



THE REPUBLIC OF UGANDA  
Ministry of Water, Lands and Environment



*FOREST DEPARTMENT*

# UGANDA FORESTRY NATURE CONSERVATION MASTER PLAN







THE REPUBLIC OF UGANDA

MINISTRY OF WATER, LANDS AND ENVIRONMENT  
FOREST DEPARTMENT

**Forestry  
Nature Conservation  
Master Plan**

(Reviewed June 2002)

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## Preface



At the United Nations Conference on Environment and Development (UNCED) in 1992, Uganda joined 150 other nations in signing the Convention on Biological Diversity (CBD). In doing so, we recognised the need to halt the loss of plants and animals that contribute to our survival, as part of a worldwide effort. We also recognised that Uganda is one of the most biologically rich countries in the world, and has a particularly important role to play in this global programme.

This Master Plan has been developed by the Forest Department with financial support from the European Union. It is a contribution to the National Biodiversity Action Plan, which describes Uganda's programme in implementing the CBD. The Forest Department is critical to this process, because it manages 7% of the country's land, with Forest Reserves in all the major ecological zones of the country.

One of the strengths of the Master Plan is that it recognises the conservation and development must go hand in hand. We need to raise the living standards of our people, and this depends on use of the country's renewable natural resources. We cannot afford to protect all our forests against all forms of extractive use, and must make difficult choices in achieving an appropriate balance between exploitation and protection. By using our forests for multiple purposes, with clearly defined management zones in each reserve as described in the plan – we can achieve our conservation and development goals.

The plan is of little value if it is not implemented. It is not an end in itself, but rather marks a milestone in an ongoing process. Implementation will require the understanding, commitment and resources of many people, particularly those living close to the planned new conservation areas. Local communities will need to adjust in the ways they use forest resources. They will be required to participate in decision making regarding controlled harvesting of forest products. Implementation will also require financial support from the international community, to ensure the new management programmes can be introduced in a timely and effective way. I trust that the plan will help generate the necessary understanding and support, so that our vital forest biodiversity is effectively conserved.

A handwritten signature in black ink, appearing to read 'H. Muganwa Kajura', written in a cursive style.

**Hon. Henry Muganwa Kajura**  
**Minister of Water, Lands and Environment**

## Acknowledgements

The Forest Department acknowledges the support of the EC-financed Forest Management and Conservation Project in the preparation and production of the Nature Conservation Master Plan, and the GEF-financed project of Institutional Support for the protection of East African Biodiversity for co-funding the biological inventory which formed the basis for the Plan.

The Plan has benefited from contributions by many individuals and organisations, with the drafting and editorial work undertaken by members of the Forest Department's Nature Conservation team. Chapters 1-3 were drafted by Dr. Peter Howard, and Chapter 4 by David Duli. The Forest Profiles were compiled by Nature Conservation Officers Edison Adribo, Kaire Kitawu, Tom Rukundo, C.D. Langoya, Israel Kikangi and Tatumwa Dunstan John, and the maps were digitised and produced by Fred Ahimbisibwe and Paolo Viskanic. Editorial work was carried out primarily by Dr. Peter Howard, Edward Mupada and Robert Nabanyumya, with a final review by Professor Derek Pomeroy. The production team was coordinated by Edward Mupada and David Duli.

The Forest Department is indebted to the various stakeholders who attended the final national consultative meeting in August 1997 to discuss an early draft of the Plan. Their contributions at the workshop were most helpful. The participants are too many to name individually, but the Minister of State for Natural Resources, Hon. Baguma Isoke is thanked particularly for his contribution to this event. The contributions that were received from participants in regional workshops in Mbale and Mbarara are highly appreciated. The participation of many Resident District Commissioners, Chief Administrative Officers, Members of Parliament, senior staff of the Forest Department, District Forest Officers, Environment Officers and Heads of the National Environment Management Authority, Uganda Wildlife Authority and Makerere University Institute of Environment and Natural Resources is gratefully acknowledged. Some of those who reviewed the draft Plan were unable to attend the meeting, providing written comments instead. These contributions have ensured that the final version of the Plan incorporates a wide range of opinion and technical expertise, and represents a sound basis for practical action.

Development of the Plan depended on strong administrative support and the efforts of the EC-financed Natural Forest Management and Conservation Project team particularly Fred Kigenyi, the late Michael Serwadda, Edward Mupada, Jones Kamugisha, Nsita Steve Amooti and David Duli are particularly acknowledged. Production of the maps benefited from technical support from the NORAD funded National Biomass Survey Project team, while secretarial services were provided by P. Bafirawala and C. Namirembe. Finally, the personal interest of the personal interest of the Commissioner for Forestry, Dick Olet and his deputy Fred Kigenyi has proven invaluable, as has the commitment of the EC-Project team leader Tony Finch and nature conservation advisor Dr. Peter Howard.

Forest Department  
June 2002

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### Abbreviations/Acronyms

AFO	Assistant Forest Officer
BZ	Buffer Zone
CBD	Convention on Biological Diversity
CFF	Commissioner for Forestry
CFR	Central Forest Reserve
DANIDA	Danish International Development Agency
dbh	diameter at breast height
DFO	District Forest Officer
EC	European Commission
EU	European Union
FAO	Food and Agriculture Organisation of the United Nations
FD	Forest Department
FG	Forest Guard
FO	Forest Officer
FORI	Forestry Research Institute
FR	Forest Reserve
GEF	Global Environment Facility
GPS	Geographic Positioning System
GTZ	Germany Development Cooperation
IDA	International Development Agency
IUCN	The World Conservation Union
NFM	Natural Forest Management
MAB	Man and Biosphere
NAADS	National Agricultural Advisory Services
NFMCP	Natural Forest Management and Conservation Project
NGO	Non-Government Organisation
NORAD	Norwegian Agency for Development
NR	Nature Reserve
NRM	National Resistance Movement
PA	Protected Area
PFE	Permanent Forest Estate
PM	Patrol Men
SNR	Strict Nature Reserve
UNCED	United Nations Conference on Environment and Development
UNDP	United Nations Development Programme
UNESCO	United Nations Educational Scientific, and Cultural Organisation
USAID	United States Agency for International Development
UTGC	Uganda Tea Growers Corporation
UWA	Uganda Wildlife Authority
WPA	Work Plan Area

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## Executive Summary

This document is a product of six years of biodiversity conservation planning work by the Uganda Forest Department. It was printed in draft form in 1999. This plan has been used as a practical document for conservation planning by the Forest Department for the last three years. Since 1999, a number of changes have taken place in the Forestry Sector including restructuring the sector, review of the forestry legislation and adoption of the new Forestry Policy (2001) that has been built on many of the principles in this Master Plan.

In view of the changes in the sector, a stakeholders' workshop was held in May 2002 to review the plan. The participants at the workshop affirmed the usefulness of the plan and agreed to include in it some of the new developments in the forestry sector and have it printed and disseminated for use by a wider audience. The plan describes the Department's strategy for integrating biodiversity conservation with other aspects of natural forest management throughout the 15,000 km<sup>2</sup> national forest estate. The strategy is based on the establishment of a national system of Strict Nature Reserves, accounting for 20% of the forest estate, designated (alongside other management zones) within the country's Forest Reserves.

The document is divided into four chapters and a series of appendices, which are summarised below. This volume provides an overall description of the strategy, and outlines the technical basis for the management prescriptions made. Much of the document is devoted to profiling the proposed Strict Nature Reserves, focusing on the specific attributes that justify each site's designation. This plan is based on information presented in a major (33 volume) series of Biodiversity Reports, which were printed in 1996 and copies are available from the Forest Department.

**Chapter One** provides a general introduction to the plan, and the national context. The forest estate comprises 721 Forest Reserves encompassing 71% of Uganda's 94 recognised vegetation communities across the forest and savanna zones of the country. It is part of a wider system of protected areas that includes ten National Parks and a similar number of Wildlife Reserves. The Forest Reserves are managed to satisfy a wide range of multiple-use objectives. This masterplan was developed on the principles of the 1988 Forest Policy, the new Forest Policy (2001), and the Forests Act of 1964. Except in exceptional circumstances, people are not allowed to reside, cultivate or graze livestock inside Forest Reserves, and management is aimed at protecting water catchments, biodiversity and other environmental attributes, whilst providing for the sustainable use of timber and other forest products by local communities and the country at large.

In order to satisfy multiple-use management objectives, Forest Reserves are best divided into clearly defined zones, each dedicated to a particular use and management regime. In this way, uses that are (at least partially) incompatible – such as biodiversity preservation and timber production – are spatially separated, and can both be achieved within the same Forest Reserve. Based on this principle, government has undertaken to establish appropriate zoning regimes within the country's Forest Reserves so that 20% of the forest estate is dedicated to biodiversity preservation, 30% to environmental protection allowing some low-impact uses, and 50% is managed for sustainable timber production. Within each forest, the Man and Biosphere (MAB) concept of reserve design is being applied, with a few exceptions, with a totally protected 'core' area managed as Strict Nature Reserve, surrounded by a buffer zone (where low-impact uses are permitted), with sustainable timber production undertaken in areas closer to the external boundary.

Uganda's forest management programmes received substantial support under the multi-donor Forestry Rehabilitation Programme (1986-1995). The production of this Master Plan has been made possible by support provided to the Forest Department's Nature Conservation Section, through the EC-financed Natural Forest Management and Conservation Project (1986-2002), and a regional programme of 'Institutional Support for the Protection of East African Biodiversity' funded by the Global Environmental Facility through FAO/UNDP (1992-1996).

**Chapter Two** describes the basis of the plan, beginning with a justification for protecting 50% of the forest estate. Uganda's biodiversity is internationally recognised as being exceptional, and much of it is concentrated in the country's forests, where the Forest Department must play a key role in its protection. Uganda understands its unique position in respect of biodiversity, and has committed itself to its protection by ratifying the international Convention on Biological Diversity in 1993. Inevitably, the establishment of forest Nature Reserves carries some costs in terms of lost timber production. However, the requirement for general purpose sawn timber can be satisfied through the establishment of softwood plantations on just 2% of the forest land. Furthermore, many of the direct costs associated with the establishment and management of Nature Reserves and similar conservation areas should be supported by the international community.

The chapter continues by describing the different management objectives applicable to Nature Reserves, Buffer Zones and Protection Zones within the forest estate. The national system of Nature Reserves aims to protect viable samples of the country's biodiversity, including examples of distinct ecological communities, viable populations of all species, and (as far as possible) the range of genetic variation within species. Within each forest, a Nature Reserve should



help sustain the productive capacity of adjacent production zones, by serving as a reservoir of seed material, dispersal agents and ecological services. Nature Reserves provide an ecological baseline for pure and applied research, as well as opportunities for education. Buffer Zones are designated to maintain the ecological integrity of areas immediately adjacent to Nature Reserves, on steep slopes, in areas destined for recreational use, and parts of the forest estate that carry dual status as National Parks or Wildlife Reserves. They are to be maintained with minimal disturbance, providing opportunities for a range of non-consumptive uses and some local community use of (mostly non-timber) forest products. Production Zones are intended for the maximum sustained production of a wide range of timber and non-wood products within a natural system that retains its ecological functions and most of its biodiversity.

Deciding which areas of the forest estate to designate for particular uses is a complex task which contributes to optimising land use. Ideally it should be based on a thorough assessment and understanding of the natural resources and needs of local communities in and around each forest. In practice, decisions have to be based on rather imprecise information, so a scoring system, based on the use of 'best available' data, was developed to compare and rank forests, according to their suitability for timber production, biodiversity preservation or community use. Proposals for land allocations could then be made on the basis of these scores.

In order to ensure that the designation of forest Nature Reserves satisfies biodiversity conservation objectives it was considered essential to collect some baseline information on biodiversity in Uganda's forests. A major biodiversity inventory programme was therefore undertaken by the Forest Department between 1991 and 1995, during which species of trees and shrubs, birds, small mammals, butterflies and moths were listed for all the major reserves. Almost 100 man-years of work was carried out, during which 17,600 plant site records were made, 100,000 trap-nights of small mammal work undertaken, and 57,000 large moths, 21,000 butterflies and 14,000 birds trapped. This provided the information necessary to ensure that the selection of Nature Reserves could be based on objective biological criteria.

**Chapter Three** describes the data analysis and criteria used in selecting forests for Nature Reserve establishment, and outlines procedures for developing appropriate zoning regimes for each of these forests. The first stage of the analysis involved identifying 'biodiversity hotspots' – areas with an unusually large number of species or concentrations of rare species, which would be particularly suitable for designation as Nature Reserves. Each site was scored for biological importance based on a measure of species diversity (relative species richness), and the 'rarity value' of the species represented within the five taxa at each site. It was then possible to rank the 65 principal forests where biodiversity data were collected in terms of their biological importance.

This ranking process provided and unprecedented insight into the relative importance of each forest for biological conservation, but fell short of establishing clear site selection priorities because it failed to take into account possible alternative demands on the same sites, for timber production, local community use, and so on. The next stage of the site selection process was therefore to evaluate each site for alternative uses, such as timber production, local community use, recreational use, and watershed protection, and derive scores for each of these criteria. These scores were then combined in a single statistic used as a measure of each forest's overall suitability for designation as Strict Nature Reserve. Thus, the highest scoring forests are those of high biological value located in important watershed areas with ecotourism development potential, where poor timber stocking combines with difficult access and low human population densities in surrounding areas to minimise the potential for land-use conflicts.

Scoring forests for Nature Reserve suitability in this way provides a reasonably objective means of ranking sites, but has the obvious disadvantage of failing to take into account the extent to which sites of similar rank support similar suites of species. An efficient national protected area system should, as far as possible avoid unnecessary duplication, since any area dedicated exclusively to biodiversity conservation carries an opportunity cost in terms of alternative development opportunities foregone. Recognising this, the next stage of the analysis was to investigate the optimum combination of sites required to protect the majority of species, using complementarity analysis. This method selects the most species rich site, followed by the one which complements it best, by adding the most 'new' species. Sites are added to the list in this way until all species are represented at least once. Such a list inevitably includes all the sites which support at least one unique species, and these make up the 'minimum critical set' of sites required to protect all species.

Based on this procedure, 44 forests were selected for Nature Reserve establishment, of which 5 are already designated as National Parks. The most important of these are described as 'prime' sites, where 30-35% of the forest will be designated as Strict Nature Reserve. In addition to the five National Parks, Budongo, Otzi and Mt. Moroto Forest Reserves qualify as 'prime' sites. The next tier of qualifying forests are described as 'core' sites, where 20-30% will be protected: these are Mt. Kei, Sesse Islands, Kalinzu-Maramagambo, Sango-Bay, Era, Kasyoha-Kitomi, Labwor Hills, Nyangea-Napore, Echuya, Bugoma and Mabira. A further 25 sites make an important contribution to national biodiversity conservation goals, and 10-25% of the area of each will be managed as Nature Reserves within these 'secondary' sites.

Developing appropriate zoning regimes for each of these 44 Nature Reserve sites will, in many cases, require further work which should be carried out alongside the development of site management plans as the current zoning plan is considered preliminary. It is particularly important to ensure that as much as possible local communities are involved in the final selection of areas to be designated for protection. In general, technically robust recommendations for zonation of many of the high Forest Reserves is now possible, whereas recommendations for the northern hills and savannas are constrained by the relatively poor state of knowledge about these sites.

**Chapter Four** describes procedures for managing biodiversity, concentrating on the establishment and management of the Nature Reserves, whilst also addressing the need to integrate biodiversity conservation activities in the management of 'buffer' and timber production zones. The chapter is divided into two broad sections, dealing with individual site management and broader institutional issues.

The section on site management provides practical guidelines for forest managers on standard procedures for developing zoning plans, demarcating boundaries (external and internal), managing protection patrols, encouraging local community participation, dealing with invasive species and other aspects of habitat and animal management, as well as fire management. Special procedures which apply specifically to Nature Reserve and buffer zone management are highlighted, and guidance given on measures to be taken in managing timber production zones, so as to minimise disruption to forest wildlife and ecological processes.

