal institutes which have facilities that could be developed for monitoring IAS and other aspects of biodiversity on agricultural land.

2.1.9. Makerere University

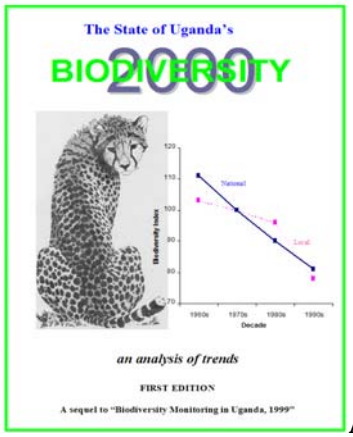
A number of Makerere University faculties, institutes, and departments have been involved in various aspects of Biodiversity Monitoring. The most relevant among these include the following (Table 1):

The MUIENR-NBDB, for example, has been instrumental in the preparation of the State of Uganda's Biodiversity Reports (Figure 2A) on a bi-annual basis showing trends in selected taxa or ecosystems. This series of reporting can be strengthened as part of national level monitoring. The universities also offer a big opportunity for manpower since they train students that conduct research in various parts of the country. The contribution of students can be harnessed and coordinated to contribute regularly to a monitoring programme.

Table 1. Biodiversity Monitoring Units and Programs in Makerere University

Faculty/Department	**Monitoring Programme/Data management Unit**
Faculty of Agriculture	Entomology
Faculty of Arts, Department of Geography	Meteorology; Mountain ecosystems
Faculty of Science, Department of Botany	-Permanent Sample Plots in Mpanga Forest Reserve -The Makerere University Herbarium with collections of specimens and a herbarium database in BRAHMS, VISUAL Plants
Faculty of Science, Department of Zoology	-Mammals e.g. Bats -Zoology Museum with preserved specimens of fauna
Faculty of Forestry & Nature Conservation, Department of Forest Management • Budongo Conservation Field Station • BIOTA	-Chimpanzee monitoring -UFRIC- forest management project: Ecosystem level changes, for example, of forest boundaries in the Buto Buvuma forest -Tree growth network
School of Medicine and Public Health	
Makerere University Institute of Environment and Natural Resources (MUIENR) • Makerere University Biological Field Station • National Biodiversity Data Bank (NBDB)	-Primate Populations -All taxa- (flora and fauna); the NBDB is a major repository of data in Uganda particularly from the IBAs and the Forest Inventories
Faculty of Veterinary Medicine, Wildlife Management Department	-Wildlife diseases

Examples of trends from previous studies reported by the NBDD include, for example, the fish showing a dramatic decline, especially in L. Victoria (Figure 2B). The estimates put L. Victoria species at 500 until mid-70s and 300 since mid-80s.



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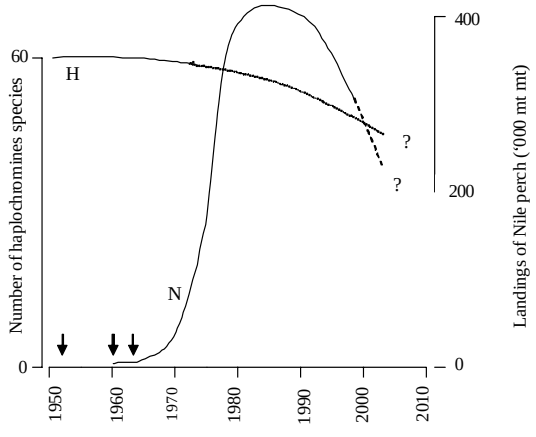

B

Sources (BD 2002)

Figure 2. A) State of Uganda's Biodiversity published by the National Biodiversity Data Bank presents an analysis of trends in biodiversity in Uganda; B) Dramatic decline in fish species in Lake Victoria following the introduction of Nile Perch.

Various databases held in Makerere University e.g. VISUAL Plants for taxonomic information (Figure 3) and BRAHMS (Figure 4) provide a very useful basis for a national monitoring programme on plants.

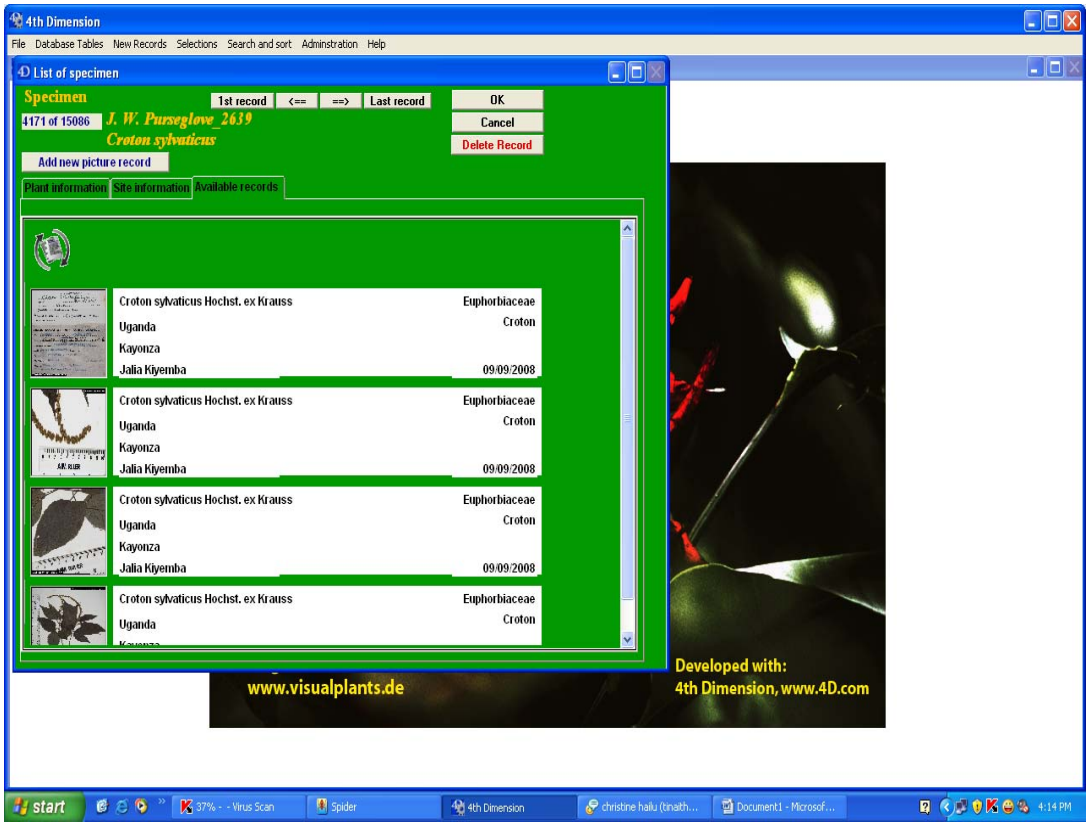

Figure 3. The BIOTA Visual Plants Database in Makerere University provides taxonomic information on plants

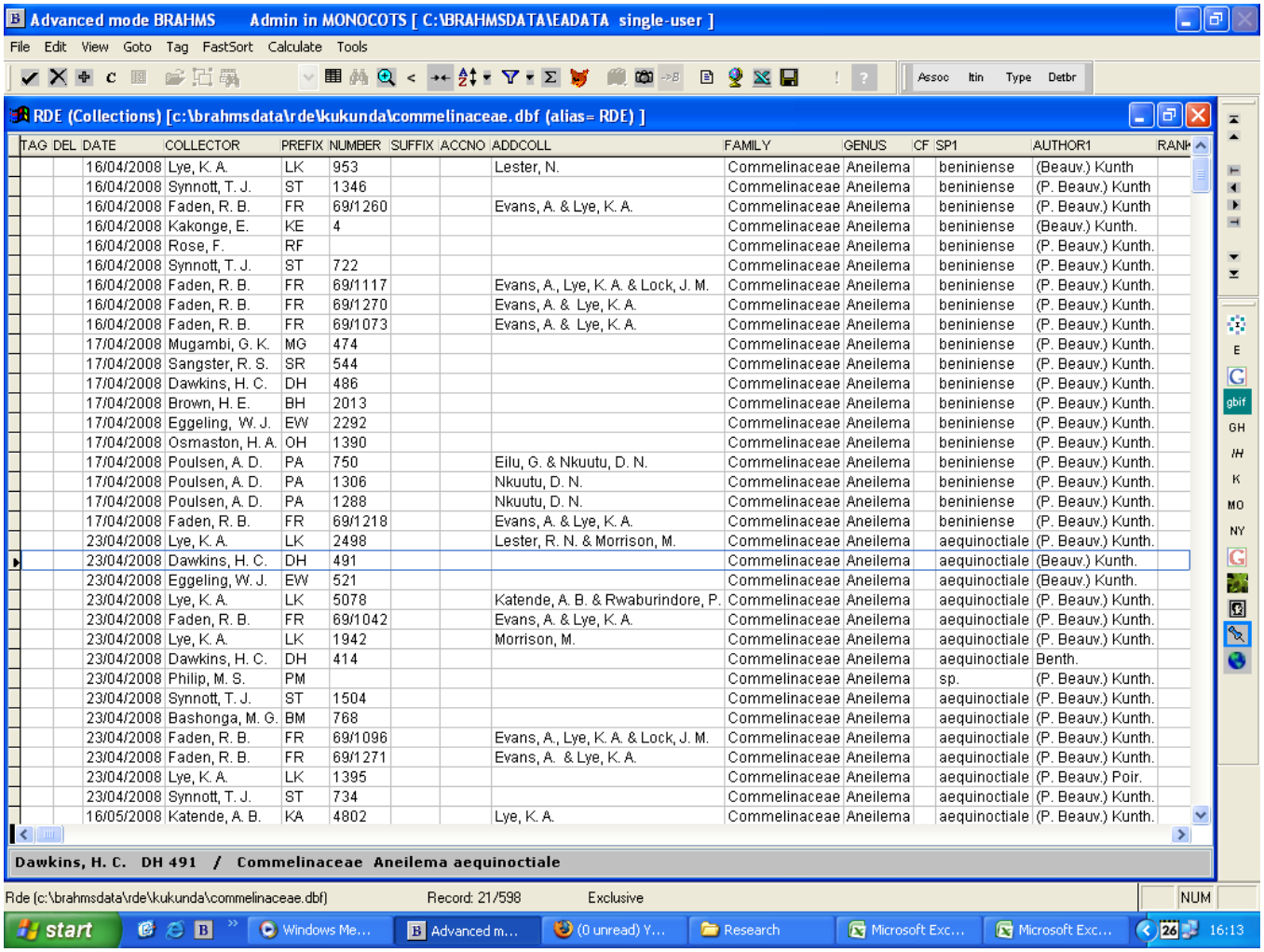

Figure 4. The BRAHMS data base held at the Makerere University Herbarium has a list of East African plants that is an essential component of monitoring

