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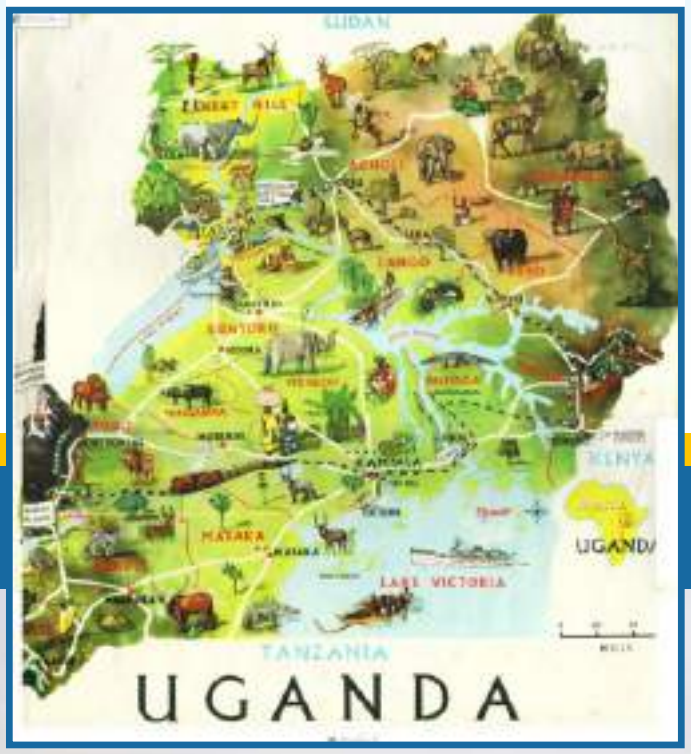
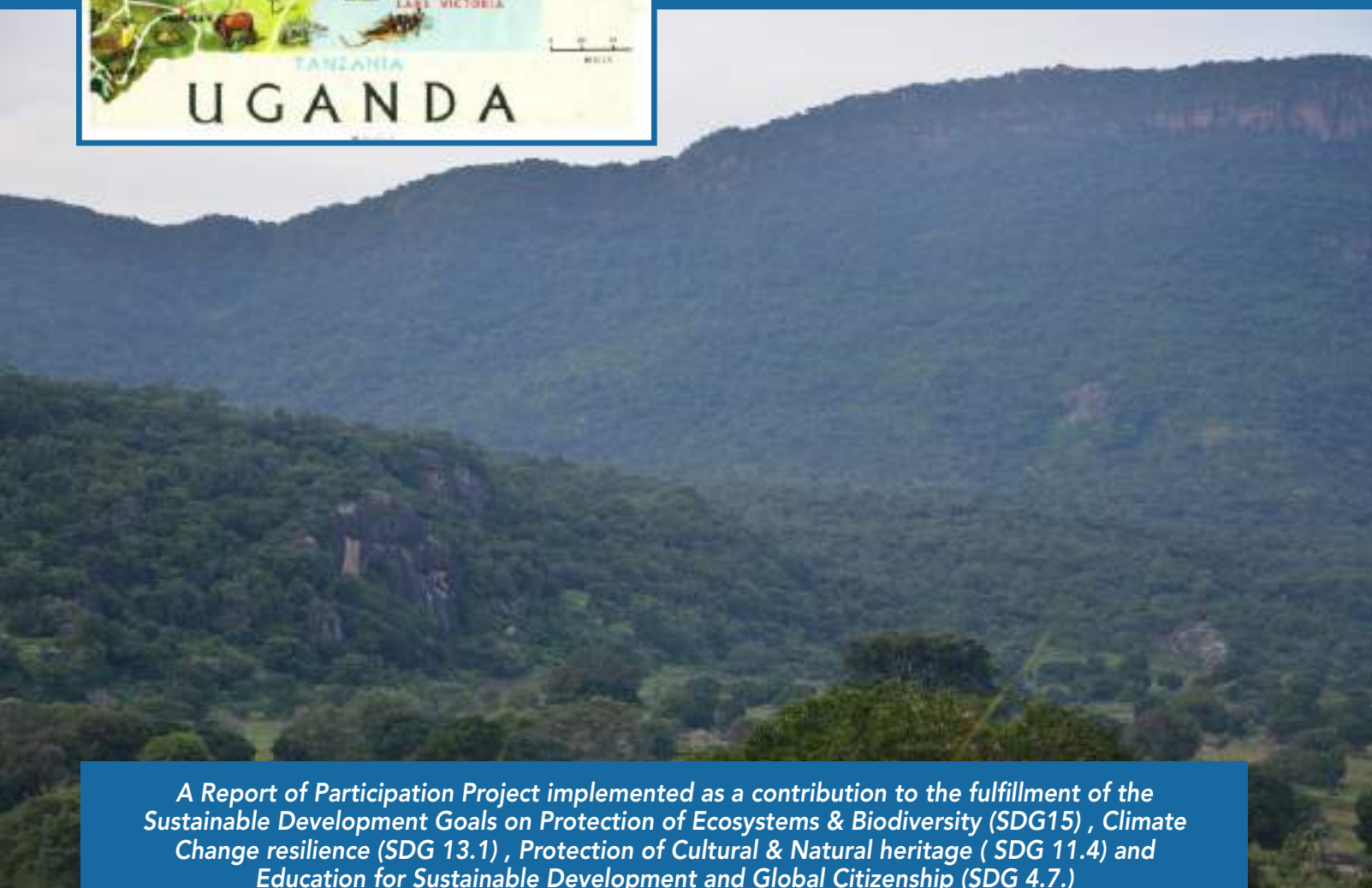


Promoting Nomination of Important Natural Sites for Designation as sites for Sustainable Governance and Climate Change Adaptation in Uganda



A Report of Participation Project implemented as a contribution to the fulfillment of the Sustainable Development Goals on Protection of Ecosystems & Biodiversity (SDG15) , Climate Change resilience (SDG 13.1) , Protection of Cultural & Natural heritage (SDG 11.4) and Education for Sustainable Development and Global Citizenship (SDG 4.7.)

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Promoting Nomination and Designation of Important Natural Sites For Sustainable Governance and Climate Change Adaptation in Uganda

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Cover PHOTOS:

Map of Uganda showing Biodiversity (above) and Photograph of The Otce Mountains, one of the proposed Geosites/Biosphere Reserves in Northern Uganda.

Printed and bound in Uganda.

Foreword by the Secretary General Uganda National Commission for UNESCO

This report is on the implementation of the participation project on promoting nomination of important natural sites for designation by UNESCO under its relevant world network of Biosphere Reserves (WNBRs) and Global Geoparks Network (GGN).

Many of Uganda's rich natural endowment with a variety of unique natural systems have remained undocumented in terms of their value for sustainable development. Existing documentation could only be traced to specific line ministries, sectors or agencies with restricted availability to the public. Worse still, the accumulated local and indigenous knowledge on these natural systems and the environment has not been tapped into for climate change adaptation and Sustainability Science Education.

In the Strategic Objective 5 of UNESCO's Medium-Term Strategy 2014–2021 (37 C/4), the focus is on promoting international scientific cooperation on critical challenges to sustainable development. The key endeavor under this is to strengthen the role and potential of the UNESCO-designated and UNESCO-affiliated sites, along with their associated networks, as pilot sites for research on mitigation and adaptation to climate change, green economies and as sites for collaboration with other international innovative environmental initiatives. These sites further serve to build scientific knowledge and identify best practices for natural resource use and ecosystem management, restoration and rehabilitation, as well as geosciences, and to strengthen the interface between science, policy and society at local, national, regional and global levels.

In this regard, the Uganda National Commission for UNESCO (UNATCOM) in due consideration of Uganda's Vision 2040 commitments on the Environment and natural resources sector commissioned this project that entails identification, mapping and documentation of the known important natural sites in Uganda with the view to recommending them to UNESCO for designation under international protection.

This report documents the detailed process that was undertaken in implementing the participation project up to the stage at which sites were identified and prioritized for nomination by the relevant stakeholders. The actual process of nomination that involves application by the Member State through the completion of specially-designed forms is outside the scope of this report.
It is our hope that those wishing to undertake a similar nomination process will find this publication very useful to them.

Rosie Agoi
Secretary General

Acknowledgement

The work that culminated into this report was supported by a number of stakeholders including the representatives of the Ministries of Tourism, Wildlife and Antiquities, Energy and Mineral Development, Water and Environment and Education and Sports in collaboration with the Uganda National Commission for UNESCO (UNATCOM). We thank them for the cooperation. Special appreciation goes to the National Forestry Authority (NFA) for providing most of the information required on the Forest Reserves under their protection and Uganda Wildlife Authority for the permission to access some of the protected sites under their jurisdiction.

UNATCOM wishes to acknowledge the efforts of the members of the National Committees of Man and Biosphere Programme (MAB) and the International Geosciences and Geoparks Programme (IGGP). Members of these two scientific Committees, MAB and International Geosciences Programme (IGCP) who formed the core of the two teams that made the field visits namely: Dr. Cassim Umba Tolo, Senior Lecturer and Julius Tumusiime, both of the Department of Biology, Mbarara University of Science and Technology; Mr. Edward Mugaddu Isabirye, Mr. Birungi Unity Sudan and Ms. Molly Kibalama Bakka Male all of the Geological Mines and Surveys, Ministry of Energy and Mineral Development, Mr. Sam Kissa Geographical Information System (GIS) Specialist, and Mr. Tom Rukundo, Environmental Impact Assessment (EIA) Specialist both of The National Forestry Authority (NFA) and Mr Ayesiga Godfrey, GIS Specialist of a private GIS firm. Each of the teams was headed by a UNATCOM Official.

The MAB and IGCP/IGGP National Committees were led to the field for data collection in two different teams headed separately by the Secretary General, Ms. Rosie Agoi (Western and Southern Regions) and the Programme Officer, Dr.Dominic Venture Mundrugo-Ogo Lali who led the team to the Eastern and Northern Regions. Gratitude to them for a successful exercise.

Finally, the District Local Government Officials, Officials of National Forestry Authority in the Reserves in Districts and the Communities in the various sites played a great role in making the fieldwork and validation workshop a success deserve special recognition for all the information they provided without which, this report would not have been complete.

For the various photos, credit goes to Mr. Ayesiga Godfrey, Mr. Kiisa Sam and Dr. Lali Mundrugo-Ogo who separately took a number of the photographs used for illustrations in this report.

Table of Contents

List of Acronyms

BUCA	Buzenga Collaborative Management Association
BZ	Buffer Zone
CBO	Community-Based Organizations
CFM	Collaborative Forest Management
CFR	Central Forest Reserve
dbh	diameter at breast height
EMWR	East Madi Wildlife Reserve
FR	Forest Reserve
GIS	Global Information System
GPS	Global Positioning System
IGCP/IGGP	International Geosciences / Geoparks Programme
KK	Kasyoha-Kitomi
LC	Local Council
Ma	Mega annum, a million years
MAB	Man and the Biosphere
MFCA	Murchison Falls Conservation
MoU	Memorandum of Understanding
MPA	Management Plan Area
NaFORRI	National Forestry Resources Research Institute
NAPE	National Association for Professional Environmentalists
NFA	National Forestry Authority
NGO	Non-governmental Organisation
PZ	Production Zone
RTEs	Rare threatened and endangered species
RZ	Recreation Zone
SMMR	Sustainable Management of Mineral Resources
SMMRP	Sustainable Management of Mineral Resources Project
SNR	Strict Nature Reserve
SSI	Special Scientific interest
UNATCOM	Uganda National Commission for UNESCO
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNHCR	United Nations High Commission for Refugees
UTM WGS	Universal Transverse Mercator coordinates system World Geodetic System
UWA	Ugandan Wildlife Authority
WAFOCODA	Wambabya Conservation Development Association

Executive Summary

Uganda is richly endowed with a variety of unique natural systems in form of environmental, geological, pastoral and agro-ecological resources that have not been or least documented in terms of their value in research and sustainable development.

In line with UNESCO's flagship programme under priority Africa on fostering science for sustainable management and disaster risk reduction and in fulfillment of Uganda's Constitutional provisions on the environment and natural resources management elaborated in the Vision 2040 and the various sectoral laws, the Uganda National Commission for UNESCO (UNATCOM) carried out a mapping and documentation on some of the known important natural sites of outstanding value with view to recommending them to UNESCO for designation under International protection. The overall objective of the project was to promote knowledge of communities and government officials on scientifically-important sites with view to nominating such sites for designation as sites for sustainable livelihoods and Climate Change adaptation in Uganda.

A variety of approaches were employed including interviews, questionnaire survey, observations, mapping and document review for both qualitative and quantitative data. The tools used included Global Positioning System (GPS) equipment, field maps, photographic cameras and land use cover descriptions. The targeted sites were visited to obtain important information and the responses from the stakeholders and site management plans were synthesized. Two categories of sites namely biospheres reserves and geoparks were considered. The implementation followed UNESCO's guidelines on Biosphere Reserves and Geoparks.

In all, forty natural sites were mapped and assessed. Twenty one of natural sites were Central Forest Reserves fit for biosphere reserves or of dual ecological and geological significance. Nineteen sites were exclusively geological. Twenty two of the forty ecosystems showed good potential for nomination as Biosphere Reserves while the nineteen geosites were recommended for grouping into three or four to form independent Geoparks. In regard to the global commitment, the project has laid a good foundation for the country to contribute to the realization of the Sustainable Development Goals especially SDG15 on the protection of ecosystems and biodiversity, SDG 13.1 on climate change resilience, SDG 11.4 on the protection of cultural and natural heritage and SDG 4.7 on Education for Sustainable Development (ESD) and Global Citizenship education.

Given that most of the geological landforms are not under any protection, it was recommended that these sites be urgently placed under regulation. For the prioritized sites with management plans and under protection, some of the plans need review to incorporate UNESCO's requirements for Biosphere Reserves and Geoparks. The sites without management plans to formulate plans as guided during the fieldwork. This calls for commitment by the communities for strong partnerships with long-term public and political support, and the development of a comprehensive strategy that will meet all the requirements. The National Committees of Man and Biosphere (MAB) and the Geosciences programme need to lead the nomination and management.

CHAPTER ONE

1.1. Introduction

Uganda is richly endowed with a variety of unique natural systems in form of environmental, geological, pastoral and agro-ecological resources. Many of these have not been documented in terms of their value in research and sustainable development. Where such documentation exists, the information is restricted to the specific line Ministries, sectors or agencies and not readily available to the public. In addition, the long accumulated extensive local and indigenous knowledge on these natural systems and the environment has not been tapped into for Climate Change adaptation and Sustainability Science education.

UNESCO'S thirty seventh General Conference approved a special flagship programme under priority Africa on fostering science for the sustainable management of Africa's natural resources and disaster risk reduction in recognition of the rich endowment of Countries like Uganda with natural resources of all types and diverse biodiversity, ecosystems, mineral resources and energy sources that can be tapped into using inclusive knowledge systems (UNESCO, 37C5). In this regard, the Uganda National Commission for UNESCO (UNATCOM) in due consideration of Uganda's Constitutional provisions regarding the environment and natural resources management and the Vision 2040 commitments on the Environment and Natural Resources Sector commissioned this study with funding from UNESCO for identification, mapping and documentation of the known important Natural Sites in Uganda with view to recommending them to UNESCO for designation under International protection.

1.2. Objectives of the Project

1.2.1. Overall Objective

To promote knowledge of communities and government officials on scientifically-important sites with view to nominating such sites for designation as sites for sustainable livelihoods and Climate Change adaptation in Uganda.

1.2. 2. Specific Objectives and scope

1. To identify, map and document the important environmental and geological sites for possible nomination to the relevant World Networks
2. To increase awareness of the communities in and around the identified sites on the need to nominate the sites for designation as laboratories and learning platforms for sustainable development.
3. To document the local accumulated indigenous knowledge about livelihoods and Climate Change adaptation in these sites
4. To support an all-inclusive, well-engendered development of management plans for each of the sites to showcase research, green tourism, renewable energy and local indigenous knowledge.

1.3. Institutional, Legal and Policy Framework

The project is in line with UNESCO's flagship 4 for Priority Africa focused on(a) Fostering science for the sustainable management of Africa's natural resources and disaster risk reduction, (b) Developing science-based upstream policies to strengthen governance of research, developing institutes, networks and agencies in biodiversity, ecosystems and mineral resources for climate change mitigation and (c) Climate mitigation and adaptation, inclusive knowledge systems

The project supports the fields of Education, Culture, Social and Human Sciences, Natural Sciences and Public Information and Guidance. It is in line with national, continental and international commitments.

1.3.1. National Legal Framework

1.3.1.1 The Constitution of Uganda, 1995 (As amend)

The National Objectives and Directive Principles of State Policy (XIII): Protection of Natural Resources and (XXVII) : The Environment: (i) Management of Land, air, water, energy (iv) a: create and develop parks, reserves and recreation areas for conservation, (iv) b: safeguard and protect the biodiversity of Uganda

1.3.1.2. The Uganda Wildlife Act, 2000 *and* The Uganda Wildlife Policy, 2014

Vision: *"Sustainably managed and developed wildlife resources and healthy ecosystems in a transformed Ugandan Society"*

1.3.1.3. The Uganda Forestry Policy, 2001

Goal: *"An integrated forest sector that achieves sustainable increases in the economic, social and environmental benefits from forests and trees by all the people of Uganda, especially the poor and the vulnerable"*

The National Forestry Authority based on the policy and subsequent law is mandated to manage 506 central forest reserves in Uganda and a total area of about 1.2 million hectares of protected areas in Central Forest Reserves. UNESCO identified National Forestry Authority as one of the key players/stakeholder to achieve the above subject. The majorly target of incorporating NFA was to identify these sites that present great universal geological, ecological and /or biodiversity heritage value that once developed can serve as learning sites as well as socio-economic and environmental infrastructure for sustainable conservation, tourism and local Community empowerment. This is why a Multidisciplinary team consisting of specialists in the areas of interest where selected to carry out the assessment and awareness creation in the various key stakeholders of the area including all other government officials and residents within the target central forest reserves.

1.3.1.4. Continental Frameworks

In terms of Continental aspiration, it contributes to the AU/NEPAD's Environment & Climate Change strategy (2010-2015) on Combating Land Degradation, Drought, Desertification, Climate Change, T/ boundary Conservation and Management of Natural Resources

1.3.1.5. International Policy Frameworks

In regard to the global commitment, this project lays a good foundation for the country to contribute to the realization of the Sustainable Development Goals especially SDG15 on the protection of ecosystems and biodiversity, SDG 13.1 on climate change resilience, SDG 11.4 on the protection of cultural and natural heritage and SDG 4.7 on Education for Sustainable Development (ESD) and Global Citizenship Education (GCED).

1.4. Methodology

1. 4.1.Scope of the Project

The scope of this project was to cover the whole country which was zoned into the six regions of North, North Eastern, Eastern, Central, Western and Southwestern. The maps of the Country showing some of the features targeted are shown in figure 1 below.

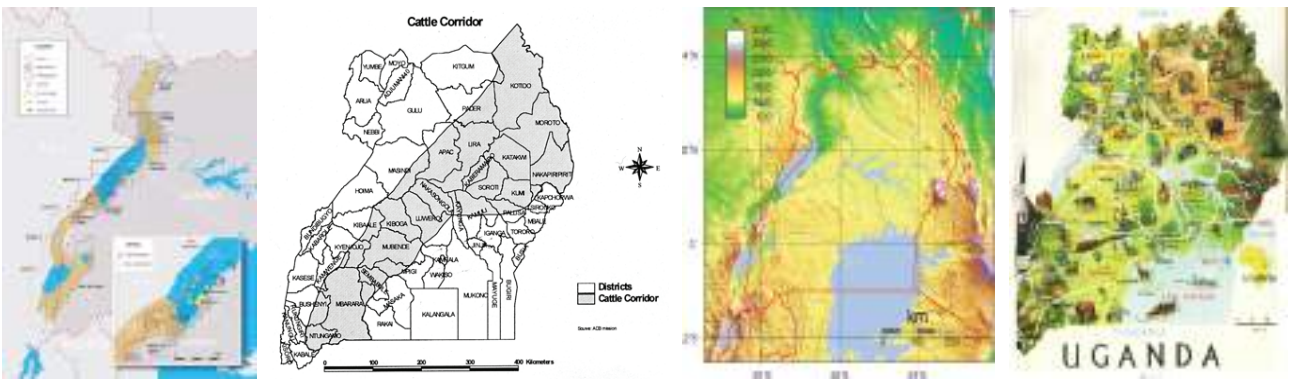


Figure 1: Maps of Uganda showing the Scope of the field work.

In executing the project, the implementation team was guided by UNESCO's guidelines on Biosphere Reserves and Geoparks.

Biosphere reserves are areas of terrestrial and coastal/marine ecosystems, or a combination thereof, which are internationally recognized within the framework of UNESCO's Programme on Man and the Biosphere (MAB). They are established to promote and demonstrate a balanced relationship between humans and the biosphere. Biosphere reserves are designated by the International Coordinating Council of the MAB Programme at the request of the State concerned. Individual biosphere reserves remain under the sovereign jurisdiction of the State where they are situated. Collectively, all biosphere reserves form a World Network in which participation by States is voluntary (http://www.unesco.org/new/en/natural-sciences/environment/ecological-sciences/biosphere-reserves/). UNESCO further describes the key characteristics of biosphere reserves: achieving the three interconnected functions of conservation, development and logistic support, appropriately zoned combining core protected areas with zones where sustainable development is fostered by local dwellers and enterprises with often highly innovative and participative governance systems and having a multi-stakeholder management approach involving local communities.

Geosites, according to UNESCO are important, have unique geological or geographical features of great geological heritage of international value-significance such as natural/geological, paleontological and archeological sites. They should be regarded as sites deserving to be preserved or protected for the community and future generations. Such sites may become tourist destinations, or may be of educational importance. There are four fundamental features to a UNESCO Global Geopark. These features are an absolute prerequisite for an area to become a UNESCO Geopark (http://www.unesco.org/new/en/natural-sciences/environment/earth-sciences/unesco-global-geoparks/fundamental-features/, http://www.unesco.org/new/fileadmin/MULTIMEDIA/HQ/SC/pdf/IGGP_UGG_Statutes_Guidelines_EN.pdf)

1.4.2. Methods and tools of data collection

1.4.2.1. Methods

A variety of approaches were employed including interviews, questionnaire survey, observations, mapping and document review. Both qualitative and quantitative data collection approaches were used to collect data for analysis and reporting. Some literature review was done to determine the location of the sites.

1.4.2.2. Data collection tools

A number of tools were used that included Global positioning System (GPS) equipment used to collect geographical location data, Field maps for navigation, Cameras for photos and land use cover descriptions respectively.

The targeted sites were visited to obtain important information in line with the objectives of the project. A synthesis of the responses from the different stakeholders and management plans of some sites is drafted in this report. The report is structured to follow the UNESCO guidelines outlined in the questionnaire for nomination of important natural sites for designation as Biosphere Reserves.

1.4.3. Stakeholder/Institutional Participation

- The memberships of the two National Committees of MAB and IGCP (Annex 1)
- Communities living in and around these targeted sites including the land owners and Local area leaders for areas outside the protected areas were consulted. Interested parties and individuals from various sectors where part of the key stakeholders together with the District Local Government (Annex 2, various tables).
- Various Institutes were involved in the whole exercise by virtue of their mandates and jurisdictions. These include: Ministry of Energy and Mineral development-on the issues of geology and geosites, Ministry of Tourism, Wildlife and Antiquities and Uganda Wildlife Authority (UWA), Ministry of Water and Environment together with National Forestry Authority and The National Environment Management Authority (NEMA).

1.4.4. Terms of Reference for the Field Appraisal Teams

i. To visit the districts and sites of identified priority natural features
ii. Report to the District, Sub-County and Agencies responsible for managing the sites and introduce the project to these Authorities at the first encounter before the field work
iii. To enlighten the communities in and around the identified sites on the project, the need to nominate the sites and the benefits of designation of such sites as laboratories and learning platforms for sustainable development.
iv. To document the local accumulated indigenous knowledge and beliefs about the sites, their livelihoods and Climate Change adaptation practices in and around these sites
v. To take pictures, draw maps and document the important ecological and geological aspects of the sites that are significant for nomination as per the provided checklist or questionnaire.
vi. To introduce to the communities the establishment of a management committee to develop in consultation with all stakeholders an all-inclusive, well-engendered management plans for each of the sites providing for research, tourism, training, livelihood activities and green development agendas that incorporate the local indigenous knowledge.