From an institutional perspective, implementation of the Master Plan will require further strengthening of capacity within the relevant agency (currently FD), particularly in the field. A re-orientation of management is required to transfer many of the rights and responsibilities for forest management to key stakeholders through participatory Forest Management Plans and Collaborative Forest Management Agreements. Publicity and public education, at local and national levels, will be required to ensure understanding of the measures described in the Plan, and their successful implementation. Substantial financial resources will be necessary to carry out the management programmes, and their successful implementation. Efforts should be made to secure further support from the international community, recognising that many of the benefits of preserving Uganda's biodiversity are of global importance. Uganda's forestry legislation is out of date, but is being revised. The draft act proposes much stronger legal protection of forest Nature Reserves, as well as providing a legal framework for local community involvement in forest management. Finally, some suggestions for biodiversity related research and monitoring are made.

**The Appendices** include profiles of each of the forests identified for Nature Reserve establishment. Each of these is divided into eight sections which describe the site's physical characteristics (size, location, topography); vegetation and forest condition; economic importance (community use, timber production, other economic values); biodiversity values; present management; proposed zonation; proposed management programmes (staffing, infrastructure requirements, patrolling, public access and community involvement); and principle reference material. Each profile includes a map of the site showing proposed zonation and infrastructure, and a Table summarising the site's biodiversity values, which lists species that are either unique to the forest or narrowly endemic (to Uganda, or the Albertine Rift).

## Chapter 1

### Introduction

#### 1.1 Objectives of the plan

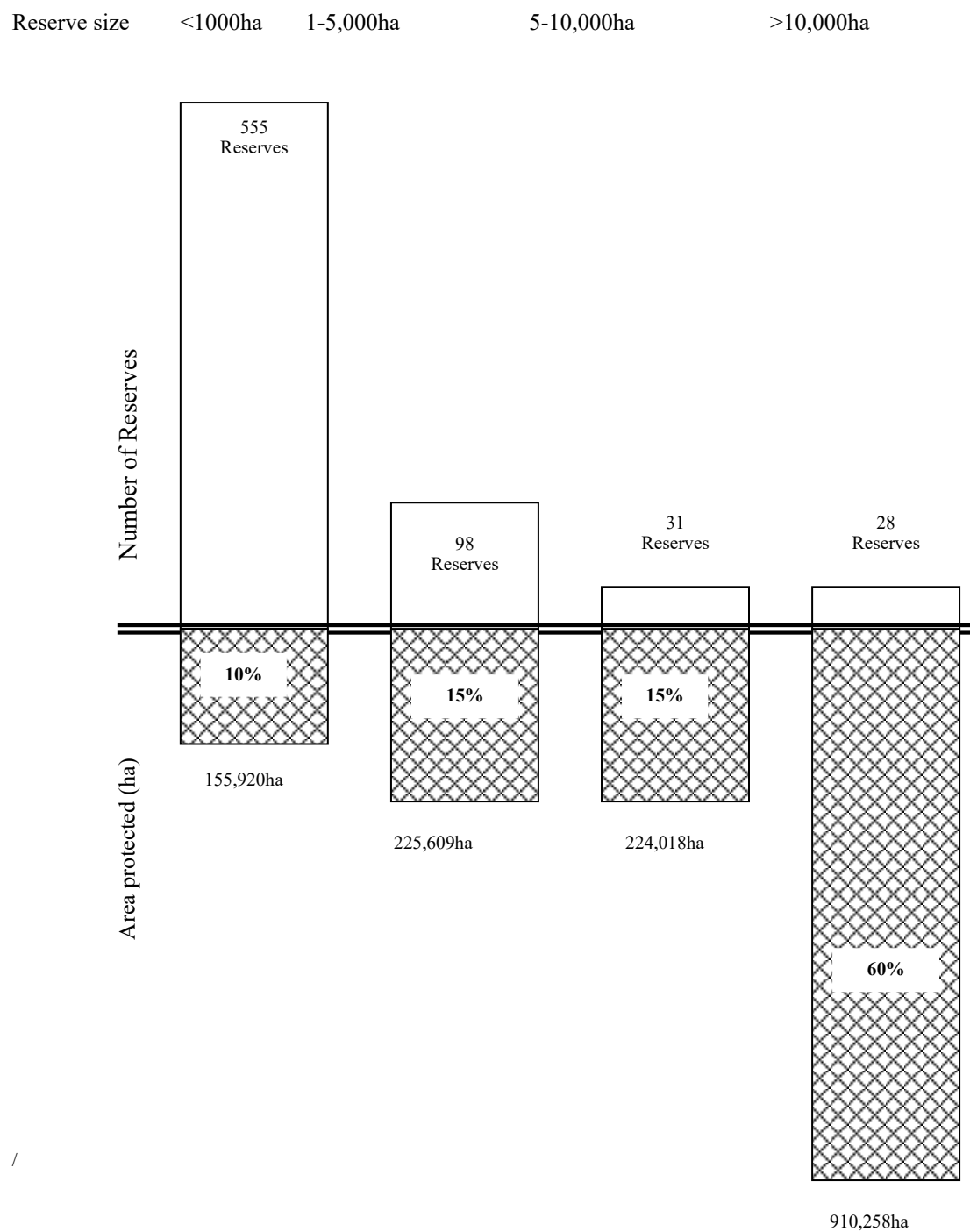
The purpose of this Masterplan is to describe how the Forest Department (or the up-coming Forest Authority), intends to integrate the conservation of biodiversity and other environmental protection measures into its programmes, and explain the reasons for doing so. This is a practical document that makes recommendations for forest management and provides guidelines for operationalisation of the plan that should be revised and updated as new information becomes available and experience is gained in the field. It should therefore not be taken as strict directives that must be implemented to the letter. The plan should however remain valid and useful as a reference document until such time as resources become available for preparation and publication of an update. Specifically, the Masterplan aims to:

- provide a general description of the forest estate and its management;
- provide an overview of biodiversity conservation activities in Uganda, and their international context, with specific reference to the role of forests;
- outline a broad strategy for integrating nature conservation and other forest management objectives; that the relevant agency and its partners can refer to as a guide.
- describe the background and rationale for the establishment of a national system of Strict Nature Reserves accounting for 20% of the forest estate, and further conservation management zones accounting for an additional 30% of the estate;
- describe the programme of biological inventory and other forest assessment work that has been carried out since 1990, as a basis for planning the new Nature Reserves and other management zones;
- present the results of this assessment work together with an analysis and interpretation of the data, with details of sites selected for Nature Reserve establishment and related conservation activities;
- describe the specific actions which need to be taken to protect biodiversity and other environmental values within the forest estate, including those related to the establishment, demarcation and management of Nature Reserves; protection activities in other management zones; institutional and financial arrangements; local community involvement; and legislation and policy requirements;
- provide a profile of each of the forests selected for Nature Reserve establishment, detailing the reasons for its selection, and (where appropriate) providing a preliminary zoning plan as a basis for future management.

#### 1.2 The forest estate

For the purposes of this plan, the forest estate is taken as all areas gazetted as forest reserves at the start of Uganda's Forestry Rehabilitation Programme in 1988, when the decision was taken to dedicate half of the estate to protective management, and use the remainder for sustainable production of timber and other forest products. The estate comprises approximately 721 separate forest reserves, scattered throughout the country, and covering a total area of about 15,950 km<sup>2</sup>. Most of the forest reserves that contribute to the estate are small (555 are smaller than 10 km<sup>2</sup>; Fig 1.1), but the greater part of the estate falls within relatively few large reserves, with 59 reserves larger than 50 km<sup>2</sup> accounting for 75% of the total area protected.

Fig. 1.1 Size distribution of Uganda's forest reserves





### 1.2.1 Policy and legislation

The establishment of forest reserves in Uganda dates back to around the turn of the century, when the authorities of Buganda, Toro and Ankole agreed to cede control of forest land in their kingdoms to the British Protectorate government. However, it was not until 1932 that any formal gazettement and demarcation took place, and it took a further two decades before the estate was consolidated to more-or-less its present extent.

The 1988 Forest Policy (Table 1.1) signalled a significant change in government's attitude to forests and forestry. Whilst the previous decades had witnessed a growing emphasis on the realisation of economic gains from timber extraction, the 1988 policy sought to achieve a more balanced approach, recognizing the importance of forests in environmental protection. For the first time, the policy included explicit recognition of the need, and intention, to 'safeguard enough forest land...to ensure that...plants and animals (including endangered ones) are conserved in natural ecosystems' (Table 1.1; para. 1)). The new Forest Policy (2001) has further cemented the principles of conservation and included new emerging issues such as Collaborative Forest Management (Table 1.2)

As one of the strategies for the implementation of the policy statement on the conservation of forest biodiversity, the Forestry Policy (2001) highlights the need to support conservation initiatives in priority forests with high biodiversity value, including both government and private forests, as identified in the Nature Conservation Master Plan. The Forestry Policy outlines the importance of developing Forest Management Plans for all reserved forests to promote expansion of forest cover and best practice in sustainable management of forest resources. Further, it encourages the development of partnerships between the government and civil society.

The principal forestry legislation is contained in the Forests Act of 1964, which sets out the rules governing forest reserves, and forest resources elsewhere. Some of the most important provisions of this legislation include the following:

- Nobody may reside, cultivate or graze livestock in a forest reserve without written authority.
- Use of any forest product from a forest reserve requires a permit, and usually involves the payment of fees.
- Local people enjoy special privileges in the use of unreserved forest produce which they may take from a forest reserve for their own personal domestic use without a permit or payment of fees.
- The Minister responsible for forestry is empowered to gazette and degazette land designated as forest reserves.
- Although no special provision is made for the establishment of forest Nature Reserves, a senior Forest Officer is empowered to close any area of forest to all forms of resource use.

Parts of the forest estate carry dual status as National Parks, Wildlife Reserves and Animal Sanctuaries, and are therefore subject to additional regulations consolidated in the Wildlife Statute of 1996.

The Forests Act 1964 is currently under revision. A new Forestry Bill, 2002 which is under preparation will soon be finalised. The Draft Forest Bill (version of 17<sup>th</sup> May 2002), will culminate in "An act to provide for the conservation, sustainable management and development of forests for the benefit of the people of Uganda; ...."

In section 2(b), one of the cardinal purposes of the draft bill is "to ensure that forests are conserved and managed in a manner that meets the needs of the present generation without compromising the rights of future generations by safeguarding forest biological diversity and the environmental benefits that accrue from forests".

In section 6(2), the bill gives distinct recognition of sites of special scientific interest, strict nature reserves and joint management reserves.

It provides specifically for effective management of forest reserves based on management plans. Section 13(2) states that "For avoidance of doubt, a forest reserve shall not be put under any use other than in accordance with the management plan".

The draft entrenches further the principle of Management Planning. Section 15 provides for Collaborative Forest Management between the responsible agency and user groups. Part III of the draft Forest Bill is even more explicit in support of conservation, citing "sovereignty over forest biological resources" and reserved species. Section 28(1) specifically states that: "All forest biological resources and their derivatives, whether naturally occurring or naturalised within a forest shall be conserved and managed for the benefit of the people of Uganda in accordance with this ACT and any other law relating to biological resources".

**Table 1.1      The Forest Policy (1988)**

- 1)      To maintain and safeguard enough forest land so as to ensure that:
  - sufficient supplies of timber, fuel, pulp, paper and poles and other forest products are available in the long-term for the needs of the country, and where feasible for export.
  - water supplies and soils are protected, plants and animals (including endangered ones) are conserved in natural ecosystems, and forests are also available for amenity and recreation.
- 2)      To manage the forest estate so as to optimise economic and environmental benefits to the country by ensuring that:
  - the conversion of the forest resource into timber, charcoal, fuelwood, poles, pulp and paper and other products is carried out efficiently;
  - the forest estate is protected against encroachment, illegal tree cutting, pests, diseases and fires;
  - the harvesting of timber, charcoal, fuelwood, poles and other products applies appropriate silvicultural methods which ensures sustainable yields and preserves environmental services and biotic diversity.
  - research is undertaken to improve seed sources for planting stock and the silvicultural and protection methods needed to regenerate the forest and increase its growth and yield. Research is also carried out into new and existing forest products including tourism and education with the object of maximising their utilisation potential. Research is undertaken to monitor and promote the preservation of environmental services and conservation of biotic diversity.
- 3)      To promote an understanding of forests and trees by:
  - establishing extension and research services aimed at helping farmers, organisations and individuals to grow and protect their own trees for timber, fuel and poles and to encourage agro-forestry practices;
  - publicising the availability and suitability of various types of timber and wood products for domestic and industrial use, and publicising the importance of environmental services provided by forests;
  - holding open days at regular intervals in all districts to demonstrate working techniques and bring attention to the positive benefits of forestry.

<b>Table 1.2 Forestry Policy (2001): Key Policy Statements</b>		
The <b>Goal</b> of the new Forestry Policy is “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 vulnerable”.	Policy Statement	Key strategies
Statement 1	The <b>Permanent Forest Estate</b> under government trusteeship will be protected and managed sustainably.	<ul style="list-style-type: none"> <li>• Government-entrusted forest land to be maintained at its current size for forestry purposes in perpetuity</li> <li>• New management options to be widened to include private concessions and collaborative management by local communities</li> </ul>
Statement 2	The development and sustainable management of <b>natural forests on private land</b> will be promoted	<ul style="list-style-type: none"> <li>• Best practice in sustainable forest management to be promoted on private land</li> <li>• Reservation of private and community forests as permanent non-government forest reserves to be promoted</li> </ul>
Statement 3	Profitable and productive <b>forestry plantation</b> businesses will be promoted	<ul style="list-style-type: none"> <li>• Improve the administration and security of tenure of concessions of government land to private businesses</li> <li>• Improve technical standards in private forestry</li> <li>• Expand credit facilities for forestry investments</li> </ul>
Statement 4	A modern, competitive, efficient and well-regulated <b>forest products processing industry</b> will be promoted in the private sector	<ul style="list-style-type: none"> <li>• Introduce competitive bidding for harvesting concessions</li> <li>• Rationalise forest products pricing/royalties and taxes</li> <li>• Remove indirect subsidies which distort markets</li> </ul>
Statement 5	<b>Collaborative partnerships</b> with rural communities will be developed for the sustainable management of forests	<ul style="list-style-type: none"> <li>• Promote community participation in forest management on government or customary land</li> <li>• Develop collaborative forest management partnerships and legal agreements between government and local groups</li> </ul>

Statement 6	<b>Tree-growing on farms</b> will be promoted in all farming systems, and innovative mechanisms for the delivery of <b>forestry extension and advisory services</b> will be developed	<ul style="list-style-type: none"> <li>• Promote farm forestry within a national framework and decentralised service delivery mechanisms</li> <li>• Support farm forestry research and technology, credit, processing and marketing, education, and the integration of forestry in agriculture</li> </ul>
Statement 7	Uganda's <b>forest biodiversity will be conserved</b> and managed in support of local and national social-economic development and international obligations	<ul style="list-style-type: none"> <li>• Ensure biodiversity conservation through a network of protected areas</li> <li>• Ensure local community participation in the benefits from conservation</li> <li>• Regulate access to, and use of, genetic resources</li> </ul>
Statement 8	<b>Watershed protection forests</b> will be established, rehabilitated and conserved	<ul style="list-style-type: none"> <li>• Promote farm forestry on degraded private lands and restoration of degraded hills.</li> <li>• Improve the management of existing natural forests on hilly private and government lands</li> </ul>
Statement 9	<b>Urban forestry</b> will be promoted	<ul style="list-style-type: none"> <li>• Promote urban forestry to improve urban livelihoods and improve the urban landscape and environment</li> <li>• Promote planting of road reserves</li> </ul>
Statement 10	The government will support sustainable forest sector development through appropriate <b>education, training and research</b>	<ul style="list-style-type: none"> <li>• Promote public education to raise awareness of the role of forests and trees in the economy</li> <li>• Develop training capacity to support the sector's changing needs</li> <li>• Promote demand-driven and responsive research</li> <li>• Improve research co-ordination and collaboration</li> </ul>
Statement 11	Innovative mechanism for the supply of <b>high quality tree seeds and improved planting stock</b> will be developed	<ul style="list-style-type: none"> <li>• Promote seed procurement, tree improvement and genetic resource conservation</li> <li>• Build capacity in the private sector to promote effective seed supply and marketing</li> <li>• Develop mechanisms to ensure high standards and quality control</li> </ul>

### 1.2.2 Ecology

The forest estate encompasses a wide variety of vegetation types and ecological communities, including several closed canopy tropical high forest types; montane communities of bamboo, heath and moorland; swamps and wetlands; and a wide range of savanna vegetation types from moist woodlands to dry bushland and thickets. In the most general terms, about half the estate can be broadly classified as some type of savanna woodland community, whilst 40% is closed canopy forest, and 10% low stature montane forest. These communities are representative of altitudes ranging from below 600 m at the bottom of the Rift Valley to over 5,000 m at the top of the Rwenzori; annual rainfall regimes ranging from over 2,000 mm in the Sesse Islands to below 600 mm in parts of north-eastern Uganda, and seasonal extremes involving bimodal patterns close to the equator in southern Uganda, and unimodal patterns in the north.