In terms of individual efforts, Prof. Derek Pomeroy has, with the help of students, carried out periodic counts of Marabou storks and Crested Cranes in various parts of the country. He has also been involved in the Water Fowl counts with *Nature*Uganda. Prof. David Taylor with staff from the Botany Department in Makerere University have collected data on trees in a Permanent Sample Plot in Mpanga Forest Reserve since the 1960s. The plot data have been used for purposes of studying changes in tree composition. Other staff e.g. Robert Kityo (Zoology Department) have been involved in monitoring other taxa e.g. bats. Prof. J.M. Kasenene (Botany Department) and Dr. J. Lwanga (MUIENR) have also been involved in monitoring primates and plants in Kibale National Park as part of MUBFS activities. Dr. F. Babweteera, Dr. G. Eilu, Prof. A. Banana and Prof. Gombya-Ssembajjwe (at the Faculty of Forestry and Nature Conservation – Makerere University) have been involved in some forestry related monitoring activities.

Makerere University Biological Field Station (MUBFS)

Makerere University Biological Field Station (MUBFS) in Kibale National Park is a research station that evolved from a former New York Zoological Society field site in the 1980s. It belongs to Makerere University and is administered by MUIENR. It has a couple of long-term projects which are crucial for providing monitoring data.

MUBFS is committed to providing opportunities for quality multi-disciplinary research and education in tropical ecosystems with particular emphasis on Kibale National Park. MUBFS's fundamental commitment is to the conservation of biological diversity and maintenance of ecosystem health. MUBFS is involved in primate censuses in liaison with other institutions such as WCS.

Within the Kibale National Park, Dr. Jeremiah Lwanga and others have carried out primate census in Ngogo over the last 30years. He has also done tree inventories since 1999 in four permanent plots. These data have been used to study forest succession. Prof. J.M. Kasenene has also carried out long term monitoring of trees for purposes of studying succession. These individual efforts could be developed into national monitoring programmes.

2.1.10. Other Universities in Uganda

Mbarara University of Science and Technology (UNCST)
The Institute of Tropical Forest Conservation (ITFC) which is a semi-autonomous unit of Mbarara University of Science and Technology. It is involved in conservation-orientated research and training in Bwindi Impenetrable National Park, Mgahinga Gorilla National Park, and Echuya Forest Reserve.

ITFC develops and carries out a range of research and monitoring programmes aimed at addressing the major conservation threats and challenges to the Albertine Rift forests. Major research themes include Mountain Gorilla Conservation and Management, the dynamics and viability of forest island habitats and the effectiveness of conservation strategies, as well as the development of a long term ecological monitoring programme. The results and recommendations are translated into management information and shared with UWA, NFA and other conservation partners.

ITFC has maintained a long term Ecological Monitoring Programme in Bwindi Impenetrable and Mgahinga Gorilla National Parks, assessing long-term changes in the conservation status of the forest and impacts of management strategies. Other monitoring programmes include: the breeding ecology of the Stripe-breasted Tit; harvesting of Non Timber Forest Products (NTFPs); Water quality; and Weather. Ecosystem change within the Nyamuriro swamp has also been monitored regularly. These experiences can be built into a national monitoring programme.

Up-country branches of NatureUganda
Other Universities in Uganda (e.g. Gulu University, Uganda Christian University and Kyambogo University) are in the process of developing monitoring programmes in their fields of specialisation. Mbarara University of Science and Technology, the Islamic University in Uganda and Gulu University house the upcountry branches of *Nature*Uganda namely the western, eastern and northern branches. These could make a contribution to biodiversity monitoring a proper framework is in place.

2.1.11. Jane Goodall institute (JGI)

The goal of JGI's Africa Program is to ensure the long-term protection of wild ape populations, while preserving biodiversity, and traditions as well as livelihoods. This goal can be achieved through increased conservation presence in national parks and protected areas, by halting the commercial trade in apes as bush meat and pets, increased government capacity, and community-based measures to increase the preservation of forest habitats and cultural livelihoods.

The objectives of JGI are to: increase primate habitat conservation; increase awareness of, support for and training in issues related to our relationship with each other, the environment and other animals (leading

to behaviour change); expand non-invasive research programs on chimpanzees and other primates; and promote activities that ensure the well-being of chimpanzees, other primates and animal welfare activities in general including primate censuses on a regular basis.

JGI-Uganda has implemented the snare removal project in Budongo FR and Uganda Chimpanzee Census (in 1999 with UWA, WCS and the then Uganda Forest Department). JGI has not, however, been directly involved in monitoring but has played a key role in animal health alongside the Wildlife Department of the Faculty of Veterinary Medicine of Makerere University. These could lead monitoring these taxa.

2.1.12. Uganda National Council for Science and Technology (UNCST)

The Uganda National Council for Science and Technology (UNCST) was established in 1990 by Act of Parliament (CAP 209 of the Laws of Uganda). It is a semi-autonomous government agency with a mandate to develop and implement policies and strategies for integrating science and technology into the national development policies. It advises the Government of Uganda on policy matters necessary for promoting science and technology and coordinates/guides national research and development.

The UNCST has specialized committees consisting of various sciences such as; agricultural, industrial, engineering and technology, natural, physical, health, information, social, and humanity. These committees advise the Council on the Science and Technology policy matters in their respective sectors. There are other standing committees such as the National Biosafety Committee that are set up to undertake specialized work and to provide technical advice in their respective fields. UNCST also has divisions such as the policy and co-ordination which aim at operationalising the national Science and Technology policy; formulating and coordinating the implementation of other related policies; strengthening the national Science and Technology human resource capacity and; strengthening the technology transfer and intellectual property management. Activities of this division include the national Science and Technology Management Information System which maintains Science and Technology databases which could benefit biodiversity monitoring. The oversight and Outreach division manages grants for science, technology and innovation projects, and coordinates the establishment of product development partnerships and management of technology transfer systems including Intellectual Property. The unit promotes innovation in firms and fosters the commercialization of research products. The unit is mainly focused on increasing public understanding and appreciation of Science and Technology policies and practices.

2.1.13. Conservation through Public Health (CTPH)

The CTPH Bwindi Telecentre is aimed at strengthening the overall ecosystem condition by monitoring the health of the endangered mountain gorillas in BINP, while improving the system of treatment of medical ailments. Maintenance of the mountain gorilla population and health is critical to the fragile environmental and economic ecosystem of the region. This project collects gorilla-health data via handheld computers to build a database, facilitating faster and better diagnosis and treatment for the species. The project also aims at raising villagers' and ecotourists' environmental awareness through environmental education programs that emphasize interactions between human public health, gorilla health and ecotourism revenue. The CTPH Telecentre thus promotes dramatic improvements in mountain gorilla health monitoring, human public health, community access to information and economic opportunities and thus facilitates the advancement of livelihoods in this region.

2.1.14. Environmental Conservation Trust of Uganda (ECOTRUST)

ECOTRUST has promoted the planting of indigenous trees for purposes of generating income from the Carbon Credits. The organisation has worked with farmers to monitor the increase in biomass and subsequently the amount of carbon sequestered. This is very relevant for promoting the planting of indigenous species and has implications for biodiversity monitoring, in particular, the biomass. This links well with the NFA program of monitoring changes in biomass in different parts of the country.

2.1.15. The Private Sector

The Private sector is becoming increasingly important in biodiversity related issues in Uganda. Notable examples include tour companies, eco-lodges, concessionaires and private investors involved in various sectors. The role of these in biodiversity monitoring is not prominent at the moment but could be harnessed for a national monitoring programme.

CHAPTER THREE

3.0. SWOT ANALYSIS OF BIODIVERSITY MONITORING IN UGANDA

3.1. Background

Mechanisms for meeting the strategic objectives of the CBD are identified in the form of 22 Indicators in the 2010 Target (see appendix II), and the NBSAP. There is strong alignment between NBSAP and some of the Indicators, moderate in some and weak in others. Areas of strongest alignment include Indicators of: (i) protected areas, (ii) threatened species, (iii) the broad-scale extent of ecosystems, and (iv) alien invasive species. The most poorly aligned areas include Indicators of: (i) trends in non-threatened, non-rare and non-utilized species (which have been shown to be of great value in monitoring programmes), (ii) the trophic integrity of terrestrial ecosystems, (ii) incidence of ecosystem failure and (iv) habitat connectivity and fragmentation. Other weakly aligned Indicators are those addressing socio-cultural (rather than biodiversity) sectors in Uganda, such as linguistic diversity, the wellbeing of ecosystem service-dependent communities, and the status of resource transfer. Nonetheless, biodiversity information to support and inform both biodiversity and socio-cultural policy are strong theme in NBSAP. The action plan, for example, includes quantification and monitoring of the value of biodiversity to the economy and to people's lives. While overarching policy goals have strong commonalities, the processes by which these goals are to be achieved differ moderately. This reflects interesting differences between Ugandan and global priorities, as well as characteristics peculiar to Uganda's constitutional imperatives, that is, a strong focus on equity, benefit sharing and traditional knowledge that are in the main addressed by other, non-biodiversity-related, institutional frameworks.

There are two areas where the NBSAP has no clear sets of objectives and even do not form an explicit part of the 2010 Target Indicators, namely, the threats to biodiversity from climate change and from genetically modified organisms. These should be dealt with outside the CBD and its global targets by, for example, the Intergovernmental Panel on Climate Change. There is need for Uganda to have a distinctive position on GM biotechnology adoption and strategies for monitoring it.