1.4.5. Proposed work plan:

The daily activities per site included the following:

1. Upon arrival to Districts and Sub-Counties : Introduction of the project to the Officials and Agents and Agency responsible for the site(Gov't, UWA, NFA, etc)
2. Visit to the targeted site(s), introduction of project to the resident Community and getting information about the site from Community(Local Indigenous Knowledge)
3. Filling the Questionnaire and Checklist and recording voices during the information gathering from Community
4. Taking pictures at site on important features : biotic, archeological and cultural including tourism trails and pictures of persons
5. Recording the coordinates of the site on the GPS Machine
6. Assisting the community to establish a management team and making development plans

Duration in each District of visit: Each team spent a maximum of two days inclusive of arrival and departure days in each district. Two teams were constituted: Eastern, Northeastern and Northern Regions team and the Western and South-Western Region team.

Procedures Followed:

In line with the TOR developed earlier, each team did the following:

1. Visited the districts and sites of identified priority natural features
2. Reported to the District, Sub-County and Agencies responsible for managing the sites and introduce the project to these Authorities at the first encounter before the field work
3. Enlightened the communities in and around the identified sites on the project, the need to nominate the sites and the benefits of designation of such sites as laboratories and learning platforms for sustainable development.
4. Documented the local accumulated indigenous knowledge and beliefs about the sites, their livelihoods and Climate Change adaptation practices in and around these sites
5. Took pictures to document the important ecological and geological aspects of the sites that are significant for nomination as per the provided checklist or questionnaire.
6. Talked to Leaders about the establishment of a management committee to develop in consultation with all stakeholders an all-inclusive, well-engendered management plans for each of the sites providing for research, tourism, training, livelihood activities and green development agendas that incorporate the local indigenous knowledge.

CHAPTER TWO:
FINDINGS FROM THE FIELD WORK

PART A: Natural Sites as Biosphere Reserves

2.1. Northern and Northeastern Region

2.1.1. Adjumani District

2.1.1.1. Zoka Forest Reserve

General Physical Description

The Zoka Forest is located in the Itirikwa and Ukusijoni sub-counties found South of Adjumani District. The forest is also a component of the larger East Moyo Wildlife Reserve. The forest measures about 1259 hectares. The Forest is a unique feature because it is the only natural tropical rain forest located in the savanna grassland and far away from the equator. It is also a habitat to a very special species of flying squirrel and wild coffee. It also harbors a rare species of colored fish. It should therefore be conserved because it as a historical and cultural site.

The governing body currently is the National Forestry Authority (CFM) but the recommendations of the district officials are that the forest be gazzetted with a proper management body placed in charge to save it from total extinction. The management arrangement proposed is the Public Private Partnership.

According to the records of the NFA forest management plan for the period 2012-2022, the Zoka Forest is part of the network of critical sites for biodiversity conservation, with a unique trasition from forest to grassland with flying squirrel found only in this place. It is water catchment area for Zoka, Itiriwa, Esia, Lidwi, and Dangani streams The forest stretches across the two subcounties of Ofua and Ciforo in Adjumani District. Zoka covers about 11.5 km East of R.Nile and 32 km South of Adjumani Town. River Zoka flows on the Northern part of the Reserve. 90% of the Reserve lies inside East Madi Wild Life Reserve.

The Geographical Positioning information is an area of 6,089 ha locations as UTM WGS84
E-351551, N-342295 and elevation of between 850m-1000m.

The records of the forest management plan for the period 2012-2022 further shows that Zoka CFR was gazetted in Legal Notice 275 of 1940 as the partially demarcated Ayugi and Zoka CFR of 31,339 ha. In Legal Notice 41 of 1948 it was re-gazetted with serial Number 130 as the Ayugi CFR (Zoka portion) of 2849 ha, as an un demarcated production reserve. In the same Legal Notice the Ayugi (remainder) CFR was re-gazetted as an un demarcated protection reserve of 51,799 ha. In Legal Notice 257 of 1948 the area of this was changed to 51,800 ha. The last gazetting was done and incorporated in the 1951 revised Laws of Uganda Cap 133 page 2134 to form the current Zoka CFR (6145 ha) with map sheet 13/3, series Y732 at 1:50,000.

The field findings showed low vegetation cover due to agriculture in the settled areas, selective tree cutting, and lots of trampling. Information from staff on site was that the relevant management practices in collaboration with other stakeholders included sensitization of local communities, routine protective patrols and engaging the communities in collaborations

Description of the proposed Biosphere Reserve

i) Conservation functions of the Reserve

Habitat for wildlife in the adjoining East Madi Wildlife Reserve (EMWR). 90 % of Zoka is within the EMWR

ii) Development function:

Has high potential as pilot because of being the only high tropical rainforest in Northern Uganda

iii) Logistic Function

Research by NARO on wild coffee, research on grasshoppers

iv) Environmental Education and public awareness activities

Roles and responsibilities and rights in collaboration forest management
Forest-based enterprises
Forest Laws/ Legislation

v) Management Approach

Threat Reduction monitoring using contracted forest patrol teams who do daily monitoring.

vi) Specialist Training being conducted

1. Boundary re-opening training
2. Implementation of Community Forestry Management
3. Training on Forest valuation
4. Training on Environmental Impact Assessment on Oil and Gas mining

vi) Potential Contribution to the World Network of Biosphere Reserves

Great but not yet in practice

vii) The Management Plan

In the records in the forest management plan for the period 2012 2022, the soils of Zoka CFR are rated as being low but the forest soil is probably one of the best soils of the area. On the ridges the soil is shallower poorer and red but supports tall *Hypermedia* grassland in parts with large savanna trees scattered throughout. Although probably too dry for the spread of the gallery forest these ridges might be suitable for Pine plantations. The Forest is gently undulating and dissected by many swamp valleys, those in the northern part of the reserve flow into the R. Zoka and the Dangali flow all the year round but all the smaller streams dry up during the dry season.

Zoka CFR is a typical Tropical high forest surrounded by savannah of varying tree density. It is very much thicker to the north and east than the south and west; in the extreme south it becomes almost open grassland. As a result of the enumeration and the interpretation of aerial photographs done long time, 8 forest types were recognized in the reserve. Zoka ranks 25th in overall biodiversity importance and 29th in species diversity. The reserve has flying squirrel unique to it. It also has variety of other fauna including Lions and elephants that come occasionally. Many streams originate from the CFR and some just outside empting into the Nile. These rivers include Zoka, Itirikwa and Esia (Permanent), Lidwi and Dangani (seasonal).

viii) Financial Sources and Yearly Budget

National Government subvention and non-tax revenue-

ix) Consultations with Local Leaders

Discussions were held with the Forest Supervisor, District Natural Resources Officer and the Chief Administrative Officer. All called for quick intervention especially given the problems in management of the reserve. To them the forest is under severe threat of complete destruction as a result of plundering by different stakeholders who have been illegally felling the trees from the reserves.

x) Management Plan

The Vision for the plan is a Sustainably managed forest estate providing multiple socio-economic and environmental benefits and contributing to the improvement of livelihoods of the surrounding communities.

xi) The Immediate objectives Management- for 3-5 years

I. Manage the CFRs for protection of the biodiversity (flora and fauna) and conservation of the ecologically fragile areas
II. Integrate surrounding communities into forest management with an aim of improving their livelihood through CFM.
III. Enhance increased forest resource base through the establishment of new plantations in the grasslands and restoration of the degraded areas.

xii)The medium-term objectives (6-10 years)

I. Manage the natural forests and plantations for production of sustained yield of timber and other wood products
II. Carryout research to obtain information for promoting sustainable forest management
III. Preserve in perpetuity an adequate protective cover for watershed management in Zoka/ Otze CFRs to prevent soil erosion and improve the water quality and quantity.
IV. Develop and promote the recreational values of Zoka/Otze CFRs through the eco-tourism activities.

The plan is for a period of 10 years effective 1st July 2011 to 30th June 2021, reviewed after 5 years in a participatory process with communities and key stakeholders for sustainability. The plan is due for revision from January 2021. The plan is operationalised in terms of Annual Work Plans (AWP).

Part of Zoka Forest

2.1.1.2. The East Madi Wildlife Conservation Center

General Physical Description.

The East Madi Wildlife Reserve in northern Uganda has existed for over 50 years in some form of protected area. During this time it has mostly been managed as a controlled hunting area and there has been little

focus on the biodiversity of the reserve. Between 1985 and 2005 the reserve was insecure and was used as a base of operations by the Lord's Resistance Army at times.
The reserve is a habitat to species of large and small mammals, birds and plants (ferns and higher plants).

2.1.2. Amuru District:

Introduction
Due to the hostility in the area during the fieldwork due to Governments proposal of leasing out land to Madhvani for sugar cane, it was difficult to get cooperation from the residents. The NFA Area manager was also not at the station at the time of fieldwork.

The sites proposed for assessment consisted of the following listed below:

2.1.2.1. Keyo 759
A catchment of river Tochi, Ayugitochipacala, Awer, Keyo and Oyitino that serves both Gulu and Amuru districts. Villages around the reserves i.e. Awer, Keyo, Wiyanono and Pagak obtain their water from these rivers. The hill tops are mainly for conserving the indigenous tree species.

2.1.2.2. Kilak, 10,205
A catchment for water supply especially streams and rivers in Amuru and parts of Gulu, prevents soil erosion up and down the hill. A largely intact ecosystem that supports plants and animals because it neighbors Murchison falls national park.

2.1.2.3. Labala, 1673

A hill reserve and catchment area for Okoil, Omee, Wenyere, Ajok and Achwa streams. A natural woodland and savannah woodland with scattered valuable tree species like Milicia excels, Khaya grandifolia and Albizzia spp. It will continue to be managed for the same ecological purposes, and timber production.

2.1.2.4. Wiceri 6,470

A source/ watershed for streams and rivers providing the Amuru district with water and joins River Nile e.g. Omee stream serving Omee community. It supports animal population from the Murchison Falls National Park.

2.1.3. Arua District

2.1.3.1. Wati-Liru-Baratuku-Odrua Ecosystems- Iti Mountains

These are a series of mountain ranges combined with forests located in Terego County near the border with Maracha. Mt. Wati is the highest mountain in West Nile. Brown granite rocks are a common site along the slopes of Mt Wati which bears both for the historical and cultural importance to local community this region. It is a potential for mountain climbing and nature walk and an eco-tourism site. It also has a crater lake on top. The other ranges next to Mt. Wati include the Offude Hills.

The mountains boast a crater lake at the top, monkeys and other animals. The complex includes the Wati Central Forest Reserve as part of the ecosystem.

It's currently under the management of NFA but also proposed to be under the Collaborative Forest Management.

The great grandfathers (Offuna and Agundu) of Terego community were buried on top of the hill and there is a structure built with mud called saku, which was left behind by these kings. According to the Assistant Chief Administrative Officer of Arua, the key issues of conservation, livelihood, heritage and development can be best addressed by the complex. The **Wati-Liru-Baratuku-Odrua Complex** is located in Terego west covering an area of N, 764 hectares; UTM WGS84 located E-283481, N-358430 and elevation between 930m-1395m. It is woodland perforated by granitic rocks with a crater lake on top. This forest is encroached and the neighboring forests are degraded.

The site has been proposed for nomination and gazzeting as one of the possible Biosphere Reserves because it has the potential

Mt Wati (Iti)

Ranking

The team ranked the Geosites/Park as follows:

1. Mt. Otze
2. Mt. Wati/Iti
3. Bari tuku ranges

2.1.3.2. Laura CFR:

Hilly reserve with rocky woodland inhabited by baboons, monkeys and various birds. Has Afzedia species that has high demand for export as logs.

Challenges: Conflict in Luuka that has affected tourism, mountain climbing, bird sanctuary, geological significance.

2.1.3.3. Ajai Wildlife Reserve

a) Introduction

The Ajai Game Reserve is a small reserve covering about 16,600 hectares located in the Northern district of Arua along the Western bank of White Nile. It is well known as the habitat for the white rhino species which has become extinct and is currently under the management of Uganda Wildlife Authority. The game reserve is part of the Murchison Falls conservation area with the major land use cover being woodland and grassland as well as bushlands. It is dominated by seasonally flooded swamps and woodland savanna. It was gazzetted as a wildlife reserve in 1965. As a Rhino sanctuary, it was home to 60 of Uganda's then remaining 80 white rhinos.

It has a wide variety of flora and fauna like monkeys, warthogs, baboons, baffalos, water bugs, Utta beasts, and a well-connected wetland network. It is currently home to a vast number of crested cranes, the bird of great national significance to Uganda as it occupies a prime position on the country's national coat of arms. Yet despite its serenity, beauty and popularity, the crested crane is facing a threat of extinction.

It is therefore on this basis that the administration in the region recommends that the sanctuary is upgraded into a Wildlife Reserve or Geopark.

There is conflict due to management dispute between UWA and the local community.
The Wildlife Reserve, measuring 166 km^2 in area, is located at 36N 0303482E, 0318063N; 665 m above sea level on the 1:50,000 – scale topographic map sheet 20/1 (Uleppi) and 20/2 (Rhino Camp) in Moyo District and the 1:250,000 – scale geological map sheet Geology_NA_36_5_Pakwach.

The underlying rocks are geologically mapped as largely Neoproterozoic age sediments comprising of sands, silts, gritty sandstones at the base and Neogene age alluvium, papyrus swamp, and floodplain muds on top. However, these are erosive products of the oldest rocks so far dated in Uganda. Implied in depth is Garnetiferous gneiss and Charnockitic gneiss rocks, among others while Quartzite; fuchsite (lithium mica – bearing) in places underlies the high-rising Biliba Ridge (846 m) nearby.

Radiometric age dating by SMMRP of the Charnockitic gneiss at Goli returned an age of 3,079 ± 14 Ma, a typical Mesoarchaean age (3500 – 2800 Ma).

In terms of mineral potential, a similar quartzite in Warr area, Zombo District was found to be gold – bearing.

b) Reserve management

The reserve, managed by Ajai UWA camp at Inde with two outposts at Madali and Lali, falls under Murchison Falls Conservation Area (MFCA) together with four others namely: East Madi, Karuma, Kabwoya and Bugungu. Gazetted in 1964, it was named after Chief Ajai who donated the land to government for conservation purposes. His residence was on an island planted with exotic acacia – still being preserved in his memory.

Once a Sanctuary for the White Rhino but which is long extinct since the 1980s, it still holds a variety of wild game including Uganda Kob, Olive baboons, Velvet monkeys, Black & white Colobus monkeys, Patas monkeys, Sitatungas, Wetland antelopes, leopards, warthogs and bush pigs. Buffalo, elephant and waterbuck also occur Rumoured to have hartebeest, oribi and duikers (Dik dik). The Shoebill stork bird also exists in the reserve. In regard to flora, various grasslands and woodlands occupy long ridges up to 4 km in length.

The reserve has been leased to a Partner, M/S Uganda Wildlife Safaris to do controlled sport hunting of baboons and Sitatunga – now suspended. Already into 8 – 9 years of his 20 – year lease, he is failing to fulfill his lease obligations. Otherwise the reserve has potential for birding, nature walks, sport fishing and game drives. Safari camps to facilitate tourism activities are still insufficient.

c) Cultural significance of the Reserve

Basket fishing during the dry season. Medicinal plants collection. The Shoe Bill stork is a respected cultural symbol. Otherwise, MoUs have been signed with communities to harvest brooms and papyrus.

Scientific Significance: Tourism, biology, local history, ecology, culture, hydrology, geography, teaching, education and research.

Interest on the site: national, regional, scientific and educational interests-
The estimated area is 15,863 hectares, UTM WGS84, E-303490, N-318070 and the elevated between 620m-800m.

d) Challenges in its management

Encroachment with agricultural activities – Resettlement of the people of Degiya still difficult due to their resistance to re-location. Otherwise was successful with Madali. Human impacts due to population growth – grazing in the dry season, the Balaalo factor. Charcoal burning and uncontrolled burning; communal hunting and trespassing (wire snares and metal traps).

Ajai Game Reserve, Madi-Okollo County, Arua District

2.1.4. Koboko District

2.1.4.1. Mt Kei Forest Reserve

Introduction and Physical Description

Mt Kei is a thick forest rich in biodiversity. It is a home to a rare species of endangered butterflies. It is a potential geosite because of the existence of a mountain; an inselberg feature and forest cover which also acts the breeding grounds for the butterflies. The western third of Mount Kei lies in Koboko County and the eastern two thirds in Aringa county. The mountain covers an altitudinal range of 915-1332 m and is bounded by the river Kaya and the international border with Sudan to the north and river Kechi to the east.

The site is also important water shed for the river separating Uganda and South Sudan. The river is also one of the tributaries of the Nile. It has a potential to be nominated for a geopark. It also has a potential

for tourist attraction because of its rich biodiversity and magnificent scenic beauty.
A collaborative management arrangement between Uganda Wildlife Authority and the Forestry Authority has been recommended.

Ecological Significance

Two hundred and twenty nine trees and shrub species are known on Mount Kei. The classification of plant species according to their ecological characteristics revealed that 21% of the species recorded from Mount Kei were forest-dependent. Forest non-dependents (species that occupy forest habitats, as well as non-forest habitats accounted for 33%. Of the tree and shrub species known to occur, 31 are uncommon and have been recorded from not more than five of the 65 reserves in Uganda. Three of these, Aeschynomene schimperi, Combretum racemosum and Morinda titanophlla have been recorded in no other site. Butyrospermum-Hyparrhenia dissoluta savannah is the most dominant species on Mount Kei. Combretum-Terminalia loudetia savanna covers a small portion of the mountain. It's therefore not surprising that forest-dependent species accounted for only 21% and open habitat species accounted for 31% during the 1996 biodiversity inventory.

There are 36 restricted-range bird species now known to occur in Mount Kei. They are generally open habitat species more common to the north in Sudan including Levant sparrow hawk (Accipiter brevipes) previously known in East Africa. Many of the species that were recorded in the 1996 biodiversity inventory are more common to the north but rare in Uganda, such as Little Green Beefeater (Merops orientalis) which has only been recorded on Mount Kei. Bird community on the mountain is dominated by open habitat species. Only 2% of the birds on this mountain are dependent on the interior of forests while a further 7% are dependent on more open and disturbed forest. Ecological characteristic breakdown shows three small - mammals forest dependent species, seven open habitat species and ten species with wide spread occurrence. Species accumulation according to the 1996 biodiversity inventory has declined and it appears that an asymptote may have been reached. Some 14 butterfly species are associated with closed forest habitats and an additional 19 with forest edge ecology. Three species Zeriris neriene, Metisella Formosa and Lepella lepeletier, are considered to be uncommon internationally. Of the species recorded, those of particular interest include Chararex kirki, which, was registered in Uganda for the first time during the 1996 biodiversity survey. This butterfly, also recorded in Moroto, Labwor Hills, Napak, Era and Muruzi Hills, and mount Kei now represents the westernmost extent of its range. The other two Charaxes of note are Charaxes boueti rectans, a sub-species which will probably have full species status in the near future and Charaxes laodice bernardiana a restricted-range species known from West Africa and a few isolated records in Western Uganda and the Nuba Mountains in Sudan. The uncommon dry-zone Lepidochrysops pterou pterou a Lycaenidae species is known only from Kenya and Uganda, although its presence in Mount Kei would indicate its likely occurrence in Uganda. Seven species were recorded nowhere else during the course of the project: Acada biseriatus, Astictopterus punctulatus, Metisella formosa, Parasmodes morantii, Euchrysops albistraiatus, Lepidochrysops pterou and Tertarhanis diversa. The large moths species of Mount Kei include a high proportion of common, widespread species, many of which are of migratory habits, in addition to species that are typically associated with grassland and savanna woodland habitats. Four hundred and eighty seven hawk moths (Sphingidae) of 31 species and 199 silk moths (Saturniidae) of 23 species were captured during the 1996 biodiversity inventory. These were predominantly widespread species in of savanna woodland habitats. Four species not known from Uganda prior to the 1996 inventory were recorded from Mount Kei (Rohaniella pygmaea, Microgone cana, Platysphinx piabilis and Polyptychus coryndoni), in addition to seven other rare species, known from no more than five other sites that were investigated. Overall richness is low compared with the other investigated sites, but high compared with other savanna woodlands in the north of the country. More than half (55%) of the hawk moths recorded at Mount Kei are widespread species and many of them are migratory. (http://www.mrc.mak.ac.ug/downloads/Mountain%20Issues%20in%20Uganda%20publication%202006.pdf).

2.1.5. Moyo District

2.1.5.1. The Metu Mountain Ranges Ecosystem (Illo-Illingwa-Otze-Nyeri Mountains System)

The Metu Mountain Ecosystem consists of the Mountain ranges of Otze, Nyeri, Umba, Illo, Illingwa and has a vast ecosystem that includes the Otze East Forest Reserve, the Dufile Wildlife Santuary and the Emin Pasha Dufile Fort. The latter is believed to be one of the sites that ancient explorer Emin Pasha settled and also named as one of the trading market point during the slave trade period. The Forest area stretches up to 18,757 hectares located as E-283481, N-358430 and an elevation of between 930m-1395m. It is very rich in biodiversity, beautiful caves, gravity flow schemes, the Panjala view point of the Nile, bamboo forest oxenthera spp, khaya species richness and the endemic ebony tree also known as iron wood.

The Otze East CFR is part of the network of critical sites for biodiversity conservation in Uganda. It is located 18 km Northeast of Moyo Town. The site covers an area of approximately 188 square kilometers. It categorized as a prime conservation forest with some unique species of flora and fauna. It is a watershed and catchment area for the River Nile. It also has a number of caves, is rich in biodiversity and is a potential site for eco-tourism. It is also rich in mineral deposits and protects the source of water for Moyo Town Council and the Sub-Counties of Metu and Laropi.

The forests of Otze are also water catchment forests for the River Nile. Most of the reserve is on an escarpment and many rivers and streams originate from it and empty into the Nile. The key streams include Chala, Apipi, Amua, Ayiro, Ubi, Ayido, Lore-eyi, Lifo, Lea, Ojjho and Awodo.

The forests being evergreen and extensive have a great contribution in absorbing carbon dioxide from the atmosphere although the quantity removed is not yet quantified to give value to the contribution

The reserve is under the protection of NFA. The team proposed collaboration with the Forest Management. As a Biosphere Reserve, the features of the ecosystem include springs, minerals, marble/limestone, mahogany, ebony (iron wood) mountane bamboo forest flora (Oxentra) used as alternative to timber. The fauna includes rare birds, elephants and chimpanzees nets seen. The Mountain system covers two sub-counties of Dufile, Laropi and Metu consisting of a total of 52 villages and a total population of 38, 758. The economic values include the bamboos, for money and Gravity water flow scheme.

Economic Activity in the area includes: farming, fishing in rivers, logging, bamboo, business, sale of thatching grass and other forest and non-forest products like honey. Endemic tree species for timber include: *Khaya grandifoliola, Khaya senegalensis, Afyzelia Africana, Kigelia Africana, Pseodocedrela kotshyi, Borassus aethiopum*.

The Otse Mountain. One of the ranges of the Metu Mountains. The series of the Otse-Nyeri Illo-Illingwa Mountain System is hidden from view

Mt Otse is a Central Forest Reserve and Game Sanctuary for flying squirrels and rare Albino tortoise

Management Plan

The plan has a vision statement of a Sustainably managed forest estate providing multiple socio-economic and environmental benefits and contributing to the improvement of livelihoods of the surrounding communities.

The Immediate objectives Management (3-5 years)

I. Manage the CFRs for protection of the biodiversity (flora and fauna) and conservation of the ecologically fragile areas
II. Integrate surrounding communities into forest management with an aim of improving their livelihood through CFM.
III. Enhance increased forest resource base through the establishment of new plantations in the grasslands and restoration of the degraded areas.

Medium – term objectives (6-10 years)

I. Manage the natural forests and plantations for production of sustained yield of timber and other wood products
II. Carry out research to obtain information for promoting sustainable forest management
III. Preserve in perpetuity an adequate protective cover for watershed management in Zoka/ Otze CFRs to prevent soil erosion and improve the water quality and quantity.
IV. Develop and promote the recreational values of Zoka/Otze CFRs through the eco-tourism activities.