Langdale-Brown *et al.* (1964) classified Uganda's vegetation communities into 22 main categories, recognising 94 specific associations, and it is informative to examine the representation of these in the forest estate. Appendix 1 provides a breakdown of the areas of each association in each of the principal forest reserves, as well as the country's National Parks and Wildlife Reserves. All of the main categories are represented in the forest estate (except Z, Post-cultivation communities), including 67 (71%) of the specific vegetation associations (Appendix 1). In other words, Uganda's forest estate is not limited to 'forest' *per se*, but encompasses a broad spectrum of the country's biodiversity, at least at the community level of organization.

Uganda is recognised as one of the most species-rich countries in the world, with around 315 species of mammals, over 1000 birds and 1200 butterflies in an area the size of Britain (240,000 km<sup>2</sup>). A high proportion of these species are represented in the forest estate.

### 1.2.3 Management

The Permanent Forest Estate (PFE) was established with two main objectives; to safeguard supplies of timber and other forest products, and protect fragile mountain catchment areas and the environmental services they provide. Over the years these objectives have been expanded to include aspects such as nature conservation, amenity and recreation, research and education, and poverty eradication as reflected in the 1988 and the 2001 Forest Policies (Table 1.1 and 1.2).

Administratively, the majority of the PFE falls under Forest Department jurisdiction, although 1,350 km<sup>2</sup> (8.5%) was transferred to Uganda National Parks in 1991, and a further 3,190 km<sup>2</sup> (20%) now carries dual status as Forest Reserve/National Park (17.6%) or Forest/Wildlife Reserve (2.4%). There is no formal arrangement between the organisations concerned over day-to-day management activities in areas of dual status, although Uganda Wildlife Authority (UWA) assumed management control in all areas designated as National Parks, and management operations in Forest/Wildlife Reserves are carried out by Forest Department and UWA.

Management of individual reserves is in theory facilitated by the use of Working/Management Plans which set out the objectives of management and the methods to be employed in achieving those objectives over any given period. Reserves under Forest Department control have a long history of planned management, going back to 1934 when the first Working Plan was prepared for Budongo Forest. By the early 1970s Uganda had developed an enviable reputation as a leader in the field of tropical high forest management.

One important aspect of management during this period was the establishment of the first forest Nature Reserves, starting with those prescribed in the Budongo Working Plan of 1945. By 1961, Nature Reserves had been proposed in at least nine of the principal forest reserves, although some of these were never actually demarcated. Those that were established, generally covered an area of 3-10 km<sup>2</sup>, far too small to remain viable in the long-term. Nevertheless, an important precedent had been set.

Unfortunately, Uganda's forests and forestry programmes suffered alongside other sectors of the country's economy during the turbulent years of the 1970s and 80s. By the time the National Resistance Movement (NRM) government assumed power in 1986, the Forest Department had become largely ineffective, and substantial parts of the forest estate were affected by encroachment, illegal felling and other activities beyond departmental control.

Soon after the NRM took power, negotiations were concluded for US\$ 36 million of foreign assistance to support a major Forestry Rehabilitation Programme. The timing of this was extremely fortuitous, since it enabled the Department to be re-equipped and strengthened sufficiently that it was able to regain control of the forest estate before the squatters and other illegal forest users became too entrenched. By 1992, most of the forest estate was back under departmental control, although illegal pitting remained a problem. With the international support provided, the Department was able to re-establish forest boundaries, and re-plant areas cleared or degraded by encroachers.

However, still only a few CFRs have current management plans and there remains much to do to bring forest management standards up to an internationally acceptable level.

### 1.3 Background to the Forest Department's nature conservation programme

The Forestry Rehabilitation Programme was a six-year multi-donor programme with a number of discrete components:

- **Departmental rehabilitation:** (US\$ 10.2 million, IDA loan) involving provision of vehicles and equipment, rehabilitation of offices and accommodation, and technical assistance.
- **Natural Forest Management;** (US\$ 10.3 million, EC grant) involving construction of field staff accommodation, support for re-establishing forest boundaries, replanting degraded forests, improving forest management, and establishing new Nature Reserves and other conservation areas.
- **Farm Forestry** (US\$ 7.5 million, DANIDA grant) involving establishment of tree nurseries in rural areas throughout the country, and promotion of agroforestry.
- **Plantation rehabilitation** (US\$ 2.0 million, IDA loan) involving rehabilitation of existing industrial softwood plantations, and their expansion.
- **Training** (US\$ 2.2 million, UNDP grant) involving rehabilitation of Nyabyeya Forestry College and sawmill training facilities at Nakawa, and support of training programmes.
- **Peri-urban plantations and biomass survey** (US\$ 2.4 million, NORAD grant) involving expansion of peri-urban plantations and assessment of biomass availability throughout the country.

This Nature Conservation Masterplan is a product of the Forestry Rehabilitation Programme, or, more specifically, the EC-financed component 'Natural Forest Management and Conservation Project' (NFMCP). Under this project, support has been provided to develop institutional capacity for nature conservation activities within the Department. A central aspect of this involves implementation of the decision (made during negotiation of the Forestry Rehabilitation Programme) to expand the area managed as Nature Reserves to cover 20% of the estate, and develop other conservation areas (where low-impact uses are allowed) accounting for a further 30%.

The Forestry Rehabilitation Programme was developed in the mid 1980s at a time of growing international awareness of environmental issues. The decision to dedicate 50% of the forest estate to protective management was undoubtedly influenced by this, and by the development of a new wildlands policy within the World Bank. At the same time it was seen as a clear demonstration of the Uganda government's commitment to conservation.

Since the Department's nature conservation programme was initiated in 1988, there have been two significant related developments that have influenced its direction.

The first of these was the gazetting of six of the most important conservation forests as National Parks, three of them (Rwenzori, Bwindi and Mgahinga) in 1991, and three (Mt. Elgon, Kibale and Semliki) in 1993. Together these areas represent 20.8% of the forest estate, and they were regarded as the 'crown jewels' of the Department's nature conservation programme. Prior to their transfer, considerable success had been achieved in developing them as model 'Forest Parks'. The transfer of such a large proportion of the forest estate to conservation management under Uganda National Parks, whilst commendable in many respects, to some extent pre-empted the planning process that was already underway, to select conservation areas on the basis of a more objective analysis of biodiversity and other values throughout the forest estate.

The second development to influence the Department's nature conservation programme was associated with the United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro in 1992, where Uganda joined other members of the international community in signing the Convention on Biological Diversity. In doing so, Uganda made a formal commitment to protect its biodiversity, and became eligible for financial support under the new Global Environment Facility (GEF) to help it do so. Subsequently, a component of the GEF-funded programme of 'Institutional Support for the Protection of East African Biodiversity' helped fund the departmental biodiversity inventory programme (see chapter 2). Presently the EU funded Forest Resources Management and Conservation Programme is supporting the Department's nature conservation efforts.

### 1.4 Multiple-use management and the principle of zonation

The forest estate must serve a variety of needs, and forest managers are faced with the challenge of deciding how best to satisfy all of these. Often the nature of the forest, and the land it occupies imposes natural limitations on the sort

of management activities that are sustainable, and Ugandan foresters have traditionally responded to this by designating particular reserves as 'production' or 'protection' reserves. However, it is most commonly the case that a particular forest is suitable for a variety of different uses, some of which are incompatible with one another. For example, Mabira forest may be well suited to timber and charcoal production, whilst at the same time supporting a rich rainforest fauna and flora dependent on undisturbed natural forest conditions; clearly it is not possible to satisfy production and nature conservation objectives simultaneously in the same area of forest; but the two objectives can be satisfied within the same forest if they are spatially separated, by dedicating particular areas to particular uses, or compatible combinations of uses.

The principle of managing protected areas in this way, with clearly defined zones dedicated to particular uses, is now universally accepted and widely practiced throughout the world. The concept was developed under UNESCO's Man and Biosphere programme in the mid-1980s, and was based on a growing awareness that protected areas alienated from local people were doomed to failure. Only by gaining support from such people, by sharing the benefits and responsibilities of management, could protected areas be expected to survive and satisfy their conservation and development objectives.

The concept of reserve design developed under the MAB programmes is basically very simple: that each reserve should be managed in a way that provides for a totally protected central 'core' area, with 'zones' of increasingly intensive use permitted closer to the external reserve boundaries (Fig.1.2). It is this concept, with a few exceptions in unique circumstances, that the Forest Department aims to apply in its management of Uganda's forests, and which underlies the decision to apportion 20% of the estate as totally protected 'Nature Reserves', 30% as protection ('buffer') zones where low-impact uses are permitted, and 50% as 'production' zones for the sustained production of timber and other forest products.

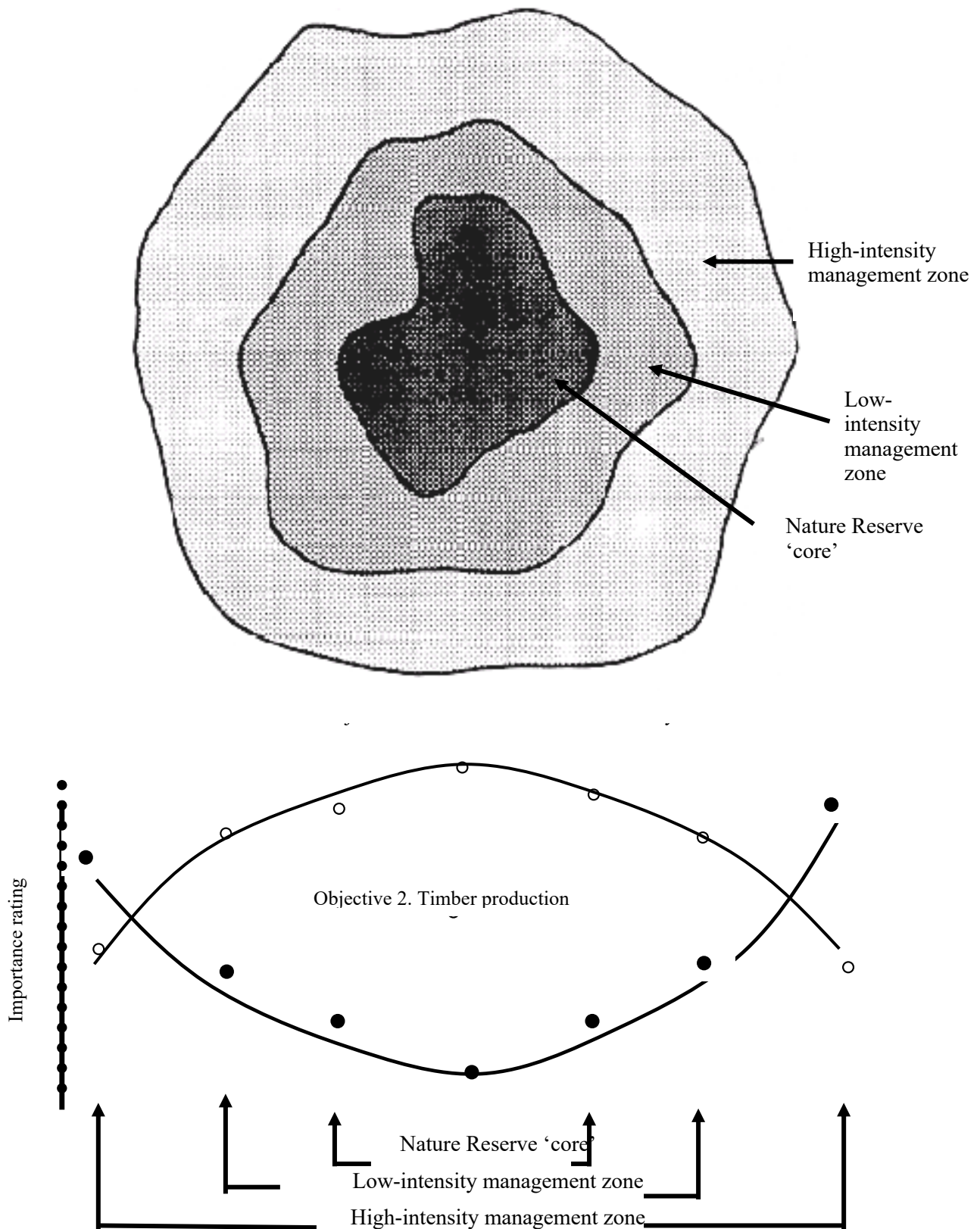


Fig. 1.2 'A' model' forest reserve with a totally protected 'core area' surrounded by concentric zones in which management becomes progressively more intensive towards the reserve boundary. The preservation of biotic diversity is the primary objective of management in the Nature Reserve 'core', whereas timber production is the primary objective in the outer zone. The relative importance of the two management objectives is inversely related, and changes gradually from the reserve's core to its boundary. After Harris (1984)



## 1.5 Protected Areas in Uganda

The forest estate is part of a wider ‘system’ of protected areas, which includes 10 National Parks, and 10 Wildlife (formerly Game) Reserves (Fig. 1.3) and it is clearly important that any decisions to establish new forest Nature Reserves takes this into account. In particular it is important to ensure that whatever biodiversity is to be protected within the forest estate, should, as far as possible, complement (rather than duplicate) what is already being protected elsewhere in the system.

Unfortunately Uganda’s ‘system’ of protected areas is not really a ‘system’ at all. It has evolved out of a series of reservations made at various times during the course of the 20<sup>th</sup> century, for a variety of reasons. The forest reserves were established to safeguard supplies of timber and other forest products, and protect environmentally sensitive mountain catchment areas. The Game Reserves were originally established to protect populations of large mammals in savanna areas of the country, primarily for hunting and cropping. As with many of the Forest Reserves, their creation was made possible by the presence of tsetse flies and associated epidemics of sleeping sickness which led to the evacuation of people from large areas of the country early this century. The National Parks followed later, starting with Queen Elizabeth and Murchison Falls in the 1950s, through re-designation and consolidation of former Game Reserves, where particular concentrations of ‘charismatic mega-fauna’ and other attractions provided a basis for tourism development.

All three categories of protected area are ‘protected’ inasmuch as they support predominantly unmodified natural systems, managed to ensure long-term protection and maintenance of biological diversity. Human habitation, settlement and livestock grazing are not normally allowed in any of these areas, which correspond to IUCN category II and category VI protected areas (Table 1.3, Appendix 2; IUCN 1994).