3.2. Performance and linkages between institutions/ monitoring programmes

A SWOT analysis of the existing (national) stakeholders and their monitoring programmes in terms of the NBSAP and 2010 Target monitoring requirements was done to assist in the identification of current needs and set a future course for biodiversity monitoring in Uganda. Assessment of individual institutions involved in biodiversity monitoring is presented here (see also Appendix III).

Uganda Wildlife Authority (UWA)

In relation to the 2010 Target Indicators, UWAs monitoring programmes appear to be strong in four indicators, falling under the focal areas of: status and trends of the components of biological diversity as well as access and benefit-sharing. The programmes are moderate in the focal areas of threats to biodiversity, specifically trends in invasive alien species and, weak in the rest. The focal areas of traditional knowledge, innovations and practices are not emphasized in UWA's monitoring programmes.

UWA is also strongly aligned with the Program of work on PAs, another CBD target and fairly strong in the achievement of the targets of the Global Strategy for Plant Conservation (GSPC) of the CBD (see Appendix III). However, UWA needs to strengthen monitoring encroachment, poaching, wildlife diseases, and other anthropogenic disturbances because these impact negatively on the alignment and achievement of desired targets and must be monitored systematically.

National Forestry Authority (NFA)

The NFAs monitoring programs are quite strong in terms of indicators related with sustainable use. They are moderate with the indicators relating to status and trends of components of biodiversity as well as access and benefit sharing but weak in the others. This probably stems from the mandate of NFA which emphasizes social forestry and sustainable utilization of forest resources from both plantations and tropical high forests. NFA is also fairly strong in the achievement of the targets of the GSPC. Nonetheless, NFA needs to improve monitoring of encroachment, and other anthropogenic disturbances including charcoal burning and illegal pitsawing. These activities are contrary to the 2010 and GSPC targets, as well as the programme on PAs.

*Nature*Uganda (NU)

*Nature*Uganda's mandate, monitoring programs and strategic objectives are strongly aligned with various indicators mainly in the areas of status and trends of the components of biodiversity, sustainable use, as well as access and benefit sharing. Indicators relating to water quality and freshwater ecosystems, health and well-being of communities (who depend directly on biodiversity goods and services) require strengthening. Focal areas that emphasize resource transfers and traditional knowledge, and innovation are hardly monitored. *Nature*Uganda has contributed to the attainment of some of the targets for the GSPC through various programs and has the capacity to enhance monitoring areas where efforts are inadequate.

Wetland Management Department (WMD)

Monitoring programs of WMD are strongly aligned with the focal areas relating to ecosystem integrity and ecosystem goods and services, as well as access and benefit sharing. Monitoring of status and trends of components of biological diversity is moderate. Monitoring resource transfers remains a major point of weakness. The WMD has aligned itself fairly strongly with the GSPC targets. However, with skilled manpower and availability of finances, the department has the capacity to improve in the areas where it is lacking, in particular on sustainable use.

The linkage between *Nature*Uganda and WMD is primarily based on the fact that their major habitats are the wetlands. This linkage therefore is relevant, for example, in the case of the water fowls that *Nature*Uganda monitors regularly. This arrangement can be strengthened and formalized as part of a future monitoring programme.

Wildlife Conservation Society (WCS)

In Uganda, WCS activities have previously centred on the Albertine Rift but there is increasing interest in northern Uganda. The monitoring programs and how the align with the 2010 target, they are strongly aligned in 10 of the 22 Indicators. The monitoring programmes focus on status and trends of the components of biodiversity, sustainable use, and access/benefit sharing. They are moderately aligned with status of the resource transfers and ecosystem integrity in terms of goods and services. This aligns moderately with goals of the Program of work on PAs CBD Target. WCS has also been able to contribute to the attainment of some of the targets for the GSPC through various programs and projects.

Environmental Conservation Trust (ECOTRUST)

ECOTRUST emphasizes a healthy environment with prosperous people. The monitoring activities are largely aligned with areas focusing on sustainable use, particularly the Indicators that emphasize (i) Area of forest, agricultural and aquaculture ecosystems under sustainable management and (ii) proportion of products derived from sustainable sources. However, ECOTRUST has the potential to improve its level of alignment with the 2010 Target.

National Biodiversity Data Bank (NBDB)

The NBDB has been involved in monitoring several taxa especially birds for several years. The BD monitoring is sometimes carried out in liaison with *Nature*Uganda especially regarding the waterfowls. The Data Bank is strongly aligned with 6 of the 22 indicators in the 2010 Target. They are mainly involved with the status and trends of the components of biological diversity and moderately with threats to biodiversity.

Budongo Conservation and Field Station (BCFS)

The BCFS is mainly involved in monitoring populations of Chimpanzees in Budongo forest. The monitoring program is strongly aligned with 4 of the 22 indicators of the 2010 Biodiversity Target and moderately aligned with the focal area of threats to biodiversity (specifically the trends in invasive alien species). It would be appropriate to expand the scope of the monitoring program beyond Chimpanzees if resources allow. There is also the Chimpanzee Health Monitoring Programme that commenced in March 2008. At the moment at least 70 chimpanzees (mainly from the Sonso Community) are monitored. There are plans to expand the Programme to Kaniyo-Pabidi, then to Busingiro. This puts the BCFS in a strong position to take a lead in this kind of work in collaboration with the Centre for Disease Control, JGI, UWA and WARM Department in Makerere University. Other areas include the tree phenology, climate (mainly rainfall and temperature), as well as tree growth.

Institute of Tropical Forest Conservation (ITFC)

ITFC is mandated to lead in the implementation of biological and socio-economic research and training that furthers conservation and management of Albertine Rift forests and biodiversity. It has an ecological monitoring program and is aligned to four of the 22 Indicators in the 2010 Target. These are in the focal areas of status and trends of the components of biological diversity. They are moderate in the access and benefit sharing focal area and weak in the other focal areas.

The ITFC, alongside MUBFS and BCFS which are field stations within National Parks (Bwindi and Kibale respectively and a Forest Reserve-Budongo) carry out some long term studies that are beneficial for the management of the PAs. ITFC, for example, runs the Ecological Monitoring Programme which was established initially to monitor the multiple use activities but has now broadened to include aspects such as water quality and climate. These long term monitoring programmes need to be incorporated into a national monitoring programme.

Makerere University (MU)

Makerere University, through the Makerere University Biological Field Station in Kibale National Park, the Departments of Zoology, Botany with the Faculty of Forestry and Nature Conservation, is involved in the monitoring of specific taxa albeit in different contexts. The BD monitoring programme strongly aligns itself with nine Indicators, moderately with three and weak in the rest. Areas where MU could perform better include (i) Trends in extent of selected biomes, ecosystems, and habitats (ii) Trends in abundance and distribution of selected species (iii) Coverage of protected areas and (iv) Change in status of threatened species. Lack of financial resources hinders the furtherance and achievement of the 2010 Biodiversity Target at MU which has also been able to contribute to the attainment of some of the targets for the GSPC through various programs.

In addition, there are linkages between various departments that would be relevant for biodiversity monitoring. The BIOTA project, for example, links the department of botany and the Faculty of Forestry and Nature Conservation in data-basing herbarium collections and live plant specimens in the Budongo Forest. The herbarium and the Museum (with botanical and zoological collections) are shared by the various departments and are vital for monitoring. Various other linkages have to be identified and used to enhance monitoring.

IUCN

IUCN encourages and assists societies to conserve the integrity and diversity of nature and to ensure that any use of natural resources is equitable and ecologically sustainable. Its monitoring programmes strongly align with the focal area of status and trends of the components of biological diversity and, access and benefit-sharing. It appears moderate in the area of sustainable use particularly with the indicators: (i) Area of forest, agricultural and aquaculture ecosystems under sustainable management (ii) Proportion of products derived from sustainable sources and (ii) Ecological footprint and related concepts. IUCN has also been able to contribute to the attainment of some of the targets for the GSPC through various programs and projects.

Jane Goodall Institute (JGI)

The Jane Goodall Institute primate monitoring programme emphasizes the focal areas of Status and trends of the components of biological diversity and access and benefit-sharing. Monitoring programs are strongly aligned with Indicators:(i) Trends in extent of selected biomes, ecosystems, and habitats; ii) Trends in abundance and distribution of selected species; (iii) Coverage of protected areas; and iv) Change in status of threatened species and access and benefit-sharing. However, the program has potential to expand and improve on the Indicators that can be achieved within their context of the monitoring programs. JG1 has also been able to contribute to the attainment of some of the targets for the GSPC through various programs and projects.

General observations

Assessing the alignment of indicators and for which data have been collated reveals several gaps. While some alignment exists for indicators of biodiversity status, trends and threats, very few indicators have been developed for the focal areas of sustainable use, ecosystem integrity and services. There is almost no indication of work in the various BD monitoring programs on socio-cultural themes of indigenous knowledge, access and benefit sharing and resource transfers. These gaps are potentially a result of both the historical sectoral focus, but are also strongly influenced by data availability and the resources required to collect new data. This is demonstrated by the comparatively good data on ecosystems and selected species distributions, compared to the general absence of data at the sub-specific level, for example, genetic diversity.

Another information need that becomes apparent is the establishment of thresholds, especially those for sustainable use and management. Regardless of the purpose, monitoring presumes the existence of information on a ‘norm’ or ‘standard’ against which levels and directions of change may be assessed. Without this baseline information, indicators of sustainability cannot be evaluated.

There are successes and challenges in the performance of existing monitoring programmes. The Convention on Biological Diversity’s 2010 target and other policy targets should provide the basis for assessment of the performance of monitoring programs. Unfortunately, these targets are hardly mentioned by any of the current monitoring programs. However, the following is observed on current programs:

- In terms of the characteristics of existing datasets, most of the data are not well balanced. Examples include plants vs. animal data; Moreover, data on fauna are data dominated by birds and mammals.
- In terms of habitat data, the quality and extent are insufficient. Where habitats are located within Protected Areas, there is subjective information on the status of some habitats. These are however, not monitored regularly and are hardly quantitative.
- There are inadequate institutional arrangements to ensure future data collection. It is, for example, not clear 'who will monitor what' in the next 10 years. This needs to be addressed.
- Explanations on the objectives, targets and indicators of the current monitoring programs are inadequate. These need to be clearly defined by each stakeholder.