This plan is for a period of 10 years effective 1st July 2011 to 30th June 2021 to be reviewed after 5 years in a participatory process with communities and key stakeholders to ensure sustainability ***(Prescription 2)***.The revision of this FMP revision shall start not later than January 2021 **(Prescription 3)**

An Annual Work Plan (AWP) shall be prepared by NFA staff in a participatory manner with major stakeholders **(Prescription *4)*** to cover:

(a) Appraisal of previous years‟ activities
(b) Proposed changes in management of the reserves
(c) Planned activities and related costs, as well as source of funding
(d) Revenue forecasts from each reserve
(e) Monitoring Plan

Development Function
Geoconservation Significance:
There are some issues concerning over-exploitation of natural resources.
The geoscientific significance of the area includes economic geology and mining and the earth history from the escarpments.

As a Geosite,
The geoscientific significance included minerals like iron and gold and limestone, unique geomorphology, sedimentary and volcanic and with a lot of valuable construction materials.

Geotourism potential: Mountain climbing. Geo-education at the site includes secondary schools visiting the site for geography lessons. Geo–heritage significance being documented.
Broader significance includes: Tourism, biology, local history, ecology, culture, geography, teaching, research and anthropology. It is home to chimpanzee, secretary bird, and other species of birds unique to the area, leopards, lions and medicinal plants (Alomi, Alakwe roge, Ondeyi, Ojhigo etc). A number of heritage sites exist in the mountains.There are infrastructural facilities like Health Centers, Schools, Water source installations and road networks.

2.1.5.2. Lomunga Wildlife Area

The Lomunga Wildlife Area is a White Rhino sanctuary and hunting ground used by the local Madi community. No management arrangement is currently in place and the team proposed that the site be upgraded to a wildlife reserve.

2.2. Western, Midwestern and South-western Regions

2.2.1. Buliisa, Hoima and Masindi Districts

Description of Budongo CFR in General
The Budongo forest complex consists of eight forest blocks namely: Biiso, Siba, Busaju, East Waibira, West Waibira,Kitigo, Nyakafunjo and Kaniyo–Pabidi that constitute the Budongo Management Plan Area (MPA). The forest lies above the escarpment shielding the Albertine rift valley, in the districts of Masindi, Buliisa and Hoima, most of it is in Buliisa. To the South, most of forest reserve lies north of the Masindi to Butiaba Road. Kaniyo-Pabidi is situated East and West of the Masindi to Paraa Lodge Road starting at 20km from Masindi.

The geographical location of the Reserve is between latitude 1^0 35′ and 1^0 55′ North and between longitude $31^0$18′ and $31^0$42′ E. The MPA is located as follows; Buliisa District 46,311ha (56.11%), Hoima District 668ha (0.81%) and Masindi District 35,551ha (43.08%). Budongo MPA has a total area of 82,530 ha consisting of 44,340ha (53.7%) of closed forest and 38,190ha (46.3%) of young colonizing and woodland forest.

Geology
The underlying rocks of most Budongo CFR are of pre- Cambrian origin consisting of gneiss, schists and granulites. Part of the southern Siba is underlain by Bunyoro–Kyoga series types of rock, which consist

of mudstones, shales, phylites, quartzites and conglomerates of pluvio glacial origin which have been metamorphosed.

Budongo CFR soils are ferrallitic representing a final stage in tropical weathering. They are deep with little differentiation into clearly defined horizons. There is little or no reserve of weatherable minerals and the clay minerals all of the lattice type (Kaolinite) are associated with large quantities of iron oxide and occasionally hydrated oxides of aluminium. The heavier textured soils are more fertile and may even possess many features common to most ferrisols, which are sandy loams and sandy clay loams in the different parts of the CFR. Laterite is abundant in the form of concretions or sheet ironstones. The latter cover some high ground especially hill tops like that of Kamusenene. Budongo CFR is underlain by quartizite rocks and generally variable from red loam containing small quantities of iron stone concretions which support forest vegetation to the ridge top pavements of solid cellular iron sheets. In Kitigo woodlands, there is an accumulation of carbon. In West Waibira block, several low rocky ridges occur with shallow soil outcrops of granulite. These ridges support quite distinct forest vegetation types characterized by an abundance of Strychnos mitis in association with *Cynometraalexandri* in the upper storey and *Celtiswightii* in the understorey.

Land use history of Budongo CFR

The local communities depended on the forest reserve for resources such as food, medicine, etc. The indigenous communities lived with the forest resource sustainably without overexploitation. The first known recorded activity by European settlers was the tapping of wild rubber in the forest from *Funtumiaafricana*. On his second visit to the forest, in 1910, Dawe the officer in charge of the Botanical, Forestry and Scientific Department, mapped the whole of Budongo forest and made 0.26% enumeration of all exploitable *Funtumiaafricana* and all timber trees species of ≥ 60cm dbh. In 1930 Brasnet, the Conservator of Forests at the time used Dawe's forest notes and data to prepare a preliminary working plan. Small quantities of timber were cut by various government departments between 1910 and 1919. In1919 FD began pitsawying mahoganies, but the practice stopped in 1926 when a circular saw mill was introduced. The first circular saw bench was installed in 1925 on a private estate outside Budongo and operated on trees cut on permit. In 1930 a licensee began to exploit portions of the main Budongo block. Construction of the Masindi – Butiaba road made the forest more accessible and the development of the infra structure saw the beginning of mass harvesting in Budongo CFR.

The core areas and buffer are not populated. However, the three districts surrounding the forest reserve have an estimated population of 979,889 people according to the 2014 census. The indigenous community comprises mainly of Banyoro and Bagungu who practice agriculture and trade as the major economic activities. Livestock farming plays a big role in the livelihoods of the local communities. The nearest major town is Masindi.

Budongo forest has cultural significance in that some members of the local communities engage in some kind of ritual activities to access herbs from the CFR for medicinal use on small scale in considering its expanse. Some of the most prominent cultural sites include; the Royal mile, Busingiro Hill, and the Omukama's (King's) fish pond in Biiso.

Physical characteristics of Budongo CFR

The forest lies above the escarpment shielding the Albertine rift valley North-East of Lake Albert. Generally the topography is rolling with a general slope to the escarpment of the valley to the west. Altitude is generally low and varies 914m and 1097m above sea level. Over the escarpment, there is a sudden drop of about 300m to reach the Butiaba flats on the lake shores (618m a.s.l).

The minimum temperature varies 23-29°C while maximum ranges 29-32°C. Low temperatures occur between May – July and high temperatures December - February during the months of the southern summer. As with equatorial climates, the daily temperature ranges 11-13°C. Budongo forest receives rainfall varying between 1397 and 1524 mm annually, on the average, from 100 to 150 rain days. The rains are characterized by thunderstorms and hailstorms. Rainfall pattern is bimodal with peaks in April - May and September to November, and occurs mainly in the afternoon as indeed elsewhere in the tropics, but morning and night rains also occur to lesser extents. In Kitigo, which is mainly grassland with parts changing into colonizing forest, rainfall is about 1045 mm annually.

The geomorphology of the reserve is as described previously in the summary.

Biological characteristics of Budongo CFR

At least, 50% of the area, is covered by Tropical High Forest communities classified as type D2 (medium altitude semi-deciduous *Cynometra-Celtis* forest) and 46% is classified as K (moist *combretum* savannah). The remainder comprises N1 (*Combretum-Loudetia* and N2 (*Combretum –Hyparrhenia*).

The D2 vegetation type has changed considerably following 70 years of selective logging and silvicultural treatment (tree stand improvement by arboricide spraying), which favoured growth of valuable timber species especially mahogany. However the original ecological characteristics are still recognisable and the forest can be divided into wooded grassland, colonising or woodland mixed forest, *Cynometra* dominated and swamp forest types.

(a) Grassland

Glades of grassland occur as enclaves or near external edges of the forest. The major natural processes here include grazing by game animals and wild fires in the dry season. Human activities include livestock farming and collection of construction materials.

(b) Colonising forest

This type is found along margins of the forest invaded by several woodland tree species including *Albiziazygia*, *Sapiumelipticum, Cordia africana, Maesopsiseminii* and *Spathodeacampanulata*. It is estimated to cover about 5% of the whole forest area of Budongo. This area is not rich in biodiversity.

(c) Mixed forest

There is more of the mixed forest type, 65% of the forest area. This type has been observed to be increasing as a result of opening up the canopy of the *cynometra* type during salvage harvesting. It is characterized by greater biodiversity of tree, shrub and herb species. As it progresses to maturity other species come as the *Celtis* spp., *Aningeriaaltissima*, *Alstoniaboonei* etc.

(d) Cynometra forest

The dominance of *Cynometraalexandri* in Budongo is found in the <10cm dbh class that is in seedlings and saplings. Many years of timber harvesting coupled with silvicultural treatment with arboricide, of the residual stand, have influenced the seral stages of a large area of Budongo forest. The mixed forest has increased as a result of opening the canopy of the *Cynometra* type.

(e) Swamp forest

Budongo forest is traversed by three main rivers and numerous streams providing an environment different from that of the well-drained sites. Valleys of the streams are characterized by vegetation of swampy conditions with species such as *Raphiafarinifera, Bombaxbuonpezense,* and *Calamusderratus*, the tall woody climbing cane among others. This forest type is the least biodiverse of all the Budongo forest types. Only species tolerant to wet soil environment are found in the stream and swampy areas of Budongo CFR.

2.2.1.1. Budongo Forest

The proposed Biosphere Reserve would contribute to conservation of landscape, ecosystem, species and genetic variation. BudongoCentral Forest Reserve (CFR) is home to some of the globally endangered chimpanzees and other primates. It is home to a diversity of species including; 465 plant spp, 359 bird spp, 24 small mammal spp, 289 butterfly spp and 130 large moth spp. Four butterfly and one moth species are regionally endemic.

Budongo CFR is a major water shade forest with the rivers Sonso, Kasokwa, Waki, Waisoke and Biizi. It serves as an important catchment area for Lake Albert. The forest also reserves a source of fresh water for domestic consumption to the surrounding communities.

Budongo CFR is the biggest forest reserve in Uganda and presents its role in climate amelioration in the region, sequesters large quantities of carbon. It is very import in regulating amounts of CO_2 in the region and globally given the increased rate of industrialization and development of the oil industry in Uganda.

The proposed Biosphere Reserve has great potential to promote sustainable economic and socio-cultural development through controlled harvesting of forest products, ecotourism and other ecosystem services like regulating local climates, watershed stabilization, etc. The forest currently contributes a great deal to the national budget. The forest has been reported to host chimpanzee habituation, ecotourism site, Kupkaba Leg's site called royal mile, birding area, catchment for Lake Albert, home of irn wood

The proposed reserve supports both local and international researcher though the potential is not fully exploited. Several researchers have studied the flora and fauna giving a floristic and faunal inventory, a basis on which monitoring is done. Indeed, researchers are considered stakeholders in the management of reserve currently.

Criteria for designation

Budongo CFR a mosaic of vegetation types with 50% covered by tropical high forest communities classified as type D2 (medium altitude semi-deciduous *Cynometra-Celtis* forest) and 46% is classified as K (moist *Combretum* savannah). The remainder comprises N1 (*Combretum-Loudetia*) and N2 (*Combretum –Hyparrhenia*).

Glades of grassland occur as enclaves or near external edges of the forest. Colonizing forest is found along margins of the forest invaded by several woodland tree species including *Albiziazygia*, *Sapiumelipticum, Cordia africana, Maesopsiseminii* and *Spathodeacampanulata*and is estimated to cover 5% of the entire forest area. There is more of the mixed forest type, 65% of the forest area. The presence Cynometra forest is due to dominance of *Cynometraalexandri* in Budongo is found in the <10cm dbh class that is in seedlings and saplings. However, many years of timber harvesting coupled with silvicultural treatment with arboricide, of the residual stand, have influenced the seral stages of a large area of Budongo forest. Budongo forest is traversed by three main rivers and numerous streams providing an environment different from that of well drained areas favouring growth of the swamp forest.

The proposed Biosphere reserve also provides an opportunity to demonstrate sustainable development through the environmentally friendly economic activities like ecotourism which currently earns the country a lot of revenue. Controlled harvesting of forest products for posterity also contributes to the same cause.

Zonation of Budongo Forest

It is zoned with Strict Nature Reserve (SNR) Zone, Recreation Zone (RZ), Buffer Zone (BZ), Special Scientific interest (SSI) and a production Zone (PZ) in the ratio of 31.1% SNR, 4.4 RZ, 6.4% BZ, 0.8% SSI and PZ 57.4% PZ.

24,488 ha are set aside as core (strict nature reserve), 5,794 ha constitute the buffer zone while the rest (52,248 ha) is considered production zone (transition). The zonation was done with the rationale of conserving the habitat and ecosystem services of the core area, reducing the human exploitation of the core by establishing a buffer zone and regeneration of the forest due to previous illegal overexploitation of the forest resource. The transition/production zone was established with the background that Sustainable yield of various wood and non- wood products and services cannot be achieved without adequate protection of the resource and regulation of its harvesting. Management effort strives to establish both quality and quantity of the forest resource for optimum resource conservation of consumptive and non-consumptive nature.

Budongo CFR is the largest forest reserve in Uganda with the appropriate size to serve the different purposes of a Biosphere reserve. It is part of the network of critical biodiversity sites in Uganda. It has therefore been zoned into Strict Nature Reserve (SNR) Zone, Recreation Zone (RZ), Buffer Zone (BZ), Special Scientific interest (SSI) and a production Zone (PZ) in the ratio of 31.1% SNR, 4.4 RZ, 6.4% BZ, 0.8% SSI and PZ 57.4% PZ respectively.

The strict nature reserve is the core area set aside for species and habitat protection and only research, education and monitoring are permitted. The buffer zone protects particularly sensitive areas such as strict nature reserves from undue human pressure that may exist outside the protected area, usually by allowing some limited and controlled human use like ecotourism and regulated access to non-timber forest resources. In the production zone (transition zone), there is sustainable exploitation to meet the demands for timber, fuelwood and other forest products to serve the development and livelihood needs of the community and the country as a whole.

Budongo as a proposed Biosphere Reserve has many stakeholders including NFA, Local Governments of Masindi, Hoima and Buliisa Districts, NGOs/ Community-Based Organizations (CBOs), Researchers and several development partners**.** The local governments and CBOs as well as some NGOs involve the local communities as much as possible in the management.

The activities in the buffer zone are regulated through shared agreements and memoranda of understanding between the users and the forest management (NFA). Renewable memoranda of understanding are signed between NGOs while Collaborative Forest Management (CFM) agreements have been signed with CBOs. The implementation of the activities of the proposed Biosphere Reserve is guided by the management plan revised after every ten years.

There are ongoing research, monitoring, education and training activities in Budongo CFR. Research studies include flora and fauna studies by both local and international researchers especially Chimpanzees, effect of climate change on germination of some seeds, invasive species like *Senna spectabilis*and *Lantana camara,* phenology of *Cordia milleniiand Balaniteswilsoniana*whose in-situ regeneration is troublesome, etc. Continuous monitoring is done by staff and community members in the CFM, while environmental education and training are normally tailored towards wise use of the forest resources to the local communities, especially the youth.

Conservation function of Budongo CFR

The proposed biosphere reserve would contribute to conservation of landscape, ecosystem, species and genetic variation. Budongo CFR is home to some of the globally endangered chimpanzees (*Pantroglodytes)* and other primates. It is home to a diversity of species including; 465 plant species, 359 bird species, 24 small mammal species, 289 butterfly species and 130 large moth species. Four butterfly and one moth species are regionally endemic. Budongo CFR is the home of Mahogany (*Khaya*spp&*Entandrophragma*spp) of high value, next to none but *Miliciaexcelsa* (Mvule) whose genetic diversity conservation is paramount

to prevent overexploitation. Budongo CFR is a major water shade forest with the rivers Sonso, Kasokwa, Waki, Waisoke and Biizi. It serves as an important catchment area for Lake Albert. The forest also serves as a source of fresh water for domestic consumption to the surrounding communities.

Development function of Budongo CFR

Sustainable development can be demonstrated at Budongo CFR through sustainable use of wood and non-wood forest products for income generation. Activities like ecotourism and research earn the country a great deal of revenue contributing not only to local but also national development. The potential for tourism for the reserve has systematically been growing. The two (2) sites of Kaniyo-Pabidi and Busingiro have frequently been visited by both Ugandans and the international community. The communities have been engaged in tracking animals mainly primates (Chimpanzees, and monkeys among others) and bird watching.

NFA has a MoU with Jane Goodall Institute to upgrade and improve ecotourism operations at both Kaniyo-Pabidi and Busingiro ecotourism sites. This activity has grown and proved that the non-consumptive ecotourism is important and calls for multipurpose management to fully utilize all available forest resources for sustainable economic development. In total, there are twelve brick and wood facilities, six at each site, to facilitate ecotourism in Budongo CFR. The local community benefits directly by getting market to their goods and employment in the tourism industry as guides, and indirectly through social service delivery from the revenue collected by the government.

Plate 1: Field meetings held; Nyakafunjo village (A),sector manager (B), Nyabyeya Forestry College, Nyabyeya parish, Budongo sub county,Bujenje County. Nyakafunjo is one of the closest communities to Budongo CFR

Logistic support function of Budongo CFR

Research has played a major role in shaping the management strategies of Budongo CFR right from the 1940s to date. Different management approaches were tried and modified to increase productivity of the forest initially and later to ensure conservation and education in the core zones, sustainable utilization and regeneration of overexploited areas while ensuring property rights and utility to the local communities. For example, the conclusions drawn from the results achieved up to 1955 showed that felling had resulted in satisfactory natural regeneration of Mahogany and other valuable light demanding species, but that this operation alone was insufficient, because it was least effective in the *Cynometra* type forest. This led to adjustments in silvicultural plans by management over the years. Currently, the research working circle encourages both local and foreign institutions to study the ecosystem dynamics of Budongo CFR and has a MoU with institution like National Forestry Resources Research Institute (NaFORRI), Makerere University and other institutions of higher learning on research matters. A compartment of 625 ha of the forest has been designated as a "site of special scientific interest" for studying primates there are plans to expand research on primates to other compartments, studying the effects of climate change on the phenology of some tree species, invasive species, etc. The tourism facilities for lodging are shared with both local and international researchers who need to spend time at the research station.

Budongo CFR is an important environmental asset to the neighboring communities, the districts and nation as a whole in ameliorating climatic conditions. The forest is vital in soil stabilization and rivers flowing through form a network as part of the hydrological system in drainage and agricultural production. This importance is emphasized to local and visiting communities through education programmes both to schools and local communities through radio programmes and meetings. The CFR has Chimpanzee habituation, ecotourism site, King Kaba's site/Royal Mile, Birding Area, Catchment for Lake Albert, Home of Iron Wood (hardest wood-cynometra climax tree)

Through liaison with Uganda Wildlife Authority, the proposed biosphere reserve will potentially collaborate with existing reserves in Uganda and beyond. There is potentially possibility to collaborate through twinning arrangements and collaborative research activities, etc.

Units of proposed biosphere reserve
Budongo CFR has different compartment as described earlier which are contiguous. However, the core compartments and respective buffer zones are not contiguous as may be seen on the map. The reserve is located and facilities for the employees and tourists/researchers also are on public land except for some sites where facilities are on private land.

In the core area, conservation, research and education occur. The main challenges due to human activity include some researchers not complying with permit conditions in course of their research and conflicts between research and outputs.

As a result of some people clearing forests and bushes on public land and cultivating to the edge (transition zone) of Budongo CFR for sugarcane growing, animal crop raiding is a major management problem. Communities look at Budongo CFR as habouring the animals/vermin marauding forest adjacent communities' food crop.

The core and buffer zones are entirely on government land under the supervision of local government (districts). Management and control is vested in the National Forestry Authority (NFA) under Section 54(i) of the National Forestry and Tree Planting Act 2003, while Section 33(1) stipulates rights and privileges of communities. Furthermore , Section 41 provides for the responsible body (in this case NFA) to issue licenses while Section 15 provides for collaborative forest management with adjacent communities both of which are aimed at promoting legal access to the forest resources.

The local communities participate in the formulation and implementation of the management plan through regular meeting with NFA management. The locals are also employed to spearhead the monitoring process as rangers.
The proposed biosphere reserve is envisioned at ensuring a sufficiently forested, ecologically stable and economically prosperous Uganda.

2.2.1.2. Wambabya Forest Biosphere Reserve
The forest is located in Buseruka sub-county in Hoima district. The forest being proposed as biosphere reserve is important for biodiversity conservation in that it is home to endemic and endangered species like Chimpanzee, white-tailed monkeys, tree species like *Khayaanthotheca*, among others. It is also home to aquatic life such as fish; tree species like *Khayaanthotheca* (Mahogany), *Muliciaexcelsa* (Mvule), *Albiziacoriaria/zygia, Ficus*spp, etc; animal species like chimpanzee, olive baboons, colobus monkeys, birds and butterfly species. As a biosphere reserve, it would contribute to the conservation of landscape, ecosystem, species and genetic variation.

The site would foster economic and human development which is socio-culturally and ecologically sustainable since it is a catchment for Wambabya River that supplies stable water table for Kabalega Hydro Power dam in Buseruka. NFA formulated Collaborative Forest Management (CFM) whereby members benefit from projects like tree planting to improve livelihoods. This site is an important country ground for the king of Bunyoro.

The site is also used locally to support demonstration projects, environmental education and training, for instance, conservation education in the neighboring primary schools by the Jane Goodall Institute CFM members also use the forest for raising nursery beds for trees.

Through ecotourism, Wambabya Forest Biosphere Reserve can promote sustainable development since Chimpanzees have been habituated and local people have been employed in that project. This has been done in collaboration with the Jane Goodall Institute.

Though zoning has not yet been done, the area of 3429 hectares of the proposed reserve is sufficiently large to serve the three functions of the Biosphere Reserve. There is an already existing collaborative forest management in the would-be transition area near the demarcated boundaries achieved through a memorandum of understanding signed in 2012. Wambabya Forest Conservation and Development Association (WAFOCODA) coordinates with NFA in the CFM.

Currently, NFA manages human use and activities in protected zone of the forest using different security agencies including environment police, the army and field force police who often conduct food patrols which helps to deter unauthorized use/mismanagement.

The current management (NFA) has got a management policy which has been recently reviewed due to oil exploration related activities near the proposed biosphere reserve.

Research, monitoring, education and training are also achieved through collaboration with stakeholders like Jane Goodall Institute, National Association for Professional Environmentalists (NAPE), Chimpanzee Trust, Ecotrust, AAI, etc.

Current management challenges

Despite the enormous benefits of the forest reserve, there are threats/challenges in the management of this resource among which are;

- Illegal logging
- Charcoal burning
- Cattle grazing

The management has however devised measures to the above challenges. Forest patrols, sensitization programs and collaborative management are some of the approaches being used currently to control the above challenges.

Current and future sustainable uses

The forest is important for conservation of flora and fauna species including chimpanzees, *Khayaanthotheca*, *Celtisdrandi,* Cedredis, etc.

It also promotes the conservation of genetic diversity of traditionally important medicinal plant species like *Vernoniaamygidalia* and *Erithrinaabysinica* from which many people derive a livelihood.

The forest is a source of fuel wood (dry fire wood), food like mashrooms, spices, termites and fruits, to mention but a few.

Ecotourism like study of flora and fauna, recreation, camping and hunting. Despite the current use in ecotourism, especially chimp tracking, the full potential of the reserve is not yet developed as it lacks documented records of visitors and recreation facilities.

The reserve has a great potential to foster wide ranging research activities although this is not yet developed. Research on biodiversity studies, environmental research, medicine and pharmaceuticals among others can be done in this forest. Currently, environmental education for sustainable development is carried out among various age groups with particular focus on primary school children. There is engagement in activities like making of tree nursery beds, education through drama and games which are guided by trained staff especially in tree planting and maintenance.

Meeting with community members

The team from UNESCO met members of the community around Wambabya Forest on 11th August 2017. The members noted that they currently interact with the forest management through CFM in their group named Wambabya Conservation Development Association (WAFOCODA). The group has a constitution governing the activities in the forest and CFM guidelines stipulated in the MoU with NFA. The executive of WAFOCODA constitutes the Chair person, Vice C/P, secretary, treasurer, mobilizer, women representative, youth representative, elderly representative, tree planting members and nursery bed members.