**Table 1.3 Summary of management objectives applicable to internationally recognised protected area categories (IUCN, 1994)**

Management Objective	Protected Area Category						
	1a	1b	II	III	IV	V	VI
Scientific research	1	3	2	2	2	2	3
Wilderness protection	2	1	2	3	3	-	2
Biodiversity preservation	1	2	1	1	1	2	1
Environmental services	2	1	1	-	1	2	1
Protecting natural/cultural features	-	-	2	1	3	1	3
Tourism and recreation	-	2	1	1	3	1	3
Education	-	-	2	2	2	2	3
Sustainable use of natural ecosystems	-	3	3	-	2	2	1
Maintaining cultural/traditional values	-	-	-	-	-	1	2

Key: 1 = Primary objective; 2 = Secondary objective; 3 = Potentially applicable; - = not applicable

### Protected Area Categories:

- 1a: Strict Nature Reserve
- 1b: Wilderness Area
- II: Ecosystem conservation and recreation (National Park)
- III: Conservation of natural features (Natural Monument)
- IV: Conservation through active management (Habitat/Species management area)
- V: Landscape/seascape conservation and recreation (Protected Landscape/seascape)
- VI: Sustainable use of natural ecosystems (Managed Resource Protected Area)

Altogether 32,880 km<sup>2</sup> of Uganda is designated as National Parks, Wildlife (formerly Game) and Forest Reserves, equivalent to approximately 13.9% of the total area of the country, or 16.9% of its land area (Table 1.4). The area designated under each category is broadly given below (see also Fig. 1.4).

**Table 1.4**      **Extent of Uganda's protected areas by category**

Category	No. of reserves*	Area (km <sup>2</sup> )	Percent of Uganda's land area
Forest Reserve	710	11,410**	5.9
National Park	10	8,520**	4.4
Forest Reserve/National Park	-	3,190	1.6
Wildlife Reserve	10	9,342**	4.8
Forest/Wildlife Reserve	-	420	0.2
<b>Total</b>	<b>730</b>	<b>32,882</b>	<b>16.9</b>

Note:      \* No. of reserves shown for each category includes those carrying dual status.

          \*\* Areas shown exclude reserves or parts of reserves carrying dual status.

The situation on the ground is not as good as these statistics suggest, however, because large areas (particularly the Karamoja Wildlife Reserves, accounting for 20% of the protected area total) are suffering from illegal settlement, cultivation, livestock grazing and other human activities incompatible with their protected status.

There is clearly a need to develop a national system of protected areas which is specifically designed to address biodiversity conservation needs. Fortunately, the existing protected areas provide a very good basis for this, since they are representative of most of the country's vegetation types (Langdale-Brown *et al.*, 1964; Annex 1) and a broad cross-section of the country's ecology. However, it is highly questionable whether Uganda can 'afford' to maintain 16.9% of its land area as reserves, and development of a more 'efficient' protected areas system would necessarily involve the transfer of some 'duplicate' and/or degraded reserves to other uses, as well as designation of some new ones, representative of ecological communities not yet protected.

This Masterplan makes a significant contribution to the development of a representative protected area system in Uganda. The aim has been to identify those parts of such a system that fall within the forest estate, so that they can be managed in an appropriate way.

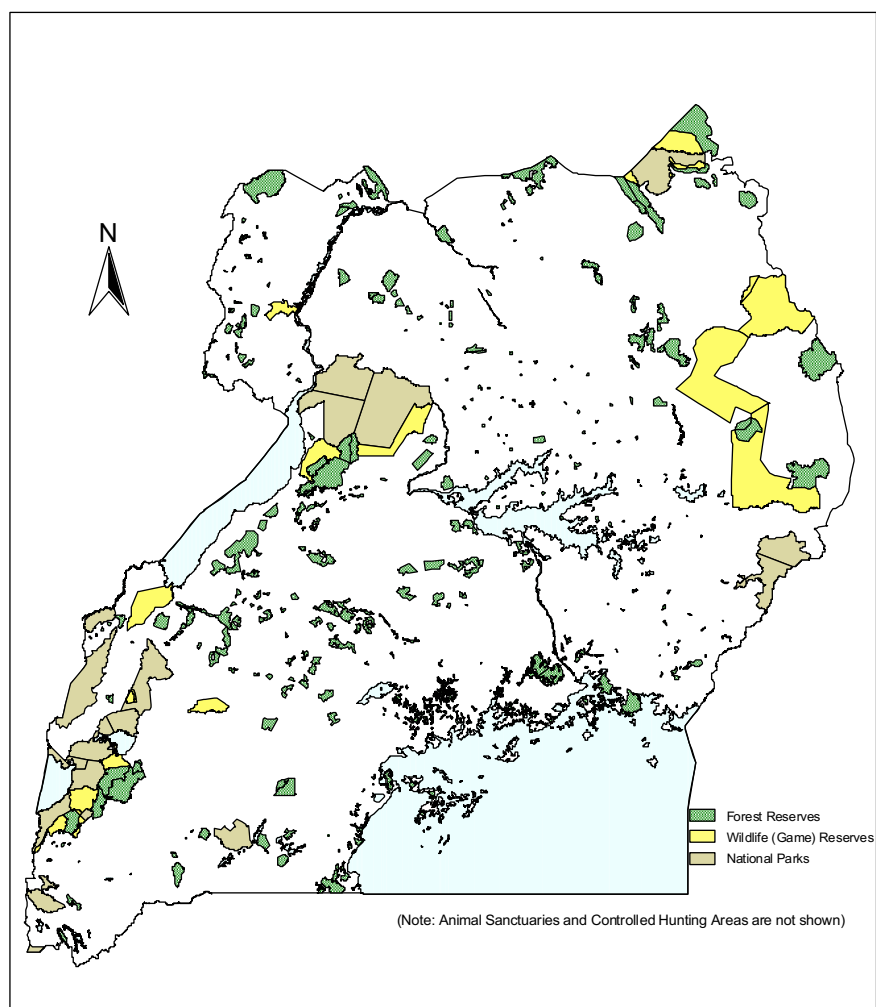


Fig. 1.3 Map of Uganda's National Parks, Wildlife (Game) Reserves, and Forest Reserves

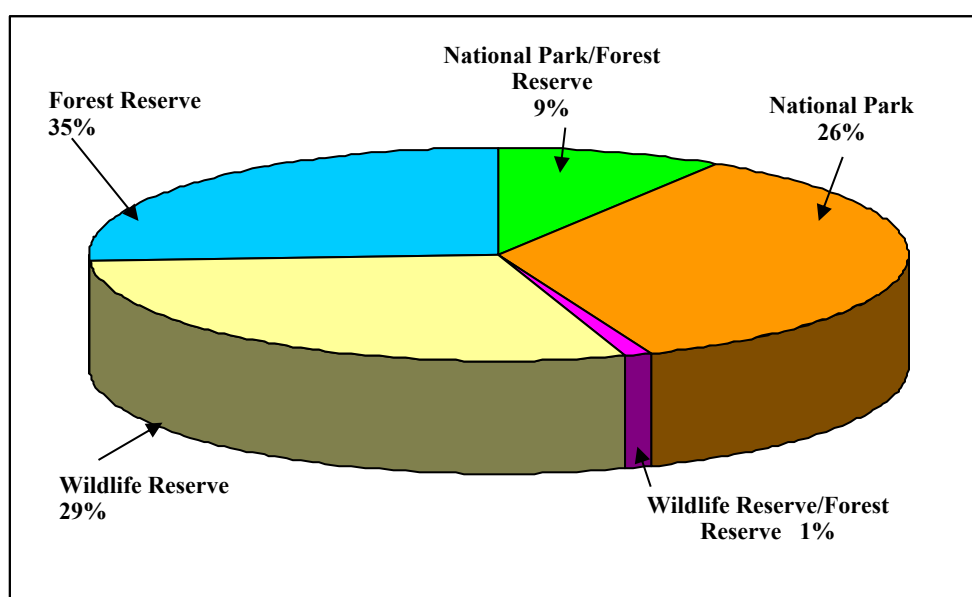


Fig. 1.4 The proportion of Uganda's Protected area designated to each category

## Chapter 2

### Basis of the Plan

#### 2.1 Introduction

The aim of this chapter is to:

- summarise the reasons for government's decision to dedicate 50% of the forest estate to 'protection';
- provide a statement of forest management objectives, with particular reference to Nature Reserves and 'Buffer Zones';
- define a strategy for the achievement of these objectives;
- outline the biological, economic, social and management considerations that are relevant to the selection of conservation areas in the forest estate;
- describe the origins, design, objectives and implementation of the Forest Department's biodiversity inventory programme, as a basis for site evaluation;
- outline other sources of information used in the planning process.

#### 2.2 Rationale for the establishment of conservation areas

The decision to commit 50% of the forest estate to protective management as 'Nature Reserves' and associated 'Buffer Zones' was the result of considerable debate, and continues to be a source of controversy. On the one hand, some argue that it is inappropriate for a poor country like Uganda to 'lock away' so much land and potentially useful timber and other forest products, while others cite scientific evidence to show that the intended Nature Reserves will be too small to maintain all their biodiversity in the long term, and more land is needed.

The country faces an acute shortage of timber and may, it is argued, have to consider importing it, partly because of the decision to dedicate so much to biodiversity conservation and other environmental concerns. Taking this argument further, some would say that forest reserves, established at a time when Uganda had no more than a quarter of its present population, can no longer be justified in the face of imminent land shortages. It would serve Uganda's development objectives better, they say, if this land were released for agricultural settlement and/or used as grazing lands.

These are powerful arguments, which will no doubt become ever more pertinent, as the country's population continues to grow, and expectations of improved living standards begin to be realised. It is therefore important to understand the counter-arguments so that biodiversity conservation and environmental protection are seen as partners in development, rather than obstacles to it. Some of the key arguments can be summarised as follows:

- **Uganda's biodiversity is an exceptional 'global resource'.** Whereas most other countries in the world are able to grow timber, few are in a position to sustain such a wealth of biodiversity. In this respect, Uganda has a strong comparative advantage;
- **Uganda has an international responsibility to conserve its biodiversity, and obligations under the Convention on Biological Diversity.** By ratifying this important convention in September 1993, Uganda has undertaken to protect all of its biodiversity. The provisions of Article 8, on *in-situ* conservation (Table 2.1) are especially important, through which Uganda has undertaken, *inter alia*, to:
  - establish a system of protected areas... to conserve biological diversity (para (a));
  - develop guidelines for the selection, establishment and management of protected areas (para (b)); and
  - promote the protection of ecosystems, natural habitats and the maintenance of viable populations of species in natural surroundings (para (d)).
- **Uganda can benefit financially from its biodiversity conservation activities.** Because most of the world's biodiversity is concentrated in the tropical countries, and many of its benefits realised in 'developed' countries, mechanisms are rapidly being developed for North-South financial support of biodiversity conservation activities. Uganda is already receiving international aid to support biodiversity conservation. This comes not

only from the Global Environmental Facility (a financing mechanism established specifically for the purpose) but also from the European Union, World Bank, USAID, GTZ, NORAD, Dutch government and others. Indeed, this support is probably sufficient to ensure that biodiversity conservation is a profitable land-use option for many of Uganda's protected areas, at least under present conditions. In addition to such international governmental support, there are some interesting examples elsewhere in the world of protected areas and biodiversity conservation activities sustained by commercial interests, such as payments by international drug companies for 'bio-prospecting rights'. Uganda is in a strong position to 'sell' its biodiversity in these ways;

- **Suitable land is already protected and available.** Because Uganda has already established an extensive network of National Parks, Forest and Wildlife Reserves, biodiversity conservation objectives can be achieved relatively easily here - at least compared with other countries where new land must be acquired for the purpose;
- **Biodiversity conservation can be achieved at relatively low cost, as part of an optimal land-use strategy.** This is because a considerable amount of biodiversity occurs in 'marginal' lands such as steep mountains, inaccessible regions and tsetse-infested areas where development opportunities are very limited. Often it is important to protect the vegetation and prevent soil erosion in such areas to safeguard water supplies, downstream fisheries, irrigation opportunities or hydro-electric installations. Biodiversity conservation objectives can be satisfied simultaneously, and at very little incremental cost;
- **Uganda's timber requirements can easily be satisfied from the existing forest land, and at the same time meet its biodiversity conservation objectives.** After 25 years of establishment, an area of 30,000 ha of softwood plantations would yield about 600,000m<sup>3</sup> of general purpose sawn timber annually - enough to satisfy all of the country's anticipated demand early next century - on less than 2% of its forest land. If 50% of the estate is dedicated to production forestry, there is clearly scope for a massive surplus timber production, whilst simultaneously maintaining 50% of the estate as protection forest;
- **Biodiversity conservation sustains other sectors of the economy,** and is therefore a worthwhile investment. Many overseas visitors come to Uganda on account of its National Parks and other protected areas, and a large part of the tourism sector is clearly dependent upon biodiversity conservation. Less conspicuously, supplies of natural forest products, including timber, are dependent upon the complex of species and ecological interactions which characterise the country's forests;

**Table 2.1 Article 8 on In-situ conservation from the Convention on Biological Diversity**

Each Contracting Party shall, as far as possible and as appropriate:

- (a) Establish a system of protected areas or areas where special measures need to be taken to conserve biological diversity;
- (b) Develop where necessary, guidelines for the selection, establishment and management of protected areas or areas where special measures need to be taken to conserve biological diversity;
- (c) Regulate or manage biological resources important for the conservation of biological diversity whether within or outside protected areas, with a view to ensuring their conservation and sustainable use;
- (d) Promote the protection of ecosystems, natural habitats and the maintenance of viable populations of species in natural surroundings;
- (e) Promote environmentally sound and sustainable development in areas adjacent to protected areas with a view to furthering protection of these areas;
- (f) Rehabilitate and restore degraded ecosystems and promote the recovery of threatened species, *inter alia*, through the development and implementation of plans or other management strategies;
- (g) Establish or maintain means to regulate, manage or control the risks associated with the use and release of living modified organisms resulting from biotechnology which are likely to have adverse environmental impacts that could affect the conservation and sustainable use of biological diversity, taking also into account the risks to human health;
- (h) Prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats or species;
- (i) Endeavour to provide the conditions needed for compatibility between present uses and the conservation of biological diversity and the sustainable use of its components;
- (j) Subject to its national legislation respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and promote their wider application with the approval and involvement of the holders of such knowledge, innovations and practices and encourage the equitable sharing of the benefits arising from the utilisation of such knowledge, innovations and practices;
- (k) Develop or maintain necessary legislation and/or other regulatory provisions for the protection of threatened species and populations;
- (l) Where a significant adverse effect of biological diversity has been determined pursuant to Article 7, regulate or manage the relevant processes and categories of activities; and
- (m) Cooperate in providing financial and other support for in-situ conservation outlined in subparagraphs (a) to (l) above, particularly to developing countries.

- **Biodiversity conservation can only be achieved by dedicating large areas for protection, because of the need to sustain minimum viable populations.** Genetics and population viability studies suggest that about 500 breeding individuals are normally required to sustain populations of most species in the long term. This means that many rainforest trees, and large animals such as chimpanzees, which occur naturally at densities of 2-4 individual per km<sup>2</sup>, require an area of 125-250 km<sup>2</sup> of suitable habitat to remain viable in the long term. It is often these larger species which play a 'keystone' role in the ecology of an area, and it is therefore vital that they are conserved. The forest Nature Reserves established in Uganda during the 1950s and 60s were clearly inadequate in this respect. However, they acted as baselines for forest management practices.

## 2.3 Forest management objectives

As outlined in Chapter 1, the Man and Biosphere concept of reserve design envisages the definition of discrete management zones, arranged concentrically around a totally protected 'core' area, and providing for progressively more intensive use towards the periphery of a reserve. In the context of Uganda's forests, this concept is to be applied by defining three distinct zones: Nature Reserves, Buffer Zones and Production Zones, and it is the aim of this section to provide a definition of management objectives within each of these zones. It is important to appreciate from the outset that many of the objectives of forest management apply throughout a reserve, and the distinction between different zones is often characterised by a shift of emphasis within a similar set of objectives, rather than the definition of a completely different set of objectives for each zone. For example, the preservation of biodiversity is an objective of management in all parts of a reserve, being the primary focus for management in the Nature Reserves, but only one of several secondary objectives in the production zones. This is made more explicit in Table 2.2, where the relative importance of each forest management objective within each zone is specified.