Additional challenges include the following:

- Lack of baseline data for most taxa: It is clear from the different monitoring programs that mostly the vascular plants (trees), birds and large mammals are monitored. The rest of the taxa (including invertebrates and non-vascular plants) have not been included in the monitoring programmes. There are various reasons for this, but it certainly needs urgent attention.
- Limited expertise: Uganda has very few taxonomists making monitoring work extremely difficult. The various stakeholders involved in monitoring depend on the services of a few experts available. Taxa, other than vascular plants (trees), birds and large mammals are therefore left out of the monitoring work.
- Limited funding opportunities: This is a major hindrance to monitoring work and to the development of a national biodiversity monitoring framework. Uganda Wildlife Authority, that should ideally take the lead, is still predominantly donor funded.
- Absence of standardization in data collection and analysis: The storage and analysis of monitoring data is handled differently by different partners. It is necessary to have some generally applied methods that would ensure that the data are comparable and can be used to develop reports that meet the requirements of the CBD targets.
- Absence of networking and data storage/reference centers: It is clear that a Clearing House Mechanism (CHM) is required for the management of monitoring data. This is lacking at the moment. The National Environment Management Authority (or some other body mandated by NEMA) should play this role. There are efforts in NEMA to operationalise CHM once funds are obtained from GEF where an application has been submitted. It will be necessary to bring biodiversity monitoring to the forefront in this process.

3.3. A synthesis of Uganda's alignment to the CBD targets

Uganda, as indicated earlier, is committed to several international conventions that emphasise the protection and conservation of biodiversity. The CBD's '2010 targets' triggered the creation of national and global biodiversity monitoring systems with which to measure progress towards the various targets.

Biodiversity monitoring in Uganda is driven by the country's national biodiversity related policies e.g. the National Environment Statute (NES) of 1995, the National Biodiversity Strategy and Action Plan (NBSAP) of 2004. These highlight the need for a national biodiversity monitoring framework. This

should ensure improved data collection and management, increased knowledge and understanding of biodiversity, and links to human wellbeing.

In the Ugandan context, the NBSAP, and the NES although not explicit on BD monitoring, aim to conserve and manage terrestrial and aquatic biodiversity to ensure sustainable and equitable benefits to the people of Uganda, and make significant progress towards the development of a national biodiversity monitoring framework.

The NES and NBSAP align well with the CBD 2010 target objectives albeit in broad terms, but differs in terms of the indicators proposed. Existing national biodiversity monitoring programmes also exhibit these indicator differences and show several gaps in indicator development and data collation. These gaps highlight concerns regarding Uganda's ability to report on the CBD's 2010 target, but together with the sound platform provided by the NBSAP, provide a good indication of national priorities and a way forward through a combination of short-term achievable tasks and longer-term development of programmes. The focus on conservation of all levels of biodiversity and ecological processes, minimizing threats to biodiversity, sustainable use and the maintenance of ecosystem services must form the cornerstones of a national monitoring framework.

The CBD recognizes that national participation towards meeting the 2010 Target must be informed and driven by national priorities. Nonetheless, the efficiency and effectiveness of meeting both national and global targets may be maximized by identifying where the alignment of national and 2010 Target goals and indicators is strongest. This will expedite short-term biodiversity assessment and reporting by focusing on the development and monitoring of those indicators meeting multiple objectives. In addition, identifying where national and global objectives differ also provides interesting insight into the relative importance of biodiversity status, threats and sustainable- use priorities across local to global scales.

3.4. Options for collaboration, harmonization and coordination

It is necessary to identify and avoid overlaps but promote complementarities within the different monitoring programs, and between the different organizations and/or stakeholders that are involved in similar activities. This should be the way forward for monitoring in Uganda

NEMA, through the National Environment Statue of 1995, Caps 5 and 42, is mandated to coordinate all Biodiversity related activities including BD monitoring in the country. It is also the CBD Focal Point in the country. Based on this premise, NEMA has developed a NBSAP and is in the process of implementing the Clearing House Mechanism as enshrined in the Bonn Guidelines. This gives NEMA the natural role of leading the coordination of biodiversity monitoring in Uganda.

- The linkages between various organizations involved with similar taxa have strengthened. The good will between the different organizations provides an opportunity for collaboration and harmonization of different programs
- The roles of the various stakeholders should be clearly described and formalised. Considering that, NEMA will coordinate the exercise, the National NEMA Technical Committee on Biodiversity should be strengthened to offer guidance on biodiversity monitoring. The framework, under which the Biodiversity Conservation and Coordination initiative (involving

NEMA, NFA, WID and UWA) was formed, could be used to give the technical committee a national outlook.

- The Clearing House Mechanism (CHM) based at NEMA as the National Focal Point for Biodiversity Conservation should be operationalised as quickly as possible for purposes of documentation and information sharing both within and outside the country.

3.5. Opportunities for biodiversity monitoring in Uganda

Uganda, like other bio-diverse regions of the world, is experiencing rapid and extensive rates of biodiversity loss, primarily as a consequence of development-related habitat conversion. Concern over the extent of these declines in biodiversity, and their effects on human wellbeing, have triggered national and international agreements to reduce or halt these trends. The 2002 commitment of the CBD, 'to achieve, by 2010, a significant reduction in the current rate of biodiversity loss at the global, regional and national levels', is one such example. The CBD's '2010 target' triggered the creation of national and global biodiversity monitoring systems with which to measure progress towards this and other policy targets. This is a major opportunity for Uganda to do the same.

As Ugandan tries to implement the NBSAP and also develop a national biodiversity monitoring framework, was necessary to review the existing programmes in relation to national and global biodiversity monitoring requirements. This is helpful to ensure alignment, identify gaps and priorities, and develop an effective and efficient framework. The main objectives of this synthesis are thus to: provide a broad over- view of current national biodiversity monitoring and assessment efforts, assess their alignment with the 2010 Target, evaluate remaining gaps, and discuss the way forward in the process of developing a national biodiversity monitoring framework for Uganda.

This involved a review of: (i) the focal areas and headline indicators (HIs) of the 2010 Target; (ii) the outcomes, activities and indicators (OAIs) of NBSAP; (iii) the indicators, used and monitored in the National State of the Environment Reports; and (vi) the targets set by the Global Strategy for Plant Conservation and programme on PAs.

National Biodiversity Strategy and Action Plan, and the 2010 Target

The CBD recognizes that national participation towards meeting the 2010 Target must be informed and driven by national priorities as defined in the NBSAP. Nonetheless, the efficiency and effectiveness of meeting both national and global targets may be maximized by identifying where the alignment of national and 2010 Target goals and indicators is strongest. This will expedite short-term biodiversity assessment and reporting by focusing on the development and monitoring of those indicators meeting multiple objectives.

In addition, identifying where national and global objectives differ also provides interesting insight into the relative importance of biodiversity status, threats and sustainable-use priorities across local to global scales. In the case of the NBAP strategic objectives and the 2010 Target, the latter has short-term objectives (albeit potential long-term benefits), whereas NBSAP provides a long-term national strategy.

Nonetheless, the 2010 Target provides impetus to national strategies to achieve some objectives in the short term. NBSAP's strategic objectives and the 2010 Target focal areas are strongly aligned, with the focus on conservation of all levels of biodiversity and ecological processes, minimizing threats to biodiversity, sustainable use and the maintenance of ecosystem services.

There is some alignment between NBSAP and the 2010 Target including HIs of: (i) protected areas, (ii) threatened species, (iii) the broad-scale extent of ecosystems, (iv) alien invasive species and (v) water quality. The most poorly aligned areas from the procedural perspective include HIs of: (i) trends in non-threatened, non-rare and non-utilized species (which have been shown to be of great value in monitoring programmes), (ii) the trophic integrity of terrestrial ecosystems, (ii) incidence of ecosystem failure and (iv) habitat connectivity and fragmentation.

Other weakly aligned HIs are those addressing socio-cultural (rather than biodiversity) sectors in Uganda, such as linguistic diversity, the wellbeing of ecosystem service-dependent communities, and the status of resource transfer. Nonetheless, biodiversity information to support and inform both biodiversity and socio-cultural policy are a strong theme in NBSAP.

For example, the action plan includes the quantification and monitoring of the value of biodiversity to the economy and to people's lives. While overarching policy goals have strong commonalities, the processes by which these goals are to be achieved differ moderately. This reflects interesting differences between Ugandan and global priorities, as well as characteristics peculiar to Uganda's constitutional imperatives, that is, a strong focus on equity, benefit sharing and traditional knowledge that are in the main addressed by other, non-biodiversity-related, institutional frameworks.

There are two areas where the NBSAP has a clear set of objectives that do not form an explicit part of the 2010 Target HIs, namely, the threats to biodiversity from climate change and from genetically modified organisms. The former is largely dealt with outside the CBD and its global targets by, for example, the Intergovernmental Panel on Climate Change. The latter reflects Uganda's distinctive position of currently having a high GM biotechnology adoption rate and under-developed policy, and virtually no ecological research in this area.

By contrast, the strong alignment in the area of invasive alien species is a consequence of Uganda's identification of the control and management of invasive alien species (IAS) as a national priority, and the implementation of significant IAS management and research programmes through NARO/GEF project. Monitoring (along with quantification, assessment, evaluation and research) is stated as an implicit part of strategic objectives of the NBSAP. Nonetheless, if progress towards and success in meeting all these objectives are to be evaluated, then monitoring must necessarily form an integral part of all of the BD activities.

Current national indicator and monitoring programmes

A review of the existing national monitoring frameworks and programmes in terms of the NBSAP and 2010 Target monitoring requirements will assist in the identification of current needs and set a future course for biodiversity monitoring in Uganda. Many of the BD monitoring programmes form an essential component of the creation of a national biodiversity monitoring framework.