Through activities like mapping, the community members signed a memorandum of understanding with NFA which is contractual. This led to restoration of a big part of the forest which had been degraded by unsustainable human activities. The members are now able to access resources like mushroom, fuel wood, herbal medicine, etc.

Local communities often participate in in the formulation and implementation of management plan through consultative meetings with NFA, joint patrols with NFA and involvement of community by NFA in major decision making.

The current management planned was started in 2009 though an agreement with the community was signed in 2012. Currently, members of WAFOCODA operate a budget of 5,000,000/= raised from membership fee of 6,000/= and an annual subscription fee of 10,000/=. They also collect revenue from plot allocation. Some of the activities sponsored by the budget include purchases of motorcycle to ease monitoring.

2.2.1.3. Bugoma Forest Biosphere Reserve

Bugoma Forest is a protected tropical forest is in Hoima District situated southwest of Hoima and northeast of Kyenjojo towns, and east of Lake Albert, in the Hoima district of western Uganda.[1] It was gazetted in the 1930s and came under the mandate of the National Forestry Authority (NFA) in 2003.[1] Its surface area is given as between 41,142 hectares (411.42 km^2)[1] and 65,000 hectares (650 km^2).[2]

It is one of a belt of extensive, lowland forests along Uganda's western rift escarpment, that are believed to have been connected with one another and the Ituri forest in former times.[3] The forest belt is situated between 500 and 1,650 metres. Bugoma is situated at between 990 and 1,300 m elevation.[2] Regional rainfall ranges from 1 250 to 1,625 mm.[3] Farmlands and regenerating vegetation fringe the forests, which includes Elephant grass and *Hyparrhenia* grassland.

The tree cover of the forest belt shows a tendency toward monospecific dominance. Early colonising forest consists of a mixed forest with *Alstonia congensis*, *Trichilia prieuriana*, *Khaya anthotheca*, *Celtis mildbraedii*, and *Cynometra alexandri*, among others. The climax forest that develops afterward depends on the altitude. From 1 000 to 1 200 m *Cynometra alexandri* is highly dominant (Uganda ironwood). *Lasiodiscus*

mildbraedii and sometimes by Celtis spp. and Strychnos mitis sometimes dominate the understorey. Very large trees other than Cynometra alexandri occur, such as Khaya spp. and Entandrophragma spp. Patches of characteristic colonising species (e.g. Maesopsis spp.) mature alongside climax canopy species in a mosaic pattern in spaces left by the fall of large trees. Another type of climax community is the Parinari forest, consisting of almost pure stands of Parinari excelsa, associated in the understorey with Carapa grandiflora. Other understorey species are Craterispermum laurinum, Trichilia prieuriana and Pleiocarpa pycnantha.[3]

In terms of wildlife 23 species of mammal, 225 species of bird, and 260 species of tree are known to occur in the reserve.

The forest is threatened by illegqal logging, and it is feared that it may succumb to settlement and agriculture. The situation is worsened by an influx of Congolese refugees, and burgeoning large-scale tea and tobacco farms on its outskirts that infringe on the reserve boundaries?

The forest is important for conservation of landscape, ecosystem, species diversity and genetic diversity. It is a catchment to many streams and rivers e.g. Rutoha, Ngemwa and Rwembaaho which supply freshwater to the local communities. It harbors a variety of wildlife including primates like Chimpanzee and black and white colobus monkey, birds, reptiles, butterfly and moth species among others. It has potential for sustainable development through ecotourism which earns the country foreign exchange. Local communities get market to their made products especially crafts. Also sustainable harvesting of timber and non-timber forest products contributes to sustainable development.

Though not yet zoned, the 41,414 ha of forest land is big enough to serve the functions of a biosphere reserve. However, plans are underway to have the proposed reserve zoned and current management (National Forestry Authority, NFA) has strategies and mechanisms to regulate activities in the core, buffer and transition zones. There is an existing management plan to guide the daily activities of forest reserve, which can be integrated with the management plan of the proposed Biosphere Reserve. The implementation of the plan can be achieved working hand-in-hand with the local communities, environmental police and other security personnel near the reserve.

The site currently hosts researchers from various governmental and especially non-governmental organizations as well as civil society organizations for training, experimentation and environmental education.

Physical description

There are nearby meteorological stations at Kisaru tea estate and United Nations High Commission for Refugees (UNHCR) station at Kyangwali. It is a tropical high forest with a variety of tree species of Mvule, Mahogany, Albizia, Bombax, etc. important for timber.

There are plans to construct tourist facilities to accommodate the increasing number of tourists as indicated by the recent advertisement to private developers who would like to construct such facilities. Chimpanzee habituation is in progress. Tourists engage in activities like chimp tracking, birdwatching, nature walks, etc. earning local communities employment opportunities as tour guides and security officers. Market to locally made items is enhanced by tourism activities.
There is no internet connection.

2.2.1.4. Masege Central Forest Reserve

General Physical Description

Masege CFR is a savannah woodland forest dominated by *Balonite*spp, *Kigeliaafricana*, *Acasiahockii*, *Tamarindusindica*, *Euphobia*spp, *Albizia*spp, etc. The important natural processes include biodiversity conservation and stabilization of the soils which are mainly sandy type. Human activities include ecotourism, livestock farming, collection of medicinal plants and, fuel wood collection, illegal charcoal burning etc. The management uses forest patrols and local CFM groups to monitor the forest and hinder these unsustainable practices. There is also licensing of livestock farmers and encouragement of private commercial tree farming by the local communities to minimize overdependence on the natural forest.

The biosphere reserve would contribute to the conservation of landscape, ecosystem, species and genetic variation. Masege CFR would conserve indigenous tree species north of the Albertine graben in addition to a diversity of mammal and bird species since it is adjacent to Bugungu Game Reserve. It is a savannah woodland forest with species adapted to dry climate e.g. B*aloniteegyptica, Kigeliaafricana, Acasia*sp, *Euphobia*sp, etc. It is the only central reserve with remnants of the black ebony tree, *Dalbergiamelanoxylon*. *Baloniteegyptica* is an essential source of oil to the local communities.

The site would foster economic and human development which is socio-culturally and ecologically sustainable since local communities are encouraged by NFA to make private tree plantations and other income generating activities like commercial tree planting (plans are in place to lease part of the forest to investors), collection of medicine, fuel wood collection, licensed livestock grazing in some plots etc. All the above benefits are gained through Collaborative Forest Management (CFM) with NFA.

Justification for designation

It can contribute to sustainable economic development through ecotourism, medicinal plants, regulated agricultural practices (grazing in the surroundings-good grass), source of raw materials for building houses, etc. It is also a catchment for rivers like Waiga which drains into Lake Albert thus important for protection of the lake. River Waiga is the only source of freshwater to the local communities given the salty nature of the lake water and dry conditions in the area. Given the current oil industry development, this forest has the potential to mitigate the negative effects of oil extraction in the Albertine rift vary.

Though not zoned, this forest reserve was reported to covers over 9,000 hectares, which could be big enough to serve the three functions of a biosphere reserve. The forested area is regarded as core but is surrounded by grasslands often grazed by herdsmen. The major economic activities in the would-be transition area include commercial tree planting, cattle keeping, small-scale agriculture for subsistence, etc. There is a MoU with the indigenous people (mainly pastoral community) with the management of Masege forest. CFM operates on contractual terms liable to extension upon expiry.

There are organizational arrangements to provide for involvement and participation of organizations and institutions like Local government, Uganda Wildlife Authority, police and NGOs among others. Indeed, these organizations and institutions are already collaborating with the forest management and the local communities.

The Forestry Policy, National Forestry and Tree Planting Act of 2003 and CFM guidelines of 2003 all aid in the implementation of the management plan. The designated authority to implement the management plan is NFA on behalf of the people of Republic of Uganda.

The forest management has on ongoing program for monitoring, education and training where local communities are trained on sustainable income generating activities that can protect the central forest reserve. Often times, there are biomass studies by NFA.

Description of the proposed Biosphere Reserve.
The majority of the surrounding population is made of Bagungu pastoralists. The nearest near towns are Bulisa and Masindi.

Plate 2: Faggots of fuel wood collected from Masege CFR were seen on the roadside during the visit

The habitat type of woodland with grasslands and few scattered trees characterized by natural processes include grazing by wild animals from the forest and nearby protected areas and bush fires in the dry season. Human activities include establishment of tree plantations, illegal grazing, charcoal burning and hunting. Continuous monitoring is also done to prevent illegal activities.

Plate 3: Masege CFR in Buliisa district, the forest acts as a habitat for many wild animals including Kobs (A) and olive baboons (B) sited by the team during the time of data collection. Notice the characteristic vegetation in the woodland habitat type of the forest

Development function
Masenge forest has a very great potential for promoting sustainable development through ecotourism. However, this sector is not yet well developed as the tourist records are currently not kept which makes it difficult to assess the economic contributions so far. Tourist activities like flora and fauna tracking, recreation, camping, bird watching and hunting can potentially be developed in the area. Currently, there is no ecotourism facility at the proposed reserve.

Ecotourism would foster economic development through foreign exchange gained from market of goods and services, employment of the local people, etc.

Logistic function

More details about previous research activities can be obtained from NFA. Currently, there is no ongoing research activity but locally based monitoring by NFA. Independ researchers are also encouraged to do research in the area on their areas of interest.

There are no permanent sampling plots which are monitored in addition to lack of a research station in the proposed biosphere reserve yet.

The proposed biosphere reserve can potentially contribute to the World Network of Biosphere Reserves through workshops, joint seminars and study tours.

Uses and Activities

No zones exist.

Institutional aspects

The proposed biosphere reserve is located in Bulisa district, western Uganda. The current management of the area as a Central Forest Reserve is entirely on government land, though there are plans to lease some land to private developers to carry out plantation forest farming.

Summary of the recommended nomination for the Western Region Biosphere Reserve

Based on the gathered information, the following ranking for nomination was recommended as Biosphere reserves. Emphasis is on suggested criteria by UNESCO which include: mosaic ecological systems; significance for biodiversity conservation; potential to demonstrate sustainable development; appropriately zoned with clearly defined core, buffer and transition area(s); organised with clear involvement of stakeholders; with mechanisms to regulate human use in buffer zone and with management plan as biosphere reserve. However, not all sites have management plans as central forest reserves (those that were visited). The ranking of the sites in descending order of priority is as follows:

I. Budongo Forest Biosphere Reserve
II. Kalinzu-Kasyoha-Kitomi Biosphere Reserve
III. Sango bay Biosphere Reserve
IV. Wambabya Forest Biosphere Reserve
V. Masege Forest Biosphere Reserve
VI. Bugoma Forest Biosphere Reserve

With provision of more information from the management plans of Bugoma CFR, Wambabya CFR, Masege CFR and Sango Bay, the order above is likely to change though it may hardly change the position of Budongo CFR. Despite lacking the official zonation, developed tourism and research facilities, the ecological importance of Sango Bay which is transboundary cannot be overemphasised.

The proposed Kalinzu CFR and Kasyoha-Kitomi CFR Biosphere Reserve share a boarder along the Mbarara-Kasese highway as well as sharing common characteristics in terms of biodiversity and connection to Queen Elizabeth National Park (a biosphere reserve).

2.2.2. Bushenyi, Rubirizi, Mitooma, Buhweju, Ibanda and Kamwenge districts:

2.2.2.1. Kalinzu Central Forest Reserve

Description of Kalinzu CFR in General

This forest is located in Bushenyi, Rubirizi and Mitooma districts and is important for conservation of landscape, ecosystem, species and genetic diversity. It protects the steep slopes, is a catchment for rivers, source of seeds for indigenous tree species as well as being an important area for biodiversity studies with established research plots. It is known to have the size and appropriate zonation to serve the functions of a biosphere reserve. Ecotourism is ongoing especially chimpanzee tracking and nature walks.

Kalinzu Central Forest Reserve (CFR) is located in three districts of Bushenyi, Mitooma and Rubirizi. The forest is located in the sub-counties of Kyamuhunga, Nyabubare, Bitereko, Kiyanga, Ryeru and Rutoto. It lies on the eastern side of the western rift valley, at the edge of the escarpment overlooking Lake Edward and Maramagambo National Park and on the western side of the main Mbarara-Kasese highway that separates Kalinzu CFR from Kasyoha-Kitomi CFR and Nkombe-Kishunju hill. Kalinzu CFR lies between latitude 0°17′ and 0°30′ S and longitude 30°00¢ and 30°07¢ E. Part of the CFR runs along Mbarara-Kasese Highway, being 89Km from Mbarara town and 76Km from Kasese town. The total reserve area is 14,126 Ha. It is zoned with a Core Area of 2,835 Ha and Buffer Zone of area 2,107 Ha representing about 35% of the CFR area. The mapping was done with the spirit of protecting Rare, Threatened and Endemic (RTE) species, hydrological characteristics and fragile ecosystem. The zonation was made in line with the long-term objectives which include:

1) Conserve in perpetuity the bio-diversity, ecological and environmental values, of Kalinzu.
2) Increase the productive value of Kalinzu forest for timber and other forest products.
3) Ensure forest adjacent communities benefit from, and contribute to responsible forest management.
4) Support conservation education for sustainable development by promoting non consumptive uses of the forest

Kalinzu CFR was first gazetted as an undemarcated crown forest under Legal Notice No.87 of 1932. It was re-gazetted as an un-demarcated CFR in Legal Notice No. 41 of 1948 but Legal Notice No. 257 of 1948, re-described Kalinzu CFR as "Demarcated" with an area of 461 km^2. Under Legal Notice No. 189 of 1956 Government reduced Kalinzu forest area to 459.2 km^2 to allow for tea growing. Subsequent resurveys re-gazetted Kalinzu CFR under SI 1967 No.74 with an area of 14,125 Ha and SI No. 63 of 1998 maintained present area of Kalinzu CFR at 14, 126Ha.

According to the 2014 census estimates, the six sub counties bordering Kalinzu CFR had a population of 147,249 people. This population is in the transition zone of the forest reserve. The core and buffer zones are not populated, save for the officers and managers at the different outpost in the buffer zone. This population is dominated by the indigenous Banyankore and Banyaruguru whose main economic activity is farming (tea, coffee, bananas/plantain, livestock and trees among others).

Kalinzu CFR has a great cultural value to the local community members as some carry out various religious activities in the forest. The management acknowledges the presence of such cultural sites which are occasionally visited by the local community members. The community has a great attachment to the forest for many services offered.

The northern boundary of Kalinzu CFR is formed by Kishunju hill (1,830m) and it is the highest point on the ridge. The forest occupies a shallow saucer-shaped depression with a floor at about 1463m. From this

depression, Grassy hills surround the eastern rim of the saucer such as Kaitampungu (Musheija Mukuru) and Katonya reach up to 1,676 ma.s.l. On the west, the forest spills over the escarpment, and falls steeply to its foot at about 1220 m.a.s.l. The west side of Kishunju hill falls to 610 m.a.s.l. in one single sweep from its top to the floor of the Rift Valley.

Meteorological information is obtained from MCLeod Russel Ankole tea Estates Company which is situated 1 km from Kalinzu CFR as well as Kalinzu ecotourism site weather station which is manually operated.

Soils and geology of Kalinzu CFR

Soils in Kalinzu forest are deep red loams according to detailed soil sampling which was done in the northern end of the forest in the grasslands for purposes of tea growing. The soils are of uniform acidity, base-deficient soils except for potash in topsoil. Soils are quite rich in nitrogen and organic matter on account of their elevation and are normal in available phosphate content.

The underlying rocks of Kalinzu Forest belong to the Toro and Karagwe-Ankolean system. The rocks consist of foliated gneiss, quartzite and felicific (clayey) seluist. Kaitampungu, Nyamihabyo, Katonya and other hills in the south-east corner are formed of quartzite. The prominent ridge running from Rubare to Kishunju is also quartzite, which belongs to the Karagwe-Ankolean system.

Biological characteristics of Kalinzu CFR

The vegetation of Kalinzu is broadly classified as medium altitude moist evergreen vegetation which is local. The major habitat type is occupied by tropical high forest communities dominated by large trees of *Parinariexcelsa*, which in some valleys form an almost pure stand. Associated with *Parinari* is *Carapa grandiflora*, a large understorey tree while *Craterispenumlaurinum* is the characteristic small under storey tree. Except in the south east *Trichiliaprecuriana* and *Pleiocarpapycnantha* also occur. This vegetation gives ecosystem services like rain formation, CO_2 sequestration, etc. The major human impact in this habitat include; selective timber harvesting, fuelwood, building poles and other non-timber forest products in the buffer zone. The management practices here include continuous monitoring and sensitization, regulating use, etc.

The second type of habitat is the mixed forest with a few of the colonizing species such as *Tremaorientalis*and *Sapiumellipticum*. More typical species are *Drypetes, Strombosia Shceffleri, Chrysophyllumfulvum, Parinari excels, Funtumia*spp, *Fagaramacrophylla* and *Newtoniabuchananii*. The management practices are similar to the first habitat type.

There is also woodland, colonizing forest and grassland. The colonization process is taking place along the forest edge and around grasslands with species such as *Acathuspubescens, Brideliaferrunginea, Croton*spp, *Tremaangolensis*. The grassland savanna exists at the edges of the forest towards the transition zone.

Conservation function of Kalinzu CFR

Kalinzu CFR is a high conservation value forest which supports flora and fauna of high biodiversity value including many rare, threatened and endangered species (RTEs). The flora and fauna include both highland and lowland species in close proximity and a large proportion are dependent on closed intact forest. The CFR is Wildlife corridor contiguous with Queen Elizabeth Protected Area-a biosphere reserve, and Kasyoha-Kitomi CFR. Together with Maramagambo CFR, Kalinzu supports more tree spp (242) than any other recorded forest system in Uganda.

Kalinzu CFR has high value conservation species that are endemic, rare, or globally threatened. Threatened species which have been recorded in Kalinzu CFR include:

- Chimpanzee (*Pantroglodytes*)

- I'hoeste's Monkey (*Cercopithecus I'hoesti*)
- Leopard (*Pantherapardus*)
- Elephant (*Loxodontaafricana*)
- White-naped pigeon (*Colombaalbinucha*), and
- African giant swallowtail butterfly (*Papilioantimachus*)

Kalinzu CFR is a watershed forest to rivers (Nchwera, Sherere, Rwampunu and Nyamweru) and Lakes Edward and George which are important fisheries in the region. It is catchment area for crater Lakes Nkugute, Kyasanduka and Nyamusingiri. The rivers support livelihoods of the communities providing clean water for man and domestic animals. The forest protects escarpment soils from erosion contributing to sustained agricultural productivity.

As a natural forest rich in wood and non-wood species, Kalinzu is a major factor in carbon sequestration. Going by the conservative average estimate of 90 tonnes of carbon per hectare of natural forest and plantation, Kalinzu has the sequestration potential of 1.2 million tonnes of carbon per rotation.

Development function of Kalinzu CFR

The vision of Kalinzu CFR is 'A sustainably managed forest providing socio-economic and environmental benefits to local and international communities'. Economic viability and ecosystem sustainability of Kalinzu is based on Medium and long term projections. These include ecotourism, sale of logs, tree planting, and carbon stock potential for financing, legal compliance (fines), etc. The types of tourism include flora and fauna studies, recreation and camping. There has been an observed increase in the revenue collected from ecotourism at Kalinzu Forest over the years indicating an increase in the number of tourists. For example, between 2010 and 2012, revenue collected increased from UGX 12,702,500 to UGX 45,079,500. The local communities benefit both directly and indirectly e.g. through employment as tour guides, markets to the locally made souvenirs and provision of social service among others.

Logistic functionof Kalinzu CFR

It is among the medium range objectives of Kalinzu CFR to develop the research agenda to a level where the Forest Reserve is a major destination for domestic and international researchers in tropical high forests. Through research, management was able to identify area to designate as core, buffer and transition so as to maximize conservation for posterity as well as support the local and international communities socio-economically.

Kalinzu ecotourism centre lacks tourist accommodation. However, NFA rehabilitated and maintains the trail network. Through partnerships with the private sector and civil society organizations, additional campsites for visitors were also developed**.** Chimpanzee tracking is currently the most popular tourist activity in Kalinzu. Chimpanzee Research, monitoring and habituation is continuously carried out and data analyzed to improve ecotourism. Improved tourist attractions are promoted and marketed through collaboration with the private sector, the Uganda Tourism Board and other stakeholders.

Ecological monitoring of distribution, regeneration /reproduction of Rare, Threatened and Endemic species (RTE) critical in biodiversity conservation is done through census and inventory carried out every five**.** Ex-situ conservation and domestication of RTE species is implemented with schools, religious institutions and community households to promote sustainable use of resources**.** Non-destructive research is licensed and carried out under strict supervision.

There is an established research facility with fairly good internet connection and permanent plots designated for research activities exist in the buffer zone. Information about the number of researchers was not obtainable.

There also exists Kalinzu ecotourism site which runs environmental education programmes for students and local communities. Visitors and researchers gain access to the information centre whenever feasible. There is a great potential for collaboration with existing biosphere reserves nationally, regionally and internationally through exchange programmes and information sharing among others.

Uses and activities in the three zones of Kalinzu CFR

The core area is a strict nature reserve set aside for species and habitat protection and in here, only research, education and monitoring are permitted.

The Buffer zone has demarcated trails for research and ecotourism as well as regulated community access to forest products (especially none woody forest products and bee keeping). Selective logging is also done by NFA. Illegal logging and over exploitation of certain tree species for medicine are the major challenges the management deals with through continuous environmental education and monitoring.

The transition zone is used for production. There are human settlements with communities carrying out different activities like plantation forestry, tea growing, etc.

Zonation: Units of the proposed biosphere reserve of Kalinzu CFR

The proposed biosphere reserve has the three zone contiguous, with the core and buffer zones under legal protection by the government of The Republic of Uganda. It is managed by National Forestry Authority on behalf of the people of Uganda. In the transition zone, collaborative forest management is done with the local communities through a MoU with NFA. Some plots are leased to private developers for plantation forestry.

The core and buffer zones are entirely on government land under the supervision of local government (districts). Management and control is vested in the National Forestry Authority under Section 54(i) of the National Forestry and Tree Planting Act 2003, while Section 33(1) stipulates rights and privileges of communities. Furthermore , Section 41 provides for the responsible body (in this case NFA) to issue licenses while Section 15 provides for collaborative forest management with adjacent communities both of which are aimed at promoting legal access to the forest resources.

Kalinzu has Crater Lakes on private land, chimpanzee and other wildlife. It has a scenic value refered to as Kayitampunga (are eagle) and has rivers and streams.
The local communities participate in the formulation and implementation of the management plan through regular meeting with NFA management. The locals are also employed to spearhead the monitoring process as rangers.

Community responses from Kayanga

A meeting was organized at Kayanga village adjacent to Kalinzu in Bushenyi district on 11th August 2017. In attendance were the members in table 1.

Plate 4: Consultations with members of Kayanga village adjacent to Kalinzu Central forest reserve on 11th August 2017

The community members have associations with which they collaborate with the forest management. For example, the Kayanga Women Bee Keepers and Tree Planters Association which includes both males and females some of which attended the consultative meeting. The members suggested that the Biosphere Reserve would improve their livelihoods through regulated access to some resources for their projects like bee keeping which currently and collection of medicinal plants among others.

The group has a formal structure with a chairperson, vice chairperson, secretary, treasurer, advisors and elders. They are guided by a constitution to implement their management plan and regular meetings conducted between community members and forest management ensure a mutual understanding is reached with regards to the management plan. For sustainability and commitment, membership fee of 2000/= is contributed annually to support the running of their projects and sometimes the government gives a helping hand.

Emerging issues

Members noted that there is little direct benefits from the collections from the ecotourism activities that take place at Kalinzu Forest. They noted that despite facing challenges like crop raiding by wild game like baboons and monkeys, they do not receive a percentage of the revenue collected from Kalinzu back to their communities as it is in other places like those around Queen Elizabeth National Park. Despite different interventions and meetings with various NGOs, the community members reiterated that mostly they do not get outcomes of their suggestions come to pass.

2.2.2.2. Kasyoha-Kitomi Forest Reserve

Description of the Kasyoha-Kitomi Forest Reserve

The forest borders Kanyambogo to the North, Kalinzu / Maramagambo Forest Reserves to the South-east, Kyamuhanga Tea Estate/Bitoma and Ndangaro parishes to the South, Rwanjere to the East and Kyambura Wildlife Reserve and Queen Elizabeth National Park to the west.