### 2.3.1 Nature Reserve Objectives

The national network of forest Nature Reserves aims to achieve the following:

1. Protect viable examples of all distinct ecological communities represented within the forest estate in an undisturbed condition, maintaining associated natural ecological processes and community succession.
2. Protect viable populations of all species represented within the forest estate, particularly rare species and those that may be threatened by human interventions elsewhere.
3. Protect, as far as possible, wild genetic resources, particularly the range of genetic variability within economically important species and those of possible future economic importance.
4. Within each major forest, contribute to the sustainable management of adjacent production zones by serving as a permanent reservoir of seed material, dispersal agents and ecological services that enhance regenerative capacity and productivity.
5. Provide areas for pure and applied ecological research where natural processes and ecological change can be monitored, and which can serve as a baseline against which to evaluate the impact of human activities elsewhere.
6. Provide areas for education and raising environmental awareness.
7. Provide opportunities for recreational use and tourism development, insofar as this is compatible with preceding objectives.

### 2.3.2 Buffer Zone objectives

The forest Buffer Zones will fall into four categories, as follows:

1. **Nature Reserve Support Zones** will protect and/or restore the natural vegetation and ecological attributes of areas immediately adjacent to Nature Reserves (particularly smaller ones) in the natural forest, thereby enhancing the viability of the Nature Reserves.
2. **Environmental Protection Zones** will protect the natural vegetation and ecological attributes of hilly and mountainous areas exceeding 15° slope.
3. **Wildlife Protection Zones** will protect the natural vegetation and ecological attributes of areas of the forest estate carrying dual status as National Parks and Wildlife (Game) Reserves.
4. **Recreation Zones** will protect and/or restore the natural vegetation and ecological attributes of areas with significant potential for recreational use and ecotourism development.

The objectives within these four categories will be the same as those stated for Nature Reserves, with the addition of two further objectives as follows:

- Provide opportunities for use of non-timber forest products for subsistence and/or commercial purposes insofar as this is compatible with preceding objectives.
- Provide opportunities for the collection of building poles and firewood by local people for their own personal domestic use and/or non-commercial local community projects.

### 2.3.3 Production Zone Objectives

The areas designated as production zones aim to:

- provide a maximum sustainable yield of sawn timber, pulpwood and other products from plantations developed in previously unforested areas;
- provide a maximum sustainable yield of high quality hardwood timber from suitable natural forest areas, insofar as this can be achieved without irreversible loss of biodiversity or disruption of natural ecological processes;
- provide a maximum sustainable yield of building poles, firewood and other wood and non-wood products for industrial, commercial and/or subsistence use insofar as this can be achieved without irreversible loss of biodiversity or disruption of natural ecological processes;
- protect and/or enhance the environmental service functions of the natural ecosystem, preventing soil erosion, maintaining water catchment quality, and sustaining other ecosystem functions such as amelioration of local climatic conditions;
- prevent the irreversible loss of biodiversity, especially where this is likely to affect the regenerative capacity of the natural vegetation, and involve biodiversity elements that may not be adequately protected elsewhere;
- provide areas for environmental monitoring and applied research, where forest management techniques can be developed and adapted to improve productivity, efficiency and sustainability;
- provide areas for education and training, insofar as this is compatible with preceding objectives;
- provide opportunities for public access and recreational use insofar as this is compatible with preceding objectives.



**Table 2.2 The relative importance of different forest management objectives within each zone**

Management objective	Nature Reserve	Buffer Zones				Production zones	
		NRSZ	EPZ	WPZ	Rec	For	Non-F
<b>Consumptive uses:</b>							
<b>(a) commercial/industrial use</b>							
Timber production (natural forests)	-	-	-	-	-	1	-
Timber production (plantations)	-	-	-	-	-	-	1
Firewood/pole production	-	-	-	-	-	1	1
Non-timber forest products (commercial)	-	3	3	-	3	1	1
<b>(b) domestic/subsistence/community use</b>							
Community woodlots	-	-	3	-	-	2	1
Non-timber forest products	-	1	1	2	2	1	1
Building pole collection	-	2	2	2	2	1	1
Firewood collection	-	2	2	2	2	1	1
<b>Non-consumptive uses:</b>							
Scientific research	2	3	3	3	3	3	3
Biodiversity preservation	1	1	2	1	2	2	2
Environmental services	1	2	1	2	2	2	2
Tourism and recreation	3	3	3	2	1	3	3
Education	2	3	3	3	2	3	3
Satisfy cultural/spiritual needs	3	3	3	3	3	-	-

Key: 1 = Primary objective; 2 = Secondary objective; 3 = Potentially applicable; - = not applicable  
**NRSZ** = Nature Reserve Support Zone; **EPZ** = Environmental Protection Zone;  
**WPZ** = Wildlife Protection Zone; **Rec** = Recreation Zone  
**For** = Production zone in forest; **Non-F** = Production zone in non-forest area

## 2.4 Planning Strategy

This section provides an overview of the broad strategy applied in assessing the suitability of different areas of the forest estate for particular uses, and deciding how best to apportion land for management as Nature Reserves, Buffer and Production Zones. The strategy is based on:

- the decision to dedicate 20% of the forest estate to management as Nature Reserves, 30% as Buffer Zones and 50% as Production Zones;
- application of the principles embodied in the MAB concept of reserve design; and
- management objectives within each zone as detailed above.

The planning process attempts to ensure that decisions over land allocations are made as objectively and explicitly as possible, based on clearly defined criteria. In the past, forest management decisions were based largely on assessments of timber resources, but modern multiple-use management objectives clearly indicate the need to use a wider range of criteria. Ideally a comprehensive assessment of land capability throughout the forest estate would be carried out, including assessment and analysis of physical geography, soil characteristics, hydrology, biodiversity, timber and non-timber forest products, and this would be integrated with simultaneous evaluations of local community needs, culture and resource-use characteristics. Such assessments are, however, way beyond the capacity of the Forest Department, and 'short-cut' methods have to be adopted so that management programmes can continue. Later, as more information becomes available, they can be modified.

The strategy developed here represents a pragmatic approach to decision making based on the use of multiple criteria, and 'best available' data. In general, the approach involves the development of a scoring system which incorporates the following considerations into a procedure for the selection of nature conservation sites:

#### **2.4.1 Biodiversity considerations:**

- forest Nature Reserves should complement one another so that together they form a system that encompasses the widest possible range of biodiversity at ecosystem, species and genetic levels;
- each Nature Reserve must be large enough to support minimum viable populations of plants and animals, particularly rare and endangered ones which often occur at relatively low population densities.

#### **2.4.2 Economic considerations:**

- wherever there is a choice, nature conservation sites should be selected to minimise the ‘opportunity costs’ of preventing alternative consumptive uses;
- parts of the forest estate that are well-suited to timber production (on account of standing timber, accessibility, topography, etc) should be used for that purpose, except where they have unique conservation values.

#### **2.4.3 Social considerations:**

- forest areas that provide important economic and cultural benefits to nearby communities should continue to do so, except where such uses conflict with the need to protect unique biodiversity values.

#### **2.4.4 Management considerations:**

- areas selected as Nature Reserves should be representative of undisturbed natural ecosystems, not significantly altered by previous management interventions;
- management of zones dedicated to particular uses must be feasible: areas that cannot be protected (in the long-term) against illegal timber harvesting and other consumptive uses should not be designated as Nature Reserves. Inaccessible areas, remote from human settlements, with few economically important resources, are most likely to remain ‘protected’ when resources for management are scarce.

### **2.5 Biodiversity Inventory Programme**

#### **2.5.1 Objectives**

The primary source of information used in the planning exercise was the Department’s biodiversity inventory programme which took place between 1991 and 1995. This was designed specifically to provide the data necessary for assessing the biological value of the country’s principal forests, as a basis for Nature Reserve site selection. The assessment made use of five ‘indicator taxa’ taken as a surrogate measure of overall biodiversity. The aim of the inventory work was to compile as complete a list of species as possible for each of these taxa from each forest. This then enabled direct comparison between sites, and determination of priorities for Nature Reserve establishment based on clearly defined biological criteria.

#### **2.5.2 Origins**

The need for such an assessment had been identified in 1988, as a survey to document the conservation values of Uganda’s twelve principal forest reserves was drawing to a close. At that stage very little information was available on the biological values of Uganda’s forests, and this was heavily biased towards a few sites where specific studies had been carried out. Clearly, a more systematic inventory, using standardised sampling procedures, was necessary to provide the sort of data that could be used in an objective priority-setting exercise of this kind.

Uganda is fortunate in being one of the few countries in Africa with a detailed vegetation map, distinguishing 92 distinct communities (Langdale Brown *et al.*, 1964). This should provide a good basis for planning a system of protected areas, which can be designed to include a representative example of each of these vegetation types.

If the distribution of plant and animal species is closely linked to vegetation types, then such a system would be expected to include the majority of species. However, there is evidence that different areas of the same vegetation type support quite different animal communities. An obvious example from Uganda’s forests is the *Cynometra-Celtis* semi-deciduous forest (type D2; Langdale-Brown *et al.*, 1964) characteristic of places like Semliki, Maramagambo, Bugoma and Budongo. Each of these four forests supports a different community of diurnal forest primates, ranging from 8 species in Semliki to 5 in Budongo - something that is considered to be a genuine biogeographical phenomenon, rather than an effect of hunting. This indicates a need to look beyond vegetation types in establishing site selection priorities, and was the underlying reason for choosing a species-based approach to Nature Reserve planning.

### 2.5.3 Selection of sites for biodiversity assessment

Before fieldwork could begin, it was necessary to decide which forests should be included in the assessment. Uganda has more than 700 forest reserves, and it was clear that not all of these could be sampled in any meaningful way with the financial, logistical and human resources, and time available. The decision was therefore taken to concentrate the work on the larger forests (i.e. all those exceeding 5,000 ha, since these are most likely to sustain viable populations of most species in the long term), together with a number of smaller reserves representing particular vegetation types that do not occur in the larger reserves.

In order to select appropriate smaller reserves for inclusion in the surveys, a 'gap analysis' was carried out, by examining the representation of vegetation types (Langdale Brown *et al.*, 1964) in all of Uganda's National Parks, Game Reserves (Wildlife Reserves) and larger Forest Reserves, and thereby identifying 'gaps' in the representation of particular types in the protected area system. The 'missing' vegetation types were then located on the map, to see whether they were represented in any of the smaller forest reserves and appropriate areas were then included in the assessment. Where there was a choice of reserves, the larger one was selected for inclusion. The final list of reserves selected for biodiversity assessment comprised 54 sites exceeding 5,000 ha, and an additional 11 smaller sites representing vegetation types not otherwise represented. The list included five major forests which became National Parks during the early stages of the assessment. In these cases inventory work was continued after the change of legal status since, although there was no longer a need to assess their suitability for Nature Reserve establishment, it was necessary to characterise their biodiversity and ensure that new Nature Reserves elsewhere were selected in a complementary way.

Ideally, the programme would have covered all the country's protected areas, including the more established (savanna) National Parks, and Wildlife (Game) Reserves, as this would have enabled a more comprehensive rationalisation of the country's protected areas. Unfortunately this was not possible.

### 2.5.4 Selection of indicator taxa

It would obviously be impossible to provide a comprehensive assessment of biodiversity, even for a single site, and the only practical way of comparing the biodiversity values of a number of different sites is to focus on 'indicator taxa' which might be expected to demonstrate general characteristics of the wider biological world. There is widespread scientific debate over the value of 'indicators', which often focuses on the question of what 'indicators' are really indicating. Often the occurrence of particular species or species groups has proved useful in indicating such things as levels of environmental pollution, disturbance of ancient woodlands, or other such parameters. Clearly, for our purposes an appropriate indicator taxon would exhibit patterns of species richness, diversity, endemism, and rarity typical of 'biodiversity' in general including all plants and animals, big and small.

Identifying such an indicator taxon presents major problems. Recent evidence from a number of studies in temperate regions of the world suggest that 'biodiversity hotspots' for different groups of animals and plants rarely coincide, so focusing on a single group may well be misleading. These studies seem to confirm the findings of the earlier biodiversity assessment work in Uganda's forests which suggested that forests that are rich in species belonging to one taxonomic group are often not so rich for others. Accordingly, it was decided that a variety of different indicator taxa should be used for the assessment work, so that collectively they would be representative of wider biodiversity.

A number of criteria were used in the selection of indicator taxa, including practical considerations as well as biological ones. In principle, plant and animal groups that are as taxonomically different from one another as possible were selected, including examples from vertebrate and invertebrate phyla, with different 'lifestyles' and varying dispersal abilities. From a practical point of view, taxa could only be considered for assessment if they could be:

- easily sampled by departmental technical staff, using locally available equipment and supplies;
- comprehensively sampled, so that reasonably complete species lists could be made within the time available;
- reliably identified using locally available expertise, literature and reference collections.

Based on these considerations, five taxa were selected for assessment, namely trees and shrubs, small mammals (five families), birds, butterflies and large moths (two families).

### 2.5.5 Sampling Strategy

In practice, it is rarely possible to compile complete lists of species for any given site, even for the most conspicuous groups of plants and animals. If valid comparisons are to be made between sites, it is therefore essential to standardise sampling effort. This was done by allocating field time in proportion to the size of each reserve, the aim being to spend one day sampling per 20 km<sup>2</sup> of reserve area. In this way each individual tree, bird or whatever had the same

chance of being sampled, whether it occurred in a big or small reserve, anywhere in the forest estate; and although no site list was complete, it is fair to assume that a similar proportion of the species total for each site had been recorded. This provided a valid basis for comparing sites, and overcame the problem of observer bias which is so common in conservation priority-setting exercises of this kind.

Throughout the field programme strict recording procedures were maintained so as to track the rate at which 'new' species were discovered at each forest with increased sampling effort. Ideally, sampling should continue until the majority of species present at a site have been recorded, as indicated by a slowing of the species accumulation rate. At some point, the return on effort (and cost) is no longer worthwhile, and it is better to spend time assessing another site. It had originally been the intention to collect sufficient information on all taxa to enable broad between-forest comparisons of biodiversity by the end of the first year of intensive fieldwork (i.e. by the end of 1993). However, examination of species accumulation data at this stage indicated a need for further sampling, so the field programme was continued until early 1995.

### **2.5.6 Field Programme Implementation**

Some ornithological and botanical work was initiated in 1991, but it was not until May 1992 that the programme was fully implemented. Eighteen Forest Rangers were selected from different parts of Uganda and provided with over three months intensive field training. These rangers were then divided between four inventory teams, each comprising two botanists, one ornithologist and one mammalogist/entomologist, supervised in the field by four full-time (graduate) biologists. In carrying out the fieldwork, the broad approach of the inventory teams was to explore the full range of habitats, altitude and aspect within each forest, from a number of strategically located base camps. Sampling techniques for each of the five taxa were based on current recognised methods, described in detail elsewhere (see Forest Department Biodiversity Reports, 1996).

### **2.5.7 Inventory Results**

On completion of the inventory work in early 1995, almost 100 man-years of work had been carried out, during which 17,600 plant site records were made, 100,000 trap-nights of small mammal work undertaken and 57,000 large moths, 21,000 butterflies and 14,000 birds trapped. A 33-volume 'Biodiversity Report Series' was completed in September 1996 describing the fieldwork and data collected from all 65 forests. These reports provide a permanent record of the findings as a basis for future comparative work, as well as presenting invaluable baseline data for long-term ecological monitoring in Uganda's forests.

## **2.6 Timber inventory programme and other information sources**

Whilst the biodiversity inventory programme provided the primary source of information for the selection of Nature Reserve sites, data from other sources were used to ensure that the decision-making process was as reliable and broad-based as possible.

### **2.6.1 Timber inventory programme**

A major inventory of Uganda's timber resources was planned for the 1988-94 period as part of the IDA-financed component of the Forestry Rehabilitation Programme. Unfortunately, this was only partially successful, providing up-to-date assessments for Budongo, Mabira and the Sesse Island forests and some forest plantations. Older inventory data, some of it dating back to the 1950s and 60s, are available for many other forests, and summarised in the report by Lockwood Consultants. As the best available information, these sources were used to provide an indication of the relative values of different forests for timber production.

### **2.6.2 Local community use**

Very few quantitative data are available on local community use of resources from forest reserves, so the value of the resource to local communities was taken to be proportional to known human population densities in parishes adjacent to each reserve (based on 1990 census statistics), and the length of forest boundary providing access to resources.