Proposed institutional arrangement for the national biodiversity monitoring plan

Since biodiversity monitoring activities and programmes involve various stakeholders, respondents propose that NEMA coordinates national biodiversity monitoring and brings other institutions together to participate. Thus NEMA remains the key implementing agency for biodiversity monitoring, while several other partners will be involved based on their specialities. UNCST has not previously played a major role in biodiversity monitoring but could contribute through co-ordination, data management, information dissemination, and fund raising. UWA, NFA, WMD and NEMA have formed the Biodiversity Conservation and Coordination Initiative (BCCI). The BCCI framework will particularly enhance this process. This body has been formed for purposes of coordinating activities of these institutions that are the key custodians of biodiversity in Uganda. This arrangement has not previously played a major in

biodiversity monitoring but should do so in the near future. The National Forestry Authority (NFA) has strong collaboration with NaFORRI and Makerere University. In addition, there is a strong link between Makerere University (National Biodiversity Data Bank) and *Nature*Uganda which should be enhanced to benefit monitoring. The ensuing data can be used in various ways. The water bird monitoring data, for example, have been used to develop single species action plans, site action plans, and production of the IBA directory. Future outputs will draw lessons from current successes.

CHAPTER FOUR

4.0. WAY FORWARD FOR BIODIVERSITY MONITORING IN UGANDA

4.1. Policy and Legal Framework

In Uganda a series of national, regional and international treaties and conventions are found to be relevant for protecting biodiversity (including monitoring) and promoting sustainable development. The national laws relevant for biodiversity monitoring occur in the following legislation: National Environmental Act, Cap 153; The National Forestry and Tree Planting Act, Cap 246; The Wildlife Act; Local Government Act, Cap 243; The Land Act, 1998 and The Plant Protection Act among others.

International and regional conventions ratified by Uganda in relation to biodiversity monitoring include the Convention on Wetlands of International Importance especially as waterfowl habitat (the Ramsar Convention). The Convention on Biological Diversity (CBD), The Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES), among others.

The NBSAP which aims to 'conserve and manage terrestrial and aquatic biodiversity to ensure sustainable and equitable benefits to the people of Uganda, now and in the future', makes little progress towards the development of a national biodiversity monitoring framework but should form the basis for the national biodiversity framework. This is, in part, Uganda's response to its obligations under the CBD. It is therefore necessary to establish an integrated programme for national monitoring of biodiversity to build on the existing monitoring programmes such as the Important Bird Areas Monitoring Programme of *Nature*Uganda. It is also necessary to have in place a timetable and an action plan for the process.

Although the NBSAP is not explicit on the BD monitoring, it provides a sound starting point for the development of a national biodiversity monitoring framework, which aligns well with Uganda's international 2010 Target reporting commitments. However, there is much work to be done in converting this alignment into an implemented national biodiversity monitoring framework. Indeed, it would appear that Uganda will not be able to report on most of the Indicators by 2010 without paying urgent attention to the creation and implementation of the framework.

4.2. Monitoring requirements

4.4.1 General Overview

Monitoring Biodiversity is driven by multiple objectives and stakeholders and, as a consequence, requires more than a single approach to satisfy these manifold demands. Indeed, there are many monitoring approaches and indicators currently used in Uganda, largely due to the variety of objectives of monitoring programmes, which differ also on spatial and temporal scales. The absence of a single universal approach to monitoring biodiversity highlights the need for a formalized strategic approach, to serve as a framework for all biodiversity monitoring programmes. This will ensure that the choice of approach is determined by the purpose and context of the current programmes. The 2010 CBD targets highlight the need for standardized and comparable methods for measuring and monitoring biodiversity status and loss, and have thus identified a suite of broadly accepted indicators.

Biodiversity Monitoring in Uganda should encompass regional, national and international requirements. The national requirements include obligations under existing national legislation, action plans and strategies, as well as other political/administrative and research-based requirements. International requirements are mainly in the form of obligations or commitments in relation to regional conventions/agreements, and international conventions/agreements.

It is important that national monitoring framework is structured in such a way as to also provide a sound basis for decision-making also at the regional level. Biodiversity Monitoring in Uganda should be management-oriented, with simple cost-effective methods that can be sustained with limited external support (Denielsen *et al*. 2003).

Monitoring, will therefore be driven by multiple objectives and stakeholders, and as a consequence, will require more than a single approach to satisfy these various needs. Further, there are many monitoring approaches and indicators currently in use, largely due to the variety of objectives of the monitoring programmes, that differ on spatial and temporal scales. The key feature is that the monitoring programme should be effective in integrating information into decision-making.

As the current programmes already contain some biodiversity elements, the proposed monitoring activities should be integrated with the current monitoring programmes. In addition nationwide monitoring programmes on terrestrial biodiversity should be established. The existing nationwide network of Permanent Sample Plots in Forest Reserves should form a foundation of the national monitoring programme.

The monitoring programme should be based on the current knowledge of cause and effect, so it is important that this knowledge is constantly being updated by new research and that the programme is flexible enough that it offers the scope to incorporate new knowledge, as it becomes available.

The National Biodiversity Monitoring Framework should include: 1) important habitats; 2) priority species; and 3) genetic biodiversity. At all levels some assessment of the relevant threats should be included in the programme. Ideally, monitoring should be performed in such a way that it is possible to differentiate between perturbations caused by natural variation and those which are the effects induced by human activities, including the positive effects of action plans and other management.

4.4.2 Habitats

Habitats should be given high priority and the monitoring should aim to assess habitat area, geographic distribution and quality (as habitat for animals and plants). The extent of habitats and their geographical distribution should be based on mapping using satellite aerial photos and other forms of imagery, combined with ground truth field observations. An appropriate Information System should be used as a tool for collating geographic data. Review cycles of 5 years may be appropriate to update area estimates. It is essential that the mapping is validated by means of field observations and other data.

Monitoring of habitats should primarily focus upon vegetation quality and extent, as well as relevant elements of the fauna and an assessment of prevailing abiotic conditions. Monitoring should also include the relevant threats to these habitats.

Spatial monitoring of land use and habitats must be performed on a national basis. For each prioritised habitat, a representative selection of localities will be monitored, potentially including localities of high priority. If all areas of a given habitat are to be monitored, the extent and frequency of monitoring can be adjusted to optimise the effort. The National Biomass Survey carried out by the Forest Department (now NFA) provides a good foundation for this process.

The approach should be a strategy involving intensive monitoring of a few localities supplemented by extensive monitoring of many localities. Intensive monitoring provides a base-line for the study of year-to-year variations, improving the potential for interpretation from the results of more extensive monitoring. This will provide detailed information on the possible causes of a given trend and enable more rapid detection. Intensive monitoring may also be relevant in localities of high priority or localities where the current state differs significantly from the quality objective. Extensive monitoring should be structured specifically to provide a nationwide perspective. The monitoring programme must comply with the monitoring requirements of the CBD targets.

4.4.3 Species/species groups

Monitoring of species should primarily focus on species for which Uganda has a specific responsibility and on species included under international monitoring obligations (e.g. Red List species). Species/species groups identified as good indicators of changes in landscape ecology (e.g. birds) processes and those invasive species threatening native biodiversity should also be monitored. Monitoring of population sizes should be restricted to only high priority species such as Mountain Gorillas and Chimpanzees.

4.4.4 Genetic biodiversity

Considerable research is still required before a nationwide monitoring programme for genetic biodiversity can be established in Uganda. A clarification and prioritisation of the problems to be addressed are needed. The results of monitoring genetic biodiversity could act as reference material for the later analyses of genetic variation.

The following outline structure could be adopted and modified:

Proposed Data Structure of a National Biodiversity Monitoring Framework

1) Trends in major impacts on biodiversity
   - Habitat Loss and degradation
   - Invasive Alien Species
   - Over harvesting species
   - Flow modification
   - Climate change
   - GMOs/Genetic Pollution
2) Trends in Uganda's biodiversity
   - Ecosystems
   - Species
   - Genes
3) Responses to the impacts and/or trends
   - Responses
   - Institutional capacity
4) The socio-economic value of Uganda's biodiversity (in relation to 2 and

The Biodiversity Monitoring Framework for Uganda needs to bring together monitoring and research which represent two different disciplines. Monitoring benefits from research results in terms of improving methods for data collection and data analysis. On the other hand, research results on cause and effect are

essential for the design of an effective monitoring programme. Similarly, monitoring data can be used for research purposes. Hypotheses and results from specific studies may be tested for general applicability at greater temporal or geographical scales.

Research projects undertaken by Masters and PhD students should be coordinated to contribute regularly to a national biodiversity monitoring framework. This will be a major contribution made by the Universities. Monitoring activities undertaken by individuals should be institutionalised into regular programmes of the University departments.

A programme for biodiversity monitoring, therefore, requires gradual development. The following steps may be adopted to guide this exercise:

SCOPING PHASE Identify policy issues and goals, strategy and objectives
DESIGN PHASE **1. Identify indicators** Follow principles and criteria that indicators should fulfil **2. Develop indicators: determine** • Variables to be measured • If the indicator is to be simple or composite • The type of indicator (pressure, state or response) • Baselines, targets and thresholds • How progress will be measured (positive or negative trends, rates of change, attainment of critical values) • How data are to be aggregated (across spatial locations, ecosystems, taxa, time periods, measures with different units) **3. Develop monitoring programme** • Determining spatial locations for measurement (number and position) • Determining temporal dimension (timing, duration, and frequency of measurements) • Compiling Indicator profiles • Developing guidelines for indicator application
TESTING PHASE • Review, testing and refinement of indicators and monitoring programme • Assessing efficiency, accuracy, cause-effect relationships, precision and utility of outputs
IMPLEMENTATION PHASE • Data management (gathering, checking, storage) • Conducting analysis and generating statistics • Publication in peer-reviewed literature (aids validation, dissemination, and adds knowledge) • Generation of National Indicator Portfolio and Report

Box 1. Process for development, testing and implementation of biodiversity indicators in assessment and monitoring (source: Reyes & McGeoch 2007)

Once the monitoring mechanisms are in place, it will be necessary to carry out the following tasks leading to the operationalisation of a national biodiversity monitoring framework:
i) Collation of existing data (for instance, the status of threatened species, and trends in the abundance of some species) to generate trend information.

ii) Collecting data for the 2010 Target Indicators where they do not exist (e.g. measures of genetic diversity, population trends, sustainable use, and indigenous knowledge).
iii) Re-assessment of existing indicators to generate trend information.
iv) Identifying and devising indicators and collecting data for Headline Indicators (of the 2010 targets) or Outcomes, activities and indicators, where they do not exist (e.g. measures of genetic diversity, population trends, sustainable use, and indigenous knowledge).