Kasyoha-Kitomi Central Forest Reserve is a tropical moist forest located at the eastern escarpment of the western arm of the Albertine rift valley located in the administrative districts of Bushenyi, Rubirizi, Buhweju, Ibanda and Kamwenge Districts. The geographical location of its area is between latitude 0° 05′ and 0°25¢S and between longitude 30°05′ and 30°20′E. The boundary of compartment 7 in Rubare block touches on the Ishaka-Kasese high way.

Land use history of Kasyoha-Kitomi CFR

The reserve was first gazetted as Kasyoha, 7770 ha, Kitoma (including other forests), 9065ha undemarcated, under Legal Notice (LN) No. 87 of 1932. Under LN No. 275 and No. 265 of 1940 reserve areas were amended, Kasyoha to 19,813.5ha (76.5 sq. miles) demarcated and Kitomi to 46,102ha undemarcated. Both reserves were designated as Kitomi and Kasyoha by LN No.41 of 1948 mainly for protection. Several attempts were made to demarcate Kitomi reserve and many negotiations were made with Ankole District Council and local communities. During 1955/56 final agreement was reached, after excising large portions.

The main objectives of the management at the time were

(a) To protect and improve existing forest and where possible, promote colonizing forest, to minimize surface run-off and improve water supplies.
(b) Subject to (a) above, to provide sustainable supplies of forest produce.

Gold mining was a major activity and licensed gold prospectors had prospecting/mining rights in Kitomi to use forest produce. Africans and travelers would use unreserved forest produce for their personal benefit.

According to the 2014 population census, the districts in which Kasyoha-Kitomi CFR is located had a population estimate of 1,158,283 people who maybe benefiting directly or indirectly from the forest products and services. The major ethnic groups in decreasing order of majority are Banyaruguru, Bakiga, Banyankore, Bakonzo, Banyarwanda, Baganda and Basoga. The major economic activity from which majority derive their livelihood if farming and trading in crops like bananas, coffee, beans, maize, sugar cane, potatoes, sorghum and millet. Fishing also takes place from the many crater lakes within the transition zone. The major towns near the forest are Ishaka-Bushenyi and Kasese. The forest is an important part of the native Banyaruguru culture who practice different religious activities within it in addition to collection of medicines.

Physical characteristics

Kasyoha-Kitomi FR occupies steeply undulating terrain at an altitude of 975-2136m above sea level, with 41% of the area exceeding 15° slope. The FR is deeply dissected by two rivers, the Chambura and Buhindagi which flow through the FR to Lake George and Kazinga Channel.

The underlying rocks include quartzites, schists, gneisses, shales and phyllites of the Karagwe Ankolean and Toro systems. Mineralisation has occurred south of Rubare ridge, where gold has been removed from alluvial deposits and in the northern Kitomi portion of the forest, where alluvial gold has also been recovered and a lead mine worked.

Soil types vary widely from sandy and clay loam pedsols (Rubare ridge) to the younger and poorly developed lithosols. The soils derived from the underlying quartizites is less fertile than that derived from the softer rocks (shales, schists).

The current management (NFA) does not maintain weather records due to lack of a weather station in the area. However, there are two rainfall peaks, the short March-May and the long September-December, the latter being the most reliable. The annual rainfall range is about 1250-1400 mm. The weather records are obtained from the nearby Rwenzori Highland Tea Company that manages Ankole Tea Estate. Between

June-August the reserve experiences a severe dry season. Annual temperatures range from minimum 13-15°C, maximum 25-26°C.

Biological characteristics

Kasyoha-Kitomi has two main habitat types which are regional. The major (first habitat type) one is tropical moist forest. The major challenges here include illegal logging and charcoal burning. In some parts, illegal grazing is also a challenge. The management uses forest patrols and local CFM groups to monitor the forest and hinder these unsustainable practices.

The second habitat type is woodland with grasslands and few scattered trees. In such areas, the natural processes include grazing by wild animals from the forest and nearby protected areas and bush fires in the dry season. Human activities include establishment of tree plantations, illegal grazing, charcoal burning and hunting. The main management practice is allocation of individual plots to private tree farmers and CFM groups. Continuous monitoring is also done to prevent illegal activities.

Description of the Kasyoha-Kitomi Biosphere Reserve

As a biosphere reserve, it would contribute to the conservation of landscape, ecosystem, species and genetic variation. It is home to aquatic life in the impressive crater lakes including the twin lakes of Kyema and Kamweru as well as Lake Kamunzuku which has a variety of tree species; animal species like forest elephants, chimpanzees and L'hoest's monkeys, baboons, colobus monkeys, bushpigs, Roller, antelopes, etc.; bird species like Afep Pigeon, Black Bee-eater, Blue-throated Brown Sunbird, Blue-throated Dusky Long-tailed Cuckoo, White-collared Olive-back, Cinnamon-breasted Bee-eater, White-napped Pigeon, Coland Grey Parrot, etc; butterfly and moth species.

The site would foster economic and human development which is socio-culturally and ecologically sustainable since local communities are encouraged by NFA to make private tree plantations and other income generating activities like bee keeping, collection of medicine, fuel wood collection, carbon credit etc. all the above benefits are gained through Collaborative Forest Management (CFM) with NFA. This forest is also an important cultural site for the community who perform their religious activities in the crater lakes within the forest.

Kasyoha-Kitomi (KK) can be used for ecological studies of the fauna therein, many of which are not well researched or even identified. The proposed reserve is important for biodiversity conservation in that that it is home to endemic and endangered species like Chimpanzee, White-napped Pigeon, Coland Grey Parrot, plant species like *Meisopsisemini, Cordia africana*. Kasyoha-Kitomi has one of the confirmed Albertine Rift endemic species, the Blue-headed Sunbird.

Through ecotourism, Kasyoha-Kitomi Forest Biosphere Reserve can promote sustainable development since it has numerous beautiful sceneries like the crater lakes, and activities like hiking, camping and bird watching among others. Habituation of chimpanzees is in progress and will promote Chimp tracking contributing to foreign exchange and employment opportunities for the local people.

There are organizational arrangements to provide for involvement and participation of organizations and institutions like Nature Uganda, Local government, Uganda Wildlife Authority, police and NGOs among others. Indeed, these organizations and institutions are already collaborating with the forest management and the local communities.

Kasyo-Kitomi has on ongoing program for monitoring, education and training where local communities are trained on sustainable income generating activities that can protect the central forest reserve. The community is involved in monitoring of plants, animals and the ecosystem as a whole.

Plate 5: Kasyoha-Kitomi forest trees on a hilly terrain in the background, the foreground is a cattle farm in the transition area

Zonation

The forest area stretches over a geographical area of 40,263 ha which has been zoned such that 20% is a strict nature reserve (Core), 30% (5229ha) is buffer zone and 50% (23,957 ha) is production (transition) zone. The main activities in the core zone are protection ecosystem, biodiversity and landscape. In the buffer zone, controlled harvesting of non-wood products such as crafts, mushroom, herbs for medicine and bee keeping are permitted. In the transition zone, commercial tree planting for timber harvesting, fuel wood collection, crop farming (mainly plantains) and animal rearing are practiced following the CFM guidelines and agreements. The zonation according to the management plan is based on sections 13 and 28 of the National Forestry and Tree Planting Act of 2003 which require the responsible body to manage forest reserves based on participatory management plans. This management plan is also in line with International treaties such as the Convention on Biological Diversity (CBD) and the Convention on International Trade of Endangered Species (CITES) which require each member country to embrace the principles of sustainable natural resource management

There is a mechanism to manage human use and activities in the buffer zone guided by the draft management plan. The Forestry Policy, National Forestry and Tree Planting Act of 2003 and CFM guidelines of 2003 all aid in the implementation of the management plan. The designated authority for to implement the management plan is NFA on behalf of the people of Republic of Uganda.

Conservation Function

The KK forest plays an important role in conservation of landscape and ecosystem diversity since it stabilizes the steep slopes of the hilly terrain of the area. It also acts as catchment area for rivers like Kyambura and Rubare. These rivers are important part of a system that maintains ecosystems in other areas like Kyambura gorge and Queen Elizabeth National Park which relies on supplies of water to the Lake George and Lake Edward. The forest also stabilizes the banks of the three crater lakes there in and also cleans the water of eroded soils.

KK forest is also home to rare, endangered and endemic species of plants and animals. Animal species like forest elephants, chimpanzees and L'hoest's monkeys, baboons, colobus monkeys, bushpigs, antelopes, etc.; bird species like Afep Pigeon, Black Bee-eater, Blue-throated Brown Sunbird, Blue-throated Roller,

Dusky Long-tailed Cuckoo, White-collared Olive-back, Cinnamon-breasted Bee-eater, White-napped Pigeon, Coland Grey Parrot, etc; butterfly and moth species.

The conservation of genetic diversity of tree species like *Prunusafricanus* which which is traditionally used to treat various types of sicknesses and *Fantumia*sp which produces very high quality of elastic timber cannot be taken lightly. These tree species have a very high local and international demand which threatens their survival in the long run.

Development function

KK forest has a very great potential for promoting sustainable development through ecotourism. However, this sector is not yet well developed as the tourist records are currently not kept which makes it difficult to assess the economic contributions so far. Tourist activities like flora and fauna tracking, recreation, camping, hiking, fishing and hunting can potentially be developed in the area. Currently, there is an ecotourism facility (house) at Magambo Sub County in the transition area.

Ecotourism would foster economic development through foreign exchange gained from market of goods and services, employment of the local people, etc. However, there is a fear that the touristic activities may interfere with the culture of the local people, e.g. introduction of western culture.

Logistic function

From previous research and observations by managers, areas with hilly terrain were protected from clearing of tree cover as this would result in disastrous soil erosion and landslides in the rainy seasons. The management has an established research circle which contributes to building up data for KK and contributing to sustainable forest management. The circle also promotes studies on environmental dynamics, biodiversity conservation, standing crop for increased productivity, impact of Forest Conservation on human activities, etc. NFA promotes research activities and issues permits to researchers and intends to collaborate with research istitutions like Mbarara University of Science and Technology, Makerere University and National Forest Resources Research Institute (NaFORRI). Currently, there is no ongoing research activity but locally based monitoring by CFM, NFA, Nature Uganda and local governments.

There are twenty permanent sampling plots which are monitored after every 10 years. However, there is no research station in the proposed biosphere reserve yet.

Environmental education and public awareness are achieved through sensitization meetings with forest adjacent communities, visiting schools, faith organisations (like churches and mosques) and other organisations. The targeted groups are school children, youth, women groups, CFM groups and other forest adjacent communities. Though there are no facilities for environmental education, drama groups, lectures and income generating activities like ecotourism are used to disseminate the intended message. Specialist training is offered to internship students and through workshops from partners. The proposed biosphere reserve can potentially contribute to the World Network of Biosphere Reserves through workshops, joint seminars and study tours.

Uses and Activities

The main activities in the core zone are mainly research and training in the buffer zone, production of non-woody forest products such as wild honey, hand craft materials, fruits, and other ecosystem services.

Institutional aspects

The proposed biosphere reserve is shared by the districts of Bushenyi, Rubirizi, Kamwenge, Ibanda and Buhweju. The current management of the area is a central forest reserve gazetted in 1932.

Community responses from Kasyoha-Kitomi

A meeting was organized at Kamacumu village adjacent to Kasyoha-Kitomi in Rubirizi district on 11th August 2017. In attendance were some members of Buzenga Collaborative Management Association (BUCA) who included the following;

Plate 6: Some members of Buzenga Collaborative Management Association during a consultative meeting with a team from UNESCO

BUCA constitutes 16 groups of 166 men and 221 women. The members consulted in the meeting envision a number of benefits from the proposed biosphere reserve which include the following; carbon credit, license for logging, firewood collection, medicine collection, collection of hand craft materials, improvement in the bee keeping project by getting nearby plots, etc. BUCA has an executive committee with a chairperson, Vice C/P, secretary and treasurer. They have a patrol team in collaboration with NFA. As a registered association, BUCA has a constitution and signed a Memorandum of Understanding with NFA. Through regular meetings, the local communities participate in implementation of the management plan of KK. This association that started in 2005 operates a budget of about 2,000,000/= raised by contributions from members and NFA (bee hives).

2.3. Central Uganda

2.3.1. Mukono/ Kayunga/ Buikwe Districts

2.3.1.1. Mabira Forest

The forest is located along the lake shores with an estimated area 29,964 hectares, location UTM WGS84, E-498840, N-52190 and elevation between 1090m-1330m.It stretches across the three districts of Mukono/ Kayunga/ Buikwe Districts. It is a tourist attraction with waterfalls. It has a rare Mangabey Monkey with white crest, rare eagle, flying squirrel, rare snakes and rare snail. It is burial site for pilgrims.

It is described as a watershed for lake Victoria/Kyoga/R. Nile system. R. Musamya from Lake Victoria with Griffin falls, Musamya swamp, R. Sezibwa to L. Kyoga and R. Waliga tributary to R. Nile from Mabira. It has some Tourism investment (Mabira Nature Based, Griffin falls, Community ecotourism). It is important for research and education, being located in a fast growing urban/industrial conurbation. Collaborative Forest Management is being done with local forest communities of Nagojje, Najjembe and the communities around Mukono and Kayunga districts.

The endemic people here are the Nakalanga Community.

Main Kampala-Jinja Road through Mabira Forest

Management Plan

The management plan covers the period of 10 years starting from 1st July 2009 to 30th June 2019 with mid-term review carried in accordance with the Forestry Act 2003. The plan places Mabira Central Forest Reserve as a complex consisting of six (6) forests namely Mabira, Namakupa, Nadagi, Kalagala Falls, Namawanyi and Namananga. All are situated in Mukono District except Kalagala falls in Kayunga District. These central forest reserves (CFR) have a total area of 31,293ha and constitute the Mabira Forest Management Plan Area.

The management plan gives the history of gazzettment of Mabira and Namakupa as central forest reserves together under legal notice No. 87 of 1932 with an area of 29,592ha, later adjusted to 30,003ha in Legal Notice No. 41 of 1948 and Nadagi was gazetted as a central forest reserve (CFR) with an area of 479ha. Later, another Legal Notice No. 78 of 1962 regazetted Mabira with an area of 29,974ha, separated Namakupa from Mabira and gazetted it with an area of 280ha while Nadagi was regazetted with an area of 479ha. Kalagala Falls, Namawanyi and Namananga CFRs were originally local forest reserves (LFR) transferred to the central Government under Statutory Instrument No. 176 of 1968.

Mabira CFR is one of the richest forests in biodiversity in Uganda in both flora and fauna. It is the only large forest in the bio geographical zone of the Lake Victoria crescent. An inventory in 2002 indicated that Mabira forest is ecologically important and provides habitat for 312 tree and shrub species, 287 species of birds, 23 small mammals, 199 species of butterflies and 97 species of large moths. The forest also supports 9 species found in Mabira only (including 6 butterflies, 1 moth, 1 bird and 1 tree species) and one endemic tree species to Uganda.

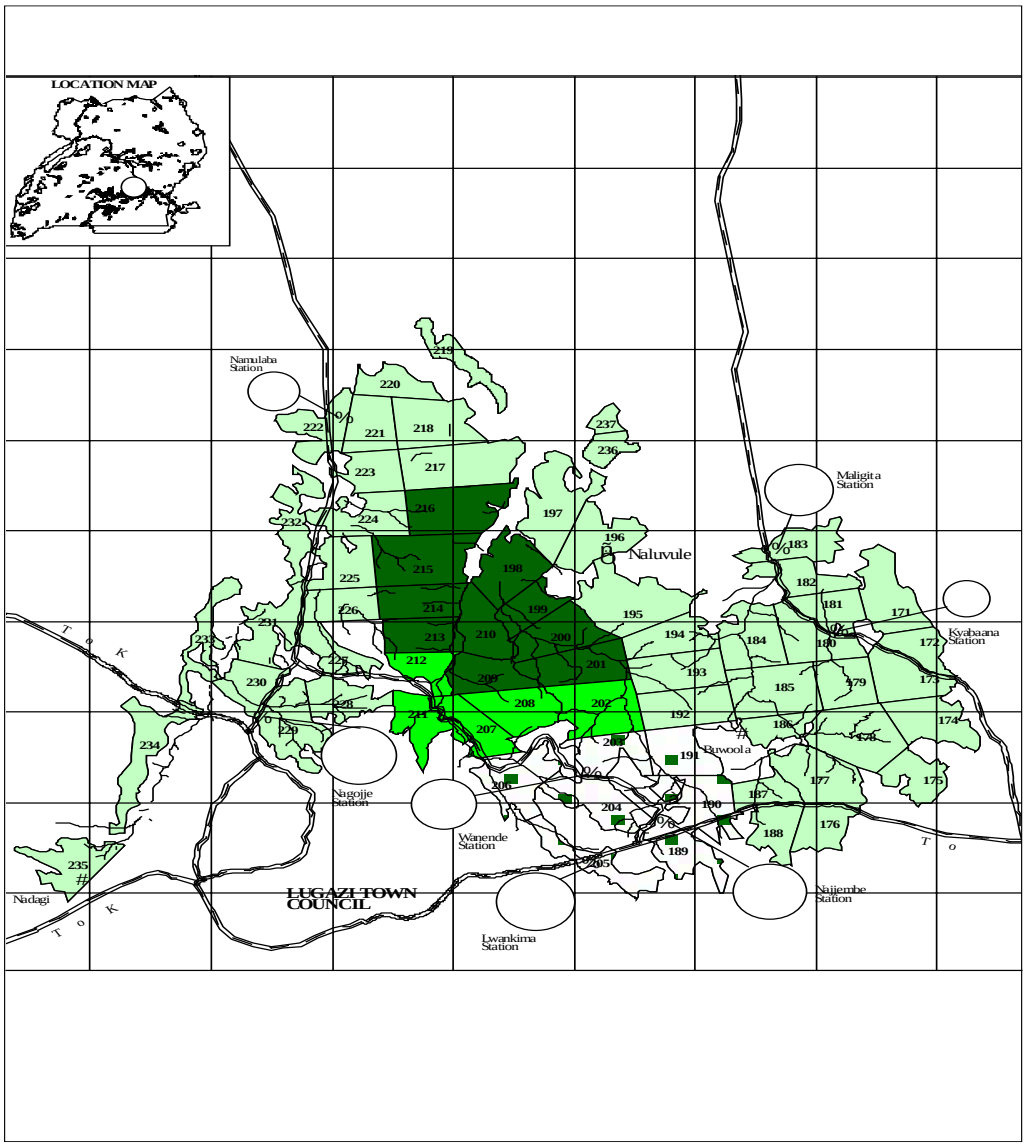
The Mabira CFR is managed subject to the provisions of the National Forestry and Tree Planting Act of 2003, and its management and control are vested in the National Forestry Authority (NFA) under section 52(1) of the same Act. The plan spelled out the revenue and expenditure budgets that define sustainability arrangements. Among the sources of revenue included ecotourism, licences, sales of seeds and various produce resource centre usage costs and surcharges. It also lists stakeholders like NEMA, NFA, District Forest Service, adjacent communities, licensees, tourists, NGOs/CBOs, Civil Society, Government and Researchers who have a lot of roles to play in successful management of the Central Forest Reserve. There is a provision for staff.

As per the NFTP Act of 2003, there are guidelines that have been developed for the implementation of collaborative Forest Management and in this regard, two agreements have been signed with communities in compartment 229 in Nagojje and 176 in Buvunya under the CBOs of NACOBA and COFSDA respectively. In addition to these, two CFM arrangements in Kalagi and Wabulongo have been launched and three initiated (Nakalanga, Kinoni and Waswa)

Zonation

Mabira CFR being part of the network of critical biodiversity sites in Uganda has been zoned into 23% Strict Nature Reserve (SNR/Core) Zone, 22% Buffer Zone (BZ) and a 54% production Zone (PZ) as per the Map below**.**

Map showing zonation of Mabira Central Forest Reserve



Source: Ministry of Water and Environment (2009): Forest management Plan for Mabira Central Forest Reserves for Periods 1st July to 30th June 2019.

As Mabira is the only large forest in the bio-geographical zone of the Lake Victoria Crescent, it is an important area for conservation. It is interesting that inspite of its being surrounded by many people, with over 60,000 people in the enclaves and the amount of encroachment it suffered in the 1970s to the late 1980s, it should still be supporting and providing habitat for such diverse species belonging to so many taxa. Due to indiscriminate illegal timber harvesting during this period, some species for example the mahoganies (*Entandrophragma spp, Mvule (Milicia excelsa) Prunus africana, Cordia spp* and *Wurbagia ugandensis*) are considered endangered.

95% of the area is occupied by *Celtis-Chrysophyllum* medium altitude moist semi-deciduous forest and 5% by *Piptadeniastrum-Albizia-Celtis* medium altitude moist evergreen forest (Langdale - Brown et al., 1964). This is the only block of medium altitude moist semi-deciduous forest type D1 (Langdale-Brown et al., 1964) in Uganda's protected area system, a vegetation type that does not occur in any of the country's National Parks or Wildlife Reserves. The economic value of this biodiversity is estimated at U Shs.23.3 billion (The inter-ministerial technical Report, 2006).

The Planned Management Activities

Both the Strict and Buffer zones are conservation zones where scientific research is carried out. The Production zone consists of all the areas where intensive silviculture is done and will continue for increased yield of forest products and services. The activities would include timber harvesting, enrichment and encroachment planting, restoration tending operations, as well as general protection and production of forest produce. Activities have been planned to include: Production working Circle, Partnership and Community livelihood working circle, Conservation working circle, Tourism working circle and Research and Education working circles. Mitigation measures have been put in place against negative impacts of implementation of the plan. Monitoring and evaluation plan is also incorporated.

The functions of the CFR include: *Ecological function (Water shed and Carbon Sequestration),* Soil and water conservation

2.4. Southern Region

2.4.1. Sango Bay Biosphere Reserve

General Physical Description

Sango bay is a mosaic wetland forest located along the shore of lake Victoria. This place is located at the point where the vegetation transitions from between the usual East and West African type of vegetation zones, there is this biogeographically organic compound that helps to ensure a very rich biodiversity. It is in Sango Bay that the sangoan culture tools where discovered and thus named after Sango Bay in Masaka. The site contained artifacts that dated about 200,000 years ago.

The majority of the surrounding populations are Baganda cultivators among other indigenous folks and the minorities are Rwandese pastoralists. The nearest near towns are Kyotera, Rakai and Masaka. The proposed biosphere reserve has cultural significance since some members of the community consider some sites such as Minziro to have healing powers. It also protects Lake Victoria famously known for its cultural significance in the traditional beliefs of the local Baganda people.

Justification for designation

Sango Bay wetland system is some kind of mosaic type of wetland and flood plains that consist of Malabingabo, Kibira, Terro East and West and Kigona. The ecosystem covers Tanzania, Rakai and entire South Western Uganda and Rwanda (Transboundary). It is used for periodic grazing in the Lake Victoria region and owing to the wide stretch, is one of Uganda's biggest swamp forests covered with a large papyrus swamp. In some parts there are herbaceous swamps that intersperse with a few palms. It includes Kagera as part of the ecosystem that stretches between Uganda and Tanzania. There are grasslands that are seasonally flooded, some parts are sandy, others are rocky as well as the forest shores. Around this wetland, there are the three rocky islands; they are located only 3 km away from the shores of the lake into this Sango Bay.

It can contribute to sustainable economic development through ecotourism, medicinal plants, regulated agricultural practices (grazing in the surroundings-good grass), source of fish for food and income, source of raw materials for building and making crafts work like papyrus and water that people use when building up their houses, when making craft works like out locally made luxurious sofa chairs and also mattresses, etc.

Though not zoned, this mosaic wetland forest covers over 30,000 hectare, big enough to serve the three functions of a biosphere reserve. The forested area is regarded as core but is interspersed by grasslands often grazed by herdsmen (illegally). The major economic activities in the would-be transition area include commercial tree planting, cattle keeping, small-scale agriculture for subsistence, etc. There is a

MoU with the indigenous people in the management of Sango Bay but no formal agreement with the pastoral communities of Rwandese origin (often illegally graze in the protected zones). CFM operates on contractual terms for a period of two years liable to extension.