### **2.6.3 Management history and forest condition**

Forest Department records and other sources were used to determine which parts of particular forests have been subjected to large-scale management operations in the past. The biological inventory teams assessed forest condition and disturbance factors during the period of the biological inventory work, and this information was used in deciding on appropriate zoning regimes within individual forests.

## Chapter 3

### Design of a National Network of Forest Nature Reserves

#### 3.1 Introduction

The aim of this chapter is to describe the procedure followed in deciding which forests, and which areas within those forests, are most appropriate for the designation of Nature Reserves and other conservation areas. The chapter begins by describing the procedure used in analysing the biodiversity data and other information used in apportioning land to different uses within each forest, and then provides details of the sites selected for Nature Reserve establishment, the criteria used in their selection, and the areas to be designated within each of these forests. The final part of the chapter describes the principles and methods employed in deciding on the location of the various conservation zones within any given forest, and provides a summary of the individual forest zoning plans annexed to the report.

#### 3.2 National allocations of forest land to different uses

Given that 50% of the forest estate is to be managed with environmental protection as the primary objective (with 20% designated as 'Nature Reserve' and 30% as 'Buffer Zone') this section elaborates the procedure used in deciding which areas should be selected for protection, and which should be allocated to other uses. The procedure follows a sequence of steps, designed to ensure selection of the minimum number of sites necessary for protection of the country's biodiversity, giving preference to areas where biodiversity conservation can be achieved at 'least cost', in terms of other development opportunities foregone. The 11-step procedure starts by selecting the most important and suitable sites for Nature Reserve establishment, progressively including additional sites until all species and habitats are represented at least once in the total list of sites.

##### STEP 1. Identify biologically important sites

###### Rationale and justification:

*Since the primary objective of establishing Nature Reserves is to protect biodiversity, some measure of the biodiversity value of different sites is clearly central to the planning process. Biodiversity can be assessed at genetic, species and ecosystem levels, and conservation efforts should be directed at all these levels of organisation. Assessments at an ecosystem/habitat level are generally rather crude, but useful for large-scale planning work where more detailed information is not available. For our purposes, better 'resolution' can be achieved by consideration of species diversity, this being the most detailed information available at present. (Later it would clearly be beneficial to consider genetic variability between populations in different parts of the country, particularly for the more economically important species such as the mahoganies or wild coffee. This would enable genetically distinct populations to be protected for possible future use in provenance trials and/or genetic improvement).*

*Biologists tend to value two quite distinct attributes of biodiversity, namely 'richness' (most readily expressed in terms of species numbers), and 'rarity'. Unfortunately, these two attributes are rarely maximised in the same place, so it is not possible to select sites which are both species-rich and support concentrations of rare species. Thus, it is necessary to consider each of these attributes separately, and the score for species conservation is derived by combining a score for 'species richness' and one for 'species rarity value'.*

###### Procedure:

A biodiversity importance score is derived from consideration of species richness, and national/ international rarity of the species represented at each forest. It is based on data collected on the five indicator taxa of plants and animals (trees and shrubs; birds; small mammals; butterflies; and large moths). Each taxon is initially considered alone, and scores for relative 'species richness' and 'species rarity value' calculated for each site as follows:

- 'Relative species richness' is a measure of the number of species per unit area. Since the number of species actually recorded at each site is dependent upon sampling intensity, valid between-forest comparisons can only be made after standardising for differences in sampling intensity. This has been done by deriving a 'smoothed' species accumulation function using rarefaction (Krebs, 1989; Prendergast *et al.*, 1993) and making pairwise comparisons of the number of species recorded at the highest level of sampling possible for each pair of forests. The relative species richness score is the mean value for these pairwise comparisons.
- 'Average species rarity value' is a measure of the 'rarity value' of the 'average' species at each site, derived from consideration of each species' Africa-wide distribution and frequency of occurrence in Uganda's forests. Species that have a restricted range across the continent (e.g. restricted to the Albertine Rift of central Africa) and occur at

few sites in Uganda are considered to be more valuable than those which are widespread across the continent and occur in many of Uganda's forests. For each forest, an 'average species value' is calculated as the mean score for each of the species listed for the forest. Each species is scored in the range 2-20, made up as the sum of its 'continental score' and its 'Uganda score'.

#### Outcome:

The results of this analysis are summarised in Table 3.1, which ranks forests in terms of their overall biodiversity importance scores. The top 12 forests are (in rank order): Bwindi, Kasyoha-Kitomi, Budongo, Mt Moroto, Kalinzu-Maramagambo, Rwenzori, Kibale, Semliki, Echuya, Otzi, Mt Kadam and Bugoma. Not surprisingly, the list includes all the large tropical high forest reserves of western Uganda, but the inclusion of three mountain catchment reserves in the dry eastern and northern parts of the country is less expected, and the very high position of Echuya is noteworthy.

There are significant differences in the scores and rankings of each forest for the two criteria ('richness' and 'rarity'). Only four of the ten most species-rich forests are also ranked amongst the top ten for rarity value. The five richest forests (Kasyoha-Kitomi, Bwindi, Budongo, Kalinzu-Maramagambo and Kibale) are all medium-altitude tropical high forest reserves in western Uganda, whereas the five forests with the greatest concentration of rare species are all highland sites (Echuya, Rwenzori, Mt Moroto, Bwindi and Mafuga).

## **STEP 2. Combine biological and socio-economic considerations to evaluate 'Nature Reserve suitability'**

#### Rationale and justification:

*Nature Reserves and other conservation areas are most likely to be maintained and afforded adequate long-term protection if (a) they provide additional benefits which complement their role in biodiversity conservation and (b) they are located in areas with little or no potential for alternative consumptive uses such as timber production or community use. The suitability (or feasibility) of any particular forest for designation as a conservation area can thus be evaluated in terms of its biodiversity value and potential for complementary uses, offset against its potential for alternative uses. Thus a biologically important area encompassing the highest parts of a mountain range with important watershed functions and high potential for recreational use, is likely to be particularly suitable for Nature Reserve designation especially when such an area is poorly stocked with timber, inaccessible and surrounded by sparsely populated communal lands.*

Table 3.1 Ranking of forests according to overall biodiversity importance scores

FOREST	SPECIES DIVERSITY (Score,max10)	RARITY VALUE (Score,max.10)	BIODIVERSITY IMPORTANCE (Score,max.20)	OVERALL RATING
Bwindi	8.2	8.4	16.5	★★★
Kasyoha-Kitomi	8.3	7.3	15.6	★★★
Budongo	7.7	7.7	15.4	★★★
Mt Moroto	6.2	8.5	14.7	★★★
Kalinzu-Maramagambo	7.6	7.2	14.7	★★★
Rwenzori	5.7	8.8	14.5	★★★
Kibale	7.6	6.9	14.4	★★★
Semliki	6.7	7.7	14.4	★★★
Echuya	4.6	9.7	14.3	★★★
Otzi	7.1	7	14.1	★★★
Kadam	7.6	6.6	14.1	★★★
Bugoma	7.3	6.8	14.1	★★★
Sango Bay	7.2	6.8	13.9	★★★
Mt Elgon	5.9	8	13.9	★★★
Mpanga	7.6	6	13.7	★★★
West Bugwe	7.5	6.1	13.6	★★★
Kabuika	7.4	6.2	13.6	★★★
Mukono	6.7	6.8	13.5	★★★
Mpigi	7.5	6	13.5	★★★
Nyangea	6.7	6.7	13.4	★★★
Era	6.9	6.5	13.4	★★★

<b>FOREST</b>	<b>SPECIES DIVERSITY (Score,max10)</b>	<b>RARITY VALUE (Score,max.10)</b>	<b>BIODIVERSITY IMPORTANCE (Score,max.20)</b>	<b>OVERALL RATING</b>
<b>Mafuga</b>	5.3	8.1	13.4	★★★
<b>Napak</b>	6.6	6.7	13.2	★★
<b>Morongole</b>	6	7.2	13.2	★★
<b>Mt Kei</b>	6.2	7	13.2	★★
<b>Ogili</b>	8	5.1	13.1	★★
<b>Mabira</b>	6.4	6.7	13	★★
<b>Agoro-Agu</b>	6.5	6.3	12.8	★★
<b>Labwor</b>	6.1	6.7	12.8	★★
<b>Mujuzi</b>	6.5	6.3	12.8	★★
<b>Kagombe</b>	6.5	6.3	12.7	★★
<b>Matiri</b>	6.5	6.1	12.6	★★
<b>S.Busoga</b>	6.4	6.1	12.5	★★
<b>Jubiya</b>	6.4	6.1	12.4	★★
<b>Zoka</b>	6.4	5.9	12.2	★★
<b>Igwe</b>	6.6	5.7	12.2	★★
<b>Rom</b>	6.1	6.1	12.2	★★
<b>Timu</b>	5.4	6.7	12.1	★★
<b>Lwala</b>	5.9	6.2	12.1	★★
<b>Kisangi</b>	6.1	5.9	12.1	★★
<b>Kasagala</b>	6	6	12	★★
<b>Rwoho</b>	5.5	6.5	12	★★
<b>Kitechura</b>	6.1	5.8	11.9	★
<b>Kasana</b>	5.8	6.1	11.9	★
<b>Zika</b>	5.5	6.2	11.7	★
<b>Sesse</b>	4.7	6.8	11.5	★
<b>Itwara</b>	5.1	6.3	11.4	★
<b>Kapimpini</b>	5.8	5.4	11.2	★
<b>Nsowe</b>	5.3	5.8	11.2	★
<b>Bwezigolo</b>	5.2	6	11.2	★
<b>Kazooba</b>	5.3	5.8	11.1	★
<b>Kijanabolola</b>	5.3	5.7	11	★
<b>Aswa</b>	5.3	5.7	11	★
<b>Namwasa</b>	5.2	5.7	10.9	★
<b>Wabisi</b>	6.6	4.2	10.8	★
<b>Maruzi</b>	4.7	6	10.7	★
<b>Lokung</b>	4.9	5.7	10.6	★
<b>Taala</b>	5.1	5.5	10.6	★
<b>Opit</b>	5.3	5.3	10.6	★
<b>Luunga</b>	4.9	5.6	10.5	★
<b>Kamusenene</b>	4.6	5.8	10.4	★
<b>Kilak</b>	4.5	5.5	10	★
<b>Kibeka</b>	4	5.8	9.9	★
<b>Bukaleba</b>	4.1	5.1	9.2	★
<b>Wiceri</b>			0	

*This step in the site selection procedure provides an assessment of Nature Reserve suitability/feasibility for each site, based on the derivation of scores for various relevant criteria. Overall Nature Reserve suitability scores are used later in the analysis as a means of (a) ensuring that 'least cost' (suitable) Nature Reserve options are taken in preference to more 'expensive' alternatives (even though these may be more efficient in terms of the number of sites required to achieve biodiversity conservation objectives), and (b) adjusting the areas to be dedicated to conservation uses within individual sites.*

#### Procedure:

A Nature Reserve suitability score is calculated for each forest as:

$$\text{Nature Reserve Suitability} = \text{Conservation Value} - \text{Alternative-use Potential}$$

where:

- **conservation value** is derived as the sum of biodiversity importance (as described above) and 'potential for compatible non-consumptive uses' (i.e. tourism, watershed protection, education and research). The score for biodiversity importance has a maximum value of 20, while that for non-consumptive use is 10, attributed to tourism (4), watershed protection (4) and education and research (2), and
- **alternative-use potential** is derived as the sum of a forest's commercial forestry prospects (maximum score 20, based on standing timber volume (10), accessibility (3), sawmill investment (3) and plantation development potential (4); and its potential for community-use of resources (maximum score 20, based on population densities and forest boundary: area ratios).

Full details of the derivation of these scores are provided in Appendix 3.

#### Outcome:

Table 3.2 provides a ranking of forests based on overall Nature Reserve suitability, together with details of the component scores for each forest. The 60 forests that were evaluated are divided into three broad categories of high, medium and low Nature Reserve suitability. In general, forests of high Nature Reserve suitability occur in the northern and eastern savanna regions of the country where population densities (and community-use pressures) are relatively low, and there is little or no potential for timber production. Most of the larger tropical high forest reserves fall into the middle category of Nature Reserve suitability since, although they have significant potential for timber production, community-use values are relatively low on account of (in)accessibility. Reserves with low Nature Reserve suitability are generally small areas in the more densely populated high rainfall regions of southern Uganda.

### **STEP 3. Examine options for a diverse national network of complementary protected areas**

#### Rationale and justification:

*Whilst it is useful and instructive to evaluate sites for 'biodiversity importance' and 'Nature Reserve suitability', site selection based solely on such criteria is likely to be inefficient, because several of the more biologically 'important' or 'suitable' sites may be very similar. Protecting several examples of a particular community, habitat, or suite of species may be difficult to justify unless at least one 'complete set' of the country's biodiversity has been identified and protected. For this reason, scientists have in recent years placed increasing emphasis on the concept of complementarity in protected area systems planning, the idea being to select a suite of sites that are as different from one another as possible. The procedure in 'complementarity analysis' is to start with the richest site, and then look for the one which complements it best by adding the most species (or habitats, or whatever) that are not already represented in the first site. A list of sites is built up in this way, each one adding to the total list of species represented, until the full complement is completed.*



Table 3.2 Ranking of forests according to nature reserve suitability scores

FOREST	Biodiversity importance (Score, max. 20)	Multiple-use (Score, max. 10)	Timber production (Score, max. 20)	Community-use (Score, max. 20)	NATURE RESERVE SUITABILITY	OVERALL RATING
Mt Moroto	14.7	7	0.6	0.5	20.6	★★★
Kadam	14.1	5	0.6	0.5	18	★★★
Napak	13.2	4	1.6	0.2	15.4	★★★
Morongole	13.2	4	0.6	1.2	15.4	★★★
Timu	12.1	2	0	0.5	13.6	★★★
Nyangea	13.4	4	4	0.2	13.2	★★★
Ogili	13.1	2	0	2.2	12.9	★★★
Agoro-Agu	12.8	4	3.6	0.8	12.4	★★★
Rom	12.2	3	3.6	0.2	11.4	★★★
Lwala	12.1	2	1.6	1.5	11	★★★
Otzi	14.1	3	4.6	2.5	10	★★★
Era	13.4	2	4	1.6	9.8	★★★
Kabuika	13.6	0	4	0.1	9.5	★★★
Labwor	12.8	2	4	1.6	9.2	★★★
Maruzi	10.7	1	3	0.7	8	★★★
Kasagala	12	2	4	2.7	7.3	★★★
Aswa	11	0	4	0.3	6.7	★★★
Kapimpini	11.2	0	4	0.4	6.8	★★★
S.Busoga	12.5	3	6.2	3	6.3	★★★
Kamusenene	10.4	0	4	0.2	6.2	★★★
Kazooba	11.1	0	4	1.1	6	★★
Nsowe	11.2	0	4	1.7	5.5	★★
Mt Kei	13.2	0	6.6	0.5	6.1	★★
Sango Bay	13.9	0	4.7	3.6	5.6	★★
Kasyoha-Kitomi	15.6	5	9.7	5.6	5.3	★★
Kibeka	9.9	0	4	1.4	4.5	★★
Jubiya	12.4	2	6.4	3.4	4.6	★★
Lokung	10.6	0	4	1.7	4.9	★★
Zoka	12.2	1	8.4	0.7	4.1	★★
Kijanabolola	11	0	4	3.5	3.5	★★
Bugoma	14.1	2	10.7	1.4	4	★★
Wabisi	10.8	0	4	3.3	3.5	★★
Opit	10.6	1	4	3.8	3.8	★★
Itwara	11.4	5	9.7	3.7	3	★★
Kilak	10	0	6.2	1.1	2.7	★★
Kasana	11.9	2	9.4	2.7	1.8	★★
Budongo	15.4	6	17.6	1.9	1.9	★★
Sesse	11.5	3	7.9	5.9	0.7	★★
Kitechura	11.9	0	8.9	2.3	0.7	★★
Matiri	12.6	1	9.9	3.7	0	★★
Kisangi	12.1	1	11.3	2.2	-0.5	★
Kalinzu-Maramagambo	14.7	5	16	4.3	-0.6	★
West Bugwe	13.6	3	6.6	10.6	-0.6	★
Rwoho	12	1	8.4	6.3	-1.7	★
Kagombe	12.7	1	8.9	6.7	-1.9	★
Taala	10.6	0	9.1	3.6	-2.1	★