4.3. Institutional Arrangements

It is necessary to organise biodiversity monitoring activities so that results can be useful regionally, nationally and internationally in order to optimise use of resources and expertise. Within the country, a regional level is proposed whereby all parts of the country get sufficient coverage. In this case, the National Environment Management Authority (or some other institution delegated by NEMA e.g. the National Biodiversity Data Bank in Makerere University) will be responsible for compilation of national data. The regional structure of the monitoring framework should perhaps be modelled around the Flora of Tropical East Africa (FTEA) zones of U1 – U4 covering the different parts of the country (with a bias towards plants which define the key terrestrial habitat types). Work in each zone will then be coordinated by the appropriate institution based in that zone.

Collaboration between the regional level and the National Environment Management Authority should be organised via a body such as the Biodiversity Conservation Coordination Initiative that currently involves NEMA, NFA, UWA and WMD. In this case it would be necessary to have steering committees developed for different taxa (the Working Groups of *Nature*Uganda offer a good foundation for this approach).

The outcomes from the zones will then be aggregated on a national scale by NEMA. A National Focal Point on Biodiversity is already established at NEMA and should coordinate the national biodiversity monitoring with the help of the NEMA National Technical Committee on biodiversity. The National Focal Point needs to be strengthened, however, in terms of staff. National Focal Point Officers for different monitoring data e.g. terrestrial or more specific as forests or taxa are required to fulfil this role.

One of the most immediate duties of the National Biodiversity Monitoring Unit in NEMA is to develop a monitoring framework for Uganda. This unit will co-ordinate and consolidate existing monitoring work rather than starting new monitoring projects. However, where important data gaps are identified (which are not covered by current work), the unit will consider starting new projects. The monitoring and reporting should be supported by an Advisory Committee. The National Technical Committee on biodiversity should be expanded to undertake this role. A Clearing House Mechanism (CHM) to manage the monitoring data should be in place as a matter of urgency. NEMA has already initiated some steps to ensure that this happens.

A number of other institutions, organisations, individuals and volunteers who collect data that may then contribute to those gathered for institutional users have to be encouraged and brought on board. Collection of relevant data should be endorsed and made publicly available in a national database at NEMA (or NBDB if mandated to do so).

The IBA monitoring program of work forms a very firm foundation for developing a national monitoring system. The monitoring programmes of other organisations should be modified as appropriate to contribute data to the IBA monitoring program. The National Biodiversity Data Bank at Makerere University could still coordinate data management, however, its status must be formalised both within the University and in the country. The various university departments will play a key role in training the

required man power. Nature Uganda, WCS and other partners have demonstrated remarkable abilities in generating the required resources and should in the short term continue with this role. In the long run however, NEMA should take a lead in sourcing funds alongside other lead agencies e.g. UWA and NFA.

4.4. Human Resources

The required build-up of expertise for the establishment of quality objectives and reproducible methods for assessing compliance is achieved by pilot monitoring and projects. Participatory Monitoring (involving the local communities) should be promoted to match the assessments of local people and ecologists. Making conservation recommendations based on the interpretation of biodiversity trends based on local knowledge and modern scientific knowledge will yield the best results. In the case of local communities, the utilitarian values rather than the preservation of total species pools is most important.

Outside Protected Areas (e.g. in the grazing lands, Oba *et al.* 2008), monitoring of biodiversity would be more effective if managers assessed biodiversity and established monitoring regimes based on improved knowledge of different local uses of biodiversity.

4.5. Financial and Physical Resources

Financing the biodiversity monitoring activities is a major challenge for conservation. The main strategy will involve integrating biodiversity monitoring into the activities of the various stakeholders. In this case, the different stakeholders will conduct biodiversity monitoring as part of their mandates and obligations. Coordination will be carried out within the NEMA structures. Data handling will, however, require additional resources. *Nature*Uganda and other partners such as WCS, WWF, NEMA and others will then play a major role in attracting funds to support the data management activities.

4.6. Multi-Stakeholder Dialogue

In order to involve the various parties in an ongoing dialogue about the content and results of the monitoring activities, a group should be established as a sort of scientific advisory committee consisting of e.g. representatives of the universities, consultancy companies, NGO's etc. At the request of the reference group, open seminars and workshops on relevant subjects may be organised. This group with be independent of, but coordinated by NEMA through the National Technical Committee on Biodiversity.

4.7. Monitoring and evaluation

Monitoring and evaluation of the implementation of the biodiversity monitoring framework/Strategy should be done by the NEMA Technical Committee on Biodiversity. This committee would co-opt other specialists, for example, from the *Nature*Uganda specialist groups or from the universities and research institutions. It will be necessary to develop a Monitoring and Evaluation Plan that stipulates the key monitoring tools such as regular reports from the relevant stakeholders on biodiversity monitoring.

4.8. Conclusion

A Biodiversity Monitoring Programme where the data can not be used to influence decision making will simply be a burden to the country. It is important that a simple, cost effective, participatory approach that involves the local communities is adopted where the data generated can be used to influence policy and legislation. *Nature*Uganda has, for example, demonstrated that this is possible by developing by-laws with local communities for the Musambwa Islands. This is a modest contribution but is certainly more useful than a an unrealistically large, complicated monitoring programme that can not be sustained with locally available funds and human resources, moreover, whose findings cannot be utilised to influence policy and legislation at the national level.

It is important to note, however, that what is covered here may not reflect the totality of monitoring requirements for Uganda's biodiversity and indicates mainly those elements of interest to the 2010 Target. The development of a national biodiversity monitoring framework should focus on issues beyond 2010 identified by the NBSAP as important to the country. These issues, as well as issues raised in this assessment, can then be used in a wider consultative context to develop a National Strategy of Biodiversity Monitoring for Uganda. This strategy would then be approved though NEMA following the laid out procedures involving the National Technical Committee on Biodiversity as well as the Board. *Nature*Uganda, having initiated the current process, will play central role in ensuring that the strategy becomes a reality.

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APPENDICES

Appendix I. Current monitoring programmes in Uganda

Institution/ Mandate	Monitoring programmes	Purpose of monitoring	Area of specialization	Achievements	Challenges/ Threats	Resources/ Strengths	linkages	Gaps	Future plans
1. UWA *To conserve and sustainably manage the wildlife and protected areas of Uganda in partnership with neighbouring communities and other stakeholders for the benefit of the people of Uganda and the global community*	- Threats on PAs areas and wildlife populations - Wildlife distribution	- Generating relevant, accurate and timely information for improving UWA's capacity to manage wildlife resources in the Proteted Areas (PAs) - Facilitate generation of information on ecological and socio economic dynamics that influence wildlife conservation	Mainly fauna in and outside PAs	- Conducted Wildlife censuses - Upgrade the Management Information System (MIST) - Prepared the national great apes survival plan - Have the most current information on animal populations in PAs	- Scarcity of communicatio n equipment - Insecurity in and around some PAs - Limited coverage of PAs - Methods for monitoring impacts of Oil extraction in the PAs - Monitoring problem animals outside PAs - Methods for monitoring	- Have a legal mandate to manage wildlife (Uganda Wildlife Act,, wildlife policy 1996, wildlife statute, 1996) - Some trained personnel available to carry out monitoring activities - Management structures in	ITFC, WCS, WWF, IGCP, AWF, ECOTRUST	- Research and monitoring needed on: poaching; encroachment; wildfires; grazing; wildlife diseases, plant resource harvesting; human wildlife conflict; invasive and exotic species, pit sawing, waste management and charcoal burning - Wildlife distribution and	- Strengthen linkage with researchers/A cademic institutions - Guide research towards the priority research topics

Institution/ Mandate	Monitoring programmes	Purpose of monitoring	Area of specialization	Achievements	Challenges/ Threats	Resources/ Strengths	linkages	Gaps	Future plans
					wild fires - Methods for monitoring encroachment and illegal grazing in PAs - Insufficient funds for monitoring - Limited coordination of research to inform monitoring activities - Expertise limited to a few taxa - Bias towards fauna	place for biodiversity monitoring e.g. research and monitoring unit - Wardens in charge of monitoring and research in all conservation areas - MIST database for managing data		populations: opportunistic and covering only a few species - Taxonomic capacity needed for more taxa	
2. BCFS *Promoting sustainable use of Budongo as a model forest*	- Chimpanzee population - Tree phenology - Chimpanzee health	- To monitor and minimize threats to the primates	- Study of primates Mainly chimpanzee behaviour	- Monitoring threats to BD especially hunting of primates, - Updates of species lists - Primate	- Uganda's legislative framework regarding BD monitoring is lacking - Lack of coherent effort to stream line	- Staff, finance and logistics available for biodiversity monitoring - Location of BCFS makes it easy to	- JGI, WCS, NFA, FFNC International: Royal zoological society of Scotland, USAID, Okland Zoo, BBSRC,	- Data on taxa other than Chimpanzees are limited	- Create a data base on impacts of forest utilisation on various taxa

Institution/ Mandate	Monitoring programmes	Purpose of monitoring	Area of specialization	Achievements	Challenges/ Threats	Resources/ Strengths	linkages	Gaps	Future plans
				census data	BD monitoring - Timing of some of the censuses often requires shifting technical staff which is costly - Permit from NFA allows BCFS to operate only in a few compartments of Budongo FR leaving the rest uncovered	monitor Budongo primates - There is solid base line information for analysis of trends - Field research facilities e.g. herbarium, laboratory and library	Leverhulme trust, Wenner-Gren Foundation and EU nest finder		
3. ECOTRUST *A healthy environment with prosperous people*	- Trees for carbon	- Document and promote increase of tree cover; Promote biodiversity conservation; -Access carbon finance; -Improve community livelihoods	- Plant diversity (trees)	-Increased tree coverage -Soliciting carbon buyers -improved community livelihoods; -Buffering protected areas - Reduction	- Focus limited to trees	Adequate in respect to BD monitoring	WCS, NBDB, NU, NFA, WMD, FFNC	- Activities limited to a few areas - Limited technical capacity	- Monitoring changes in incomes of farmers, service providers - Developing capacity for climate change mitigation; BD conservation on Farm