There are organizational arrangements to provide for involvement and participation of organizations and institutions like Nature Uganda, Local government, Uganda Wildlife Authority, police and NGOs among others. Indeed, these organizations and institutions are already collaborating with the forest management and the local communities.

The proposed biosphere reserve would contribute to the conservation of landscape, ecosystem, species and genetic variation. Sango Bay wetland system is some kind of mosaic type of wetland found in the Lake Victoria region gazetted for protection. This wetland is one of Uganda's biggest swamp forests in Uganda covered with a large papyrus swamp, in some parts there are herbaceous swamps that intersperse with a few palms.

The site would foster economic and human development which is socio-culturally and ecologically sustainable since local communities are encouraged by NFA to make private tree plantations and other income generating activities like bee keeping, collection of medicine, fuel wood collection etc. all the above benefits are gained through Collaborative Forest Management (CFM) with NFA. It is in Sango Bay that the Sangoan culture tools were discovered and thus named after Sango Bay in Masaka. The site contained artifacts that dated about 200,000 years ago.

This place supports a big population of bird species especially the water bird species and according to the records, this place hosts averagely 16.5% of the entire Grey-headed Gulls, *Laruscirrocephalus*. It also hosts quite a big number of the globally recognized endangered animals which include the Elephants; there are primates like the Black and White Colobus Monkey, the vervet Monkey.

The Forestry Policy, National Forestry and Tree Planting Act of 2003 and CFM guidelines of 2003 all aid in the implementation of the management plan. The designated authority for to implement the management plan is NFA on behalf of the people of Republic of Uganda.

Sango Bay has an ongoing program for monitoring, education and training where local communities are trained on sustainable income generating activities that can protect the central forest reserve. Often times, there are field excursion by students from Makere University.

Description of the proposed Biosphere Reserve.

Biological characteristics

Sango Bay wetland system is a mosaic of habitat types including the evergreen forest, woodland, grassland and papyrus swamps. Some of the grassland areas are occasionally flooded. The forest vegetation is Msizi dominated. The important natural processes in Sango Bay include biodiversity conservation, water purification, water catchment, rain formation and bank stabilization among others. Human activities include ecotourism, fishing, collection of medicinal plants and art facts, fuel wood collection, etc. The availability of water and good pastures attracts pastoral communities who often over exploit the resources. The management uses forest patrols and local CFM groups to monitor the forest and hinder these unsustainable practices.

The second habitat type is woodland with grasslands and few scattered trees. In such areas, the natural processes include grazing by wild animals from the forest and nearby protected areas and bush fires in the dry season. Human activities include establishment of tree plantations, livestock grazing, charcoal burning and hunting. The main management practice is allocation of individual plots to private tree farmers and CFM groups. Continuous monitoring is also done to prevent illegal activities.

Plate 7: grassland interspersedwith trees (A) and cattle drinking at one of the rivers in Sango Bay

Despite being in the lowlands, Sango Bay contains some highland tree species like *Carapas*pp, demonstrating the geological history of the landscape. Therefore, this site is very important for studies demonstrating such aspects as adaptation and resilience species to disturbances.

Conservation Function
Refer to summary.

Development function
Sango forest has a very great potential for promoting sustainable development through ecotourism. However, this sector is not yet well developed as the tourist records are currently not kept which makes it difficult to assess the economic contributions so far. Tourist activities like flora and fauna tracking, recreation, camping, fishing and hunting can potentially be developed in the area. Currently, there is no ecotourism facility at the proposed reserve.

Ecotourism would foster economic development through foreign exchange gained from market of goods and services, employment of the local people, etc. However, there is a fear that the touristic activities may interfere with the culture of the local people, e.g. introduction of western culture.

Logistic function
More details about previous research activities can be obtained from NFA. Currently, there is no ongoing research activity but locally based monitoring by CFM, NFA, local governments and NGOs. Independ researchers are also encouraged to do research in the area on their areas of interest.

There are no permanent sampling plots which are monitored in addition to lack of a research station in the proposed biosphere reserve yet.

Environmental education and public awareness are achieved through tree planting demonstrations and sensitization meetings with forest adjacent communities and university students. The target groups are school children, youth, women groups, CFM groups and other forest adjacent communities. There is a demonstration garden of indigenous trees at the station where NFA office are situated. The proposed biosphere reserve can potentially contribute to the World Network of Biosphere Reserves through workshops, joint seminars and study tours. There is information sharing facilitated by collaboration with neighboring national parks in Tanzania.

Uses and Activities: No zones exist.

Institutional aspects
The proposed biosphere reserve is shared by the districts of Kyotera, Masaka and Rakai. The current management of the area is a protection forest reserve on both government land and mailo land.

Community responses from Sango Bay
A meeting was organized at Nkalwe village adjacent to Sango bay in Kyotere district on 12th August 2017. In attendance were the following members;

The members belong Nkalwe Sango bay Twezimbe CFM group which has a complete executive with a chairperson, Vice C/P, secretary, advisor elders' and women representatives. The members consulted in the meeting envision a number of benefits from the proposed biosphere reserve which include the following; firewood collection, medicine collection, collection of hand craft materials, bee keeping project and increased community vigilance to conservation. They have a MoU with NFA. As a registered association, they have a constitution which directs their activities. Through regular meetings, the local communities participate in implementation of the management plan of Sango bay. This association that started in 2000 operates a budget of about 10,000,000/= raised by annual contributions of 10,000/= from members in addition to membership fee at registration.

PART B: Natural Sites as Geosites

2.5. Important Natural Sites for Designation as Geopark and Geosites for Sustainable Governance and Climate Change Adaptation in Uganda

2.6. Introduction and Background

In 1995, the International Union of Geological Sciences (IUGS) and the United Nations Educational, Scientific and Cultural Organization (UNESCO) set up a global scheme to promote geo-conservation, with a focus on identifying globally significant sites. The aim of the geosites project was to produce an evolving, comprehensive inventory of the more valuable geosites including their potential value in education and research (Wimbledon, 1996).

It is important to note that some of these natural/geological sites are either unique in their own right and/or host natural forests that may, in turn, be hosts for endangered flora and fauna let alone threated human communities on top of these forested mountains; all of which deserve protection and/or recognition.

Attempts of compiling a preliminary inventory of possible geosites within Uganda had been made in the late 90s (Schlueter, 1997, Muwanga & Kamuhangire 1999) and beginning of 2000 (Schumann & Echegu, 2000, Schlueter, 2001, Schlueter et al. 2001; Schumann et al. 2001; Schumann & Muwanga 2003), and more recently by Bakka-Male (2009), Muwanga (2010) and Staudt (2010). So far, about 20–30 possible geosites had been suggested. However, many of the sites still lack a proper description of the location (e.g. missing GPS coordinates) or a detailed description of the site itself, and some of the known sites have to be re-visited in order to evaluate their condition.

The most exhaustive compilation of geosites is carried in the report by Schumann et. al. (2011) under the auspices of the Sustainable Management of Mineral Resources Project (SMMRP), a project of the GoU/WB/AfDB/NDF that was executed by the GTK Consortium and the Directorate of Geological Survey and Mines (DGSM) of the Ministry of Energy and Mineral Development (MEMD) between 2006 and 2012.

A total of thirteen (13) geosites/Biosphere Reserves were visited and documented in the selected region covered by the group.

2.7. Geosites in Eastern Uganda

Busoga Region

2.7.1. Buyende District

2.7.1.1. Kagulu Rock

Physical Description

Kagulu Rock ia located in Kagulu Sub-County, Buyende District atop Kagulu Hill (UP 48) that stands highest (1,276 m above sea level) of all the hills visible in the area, the others being: Kitukiro (1,155 m) and Nsomba (>1,128 m) to the south, with Kagwese – Mpango – Chololo (>1,113 to >1,142 m) complex to the north; all together forming high-standing, generally imposing rocky hills that jut out of the surrounding flat country, geographically referred to as 'inselbergs' with bare cliffs. When viewed from any high point on Kagulu, they are of such scenic beauty that ought to be preserved for future generations.

Kagulu Rock, examined at [36 N 0536376E, 0134523N; 1,087m] but with its highest peak at [36N 536764E, 134641N] and the rest are located on the 1:50,000 – scale topographic map sheet 52/4 (Nawaikoke) and the 1:250,000 – scale geological map sheet Geology_NA_36_11_Mbale. The rocks are geologically mapped as Neoarchaean Mbale granite, generally porphyritic (i.e. large feldspar crystals in places) texture dated at about 2.63 billion years. In outcrop, it is massive with occasional pegmatitic veins.

Kagulu Rock is a cultural heritage site for many clans in Busoga Region and the Basoga tribe, as it is considered to be the first resting place of Prince Mukama Namutukula of the royal Babiito dynasty in Bunyoro, believed to be the grandfather of the Basoga.

Kagulu Rock, Buyende District

2.7.2. Tororo District

2.7.2.1. Tororo Rock, Tororo Municipality and Sukulu Hills, Tororo District

Physical Description

Tororo Rock (UP 52 – 36N 631602E, 75541N) is located in Tororo Municipality, and standing at 1,484 m above sea level, forms an imposing feature above Tororo town. Next to this in the neighbouring area some 4 km to the south-southwest just outside the Municipality are the majestic Sukulu Hills. The Tororo Rock and Sukulu Hills are located on the 1:50,000 – scale topographic map sheet 64/3 (Tororo) and the 1:250,000 – scale geological map sheet Geology_NA_36_15_Jinja. The rocks are geologically mapped as Nephelinite, carbonatite of Neogene age (23 – 2.59 million years). They both jut out of ground to impose scenic beauty around the surrounding flat country. Geographically, they form 'inselbergs'. When viewed from any point from the Jinja – Tororo Highway, they are of such scenic beauty that they ought to be preserved for future generations.

However, the giant Sukulu Hills is a hot bed for a plethora of mineral commodities and is/has been the subject of mineral development activities now and in the past but the location of Tororo Rock within the town centre precludes its destruction by mineral exploitation activities, even if they were to occur.

Geosite Signi icance

Tororo Rock is a geological feature of significance to Tororo in that it hosts water tanks supplying water to the Municipality. It also supports a small natural forest that serves to modulate the climate of Tororo in addition to harbouring plants of herbal medicinal value. Any planted trees at the lower slopes are aimed to stem boulder rock fall that would pose an occupational hazard to the surrounding communities.

2.8. Geosites in North-Eastern Uganda

2.8.1. The Karamoja Region Landscape - The Karamoja Hills:

These are spread all over the 7 Districts namely: Nakapiripirit, Napak, Moroto, Amudat, Abim, Kotido and Kabong.

In general, Karamoja is a special place. It lies to the North-East of Uganda and is semi-arid with volcanoes from Miocene dating between 6 million and 20 million years old. On the slopes of the volcanoes are sediments which yielded the first fossils in 1921 at Napak. In 1950s and 1960s two scientists, John Wilson and Bill Bishop collected hundreds of fossils of mammal bones (apes), reptiles and snails at different sites of Napak volcano and Moroto.

The Karamoja archeological sites are said to be among the richest in East Africa for study of fossils of apes and their environments.

2.8.2. Nakapiripirit and Amudat Districts

2.8.2.1. Kadam Mountain

Physical Description

Kadam Mountain [UP 13 – 36N 690087E, 195025N; 3,069 m, 39,917] sprawls for several kilometres over a very large area above the low – lying country north of Mountain Elgon. It is one of a chain of volcanoes along Uganda's international border with Kenya that begins with Mount Elgon in the south and includes

Mount Moroto and Mt. Morungole. It is surrounded by the Pian – Upe Game Reserve to the south and the South Karamoja Hunting area to the east and west, in Nakapiripirit district. It is generally higher in the north with basement rock exposed in a bench on the Namalu – Nakapiripirit road close to Nakapiripirit. The Kadam Mountain sprawls over all four of the 1:50,000 – scale topographic map sheets 45/1 (Namalu), 45/2 (Amudat), 45/3 (Chepsikunya) and 45/4 (Karita) and the 1:250,000 – scale geological map sheet Geology_NA_36_12_Kapenguria.

Geosite Significance and Physical Description

The rocks are geologically mapped as lavas and agglomerates of Neogene age (23 – 2.59 million years) and are of extrusive (volcanic) origin that mantle over the much older Basement country rock, with occasional enclaves of the same exposed deep within the mountain. Basement rock is Neoarchaean age banded granite gneiss and migmatite (2800 – 2500 Ma). Although not exposed, given the current level of erosion, Kadam Mountain is equqlly of carbonatitic affinity, like all the other known carbonatities of Sukulu, Tororo, Bukusu, Lolekek, Napak, Toror and Zulia. Its highest peak is Nathupai Kadam (Community Information, August 2017).

The mountain consists of ranges and central forest reserve. The highest peak is called Nachupai. Also referred to as the Nakapiripirit Karamoja Range, the estimated area is about 39,917 hectares, UTM WGS84, E-691226, N-195737 and elevation of between 1140m-3040m consisting of fragile rocks of Schists and Gneisses.

There are lakes like Opeta, Bisina, Aguu,Jogate and the Mpologoma Swamp.

Kadam Mountain as seen from Namalu-Nakapiripirit Road

2.8.3. Moroto District

2.8.3.1. Mount. Moroto

Mount. Moroto is adjacent to the town of Mororto town, Mororto Municipality and is approximately 3 kilometers (1.9 mi), by road, east of Moroto's central business district (https://en.wikipedia.org/wiki/Mount_Moroto). The mountain is one of a chain of volcanoes along Uganda's international border with Kenya that begins with Mount. Elgon in the south and includes Mount Kadam and Mt. Morungole. The region around Mount Moroto is a forest reserve protecting a range of habitats from arid thorn savanna to dry montane forest. The coordinates of Mount Moroto are 2°31'30.0"N, 34°46'21.0"E (Latitude: 2.5250; Longitude: 34.7725). Mt. Moroto has estimated area of 48,210 hectares, UTM WGS84, E-691226, N-277211 and elevation of between 1000m-2980m. The forest is a catchment area for Okere and Okwanges rivers

which are permanent water sources for cattle and communities of Kadike, Lothaar, Michokho, etc. The forest is rich in biodiversity and supports two species of butterflies and moth not found elsewhere in Uganda. Mount Moroto is also very rich in minerals such as marble and gold.

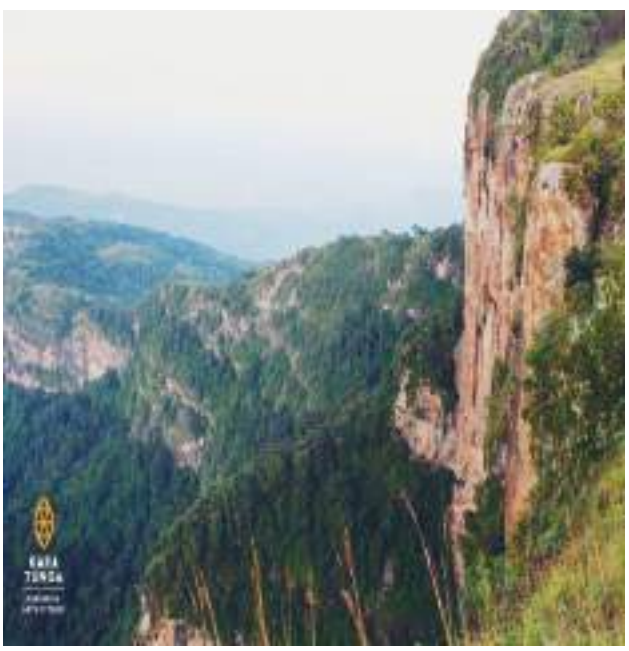
Mount Moroto (Wikipedia, https://en.wikipedia.org/wiki/Mount_Moroto).

2.8.4. Napak district

2.8.4.1. Napak Central Forest Reserve

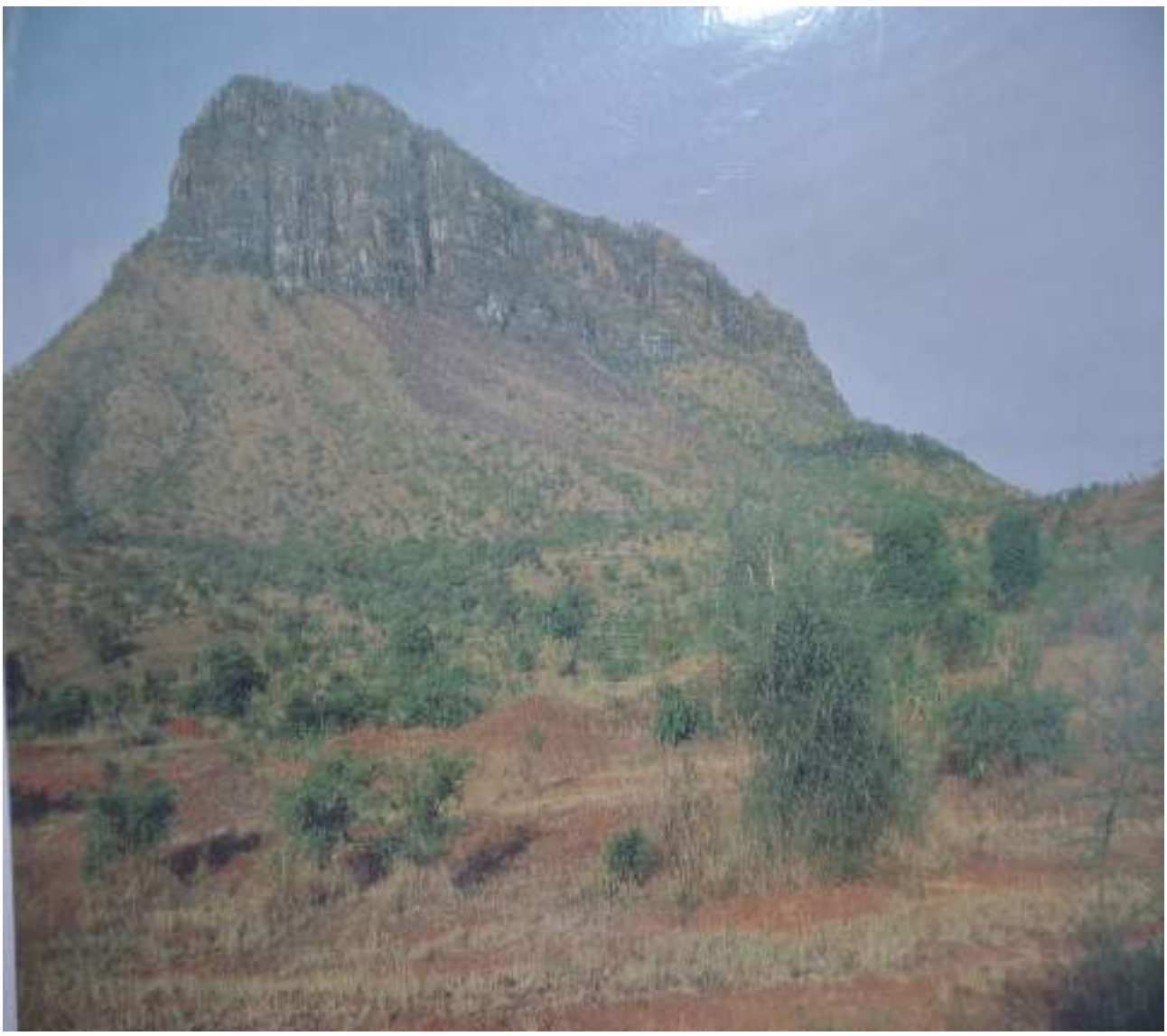
Physical Description

Mount Napak is the third highest mountain in the Karamoja region and has a unique location within the Pian Upe Wildlife Reserve. It covers an estimated area of 20,316 Hectares, TM WGS84, E-645355, N-229165 and elevation of between 1720m-2000m. It has steep cliffs, summits, ridges and wild vegetation that make it unfavorable for people to live on. The Karamojong and Iteso people live at the foot of the mountain. The mountain provides them food by hunting for small wild animals and having their gardens at the fertile foothills. The mountain has been ranked more beautiful and more experiential Mountain hiking experience in Uganda compared to the others. The vegetation patterns in the middle of the hike are with baboons in this vegetation which all looks amazing during your breathless sights spots. The rocks are blessed with water and along are black frogs.



Mt. Napak Peak (https://gulutours.wordpress.com/2017/07/17/hiking-mount-napak-in-the-karamoja-region-northern-uganda/).

Geological Significance
It is on the slopes of the volcanoes of Napak that sediments which yielded the first fossils occurred in 1921. In 1950s and 1960s two scientists John Wilson and Bill Bishop collected hundreds of fossils of mammal bones (apes), reptiles and snails at different sites of Napak volcano and Moroto.



Mt. Napak from a distance: Field Photo (Credit: Dr. Lali Mundrugo-Ogo and Kiisa Sam)

2.8.5. Kaabong District

2.8.5.1. Morungole Mountains

Physical Description
Mount Morungole is situated in the North Eastern part of Uganda in Kidepo valley national park bordering the south boundary of Kidepo valley; a location that is in the absolute northern hills of Karamoja. The mountain stands 2750 metres above sea level overlooking the vast Kidepo and Narus plains of the park and its is one of a chain of mountain volcanoes along Uganda's international border with Kenya that begins with Mount. Elgon in the south and includes Mt. Moroto and Mt. Kadam.

The mountain Morungole slopes are a home to the Ik people, the smallest ethnic group in Uganda with their unique culture. As a result, the Mount Morungole is also known as Ikland.
The Ik have always lived in nowadays Kidepo Valley National Park but have been displaced 50 years ago whereby they now live on the mountain ridges (www.kara-tunga.com/tours/1-day-hike-ik-mount -morungole/?date=2018-05-02).
The Ik are a unique tribe in Africa and the Ikland has stunningly beautiful scenery that upon climbing of the mountain provides breathtaking scenes in the valleys below and into the Eastern Rift Valley of Kenya and over to Southern Sudan.

The mountain is also crossed by the Kidepo and Narus rivers which are the main water sources to the wildlife of kidepo valley national park, Mount Morungole is an ideal place for mountain hiking with an experienced and knowledgeable game ranger guide.

It has an estimated area of 15,063 hectares, UTM WGS84 E-609492 N-421082. Elevation is between 1200m-2730m. It is part of the network of sites for biodiversity conservation and a corridor for Wildlife part of the Karamoja Hills, a catchment area for River Nalkas, a source of water for Kapedo Sub county communities, protecting the soils, and sustaining the permanent settlement along the boundary. Has potential for nature tourism, scenic drives and mountain climbing.

Mt Morungole viewed from a distance (Dr. Lali Mundrugo-Ogo & Sam Kiisa, August, 2017)

Mt Morungole viewed from a distance (Dr. Lali Mundrugo-Ogo & Sam Kiisa, August, 2017)

https://www.google.com/search?ei=jYXpWqO1IoP0Usytn9AL&q=mountain+Morungole+&oq=mountain+Morungole+&gs_l=psy-ab.12..0i13i30k1.14482.18598.0.2

https://www.google.com/search?ei=jYXpWqO1IoP0Usytn9AL&q=mountain+Morungole+&oq=mountain+Morungole+&gs_l=psy-ab.12..0i13i30k1.14482.18598.0.2

https://www.google.com/search?ei=jYXpWqO1IoP0Usytn9AL&q=mountain+Morungole+&oq=mountain+Morungole+&gs_l=psy-ab.12..0i13i30k1.14482.18598.0.2

2.8.5.2. Timu Central Forest Reserve as part of the Morungole Ranges

The estimated area is 11,751 Hectares, UTM WGS84, E-647808, N-397136, elevation is between 1720m-2000m. The forest is among the network of Sites of biodiversity conservation which is a hill reserve as part of the Karamoja hills. It has river Katorosa and R. Namoru as water source for the communities. The ik (teuso) indigenous community co-exists with the forest from which they derive their livelihood. The area is bordered by steep escarpments leading to the Eastern Rift valley.

2.8.6. Moroto Mountains, Moroto District

Moroto Mountain [UP 13 – 36N 697105E, 279302N; 3,084 m] equally sprawls for several kilometres over a very large area over the surrounding flat Karamoja Pediment plain.