FOREST	Biodiversity importance (Score, max. 20)	Multiple-use (Score, max. 10)	Timber production (Score, max. 20)	Community-use (Score, max. 20)	NATURE RESERVE SUITABILITY	OVERALL RATING
Echuya	14.3	4	1	20	-2.7	★
Namwasa	10.9	0	9.4	6.5	-5	★
Luunga	10.5	0	9.4	5.8	-4.7	★
Bwezigolo	11.2	0	9.7	6.4	-4.9	★
Mpigi	13.5	5	6.4	20	-7.9	★
Wiceri	0	0	8.4	1.1	-9.5	★
Mujuzi	12.8	0	8.7	14.8	-10.7	★
Mabira	13	5	8.5	20	-10.5	★
Zika	11.7	5	7.3	20	-10.6	★
Mukono	13.5	3	7.4	20	-10.9	★
Bukaleba	9.2	3	8.4	14.8	-11	★
Mpanga	13.7	4	9.1	20	-11.5	★
Igwe	12.2	1	5.2	20	-12	★
Mafuga	13.4	2	10.9	16.4	-11.9	★

Note: Five forests already designated as National Parks were not assessed for Nature Reserve suitability

Horizontal lines separate forests of high, medium and low nature reserve suitability

*Of course a list of sites selected in this way (which may be optimal from a biological point of view and require a minimum number of sites), is not necessarily optimal from an economic, social or political perspective, and does not necessarily lead to optimal land-use decisions. It may, for example, be better to protect the country's biodiversity in a larger number of sites, if these are areas with low potential for other uses, where protection would provide additional complementary benefits such as watershed protection. Such considerations can be built into complementarity analysis if, instead of relying entirely on 'species added' as the criterion for adding sites to the list, other criteria are applied.*

*Thus in the analysis that follows, instead of starting the complementarity table with the richest site, areas designated as National Parks are considered first, followed by steep mountain catchment reserves. Biodiversity within these areas can be considered preferentially protected, because the necessary political decisions and institutional mechanisms for this are already in place.*

*The next stage is therefore to see which forest reserves add most species to this 'pre-existing' set of sites. Again, it is important to give preference to sites which are 'suitable' for Nature Reserve establishment, so the complementarity table is built up in 'layers' starting with sites of high 'Nature Reserve suitability', then 'medium' suitability, adding those of low Nature Reserve suitability at the bottom of the table. In this way, forests that are heavily stocked with timber and located in densely populated rural areas are deliberately 'disadvantaged' in the complementarity ranking process, in the search for candidate Nature Reserve sites which can be more readily protected and maintained at lower 'cost', in terms of alternative uses foregone.*

*A degree of caution is appropriate in the use and interpretation of complementarity analysis, particularly as the technique is gaining popularity internationally and several of its main proponents advocate heavy dependence on it. The main disadvantage in the context of this programme arises from the use of incomplete species lists, and the risk of excluding potentially important conservation areas simply because they remain relatively unknown.*

#### Procedure:

Two separate complementarity tables are constructed, based on consideration of species belonging to the five indicator taxa, recorded in each forest. The tables are built up progressively, adding one site at a time, and calculating for each site an overall complement of species added. The overall complement, expressed in percentage terms, is derived as an average of the percentage of plants added by each forest and the percentage of animals. The animals' complement is derived by averaging the complements added for each of the four animal groups, expressed in percentage terms. Thus, in the overall assessment 50% of the recorded 'complement' of species contributed by each forest is attributable to its trees and shrubs, while 12.5% is attributed to each of the animal groups (butterflies, birds, mammals and moths).

The first complementarity table is designed to examine the optimal choice of sites based entirely on consideration of species complements. All of the country's National Parks and Forest Reserves are included in the analysis. In this case, the table starts with the richest site, to which is added the site with the most additional 'new' species not

represented in the first. A third site is then added on the basis of its contribution of 'new' species not represented in either of the two earlier sites. Additional sites are added in this way until all species known to occur in Uganda's protected area system are accounted for.

The second complementarity table represents a more pragmatic approach to site selection, in which feasibility/suitability criteria are introduced. The table is built up in five 'layers', added consecutively, as follows:

1st layer:	sites designated as National Parks.
2nd layer:	steep catchment reserves, where >50% of area is >15° slope
3rd layer:	sites classified as high Nature Reserve suitability (STEP 2)
4th layer:	sites classified as medium Nature Reserve suitability (STEP 2)
5th layer:	sites classified as low Nature Reserve suitability (STEP 2)

Within each 'layer' of the table, sites are sorted by the standard procedure, based on species complements, taking into account all species represented higher up the table.

#### Outcome:

Table 3.3. presents the results of complementarity analysis without suitability/feasibility sorting. According to this analysis, 55 sites (including nine National Parks) are required to ensure representation of all species at least once in the protected area system. Ninety percent of species can be represented in 13 sites (including 7 National Parks) and it would require only 20 sites to protect 95% of species. In this case, however, the 20 sites would include 4 major closed canopy forest reserves (Budongo, Kasyoha-Kitomi, Sango Bay and Kalinzu-Maramagambo) in addition to the major forests already (recently) gazetted as National Parks (Bwindi, Kibale, Semliki, Mt. Elgon and Rwenzori).

Table 3.4 presents the results of complementarity analysis when sites are prioritized according to legal status and Nature Reserve suitability. In this case, 77% of species are represented in nine National Parks (Mgahinga was excluded for lack of data), and almost 90% of species are represented in the 23 sites in the top two priority categories (i.e. National Parks and steep mountain catchment reserves). With sites prioritised in this way, 33 sites would be required to protect 95% of species, but only one of these (Budongo) would be a major closed-canopy forest.

#### **STEP 4. Select 'prime' sites for Nature Reserve establishment, based on their contribution to the national protected areas system**

##### Rationale and justification:

*Examination of the prioritised complementarity analysis (Table 3.4) reveals three forest sites (Otzi, Mt. Moroto and Budongo) which are distinct in contributing significantly more than any of the 'next best' sites. Even the least valuable of these three sites (Mt. Moroto, contributing 2.95% of the total complement) contributes more than twice that of the 'next best' forest (Nyangea-Napore, contributing 1.40%). The 2% contribution criterion is thus a 'natural' (although arbitrary) division, providing a clear basis to recognise the special contribution these three sites can make to a national system of protected areas. Their importance is confirmed by reference to the non-prioritised complementarity table (Table 3.3) where they appear as the only forest reserves amongst the top nine sites (the others are all National Parks) each contributing more than 3% to the total complement of species represented in the protected area system.*

##### Procedure:

This step in the selection process involves examination of the complementarity tables to identify sites which have the potential to make an outstanding contribution to national biodiversity conservation objectives. The number of sites selected as 'prime' for Nature Reserve establishment is somewhat arbitrary, depending on a minimum 2% contribution to the overall national protected area system species complement.

##### Outcome:

On this basis, Budongo, Otzi and Mt. Moroto are selected as 'prime' sites, together contributing almost 12% of species to the total protected area system complement. Together with the nine National Parks for which data are available, these forests would ensure protection of 89% of species belonging to the five indicator taxa. Of the three sites, Budongo is especially important, contributing as many species as the other two sites added together.

Table 3.3 Complementarity table for all National Parks and Forest Reserves without sorting for legal status or Nature Reserve suitability

Forest			Butterflies				Birds				Mammals				Moths				Plants				Fauna average			Combined	
Code	Name	Priority	Add	Add%	tot	tot%	Add	Add%	tot	tot%	Add	Add%	tot	tot%	Add	Add%	tot	tot%	Add	Add%	tot	tot%	Taxa	Add%	tot%	Add%	tot%
3	Budongo	4	254	34.51	254	34.5	359	37.43	359	37.4	24	26.67	24	26.7	130	62.8	130	62.8	465	47.21	465	47.2	4	40.35	40.35	43.78	43.78
70	Queen Elizabeth NP	1			254	34.5	279	29.09	638	66.5	8	8.89	32	35.6			130	62.8	91	9.24	556	56.4	2	18.99	49.85	14.11	53.15
19	Bwindi	1	76	10.33	330	44.8	90	9.38	728	75.9	17	18.89	49	54.4	23	11.1	153	73.9	82	8.32	638	64.8	4	12.43	62.28	10.38	63.52
72	Kidepo Valley NP	1			330	44.8	111	11.57	839	87.5	9	10	58	64.4			153	73.9	39	3.96	677	68.7	2	10.79	67.67	7.37	68.2
15	Semliki	1	115	15.63	445	60.5	50	5.21	889	92.7	10	11.11	68	75.6	6	2.9	159	76.8	23	2.34	700	71.1	4	8.71	76.38	5.52	73.72
6	Moroto	2	51	6.93	496	67.4	19	1.98	908	94.7	4	4.44	72	80	12	5.8	171	82.6	36	3.65	736	74.7	4	4.79	81.17	4.22	77.95
1	Mt. Elgon	1	15	2.04	511	69.4	12	1.25	920	95.9	2	2.22	74	82.2	6	2.9	177	85.5	43	4.37	779	79.1	4	2.1	83.27	3.23	81.18
17	Otzi	2	22	2.99	533	72.4	2	0.21	922	96.1	2	2.22	76	84.4	6	2.9	183	88.4	43	4.37	822	83.5	4	2.08	85.35	3.22	84.4
2	Rwenzori	1	11	1.49	544	73.9	3	0.31	925	96.5	7	7.78	83	92.2	1	0.48	184	88.9	18	1.83	840	85.3	4	2.52	87.87	2.17	86.57
11	Kasyoha - Kitomi	4	33	4.48	577	78.4	1	0.1	926	96.6			83	92.2			184	88.9	15	1.52	855	86.8	4	1.15	89.02	1.33	87.91
12	Mt. Kei	4	14	1.9	591	80.3	7	0.73	933	97.3	1	1.11	84	93.3	4	1.93	188	90.8	7	0.71	862	87.5	4	1.42	90.44	1.06	88.97
73	Lake Mburo NP	1			591	80.3	7	0.73	940	98	1	1.11	85	94.4			188	90.8	11	1.12	873	88.6	2	0.92	90.9	1.02	89.76
62	Sese Islands	4	13	1.77	604	82.1			940	98	1	1.11	86	95.6	1	0.48	189	91.3	11	1.12	884	89.7	4	0.84	91.74	0.98	90.74
7	Labwor Hills	2	7	0.95	611	83	1	0.1	941	98.1	2	2.22	88	97.8	1	0.48	190	91.8	10	1.02	894	90.8	4	0.94	92.68	0.98	91.72
20	Sango Bay	4	17	2.31	628	85.3	3	0.31	944	98.4			88	97.8	4	1.93	194	93.7	6	0.61	900	91.4	4	1.14	93.81	0.87	92.59
5	Kibale	1	11	1.49	639	86.8	1	0.1	945	98.5			88	97.8	4	1.93	198	95.7	5	0.51	905	91.9	4	0.88	94.7	0.7	93.29
21	Morongole	2	5	0.68	644	87.5			945	98.5			88	97.8			198	95.7	10	1.02	915	92.9	4	0.17	94.87	0.59	93.88
55	Echuya	2	10	1.36	654	88.9	1	0.1	946	98.6			88	97.8			198	95.7	7	0.71	922	93.6	4	0.37	95.23	0.54	94.42
22	Timu	3	7	0.95	661	89.8			946	98.6			88	97.8			198	95.7	8	0.81	930	94.4	4	0.24	95.47	0.52	94.94
4	Kalinzu - Maramagambo	5	11	1.49	672	91.3	1	0.1	947	98.7	1	1.11	89	98.9			198	95.7	3	0.3	933	94.7	4	0.68	96.15	0.49	95.43
39	Era	3			672	91.3			947	98.7	1	1.11	90	100	1	0.48	199	96.1	5	0.51	938	95.2	4	0.4	96.55	0.45	95.89
8	Nyangea - Napore	2	7	0.95	679	92.3			947	98.7			90	100			199	96.1	5	0.51	943	95.7	4	0.24	96.78	0.37	96.26
13	Mabira	5	10	1.36	689	93.6	2	0.21	949	99			90	100	2	0.97	201	97.1	1	0.1	944	95.8	4	0.63	97.42	0.37	96.63
71	Murchison Falls NP	1			689	93.6	10	1.04	959	100			90	100			201	97.1	2	0.2	946	96	2	0.52	97.68	0.36	96.86
9	Bugoma	4	11	1.49	700	95.1			959	100			90	100	2	0.97	203	98.1			946	96	4	0.62	98.29	0.31	97.17
14	Agoro - Agu	2	1	0.14	701	95.2			959	100			90	100			203	98.1	5	0.51	951	96.5	3	0.05	98.33	0.28	97.44
16	Napak	2	2	0.27	703	95.5			959	100			90	100	1	0.48	204	98.6	3	0.3	954	96.9	4	0.19	98.52	0.25	97.68

Forest			Butterflies				Birds				Mammals				Moths				Plants				Fauna average			Combined	
Code	Name	Priority	Add	Add%	tot	tot%	Add	Add%	tot	tot%	Add	Add%	tot	tot%	Add	Add%	tot	tot%	Add	Add%	tot	tot%	Taxa	Add%	tot%	Add%	tot%
60	Mpanga	5			703	95.5			959	100			90	100	1	0.48	205	99	3	0.3	957	97.2	4	0.12	98.64	0.21	97.9
56	Mafuga	2	1	0.14	704	95.7			959	100			90	100			205	99	3	0.3	960	97.5	4	0.03	98.67	0.17	98.07
57	West Bugwe	5	1	0.14	705	95.8			959	100			90	100			205	99	3	0.3	963	97.8	4	0.03	98.71	0.17	98.24
36	Aswa River	3			705	95.8			959	100			90	100			205	99	3	0.3	966	98.1	3	0	98.71	0.15	98.39
45	Zoka	4			705	95.8			959	100			90	100			205	99	3	0.3	969	98.4	4	0	98.71	0.15	98.54
18	South Busoga	3	2	0.27	707	96.1			959	100			90	100	1	0.48	206	99.5	1	0.1	970	98.5	4	0.19	98.89	0.15	98.69
53	Opit	4	2	0.27	709	96.3			959	100			90	100			206	99.5	1	0.1	971	98.6	2	0.14	98.96	0.12	98.77
25	Kasagala	3	1	0.14	710	96.5			959	100			90	100			206	99.5	2	0.2	973	98.8	4	0.03	99	0.12	98.89
23	Kagombe	5	3	0.41	713	96.9			959	100			90	100			206	99.5	1	0.1	974	98.9	4	0.1	99.1	0.1	98.99
32	Rwoho	2	3	0.4076	716	97.3			959	100			90	100			206	99.5	1	0.1015	975	99	4	0.1	99.2	0.1	99.09
24	Rom	2			716	97.3			959	100			90	100			206	99.5	2	0.2	977	99.2	4	0	99.2	0.1	99.19
46	Mujuzi	5			716	97.3			959	100			90	100			206	99.5	2	0.2	979	99.4	4	0	99.2	0.1	99.3
41	Kijanabolola	4	1	0.14	717	97.4			959	100			90	100			206	99.5	1	0.1	980	99.5	3	0.05	99.23	0.07	99.36
64	Jubiya	4	4	0.54	721	98			959	100			90	100			206	99.5			980	99.5	4	0.14	99.37	0.07	99.43
35	Itwara	4	1	0.14	722	98.1			959	100			90	100			206	99.5	1	0.1	981	99.6	4	0.03	99.4	0.07	99.5
58	Igwe - Luvunya	5	1	0.14	723	98.2			959	100			90	100			206	99.5	1	0.1	982	99.7	4	0.03	99.44	0.07	99.57
61	Mpigi	5	1	0.14	724	98.4			959	100			90	100			206	99.5	1	0.1	983	99.8	4	0.03	99.47	0.07	99.63
63	Zika	5			724	98.4			959	100			90	100	1	0.48	207	100			983	99.8	4	0.12	99.59	0.06	99.69
49	Ogili	2			724	98.4			959	100			90	100			207	100	1	0.1	984	99.9	3	0	99.59	0.05	99.75
30	Kibeka	4			724	98.4			959	100			90	100			207	100	1	0.1	985	100	4	0	99.59	0.05	99.8
37	Kabuika - Mujiwalanganda	3	2	0.27	726	98.6			959	100			90	100			207	100			985	100	4	0.07	99.66	0.03	99.83
48	Matiri	4	2	0.27	728	98.9			959	100			90	100			207	100			985	100	4	0.07	99.73	0.03	99.86
50	Kitechura	4	2	0.27	730	99.2			959	100			90	100			207	100			985	100	4	0.07	99.8	0.03	99.9
54	Nsowe	4	2	0.27	732	99.5			959	100			90	100			207	100			985	100	4	0.07	99.86	0.03	99.93
28	Bukaleba	5	1	0.14	733	99.6			959	100			90	100			207	100			985	100	3	0.05	99.9	0.02	99.95
10	Kadam	2	1	0.14	734	99.7			959	100			90	100			207	100			985	100	4	0.03	99.93	0.02	99.97
47	Lwala	2	1	0.14	735	99.9			959	100			90	100			207	100			985	100	4	0.03	99.97	0.02	99.98
51	Bwezigola - Gunga	5	1	0.14	736	100			959	100			90	100			207	100			985	100	4	0.03	100	0.02	100