Institution/ Mandate	Monitoring programmes	Purpose of monitoring	Area of specialization	Achievements	Challenges/ Threats	Resources/ Strengths	linkages	Gaps	Future plans
				of illegal activities (pit sawing) in PAs and FRs - Data on tree growth rates					lands as well as PAs - Developing funding for the conservation of biodiversity
4. ITFC *To lead in the implementation of biological and socio-economic research and training that furthers conservation and management of Albertine Rift forests and biodiversity*	- Ecological monitoring programme	- Addressing the major conservation threats and challenges for (Bwindi Impenetrable National Park, Mgahinga Gorilla National Park, and Echuya Forest Reserve)	- conservation and management of mountain gorillas - dynamics and viability of forest island habitats and the effectiveness of conservation strategies	- A wide range of information on biodiversity and ecosystems that can be useful in BD monitoring accumulated over the years - Long term monitoring data on Mgahinga and Bwindi	- Insufficient Funding - Limited number of taxonomists	- Human capacity in biodiversity - Located at the field site in the Albertine Rift - Has long experience in ecological monitoring - Has a field herbarium	UWA, NFA, WCS, WWF, AWF, USAID, IGCP, UNESCO, CDC, Makerere University	- Monitoring limited to a few taxa - No major data base	- To work with other organisations in conservation - Need to develop a database
5. NBDB *To inventory and monitor national biological resources and to provide information to*	- All taxa (flora and fauna) - Water fowls - Bats - Marabou Storks	- Provide data for use by several stakeholders (policy makers) - Analyse data to show trends - Produce State	- All taxa	- Production of biodiversity reports after every two years	- Insufficient funding - Limited number of technical specialists - Monitoring is not	- Location strategic and able obtain data from researchers - Database available	- *Nature*Uganda, NFA, UWA, WCS, FFNC among others	- Some taxa are not efficiently studied and monitored - Limited data coverage	-To cover all taxonomic groups in future -Produce biodiversity atlas for all taxa

Institution/ Mandate	Monitoring programmes	Purpose of monitoring	Area of specialization	Achievements	Challenges/ Threats	Resources/ Strengths	linkages	Gaps	Future plans
those interested in the conservation and sustainable utilization of these resources		of Uganda's Biodiversity Reports			institutionalised in Uganda - Mandate and legal status unclear	- Experience in handling biodiversity data -GIS Unit			- To have an institutionalised monitoring program
6. MUBFS *Training, Research and Monitoring Outreach*	- Chimpanzee monitoring - Regeneration of trees	- Primate populations - Vegetation dynamics - Human-Wildlife interactions	- Primates - Vegetation dynamics - Tree dynamics	- Publications on population trends of primates	- Insufficient funding - Limited number of technical specialist - Dependence on donor funding	- Well developed research and accommodation facilities e.g. library, laboratory - Published account of the forest	WCS MUIENR UWA FFNC	- Limited scope of monitoring - No complete database	- Attract funds to broaden scope of monitoring
7. NFA *Manage Central FRs on a sustainable basis & supply high quality forestry-related products and services*	- National biomass monitoring - Permanent sample plots in various forest reserves	- Improvement of the management of the Central Forest Reserves - Expanding partnership arrangements - Supplying quality products and services	Woody plants, mainly trees (Biomass)	- Publication on biomass, land use and land cover change in the country - Biodiversity reports of Uganda's forests	- Funding uncertainty and limited personnel in BD monitoring - Management of old PSP data is uncertain - Current focus is mainly on the business and plantations of exotics	- Has legal mandate to monitor forest resources e.g. National Forests and Tree Planting Act (2003) etc - Baseline biodiversity data on several Forest Reserves - National	- UWA, WMD, NaFORRI, FFNC, BCFS	- Information is still insufficient for forest is some areas	- Need to evict encroachers and strengthen management of natural forest

Institution/ Mandate	Monitoring programmes	Purpose of monitoring	Area of specialization	Achievements	Challenges/ Threats	Resources/ Strengths	linkages	Gaps	Future plans
						Biomass Unit with GIS facilities			
8. *Nature*Uganda *To promote the understanding, appreciation and conservation of nature.*	- Avian influenza - Conservation of biodiversity in Agricultural landscape in Uganda (BTC) - IBAs monitoring project; Bi-annual water fowl counts etc.	- Minimize threats to biodiversity by providing information relevant for protection and conservation of biodiversity	- Mainly birds but other taxonomic groups (e.g. insects and microbes) also monitored	- IBA book published - Implementation of an Africa-wide Darwin funded project for the conservation of globally threatened bird species - Getting sites listed for Ramsar - Advocacy against illegal wildlife trade in Uganda - Developed action plans for priority species and sites - Championed the process of getting sites listed for Ramsar - Developed	- Limited capacity on Avian influenza - Membership organisation with limited permanent technical staff	- Strength in terms of voluntary staff capacity - Finance and logistics for biodiversity monitoring are available	- MUWRP, IPH, Makerere University, faculty of veterinary medicine, FFNC, MUIENR, NBDB	- Knowledge about the circulating strains of influenza - Insufficient information on other flora and fauna other than birds	- Advocate for policies favourable for environment - Conserve priority species and habitats to benefit of people - Enhance knowledge of Uganda's natural history - Create a nature friendly public - Strengthen monitoring of taxa other than birds

Institution/ Mandate	Monitoring programmes	Purpose of monitoring	Area of specialization	Achievements	Challenges/ Threats	Resources/ Strengths	linkages	Gaps	Future plans
				site conservation projects (e.g. Mabamba and Musambwa)					
9. NEMA *To promote and ensure sound environmental management practices for sustainable development*	- Management of the environment	- To supervise and ensure that all activities in the environment field are in line with guidelines	- Environment and natural resources	- Produce state of environment reports for Uganda	- Limited finances - Limited skilled Personnel particularly in biodiversity monitoring	- Mandated by National Environment Act (NEA) cap 153 as the principle agency in Uganda responsible to co-ordinate, monitor, supervise & regulate environment management matters	- NFA, UWA, Nature Uganda, WMD, Universities, Research Organisations etc.	- Rely on information from other organisations for reports thus sometimes data are insufficient - Has not developed the National Focal Point on biodiversity	- Develop clearing house mechanism to document and monitor biodiversity trends - Co-ordinate BD monitoring activities in liaison with other stakeholders - Develop National Focal Point on Biodiversity
10. JGI *Contribute to the preservation of great apes and their habitats by combing conservation with education and promotion of sustainable*	- Monitoring the impact of tourism on chimpanzee populations - Population baseline monitoring - Attitudes of	- Keep track of trends in primate habitat conservation - Research on chimpanzees and other primates - Well-being of chimpanzees, other primates and animal welfare activities	- Primates - chimpanzees	- Monitoring chimps in captivity (e.g. Ngamba Island) -Generated data on snare removal in Budongo, Kibale, Kalinzu) -Established a	- Limited mandate	- Established linkages with other institutions and organisation s e.g. IUCN	WCS BCFS UWA NFA FFNC	- Limited data on taxa other than primates	- Continue with monitoring of population health, human impacts - Alternative cropping / buffer zone ; understanding small fragment

Institution/ Mandate	Monitoring programmes	Purpose of monitoring	Area of specialization	Achievements	Challenges/ Threats	Resources/ Strengths	linkages	Gaps	Future plans
livelihoods in local communities *Improve global understanding and treatment of great apes through research*	hunters following education	in general - Primate populations - Attitude of hunter's -Population health of humans & chimps that interact - Impacts of tourism		pan Africa sanctuary alliance - Developed Chimpanzee action plan					populations
11. WCS *to protect the premier sites that are biologically outstanding, where long-term conservation of species and ecological processes is viable*	Wildlife and wild lands	- To build the capacity of the UWA and NFA - To assess species distribution in forests and savannas of western Uganda - To conduct applied field-research on the ecology of key species to better understand their conservation requirements	- Wildlife (flora and fauna)	- Use the latest satellite imagery and data analysis techniques - Spread internationally and have data of the various flora and fauna	- Conservation and monitoring takes place in a complex socio-economic landscape	- Have latest data analysis techniques - Uses landscape approach that is holistic	UWA, NFA, BCFS, Nature Uganda, ITFC, MUBFS, Makerere University, Gulu University, and others	- Focus has previously been on the Albertine Rift	- Developing management systems and land use plans that will ensure long-term conservation - Initiate activities in northern Uganda
12. IUCN *To encourage and assist societies to*	Protected Areas and red list species	- To support organizations and individuals to carry out biodiversity	- Protected areas, Red list species	- Have established lists of priority species for conservation	-Inadequate human resource capacity at district level	- International resources	- Several societies, institutions and organisations e.g. UWA,	- Inadequate mechanisms for building synergy between parks	- Capacity building - Planning monitoring

Institution/ Mandate	Monitoring programmes	Purpose of monitoring	Area of specialization	Achievements	Challenges/ Threats	Resources/ Strengths	linkages	Gaps	Future plans
conserve the integrity and diversity of nature and to ensure that any use of natural resources is equitable and ecologically sustainable.		monitoring		in Uganda or globally	-Inadequate funding mechanism for the environment in the district		NFA, WCS, BCFS, WMD Universities e.g. Makerere	long term management plan	and co-ordination
13. NaFORRI *Generate appropriate technologies for increasing the productivity and supply of forest products on a sustainable basis*	Permanent sample plots in forest reserves with NFA	-Ensure efficient, effective and environmentally sound and socially acceptable forest management and utilisation systems - Facilitate scientific forest-based conservation of biodiversity and environment protection.	- Agroforestry - Forest management - Forest products - Plant genetic resources	- Generating new AF technologies - Technologies transferred - Verification and assessment of permanent sample plots in natural forests - Monitoring research plots	- Inadequate finances		NFA, ICRAF, IIBC, Makerere University e.g. FFNC	- Research limited to selected species and specific areas - No database developed	- Focus on trends of forest management - Maintain ecological stability & participatory management of forest - Strengthen links with development organisations - Develop PSPs in woodlands
14. WMD *To oversee wetland management in the country Vision*;	- Wetlands use and management	- Monitoring change in ecological integrity of wetlands - Maintaining up to date inventories of all	- Wetlands	- Have baseline data on various wetlands - In advanced stages of developing a wetland	- Insufficient financial and human resources - Lack of equipment	- Have a legal mandate from the wetlands act 2001	NEMA, WWF, NU, UWS, MUIENR, BOT, ZOO, UWA, NFA, NaFFIRI	Insufficient data (quantitative)	- Carrying out specific ecological surveys on targeted wetland systems - Develop a