Mt. Moroto sprawls over all four of the 1:50,000 – scale topographic map sheets 27/3 (Moroto), 27/4 (Loolimo), 36/1 (Lotome) and 36/2 (Katikiekile) and the 1:250,000 – scale geological map sheet Geology_

NA_36_8_Moroto. The rocks are geologically mapped as lavas and agglomerates of Neogene age (23–2.59 million years) and are predominantly of volcanic (or extrusive) origin that mantle over the much older Basement country rock, with occasional enclaves of the same exposed deep within the mountain. Basement rock is Neoarchaean age banded granite gneiss and migmatite (2800 – 2500 Ma). However, an intrusive phase of the mountain – forming process is indicated by ijolite – a plutonic rock which is indicative of a carbonatitic origin of the mountain, just like Sukulu, Tororo, Bukusu and others in the south and north of here. In addition, lenses of marbles are intercalated with the Basement lithologies. Examples are the white blocks of rock being worked by artisanal miners near the Karamoja Museum & Cultural Centre [36N 0687277E, 0278774N; 1505 m]. They are a raw material for cement manufacture and industrial materials.

Mt. Moroto is not only a feature of geological significance but can be a good candidate for a Biosphere Reserve because not only does it host a Central Forest Reserve (Moroto Forest Reserve) with rich flora (Acacia family, Ballanites, Terminalia, Euphorbia and Ficus family) but also wild fauna (leopard, Dik dik, antelope, baboon, wild cat, fox and wild pig among others) alongside a Sub-ethnic group of Karamojong people called 'the Tepeth' who live at the topmost parts of the mountain and which is covered by forest. As such, it can be a perfect Geopark. Mount Moroto is a catchment area for Okere and Okwanges rivers which are permanent water sources for cattle and communities of kadike, Lothaar, Michokho, etc. Mount Moroto is rich in biodiversity and supports two species of butterflies and moth not found elsewhere in Uganda. Mount Moroto is also very rich in minerals such as marble and gold. An ethnic group called the Tepeth is found on top of the Mount Moroto and elsewhere on the Napak Carbonatite Complex.

The nature reserve that encloses Mount Moroto measures 483 square kilometres (119,000 acres) and contains over 220 bird species, monkeys and wild cats. Climbing trails exist and mountain guides are available. The natural springs on the slopes of the mountain coalesce to form springs and small rivers. The World Food Program is teaching the Karamojong people how to harvest and store that water and use it to irrigate agricultural produce for household food and for income generation.

Moroto Mountain with Central Forest Reserve

2.8.7. The Morungole Hills, Kaabong District

Composed of several mountain peaks, the Morungole Massif [UG 30 - 36N 614370E, 421534N; 2,751 m] and measuring some 40 km × 60 m, is named after the Morungole mountain peak (2,751 m) and the nearby township. It straddles the north-eastern corner of Uganda gracing the Kidepo Valley Park to the north and sprawls over all four of the 1:50,000 – scale topographic map sheets 9/2 (Kawalakol), 9/4 (Magos), 10/1 (Pire) and 10/2 (Kaabong) and the 1:250,000 – scale geological map sheet Geology_ NA_36_3_NA_4_Kaabong_Lodwar. The Massif is one of three such massifs that were outlined by the SMMR project; the others being the Akur and Ukutat massifs.

The Akur Massif, named after the highest peak (1,885 m) belongs to the Labwor Hills found in Abim District while the Ukutat Massif in Napak District, is a sparsely populated, featureless, flat terrain intersected by numerous wide alluvial plains and marshland with braiding rivers draining into Lake Opeta. The Neogene Napak alkaline intrusive (2,537 m), located on its north-western tectonic contact Napak District stands out in this flat scenery. The Ukutat Massif complex, named after one of the intersecting rivers, is composed of banded granulite and charnockite of the Kalongo Group, an oversimplification due to the poor accessibility and exposure.

What is common about all these massifs is that they are composed of rocks formed by ultra-high temperature metamorphism principally granulites and charnockites. 'Dry' minerals (i.e. lacking -OH radical in their crystal lattice) characterise these rocks. Temperatures of metamorphism exceeded 1000°C while pressures in the vicinity of 7 – 9 kbar, among other conditions prevailed in deep depth prior to uplift.

Traditionally, the granulites and charnockites of the West Karamoja Group were viewed as 'Watian' rocks belonging to the Archaean Basement Complex. However, recent age dating by SMMRP of two charnockite samples from the Labwor Hills (UG_9 and UG_34) returned 684 ± 6 Ma and 737 ± 11 Ma respectively, typical Neoproterozoic Pan-African ages. By contrast, the Watian rocks (also composed of granulites and charnockites) are of Neoarchaean age.

The Morungole Massif is not only a feature of geological significance but can be a very good candidate for a Biosphere reserve for not only does it host four (4) Central Forest Reserves (Morungole, Lotim-Puta, Lwala and Zulia) thereby harbouring rich flora but also wild fauna alongside a Sub-ethnic group of Karamojong people called 'the Ik'. As such, the massif can form a perfect Geopark.

2.8.7.1. Nyangea – Napore Central Forest Reserve, Kaabong District

The Forest Reserve, occupying the Karenga Ridge, falls on the 1:50,000 – scale topographic map sheet 9/3 (Apoka) at the west end of Kaabong District and the 1:250,000 – scale geological map sheet Geology_ NA_36_3_NA_4_Kaabong_Lodwar. The rocks are geologically mapped as Biotite-hornblende gneiss of Neoarchaean age (2800 – 2500 million years) of possibly volcanic origin.

The estimated area is 14,064 Hectares, UTM WGS84 E-568682 N-397461, elevation is between 1040m-2280m. It is a hill reserve that is among the CFRs constituting network of sites of biodiversity. It Protects Kidepo River valley for conservation of wildlife.

There is a ridge which is not only a feature of geological significance but can be a good candidate for a Biosphere reserve because it hosts a Central Forest Reserve (Nyangea - Napore Forest Reserve) with rich flora and possibly fauna. As such, it can be a perfect Geopark.

The Nyangea Napore Mountain (Photo credit: Sam Kiisa and Dr. Lali Mundrugo-Ogo)

2.9. Geosites in Northern Uganda

2.9.1. The Otze- Illingwa- Illo and Nyeri Ridges Moyo District

The three high – rising parallel ridges of (from east to west): Illingwa, Illo, Otze and Nyeri Ridges are covered with a forest reserve. They are located on the 1:50,000 – scale topographic map sheet 5/4 (Laropi) in Moyo District and the 1:250,000 – scale geological map sheet Geology_NA_36_2_Kitgum. The underlying rocks are variously mapped as the Madi Group lithologies which comprise predominantly of various shades of quartzite (often underlying the highest ridges), largely tightly folded ranging from pure quartzite (of Ilengwa Ridge and Ovuvu type) through quartzite intercalated with mica schist (of Apipi type) to higher metamorphic grade quartz mica schist (of Anyurapi type) and Calc – silicate quartzite (of Kungi type); but all of Mesoproterozoic age (1600 – 1000 million years) and possibly of metasedimentary origin. Dolomitic marbles are also interfolded within these units.

Radiometric age dating by SMMRP of a Dacitic metatuff rock from Metu (UG-46) and a Quartz-muscovite schist from Anyurapi (UG-39) returned ages of respectively: 984 ± 8 Ma and <977 ± 5 Ma, which are at the Mesoproterozoic/Neoproterozoic margin while the nearby Laropi intrusive Adjumani granite (UG-43) is dated at much lower 659 ± 15 Ma and not very different from the Pan- African ages established in the ultra-high temperature (UHT) rocks of the West Karamoja Group (e.g. Morungole Massif).

In terms of mineral potential, the Gweri (Nyeri) dolomitic marbles have been investigated for possible cement raw materials while gold is a possibility there too. The Emin Pasha Fort, Dufile is located at 36N 0385989E, 039031N; 614 m, the Emin Pasha Fort is an archaeological site on the north bank of the River Nile named after Emin Pasha, a German explorer who entered Uganda from Egypt in 1885. It is believed, he established this fort and could have died here. Three graves are visible in the area – Emin Pasha's burial ground? Burnt Earth bricks are strewn within the fort area which is protected by an earth embankment – now long reduced in height by erosion, which is in turn encircled by a deep trench. The observation point in the northwestern corner is higher due to built-up earth to accord long visibility.

Mt Otze Moyo District-The Illingwa- Illo and Nyeri Ridges are not visible

2.9.2. Wati Hills, Terego County, Arua District

The Wati Hills, named after the highest peak Wati (1,250 m, wikipeadia), are a majestic group of hills made up of generally dark brown rocks located on the 1:50,000 – scale topographic maps 11/2, 12/1 (Ladonga) and 12/3 (Terego) in Arua District. The relevant geological map sheet is Geology_NA_36_1_Arua and characterizes them as Tara brown granite The Tara brown granite is named after a type locality, Tara, along the Koboko – Torome road where isolated little hills (3 nos.) are made of brown granite rocks; the others being Liru and Tukaliri. In Uganda geology nomenclature, they are collectively grouped into the Watian Complex.

The Watian Complex is essentially composed of rocks formed by ultra-high temperature metamorphism principally granulites and charnockites. 'Dry' minerals (i.e. lacking -OH radical in their crystal lattice) characterize these rocks. Temperatures of metamorphism exceeded 1000°C while pressures in the vicinity of 7 – 9 kbar, among other conditions prevailed in deep depth prior to uplift.

Radiometric age dating of type rock (UG-8) by SMMRP returned a Neoarchaean age of 2622 ± 5 Ma, which is a typical Upper Neoarchaean age, thereby differentiating them from the granulites and charnockites or the West Karamoja Group underlying the Morungole Massif, for example (see Sec. 3.5 above).

The Wati Hills are hosts to Mt. Wati CFR, Watibarituku, Liru and Odruwa Light Forest Reserves with a variety of flora of benefit to society. Limited fauna ought to exist too.

Conclusion:

In summary, the geosites in the Eastern and Northern Regions can form two Geoparks namely the Eastern Region Geopark consisting of the geosites in Busoga-Bukedi and Karamoja and the Northern Geopark consisting of the Omi and Iceni hills in Adjumani , the Mt Oce-Illo-Illingwa-Nyeri Complex of Moyo and the Wati Hills of Terego, Arua District.

Wati Hills (Photo credit: Sam Kiisa ad Dr. Lali Mundrugo-Ogo)

2.10. Geosites in Western Uganda

Introduction

During field work 8 Geosite locations were visited in the western region. These included geo-relevant sites such as natural/geological, palaeontological, and archaeologial sites. However, many of the visited places have also a cultural or traditional background, hence might also be regarded as cultural or traditional sites, although legends of the sites are often contradictory, and differ from information received at the site from information obtained during the desk study.

During the mapping and surveying of the above mentioned sites more effort was dedicated to promote knowledge of communities and local government officials on scientifically-important sites with view to nominating such sites for designation as sites for sustainable livelihoods and Climate Change adaptation in Uganda and to increase awareness of the communities in and around the identified sites on the need to nominate the sites for designation as laboratories and learning platforms for sustainable development.

The geosite in Western Uganda can form two independent geoparks right from Bullisa district to Fort Portal one geopark which will include Lake Albert, Bukuumi archeological site, Katasiiha Cave / tunnel, Mparo tombs, Katoosa catholic martyrs shrine, Amabereganyina Mwiru and the surrounding Fort Portal Craters, Rwenzori Ranges and Tooro Bunyoro escarpment up to Fort Portal which includes Rwenzori Mountain and Ranges, Katwe Salt Lake and Munyanyange crater known for having seasonal flamingos a rare bird species, surrounding craters lakes in the rift valley, giving a good view of the rift valley.

From Rukingiri, Rubirizi and Sembabule Districts to Kisoro District, another Geopark which includes Kyambura gorge and escarpment, Lakes Edward and George, Kazinga Channel, Bunyaruguru Crater Lakes Bigo Bya Mugenyi archeological sites and the Kigezi Hills and Mountain Muhavura with Lake Bunyonyi and Echuya Forest reserve.

2.10.1. Bukuumi Archeological/ Cultural site

The site is located in Buliisa district at the GPS coordinates 36N 0320422, 0198156 altitude 724m and it can be accessed by taking Kampala – Masindi road and from Masindi taking Buliisa road through Biiso town to Bukuumi , the site lies along the Toro Bunyoro escarpment on the road to Buliisa town. It's archaeological and cultural/traditional site and it's currently used for tourism.

Geological Description
The site lies in the stratigraphy of mesoarchean supergroup of the budongo formation, they numerous out crops of granite gneiss and mafic granulite at the archeological site.

Traditional/cultural background
The site has numerous tombs believed to be for Bachwezi clan of Bunyoro, people usually gather for prayers trying to connect with Bachwezi, they request for blessing from the Bachwezi who are believed to be owners of the land. The cultural site is facing a threat of destruction due to excavation of murram on the road side by constructors.

2.10.2. Katoosa Catholic Martyres Shrine/ Geosite

The Geosite is located in Kyenjojo district at GPS coordinates 36N 0238085E, 0070216N, 1377m and can be accessed on Kampala Fort Portal road to Kyenjojo town, then Branch on Hoima road about 2.5km north of Kyenjojo town.

Geological Description
This Katoosa granite body has been interpreted as a small satellite intrusion of Mubende-Singo Suite. It has intruded into low- to medium-grade metamorphic pelitic rocks of the Buganda Group and, like the batholiths of the Mubende-Singo Suite; it represents a post-tectonic phase of magmatism.

The Kyenjojo granite is a light grey, fine- to medium-grained, equigranular, unfoliated, and almost massive and leucocratic rock with a small amount (~5 vol%) of biotite (Fig. 1). Usually this granite is very homogeneous, but occasionally complex late magmatic flow structures can be observed in places with 2–3 cm thick bands enriched in biotite**.** Some very small mafic enclaves occasionally occur and also scattered K-feldspar phenocrysts, up to 3cm in size, have been encountered. Pegmatite granite veins and dykes, up to 50 cm thick, occur randomly in places.

Religious Background
Katoosa granites are painted with photos of some of Uganda martyrs and one them happen to be born of the area in Katoosa, pilgrims from all over East Africa and beyond usually come for prays to seek blessings from the paited rocks.

Figure 2: A and B are Katoosa pilgrim's granite rocks

2.10.3. Katasiiha Historical Cave/Tunnel

The geosite is located in Hoima district at GPS coordinates 36N 0315347E 0160640N and can be accessed by taking Kampala Hoima road to Hoima town. Katasiiha Cave lies 2km North of Hoima town along Kaiso Tonya road at Miiki Eco Resort Hotel.

Geological Description
The main rock types represented in the area are mylonitized quartzite, Travertine rocks, and mylonitized gneisses.

Cultural / Historical Cave / Tunnel
The site is an artificial Cave / Tunnel dug by late King of Bunyoro Sir Kabalega as defensive mechanism against colonialist. The cave / tunnel runs for about 7km right from Katasiiha up to Mparo tombs.
The site has water fall and a variety of natural tree species which are very important for herbal medicine.

2.10.4. Amabeere ga Nyinamwiru in Nyakasura

These are Cave/rock shelter, waterfall scenic environment with craters and crater lakes within the Fort Portal volcanic field (fig 3). They are Natural/geological and cultural/traditional type of geosite but also archaeological.

They are found in Kabarole district and can be accessed taking Kampala–Fort Portal road, branch off at Fort Portal, take Fort Portal–Bundibudgyo road, branch off after 5 km, and follow signpost to the caves (another approx. 2.5 km) at the GPS coordinates: 36N 191103/74930, altitude 1558m.
Immediate site around the caves: 100x100m, wider area several square kilometres.
The caves are found on private property and the land belongs to Mr. Rubombora family.
The site is currently used for tourism, but also for tradition/culture and it's well preserved.

Geological description
These are caves with unique structures – stalactites and stalagmites unknown elsewhere in Uganda. They are spectacular because they occur in carbonatitic lavas and tuffs, and not in the usual limestone or marble environments. There are three major caves with the biggest about 11–22m long, 7m high and 4–6m deep.

Traditional/cultural and archaeological background
The caves are known locally as "Amabeere ga Nyinamwiru" translating as "the breasts of the mother of Mwiru". From legends, "Ndahura the King of the Bachwezi" who occupied this area lived in these caves and was fed as a child from the "breasts" (stalactites) that dripped a milky liquid. This is a cultural site recognised locally but not nationally gazetted. It is reported that in these shelters, human bones and other materials (cowry shells, pots) used by earlier "Bachwezi" kings were found. In the same area a fissure filling structure is found, 6m wide, 9m deep and 62m long, indicating a fissure eruption during the time of formation. Its trend is E/NE–W/SW. Due to its shape it is locally named "obwato" (small boat). These "obwato" were used by "Bachwezi" kings as ponds to store water for their cows but also as shelters. One of the "obwato" is called "omwigo gwanyinamwiru" (stick of "Nyinamwiru").

Figure 3: A is Waterfall at Nyakasura and B a Large stalactites, and stalagmites

Figure 4: Small, up to 15cm high stalagmites

Figure 5: Scenery near Nyakasura. In the background is Kyeganywa hill, in the foreground is the Kigere Crater Lake.

2.10.5. Nkuruba Crater Lake

They numerous Scenic craters and crater lakes within the Ndale (Kasenda) volcanic field Natural/geological type of geosite and located in Kabarole district.

It Accessed by taking Kampala–Fort Portal road, branch off at Fort Portal, take Fort Portal–Kamwenge road, branch off again towards Kakanihanda (about 18km from Fort Portal).36N 0199603E, 0057668N altitude 1493m GPS coordinate of the site and Immediate site is 100x100m, wider area several square kilometres. It's currently used for Touristic and educational purposes. The site is well preserved by its management.

Geological description

This explosion crater (with a lake) is among the many around Kasunganyanja. It is part of the Ndale (Kasenda) volcanic field. It is here that mankind appreciate how nature through volcanism sculpted landscape. Of interest to this site is a huge crater which was left behind after the explosion and absence of

volumes of material (at the immediate site) which resulted from this explosion. Only a thin pyroclastic layer is partly covering the basement rocks. It is of geological interest, that the crater walls expose a contact between meta-sediments and granitic rocks. Kaolin (probably the weathering product of a pegmatitic dike in the basement rocks) is mined here for house painting and the water of the lake is used for domestic purposes.

Figure 6: Nkuruba Crater Lake

2.10.6. KATWE SALT LAKE

Katwe Salt Lake is located in Kasese district at GPS coordinates 35N 0819791E, 9986146N, altitude 948m and can be accessed by taking Kampala - Fort Potal road, then continue to Kasese from Kasese to take Mbarara road and then Branch off to Katwe-Kabatooro town.

It's Natural / Geological geosite, the scenic craters and crater lakes as well as springs within Katwe-Kikorongo volcanic fields (Queen Elizabeth National Park). The site covers about 4km^2 and it's owned by local government and controlled/ managed by Katwe/Kabatooro town council.

The site is currently used for tourism and economic activity through mining, it's poorly protected and faces a threat of local mining and domestic activities that might destroy valuable geological spots at the immediate site.

Geological Description

There are two craters which coalesced to form one with a diameter of about 1300m covering an area of about 2.5 km^2 (fig 6). The inner walls of the crater expose well bedded pyroclastic layers, and surge deposits, in cases exhibiting cross bedded layers. Up to 15m high calcium carbonate moulds and travertine cones indicate past, extensive hot spring activity. The cones are occasionally mined for lime production. Further indications of hot spring activities include travertine channels in the tuffs gaseous emissions and thermophyllic grass, the latter being an endemic plant species. In the central part of the crater, saline lake water is used for salt production.

The Lake Katwe salt gardens, so far, form the largest saline mineral reserve in Uganda. The saline lake level is below the neighbouring fresh water level of Lake Edward.

Traditional/cultural background

Salt mining at Katwe is one of the indigenous African's oldest industries still surviving. More than 3000 people still work in the Katwe 'mines', owing salt pans to take care of (Fig.). Since the 16th century, salt has been one of the most important goods that attracted attention of many people and traders. The explorer Sir Henry Morton Stanley was the first white man who mentioned the site in his report. He visited Lake Katwe with his expedition team in 1875.

Figure 7: Lake Katwe

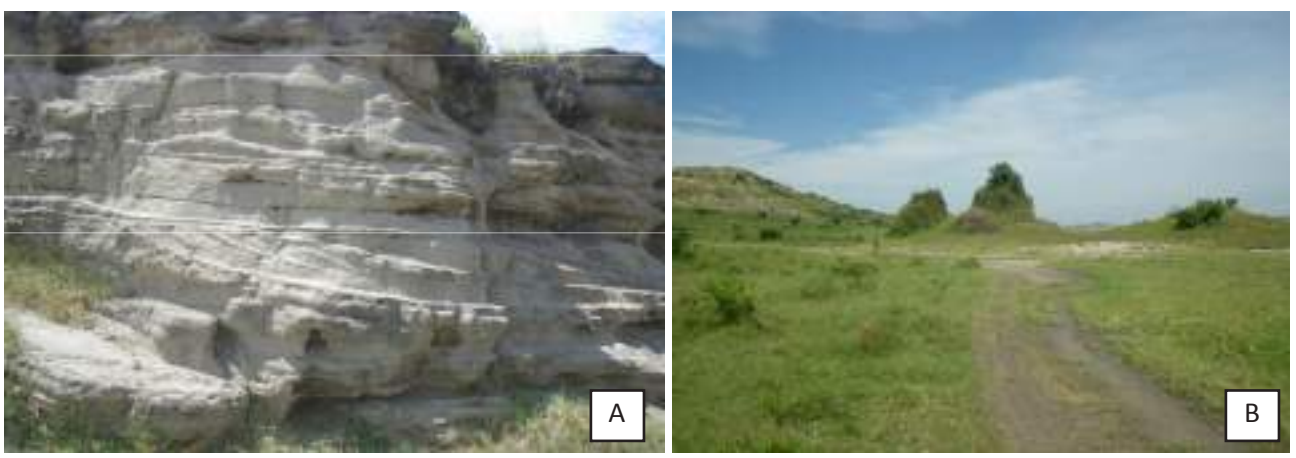


Figure 8: A is partly cross-bedded pyroclastics and B is large travertine cones

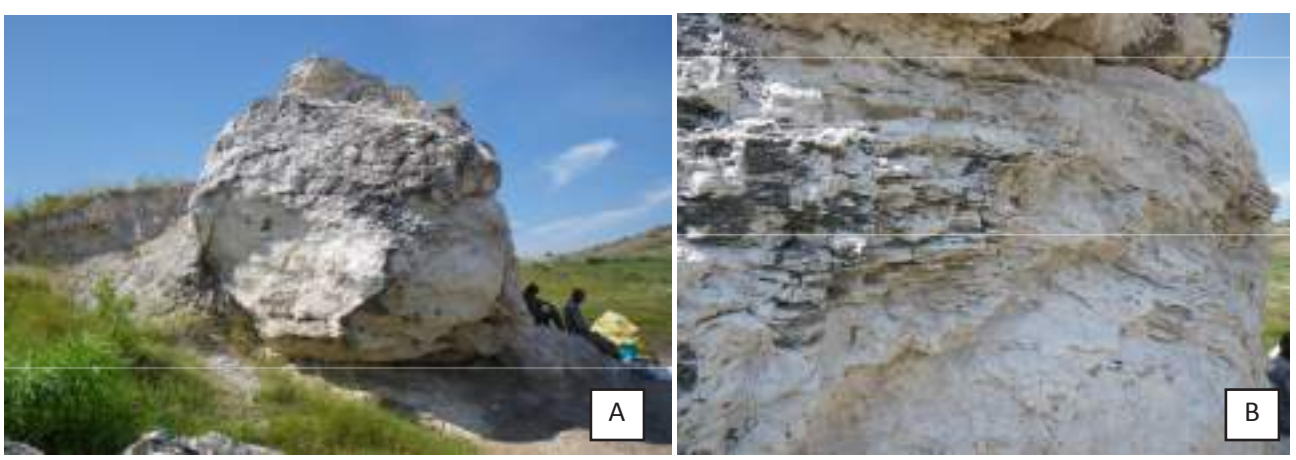


Figure 9: A is Travertine cone mined for lime production and B is Layers of travertine

Figure 10: Lake Katwe salt gardens.

2.10.7. Bigo Byamugenyi Earth Works

The site is located in Ssembabule district at the GPS coordinates 36N 0306165E, 0017284N, altitude 1221m and it can be accessed by taking Kampala – Fort Portal road to Lusalira and then branch to Kasambya and continue to Ntusi subcounty. It's archaeological and cultural/traditional site and it's currently used for tourism.

Geological Description

There are no rock outcrops at the immediate site. However, the soils used to create the concentrically arranged, and up to 4m high walls are rich in small quartz pebbles, indicating a granitic source of the weathered material.

Archaeological, Traditional/Cultural Background

Bigo Byamugenyi mounds are the largest ancient settlement in Uganda and it is believed to predate the 'Bachwezi' dynasty as early as the 10th century. The villagers probably lived in small cone huts and grew sorghum and millet and herded cattle. There are two concentric earthworks (male and female), an outer ditch and an inner royal enclosure in which local people believe that the earthworks have supernatural powers. There pottery shards. The people made ceramic pots with a distinctive rouletted pattern. Iron smelting, fire clay materials, and pottery are reported in the area. It is asite with occasional believers visiting it intermittently to get spiritual powers.

Bigo Byamugenyi evokes images of the ancient 'Bachwezi' dynasty. It is an abandoned treasure of massive earthworks. Excavation revealed huge piles of refuse heaps deposited over a 300 year period. Several scrapped depressions are reported in the middle ('obwogero'). The largest is believed to be 20m deep. This deep 'obwogero' lies 150m from the 'male' mound. These 'obwogero' are probably associated with ancient irrigation ditches. These areas hold cultural (myth, legend, spirit). It holds significant archaeological importance and should not have been trampled upon by neighboring communities. The spirit medium, seeks spiritual powers from here and people flock her shrine for miracles, cleansing, worshiping and offerings.

2.10.8. Nsongezi Cave/ Rock shelter

It's a cave/ rock shelter located in Isingiro district at the GPS coordinates 36N 0249664E, 9890568, altitude1218m and be accessed by taking Mbarara- Kikagati road, about 2km from Nsongezi town towards Kikagati trading centre. It's currently used for tourism and also traditional/cultural.

Geological description

The rocks are gravels which have been lateritized and hardened. Pebbles and gravels of quartz are visible.

Archaeological, traditional/cultural background

They are abandoned rock shelters. Once justifiably associated with archaeological treasures, Nsongezi is no more. It needs urgent remedial action. It is reported archeologists carried out some work here and found ancients materials. Legend ties it to 'Bachwezi' kings.

Figure 11: Nsongezi cave / Rock shelter

2.10.9. Kigezi Hills and Mountain Muhavura with Lake Bunyonyi and Echuya Forest

Mount Muhabura, also known as **Mount Muhavura**, is an extinct volcano in the Virunga Mountains on the border between Rwanda and Uganda. Its elevation is 4,127m(13,540ft), prominence is 1,530m(5,020) and coordinates are 01°23′00″S, 29°40′00″E .

At 4,127 metres (13,540 ft) Muhabura is the third highest of the eight major mountains of the mountain range, which is a part of the Albertine Rift, the western branch of the East African Rift Valley. The **Virunga Mountains** (also known as **Mufumbiro**[1]) are a chain of volcanoes in East Africa along the northern border of Rwanda the Democratic Republ;ic of Congo (DRC), and Uganda. The Mountain range is a branch of the Albertine Rift Mountains which border the western branch of the East African Rift. They are located between Lake Edward and Lake Kivu. The name "Virunga" is an English version of the Kinyarwanda word *ibirunga*, which means "volcanoes".

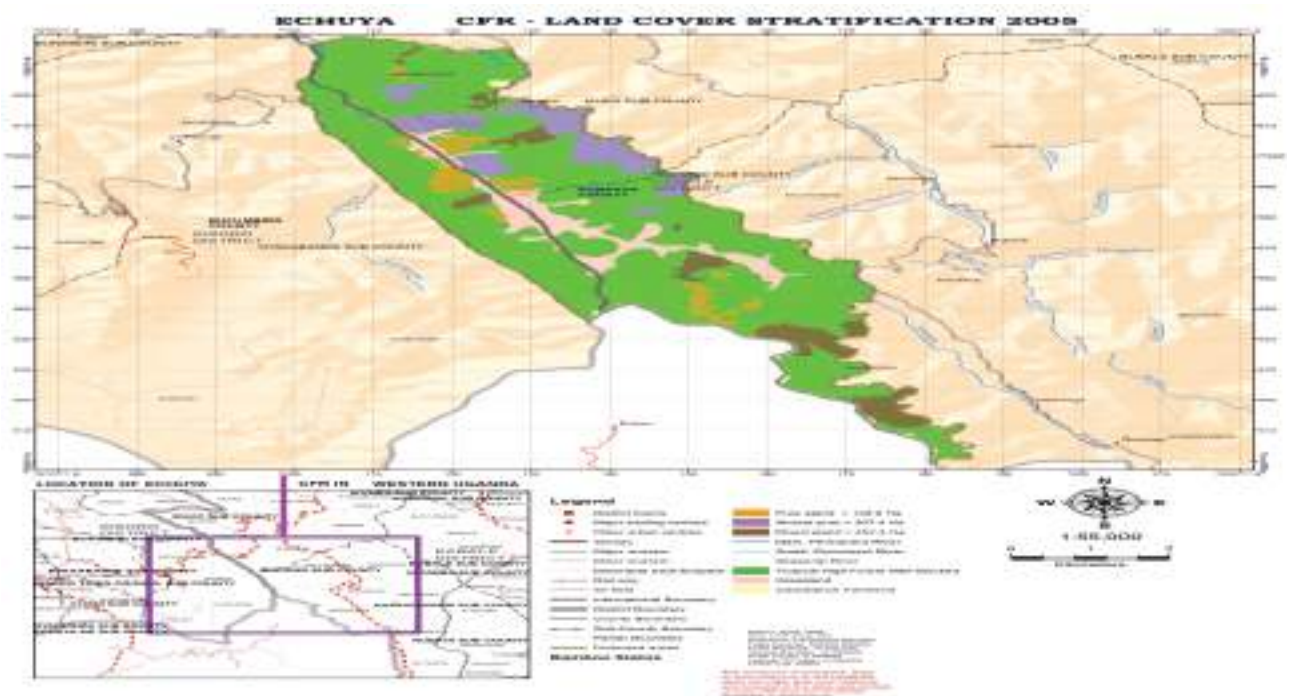
The mountain range consists of eight major volcanoes. Most of them are dormant, except Mount Nyiragongo 3,462 metres (11,358 ft) and Mount Nyamuragira 3,063 metres (10,049 ft), both in the DRC. Recent eruptions occurred in 2006 and in January 2010. Mount Karisimbi is the highest volcano at 4,507 metres (14,787 ft). The oldest mountain is Mount Sabyinyo, which rises 3,634 metres (11,923 ft) above sea level.

The Virunga Mountains are home of the critically endangered Mountain gorilla, listed on the IUCN Red List of Endangered Species due to habitat loss, poaching, disease, and war (Butynski et al. 2003). There is a Karisoke Research Centre, founded to observe gorillas in their native habitat located between Mount Karisimbi and Mount Bisoke. (https://en.wikipedia.org/wiki/Mount_Muhabura).

Mount. Muhavura (background) and Lake Bunyonyi (foreground)

Lake Bunyonyi is believed to be one of the deepest lakes in Africa and it covers a total area of 61km², probably even the most beautiful lakes in Africa as well, dotted with numerous islands and surrounded by terraced **hills** (https://africageographic.com/blog/10-top-things-experience-ugandas-lake-bunyonyi).

Lake Bunyonyi is located in southwestern Uganda between the districts of Kisoro and Kibale and its shores are just seven (7) kilometers from the town of Kabale (which is popular for its terraced **hills**). www.primeugandasafaris.com/.../the-magical-lake-bunyonyi-of-southwestern-Uganda).



Kigezi Hills showing Echuya Forest

CHAPTER THREE

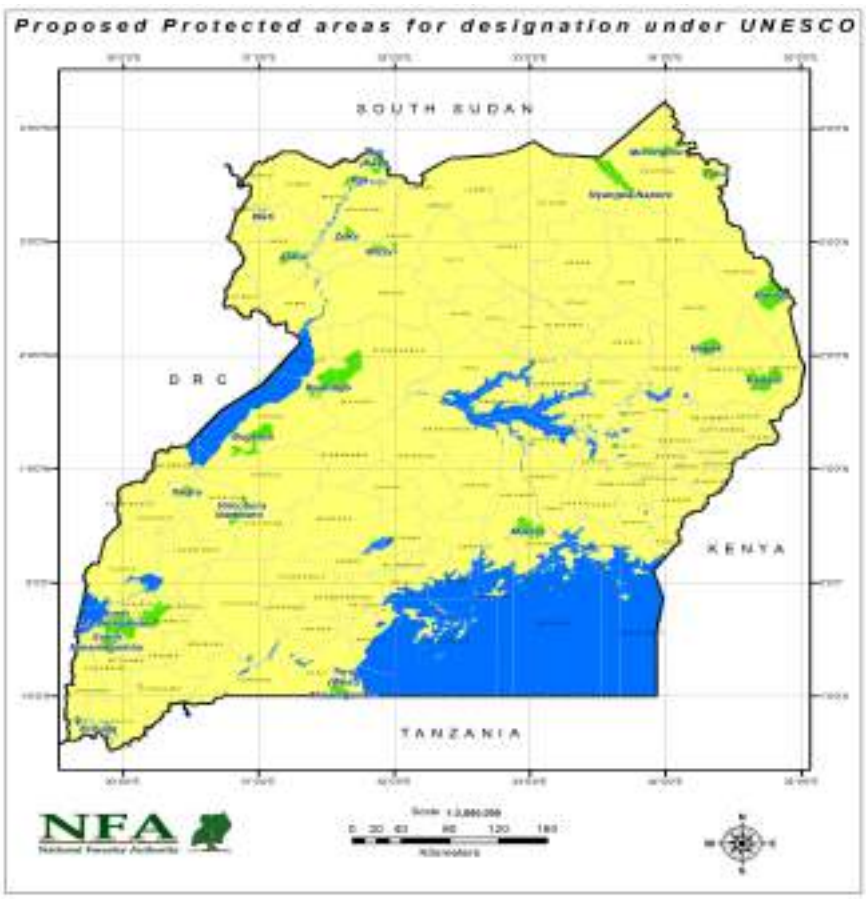
3.0. General Challenges/Limitations

Some of the planned sites were not reached due to the limited time and resources. These included the sites in Abim, Bundibugyo, Rukungiri, Kisoro and Kabale districts. In the areas under conservation, some of the site managers were non-cooperative.

3.1. Conclusions and Recommendations

3.1.1. Conclusions

The thirty four ecosystems covered in the mapping and assessment consists mostly of Central Forest Reserves including those of dual ecological and geological significance. For the geological sites, twenty one were found to be of exclusive geological nature after the mapping, assessment and documentation. These have potential as UNESCO designated sites. Twenty two of the thirty four ecosystems have been listed for phased nomination in order of priority as Biosphere Reserves while all the twenty one geosites were recommended for grouping into three or four independent Geoparks. There has been no single designated Geopark in Uganda and hence no national controlling body for protecting these sites except those that are found in National Parks are by default protected by Uganda Wildlife Authority who mainly focus on the biodiversity rather than geodiversity protection. Other geosites fall within sites recognized by Uganda Museum, or are situated on private land and occasionally fenced, hence having some kind of protection status. The maps below summarize the sites that have been mapped and are set for nomination in phased and prioritized manner.



The project has strongly reflected the needs of Uganda as a member State in the fields of Education, Culture, Social and Human Sciences, Natural Sciences and Public Information and Guidance and has been a right step in contribution to the in fulfilling its constitutional Objectives and Directive Principles of State Policy on Protection of Natural Resources and the environment specifically in regard to the management of Land, air, water, energy and the need to create and develop parks, reserves and recreation areas for conservation, safeguarding and protecting the biodiversity of Uganda . It also fulfills the provisions of the Uganda Wildlife Act, the Uganda Forestry Policy, 2001 and the the Uganda Wildlife Policy, 2014.

In regard to the global commitment, it has laid a good foundation for the contry to contribute to the realization of the Sustainable Development Goals especially SDG15 on the protection of ecosystems and biodiversity, SDG 13.1 on climate change resilience, SDG 11.4 on the protection of cultural and natural heritage and SDG 4.7 on Education for Sustainable Development (ESD) and Global Citizenship Education (GCED). In terms of Continental aspiration, it contributes to the AU/NEPAD's Environment & Climate Change strategy (2010-2015) on Combating Land Degradation, Drought, Desertification, Climate Change, T/boundary Conservation and Management of Natural Resources.

3.1.2 Recommendations

Given that almost all these geological landforms are not under any protection, and yet irreplaceable when destroyed, action must be taken to protect them from elements of the weather and destructive human activities. The same urgency applies to the ecological sites that currently do not enjoy any state protection. They are the fundamental components of the natural heritage and can be a source of revenue with great scientific/educational and cultural value to the Country and the scientific community.

For the prioritized sites that have existing management plans by virtue of being already under protection, the plans that are have gaps be reviewed to incorporate the UNESCO's requirements for Biosphere Reserves and Geoparks. On the other hand, the sites without management plans also need to formulate plans in line with the guidance provided during the fieldwork of the implementation of this project to ensure sustainability of the sites covering the conservation.

There is urgent need for a follow up to conclude the zonation and nomination processes and support to the communities in long-term planning and initiation of ecologically green projects including tourism for sustenance of the management of the sites related to the relevant and desired designation. This calls for firm commitment by the local communities for a strong local multiple partnership with long-term public and political support, and the development of a comprehensive strategy that will meet all the requirements. The National Committees of Man and Biosphere Programme and the Geosciences programme need to provide leadership and play great roles in the successful nominations in the months to come.

ANNEXES

Annex 1

List of Technical Persons Drawn from the Man and Biosphere and the Geosciences Programme Committees

A. Geoscientists

1. **Mr. Edward Isabirye Mugaddu:** Senior Geologist, Ministry of Energy and Mineral Development (MEMD) and Chairman of the National Committee of IGCP

2. **Dr. Betty Nagudi:** Geochemist, Senior Lecturer, Department of Geology and Petroleum Studies, Makerere University , Member of the Association of African Women Geoscientists, Association of Uganda Women Scientist, the Geological Society of Africa and the Geological Society of Uganda and Vice Chairperson National IGCP.

3. **Dr.Kevin Aanyu:** Geoscientist and Lecturer in the Department of Geology and Petroleum Studies, College of Natural Sciences, Makerere University Makerere University and member of the Geological Society of Uganda (GSU) and the Association of African Women Geoscientists (AAWG). She is currently studying the Paleostresses in Rwenzori Mountains of the Albertine Rift (Uganda), Western Branch-East African Rift System.

4. **Ms. Molly Kibalama Bakka Male**: Senior Geologist with the Directorate of Geological Survey in the Ministry of Energy and Minerals development (MEMD), department of geological survey and mines with over 30 years of experience in Field Geology mapping, GIS and Remote Sensing interpretation techniques and Metadata management, Petrology and Gemmology (Macroscopy and specimen slide management), Geosites inventory initiation, Geoheritage promotion, Geoheritage Geotourism and Geoparks.
5. **Ms. Sudan, Unity Birungi** of Tulibamu Company Limited holds a Bachelor of Science in Geological Resource Management Degree

B. Bio Scientists (Biodiversity Conservationists)

1. **Dr. James Kalema**; Botanist with specialized training in Natural Resource Ecology and Conservation. A ***Senior Lecturer*****,** Dept. of Biological Sciences (Botany), 20years at Makerere, former *Park Warden* with the then Uganda National Parks under the Ministry of Tourism, Wildlife and Antiquities for two years where he was in charge of Education, Tourism and extension programmes and a member of the National MAB Committee under the Uganda National Commission for UNESCO.

2. **Dr. Casim Umba Tolo;** Biologist (Palaeo-climate and Palaeo-environmental changes**),** a senior Lecturer with fourteen years of teaching and research experience in the Department of Biology, Faculty of Science, Mbarara University of Science and Technology, Uganda. a member of the National Man and Biosphere (MAB) Programme, Uganda National Commission for UNESCO, Kampala-Uganda.

C. GIS Specialists (Forester/General Environmentalists)

1. **Mr. Amadra ori-Okido:** Forest Specialist, Natural Resources Specialist (Forestry), and GIS Specialist, GIS Systems Analyst EIA Specialist, Database Developer and a trainer, a member of the Association for Impact Assessment EIS-AFRICA, Uganda Forestry Association, the Data Standards Committee and the Environment Information Network of which he was formerly a Chairperson.

2. **Mr. Victor Onama**: Environment and Natural Resources Management, Desktop and Mobile Geographical Information Systems (GIS) Applications and Design and Management of Geo-databases AND Management/Geographical Information Systems (MIS/GIS) Consultant,

D. UWA Representative

1-Mr. John Makombo: Director for conservation and member, MAB

E. Ministry of Tourism Representative

1-George Owoyesigire: Principal Tourism Officer

F. UNATCOM Representatives

1. **Dr. Dominic Venture Mundrugo-Ogo Lali:** Programme Officer for Natural Sciences , Focal Person and Secretary for the National Committees of Man and Biosphere (MAB) and the Geosciences (IGCP) Programmes, technical coordinator, guide and supervisor of the project.

2. **Rosie Ago**i: Ag. Secretary General, Accounting Officer and the Overall Supervisor.

Annex 2

Table 1: The Kalinzu Forest community members that attended the meeting at Kayanga village

Name	Sex	Member
Rubinga Joseph	M	Member
Kagumire Nathan	M	Chairperson LC1
Basiime Brian	M	Member
Kyarimpa Benon	M	Member
Mwije Willis	M	Member
Katwesigye Stuart	M	Member
Atwongirwe Harriet	F	Member
Bangirana Festo	M	Member
Kyarisima Anet	F	Member
Kyohairwe Provia	F	Member
Kyomugisa J.	F	Member
Moneka A.	F	Member
Byaruhanga W.	F	Member
Tayebwa S.	M	Member
Byarugaba Julius	M	Member
Baryomumyanya Vina	F	Member
Karuhanga Frank	M	Member
KiconcoKeeti	F	Member
Byamukama Lowrence	M	Member

Table 2: The Kasyoha-kitomi community members that attended the meeting at Kamacumu village

Name	Sex	Designation
Tibetaho Dezi	M	Secretary BUCA
Tiberindwa Charles	M	Member
Daneri Rukanyanga	M	Member
Nuwagaba Jane	F	Member
Busingye Ruth	F	Member
Tumusime John Bosco	M	Member

Name	Date
Arionga Simon	
Charles Omara	09.08.2017
Okong Benson	10.08.2017
Simoiwo Moses	11.08.2017
Nyeko Patrick	12.08.2017
Richard Lotule	12.08.2017
Giyaya Charles	13.08.2017
Tonny Olinga	13.08.2017
Acuti John Bosco	14.08.2017
Scovin Iceta	15.08.2017
Peter Apaja	11.08.2017
Odongkara JB	10.08.2017
Abura Joseph	15.08.2017
Koboi Cornelius	15.08.2017
Kakana Kakaaga Steven	09.08.2017

Okong Benson	
Olaica Tom	
Atibu A. Loese	
Oguti Vincent	
Simoiwo Moses	11.08.2017
Odongkara John Bicky	11.08.2017
Francesca Namuya	11.08.2017
Elizabeth Mamemda	

Table 4: The Sango Bay community members that attended the meeting at Nkalwe village

Name	Sex	Member
Namubya Specioza	F	Member
Zamira Agasa	F	Member
Mirembe Julius	M	Member
Yozefina Nayiga	F	Member
Nanzin Immy	F	Member
Kato P	M	Member
Mukasa Vincent	M	Chairman
Ndawula M. Ssalongo	M	Member
Mpagi Paulino	F	Member
Nalule Regina	F	Member
Namutebi Elivania	F	Member
Nanyonga Madiina	F	Vice chairperson
Latibu K.	M	Member
Namwanje	M	Member
Omaido Paul	F	Security officer

ATTENDANCE LIST OF THE PARTICIPANTS IN THE VALIDATION

	Name	Position/Title	District /Ministry /Organization
1	Kihika Mary Mujumura	Sec. Environment	Masindi District
2	Edward Isabirye Mugaddu	Principal Geologist/Member IGCP	Directorate of Geological Surveys and Mines, Ministry of Energy and Environment
3	Birungi Unity Sudan	Geologist,	Directorate of Geological Surveys and Mines, Ministry of Energy and Environment
4	Dr. Casim Umba Tolo	Senior Lecturer /Member MAB	Mbarara University
5	Tumusiime Julius	Assistant Lecturer	Mbarara University
6	Otita Joseph	Sec. Production	Moroto District
7	Lotyang John	Natural Resource Officer	Moroto District
8	Alule A. Herbert	For District Natural Resources Officer	Moyo District
9	Maiku Didi Paul	Sec. Production & Natural Resources	Moyo District
10	Ezuma Pontious	Conservation Manager	Bwindi-Mgahinga Conservation Area, Uganda Wildlife Authority
11	Amadra Ori - Okibo	Geo-information Systems Specialist	GIC LTD Kampala
12	Okiror Stephen Fred	Tourism Officer	Ministry of Tourism, Wildlife and Antiquities
13	Rukundo Tom	Environmental Impact Assessment Officer	National Forestry Authority, Kampala
14	Mugyenyi Cyril	District Natural Resources Officer	Bushenyi District
15	Musoke Solomon	District Natural Resources Officer	Buikwe District
16	Monday Swaibuh Lwanga	District Natural Resources Officer	Rubirizi District
17	Giyaya Charles	District Natural Resources Officer	Adjumani District

18	Lomeri John Mark	Sec. Production & Natural Resources	Kaabong District
19	Murungi Ritah	District Environment Officer	Rubirizi District
20	Nsimure William	District Natural Resources Officer	Masindi District
21	Patrick Byakagaba	Lecturer/Member MAB	Makerere University , College of Agriculture and Environment Sciences
22	AA Rokani Moses Simba	Sec. Production and Natural Resources	Adjumani District
23	Ngiro James	District Natural Resources Officer	Napak District
24	Betty Nagudi	Geologist/Senior Lecturer/Chairperson, IGCP	Makerere University, College of Natural Sciences
25	Kabi Maxwell	Natural Resources Coordinator	National Forestry Authority
26	Mugisha M. Charles	District Natural Resources Officer	Kyenjojo District
27	Muhairwe Timothy	District Forest Officer	Kabarole District
28	Abura Jeremiah	Sec. Production	Napak District
29	Wilson Mbile Tumushalse		Ministry of Energy and Mineral Development
30	Kevin Aanyu	Lecturer/Member, IGCP	Makerere University
31	Rosie Agoi	Secretary General	UNATCOM
32	Ochalvi Mathew	Driver	UNATCOM
33	Robert Tugume	Lecturer	Makerere University
34	Joseph Katswera	District Natural Resources Officer	Kasese District, Local Government
35	Muhindo Catherine		Kasese District , District Local Government
36	Bomukama John	Sec. Natural Resources	Bushenyi District
37	Drateru Natalia	Sec. Production Natural Resources	Arua District
38	Robnah Mulimba	Sec. Production Natural Resources	
39	Otulu Daniel	Principal Assistant Secretary	Ministry of Water and Environment
40	Balimungi Moses		Department for Education
41	Bintoora Ademia		Ugandan Wildlife Authority
42	Nambatya Sauya	Sec. Natural Resources	Buikwe District
43	Adiribo Edison	District Natural Resources Officer	Arua District
44	Johanna Krone	Intern	UNATCOM
45	Bigabwo Julius	Sec. Environment	
46	Mathilde Stoetzler	Intern	UNATCOM
47	Ogal Vincent	Volunteer	UNATCOM
48	Nancy Okwong	Intern	UNATCOM
49	Baguma Brian James	Environment officer	Kabarole District
50	Busvulira Steven	UNNGOP	
51	Tugume Benale	District Natural Resources Officer	Buhusa District
52	Vincent Barugabe	Principal Wetlands Officer	Ministry of Water and Environment
53	Omongin Emmanuel	District Natural Resources Officer	Kaabong District
54	Lowanyang Alfred	Sec. Production	Nakapiripirit
55	Iyango Lucy	Assistant Commissioner /Rep Permanent Secretary	Ministry of Water and Environment
56	Grace Nantale Kakowia	Journalist	Daily Monitor
57	Kajumba Annah	Journalist	UBC
58	Noah Agaroi	Accounts	UNATCOM
59	Stella Linda	Accounts	UNATCOM
60	Mutesi Josephine	Journalist	NBS, Kampala

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