Institution/ Mandate	Monitoring programmes	Purpose of monitoring	Area of specialization	Achievements	Challenges/ Threats	Resources/ Strengths	linkages	Gaps	Future plans
		wetlands in Uganda		information system					research strategy with clearly defined biodiversity indicators for monitoring
15. Botany Department, MaK *Provide quality education and research in taxonomy and ecology in plants and animals*	Permanent sample plots in Mpanga forest	Monitoring tree growth, regeneration and survival in Mpanga Forest	Flora	Publication on tree growth and survival in Mpanga forest	Funding	Qualified personnel and experience	WMD, *Nature*Uganda FFNC MUIENR UWA NFA	- Limited area of study hence limiting the amount of data available	- Expand monitoring to other habitats and species considered sensitive e.g. Cycads
16. Zoology Department, Mak *Provide quality education and research in fauna*	- Mammals e.g. bats	- Monitoring Bat populations in Uganda's selected habitats	Fauna	- Bat atlas in offing	- Funding is insufficient	- Qualified personnel and experience	UWA	- Limited in area and species of study hence insufficient data	- Strengthen the monitoring programme
Faculty of Forestry and Nature Conservation Makerere University	- UFRIC-forest management - Tree growth network with BIOTA project	- The UFRIC team works with local communities to monitor trends in forest boundaries/institutions	- Forest management - Database established at FFNC	- Improved management, increased awareness of the importance and conservation of forests	- Funding is insufficient -	- Highly trained manpower - Strong linkages	*Nature*Uganda, UWA, NFA, NaFFORI, NEMA, IUCN etc.	- Limited long term data - Need to monitor the increasing coverage of plantations and its impact	- Link with NFA and NaFFORI to regularly monitor PSPs - Develop the tree growth network

Appendix II. CDB- 2010 Target indicators relevant for biodiversity monitoring in Uganda

Focal Area	Indicators
1. Status and trends of the components of biological diversity	i) Trends in extent of selected biomes, ecosystems, and habitats ii) Trends in abundance and distribution of selected species iii) Coverage of protected areas iv) Change in status of threatened species v) Trends in genetic diversity of domesticated animals, cultivated plants, and fish species of major socioeconomic importance
2. Sustainable use	i) Area of forest, agricultural and aquaculture ecosystems under sustainable management ii) Proportion of products derived from sustainable sources ii) Ecological footprint and related concepts
3. Threats to biodiversity	i) Nitrogen deposition ii) Trends in invasive alien species (numbers and coverage)
4. Ecosystem integrity and ecosystem goods and services	i) Marine Trophic Index ii) Water quality of freshwater ecosystems iii) Trophic integrity of other ecosystems iv) Connectivity / fragmentation of ecosystems v) Incidence of human-induced ecosystem failure vi) Health and well-being of communities who depend directly on ecosystem goods and services vii) Biodiversity for food and medicine
5. Status of traditional knowledge, innovations and practices	i) Status and trends of linguistic diversity and numbers of speakers of indigenous languages ii) Other indicator of the status of indigenous and traditional knowledge
6. Status of access and benefit-sharing	i) Indicator of access and benefit-sharing
7. Status of resource transfers	i) Official development assistance provided in support of the Convention ii) Indicator of technology transfer

Appendix III. Performance of Stakeholders in relation to the CDB- 2010 Target indicators

Institution	Monitoring programme	Relevant CBD Indicators	Performance	Remarks
1. Uganda Wildlife Authority	- Threats affecting PAs and wildlife - Wildlife distribution and populations	- Trends in abundance and distribution of selected species - Coverage of PAs - Change in status of threatened species - Access and benefit sharing	- Data available on population trends of Mountain gorillas in BINP/Mgahinga, primates in KNP, and large mammals in several National Parks - 20% of the gate collections given back to local communities neighbouring PAs	Only a few species so far covered
2. BCFS	Chimpanzee monitoring	- Trends in extent of selected biomes, ecosystems, and habitats - Trends in abundance and distribution of selected species - Coverage of protected areas - Change in status of threatened species	- Regular monitoring of chimpanzess in part of Budongo - Regular collection of tree phenology data	- Need to develop proper data base -Need to expand coverage to the rest of Budongo
3. ECOTRUST	Trees for Carbon	- Area of forest, agricultural and aquaculture ecosystems under sustainable management - Ecological footprint and related concepts	- Monitoring data available on trees for carbon	- Coverage limited to western Uganda
4. ITFC	Ecological Monitoring Programme	- Trends in extent of selected biomes, ecosystems, and habitats - Trends in abundance and distribution of selected species - Coverage of protected areas - Change in status of threatened species	- Monitoring of species limited to a few e.g. Mountain Gorilla - Habitat monitoring limited to one wetland	- Need to develop proper database - Taxa monitored could be increased
5. NBDB	- All taxa- (flora and fauna)	- Trends in extent of selected biomes, ecosystems, and habitats	- Regular production of bi-annual reports on trends of	- Few taxa are covered by the reports

Institution	Monitoring programme	Relevant CBD Indicators	Performance	Remarks
		- Trends in abundance and distribution of selected species	biodiversity - NBDB gives good coverage of birds and higher plants	- National coverage probably not attained as yet - Relies on data collected by partners
6. MUBFS	- Chimpanzee populations and behaviour - Tree regeneration	- Trends in extent of selected biomes, ecosystems, and habitats - Trends in abundance and distribution of selected species - Coverage of protected areas - Change in status of threatened species - Trends in genetic diversity of domesticated animals, cultivated plants, and fish species of major socioeconomic importance	- No well developed regularly updated database	- Need to develop database
7. National Forestry Authority	- National biomass monitoring - Permanent Sample Plots in various Forest Reserves	- National Biomass Survey data and indicators - Area of forest, agricultural and aquaculture ecosystems under sustainable management - Proportion of products derived from sustainable sources - Ecological footprint and related concepts	- CFM in Budongo, Mabira, Mpanga, Sango-Bay encouraging sustainable management	Biomass monitoring data missing for the northern region due to (insecurity)
8. *Nature*Uganda	- Avian influenza pandemic influenza project - Conservation of biodiversity in Agricultural landscape in Uganda - IBAs monitoring project - Bi- annual waterfowl counts	- Trends in extent of selected biomes, ecosystems, and habitats - Trends in abundance and distribution of selected species - Trends in abundance and distribution of selected species	- Data on Population trends of birds- water birds, migratory birds available - Regular monitoring of IBAs (RAMSAR sites)	- More sites need to be included
9. NEMA	- Management of the Environment	- All CBD 2010 target indicators	- Regularly produces State of Uganda's Environment Report - Does environmental monitoring as well as EIA	- Overall body to oversee activities of various organisations - Need to develop CHM
10. JGI	- Monitoring the impact of	- Trends in extent of selected biomes, ecosystems,	- Covers ex-situ aspects	- Limited mandate

Institution	Monitoring programme	Relevant CBD Indicators	Performance	Remarks
	tourism on chimpanzee population - Population baseline monitoring - Hunters attitude	and habitats - Trends in abundance and distribution of selected species - Coverage of protected areas - Change in status of threatened species - Trends in genetic diversity of domesticated animals, cultivated plants, and fish species of major socioeconomic importance		
11. WCS	- Wildlife	- Trends in extent of selected biomes, ecosystems, and habitats - Trends in abundance and distribution of selected species - Coverage of protected areas - Change in status of threatened species - Trends in invasive alien species	- Coverage still limited to a few species	- More species should be focused on - Funds activities of monitoring in various PAs e.g. large mammal counts, invasive species
12. IUCN	PAs and Red list species	-Trends in extent of selected biomes, ecosystems, and habitats -Trends in abundance and distribution of selected species -Coverage of protected areas -Change in status of threatened species	- Produced a red list of species	- Work linked to other organisations
13. NaFORRI	-Agroforestry -Forest management -Forest products -Plant genetic resources	-Area of forest, agricultural and aquaculture ecosystems under sustainable management -Proportion of products derived from sustainable sources -Ecological footprint and related concepts	- Is in the process of setting PSPs in woodlands	- Long-term data from Uganda's forest PSPs are not analysed
14. WMD	- Wetlands use and management	- Trophic integrity of ecosystems - Incidence of human-induced ecosystem failure - Health and well-being of communities who depend directly on local ecosystem goods and services - Biodiversity for food and medicine	- Community Based Wetlands Management in place for some wetlands - Eviction encroachers from some wetlands - Eviction of encroachers - Inventories done	- No definite focus to meet CBD target indicators - No clear data on some indicators
15. Botany	Permanent Sample Plots in	- Area of forest, agricultural and aquaculture	- Long-term tree data	- Coverage limited to

Institution	Monitoring programme	Relevant CBD Indicators	Performance	Remarks
Department, Makerere University	Mpanga Forest Reserve	ecosystems under sustainable management - Proportion of products derived from sustainable sources - Ecological footprint and related concepts	covering over 30 years	one forest and one plot
16. Faculty of Forestry, Makerere University	UFRIC- forest management	- Proportion of products derived from sustainable sources - Ecological footprint and related concepts	- Database on forest boundary changes and institutions	- Need to broaden coverage
Zoology Department, Makerere University	Bats	- Trends in extent of selected biomes, ecosystems, and habitats - Trends in abundance and distribution of selected species - Coverage of protected areas - Change in status of threatened species - Trends in genetic diversity of domesticated animals, cultivated plants, and fish species of major socioeconomic importance	- Data available covering several years	- Need to broaden coverage which is at the moment limited to Kampala