Table 3.4 Complementarity table for all National Parks and Forest Reserves sorted according to legal status and Nature Reserve suitability class

Forest			Butterflies				Birds				Mammals				Moths				Plants				Fauna average		Combined	
Code	Name	Priority	Add	Add%	tot	tot%	Add	Add%	tot	tot%	Add	Add%	tot	tot%	Add	Add%	tot	tot%	Add	Add%	tot	tot%	Add%	tot%	Add%	tot%
15	Semliki NP	1	309	41.98	309	41.98	435	45.36	435	45.36	31	33.7	31	33.7	81	39.13	81	39.13	336	34.11	336	34.11	40.04	40.04	37.08	37.08
72	Kidepo Valley NP	1			309	41.98	263	27.42	698	72.78	12	13.04	43	46.74			81	39.13	89	9.04	425	43.15	20.23	50.16	14.63	46.65
19	Bwindi NP	1	76	10.33	385	52.31	75	7.82	773	80.61	18	19.57	61	66.3	36	17.39	117	56.52	115	11.68	540	54.82	13.78	63.94	12.73	59.38
70	Queen Elizabeth NP	1			385	52.31	98	10.22	871	90.82	2	2.17	63	68.48			117	56.52	65	6.6	605	61.42	6.2	67.03	6.4	64.23
1	Mt Elgon NP	1	25	3.4	410	55.71	15	1.56	886	92.39	5	5.43	68	73.91	14	6.76	131	63.29	61	6.19	666	67.61	4.29	71.32	5.24	69.47
2	Rwenzori NP	1	12	1.63	422	57.34	3	0.31	889	92.7	8	8.7	76	82.61	5	2.42	136	65.7	21	2.13	687	69.75	3.26	74.59	2.7	72.17
5	Kibale NP	1	35	4.76	457	62.09	4	0.42	893	93.12	1	1.09	77	83.7	18	8.7	154	74.4	12	1.22	699	70.96	3.74	78.33	2.48	74.65
71	Murchison Falls NP	1			457	62.09	19	1.98	912	95.1	0	0	77	83.7			154	74.4	18	1.83	717	72.79	0.99	78.82	1.41	75.81
73	Lake Mburo NP	1			457	62.09	6	0.63	918	95.72	1	1.09	78	84.78			154	74.4	19	1.93	736	74.72	0.86	79.25	1.39	76.98
17	Otzi	2	44	5.98	501	68.07	1	0.1	919	95.83	4	4.35	82	89.13	12	5.8	166	80.19	49	4.97	785	79.7	4.06	83.31	4.52	81.5
6	Mt Moroto	2	37	5.03	538	73.1	17	1.77	936	97.6	3	3.26	85	92.39	12	5.8	178	85.99	19	1.93	804	81.62	3.96	87.27	2.95	84.45
8	Nyangea-Napore	2	14	1.9	552	75	1	0.1	937	97.71	2	2.17	87	94.57	2	0.97	180	86.96	15	1.52	819	83.15	1.29	88.56	1.4	85.85
21	Morongole	2	4	0.54	556	75.54	0	0	937	97.71	0	0	87	94.57	0	0	180	86.96	12	1.22	831	84.37	0.14	88.69	0.68	86.53
14	Agoro-Agu	2	2	0.27	558	75.82	0	0	937	97.71	0	0	87	94.57			180	86.96	12	1.22	843	85.58	0.09	88.76	0.65	87.17
7	Labwor Hills	2	8	1.09	566	76.9	1	0.1	938	97.81	1	1.09	88	95.65	0	0	180	86.96	5	0.51	848	86.09	0.57	89.33	0.54	87.71
55	Echuya	2	9	1.22	575	78.13	1	0.1	939	97.91	0	0	88	95.65	0	0	180	86.96	6	0.61	854	86.7	0.33	89.66	0.47	88.18
24	Rom	2	3	0.41	578	78.53	0	0	939	97.91	0	0	88	95.65	0	0	180	86.96	7	0.71	861	87.41	0.1	89.76	0.41	88.59
56	Mafuga	2	2	0.27	580	78.8	0	0	939	97.91	0	0	88	95.65	1	0.48	181	87.44	6	0.61	867	88.02	0.19	89.95	0.4	88.99
16	Napak	2	3	0.41	583	79.21	0	0	939	97.91	0	0	88	95.65	2	0.97	183	88.41	2	0.2	869	88.22	0.34	90.3	0.27	89.26
32	Rwoho	2	6	0.82	589	80.03	0	0	939	97.91	0	0	88	95.65			183	88.41	2	0.2	871	88.43	0.27	90.5	0.24	89.46
10	Kadam	2	2	0.27	591	80.3	0	0	939	97.91	0	0	88	95.65	0	0	183	88.41	3	0.3	874	88.73	0.07	90.57	0.19	89.65
49	Ogili	2	0	0	591	80.3	0	0	939	97.91	0	0	88	95.65			183	88.41	1	0.1	875	88.83	0	90.57	0.05	89.7
47	Lwala	2	1	0.14	592	80.43	0	0	939	97.91	0	0	88	95.65	0	0	183	88.41	0	0	875	88.83	0.03	90.6	0.02	89.72
18	South Busoga	3	7	0.95	599	81.39	0	0	939	97.91	0	0	88	95.65	5	2.42	188	90.82	2	0.2	877	89.04	0.84	91.44	0.52	90.24
39	Era	3	1	0.14	600	81.52	0	0	939	97.91	1	1.09	89	96.74	1	0.48	189	91.3	5	0.51	882	89.54	0.43	91.87	0.47	90.71
22	Timu	3	7	0.95	607	82.47	0	0	939	97.91	0	0	89	96.74	0	0	189	91.3	6	0.61	888	90.15	0.24	92.11	0.42	91.13
36	Aswa River	3	1	0.14	608	82.61	0	0	939	97.91	0	0	89	96.74			189	91.3	3	0.3	891	90.46	0.05	92.14	0.17	91.3
25	Kasagala	3	2	0.27	610	82.88	1	0.1	940	98.02	0	0	89	96.74	0	0	189	91.3	2	0.2	893	90.66	0.09	92.24	0.15	91.45
40	Maruzi Hills	3	1	0.14	611	83.02	0	0	940	98.02	0	0	89	96.74	0	0	189	91.3	1	0.1	894	90.76	0.03	92.27	0.07	91.52

Forest			Butterflies				Birds				Mammals				Moths				Plants				Fauna average		Combined	
Code	Name	Priority	Add	Add%	tot	tot%	Add	Add%	tot	tot%	Add	Add%	tot	tot%	Add	Add%	tot	tot%	Add	Add%	tot	tot%	Add%	tot%	Add%	tot%
37	Kabuika-Muj.	3	3	0.41	614	83.42	0	0	940	98.02	0	0	89	96.74	0	0	189	91.3	0	0	894	90.76	0.1	92.37	0.05	91.57
44	Kamusenene	3	1	0.14	615	83.56	0	0	940	98.02	0	0	89	96.74			189	91.3	0	0	894	90.76	0.05	92.41	0.02	91.58
3	Budongo	4	20	2.72	635	86.28	10	1.04	950	99.06	0	0	89	96.74	7	3.38	196	94.69	46	4.67	940	95.43	1.79	94.19	3.23	94.81
62	Sesse Islands	4	8	1.09	643	87.36	0	0	950	99.06	1	1.09	90	97.83	1	0.48	197	95.17	11	1.12	951	96.55	0.66	94.86	0.89	95.7
12	Mt Kei	4	11	1.49	654	88.86	4	0.42	954	99.48	1	1.09	91	98.91	2	0.97	199	96.14	5	0.51	956	97.06	0.99	95.85	0.75	96.45
20	Sango Bay	4	15	2.04	669	90.9	2	0.21	956	99.69	0	0	91	98.91	2	0.97	201	97.1	5	0.51	961	97.56	0.8	96.65	0.66	97.11
11	Kasyoha-Kitomi	4	17	2.31	686	93.21	1	0.1	957	99.79	0	0	91	98.91	0	0	201	97.1	4	0.41	965	97.97	0.6	97.25	0.5	97.61
9	Bugoma	4	12	1.63	698	94.84	1	0.1	958	99.9	0	0	91	98.91	2	0.97	203	98.07	0	0	965	97.97	0.68	97.93	0.34	97.95
45	Zoka	4	0	0	698	94.84	0	0	958	99.9	0	0	91	98.91	0	0	203	98.07	3	0.3	968	98.27	0	97.93	0.15	98.1
53	Opit	4	2	0.27	700	95.11			958	99.9			91	98.91	0	0	203	98.07	1	0.1	969	98.38	0.14	98	0.12	98.19
41	Kijanabolola	4	1	0.14	701	95.24	0	0	958	99.9	0	0	91	98.91			203	98.07	1	0.1	970	98.48	0.05	98.03	0.07	98.25
64	Jubiya	4	4	0.54	705	95.79	0	0	958	99.9	0	0	91	98.91	0	0	203	98.07	0	0	970	98.48	0.14	98.17	0.07	98.32
35	Itwara	4	1	0.14	706	95.92	0	0	958	99.9	0	0	91	98.91	0	0	203	98.07	1	0.1	971	98.58	0.03	98.2	0.07	98.39
50	Kitechura	4	3	0.41	709	96.33	0	0	958	99.9	0	0	91	98.91	0	0	203	98.07	0	0	971	98.58	0.1	98.3	0.05	98.44
30	Kibeka	4	0	0	709	96.33	0	0	958	99.9	0	0	91	98.91	0	0	203	98.07	1	0.1	972	98.68	0	98.3	0.05	98.49
54	Nsowe	4	2	0.27	711	96.6	0	0	958	99.9	0	0	91	98.91	0	0	203	98.07	0	0	972	98.68	0.07	98.37	0.03	98.53
48	Matiri	4	2	0.27	713	96.88	0	0	958	99.9	0	0	91	98.91	0	0	203	98.07	0	0	972	98.68	0.07	98.44	0.03	98.56
4	Kalinzu-Maramagambo	5	9	1.22	722	98.1	0	0	958	99.9	1	1.09	92	100	0	0	203	98.07	3	0.3	975	98.98	0.58	99.02	0.44	99
13	Mabira	5	6	0.82	728	98.91	1	0.1	959	100	0	0	92	100	2	0.97	205	99.03	1	0.1	976	99.09	0.47	99.49	0.29	99.29
57	West Bugwe	5	1	0.14	729	99.05	0	0	959	100	0	0	92	100	0	0	205	99.03	3	0.3	979	99.39	0.03	99.52	0.17	99.46
60	Mpanga	5	0	0	729	99.05	0	0	959	100	0	0	92	100	1	0.48	206	99.52	2	0.2	981	99.59	0.12	99.64	0.16	99.62
23	Kagombe	5	3	0.41	732	99.46	0	0	959	100	0	0	92	100	0	0	206	99.52	1	0.1	982	99.7	0.1	99.74	0.1	99.72
46	Mujuzi	5	0	0	732	99.46	0	0	959	100	0	0	92	100	0	0	206	99.52	2	0.2	984	99.9	0	99.74	0.1	99.82
61	Mpigi group	5	1	0.14	733	99.59	0	0	959	100	0	0	92	100	0	0	206	99.52	1	0.1	985	100	0.03	99.78	0.07	99.89
63	Zika	5	0	0	733	99.59	0	0	959	100	0	0	92	100	1	0.48	207	100	0	0	985	100	0.12	99.9	0.06	99.95
28	Bukaleba	5	1	0.14	734	99.73	0	0	959	100	0	0	92	100			207	100	0	0	985	100	0.05	99.93	0.02	99.97
58	Igwe-Luvunya	5	1	0.14	735	99.86	0	0	959	100	0	0	92	100	0	0	207	100	0	0	985	100	0.03	99.97	0.02	99.98
51	Bwezigolo-Gunga	5	1	0.14	736	100	0	0	959	100	0	0	92	100	0	0	207	100	0	0	985	100	0.03	100	0.02	100

**STEP 5. Select ‘core’ forest sites for Nature Reserve establishment, based on the occurrence of ‘concentrations’ of species not found elsewhere.**Rationale and justification:

*A strategy aimed at protection of all of Uganda’s biodiversity would ideally ensure that each species is represented at least once in the country’s system of protected areas. On this basis it is possible to compile a list of the minimum critical set of sites required to protect all species. Inevitably, such a list would include all sites which are the only known locality for at least one species.*

*In practice, the majority of the forests sampled under the programme support at least one species found in no other Ugandan protected area, and it is useful to distinguish sites where there is a concentration of unique species, and sites that support unique species of (possible) conservation concern. Accordingly a subset of sites from the ‘minimum critical set’, is identified in which at least 1% of the species within any taxon are unique to the forest concerned. The 1% criterion is, of course, an arbitrary threshold, meaning that a site would need to support at least 10 species of trees, 8 butterflies, 10 birds, 1 mammal or 3 moths found nowhere else in order to qualify.*

*Forests with such a concentration of unique species will inevitably appear near the top of a complementarity table and it may at first appear unnecessary to distinguish this step from step 6 (below) in which complementarity analysis is used to select further ‘core’ sites on the basis of contributing 1% of species within any taxon. However, by selecting sites with at least 1% of unique species initially, and moving these up the complementarity table, it may be possible to reduce the number of additional core sites required, because some of the species these additional sites would have ‘contributed’ are now represented in the forests with the concentrations of unique species.*

Procedure:

A minimum critical sites matrix is compiled by listing each site and the number of species of each taxon that are unique to it. The species lists that are used to compile this matrix are examined so as to distinguish those that are of possible conservation concern, based on known distributions. Species that are restricted to the Afrotropical or Somalia-Masai regional centres of endemism are distinguished, alongside those that are more narrowly endemic to Uganda or the Albertine Rift region.

Outcome:

The minimum critical sites matrix is presented as Table 3.5 and the locations of the 52 forests which make up the ‘critical set’ are shown in Fig. 3.1. Of the 65 forests that were sampled only 13 had no unique species, an important observation with obvious implications for protected area system design.

Twelve sites support concentrations of unique species, accounting for at least 1% of Uganda’s protected area total within any taxon. These sites are: Mt. Elgon, Rwenzori, Budongo, Kalinzu-Maramagambo, Mt. Moroto, Kasyoha-Kitomi, Mt. Kei, Semliki, Bwindi, Sango Bay, Era and the Sesse Islands. Of these twelve, seven sites have concentrations of unique species in more than one taxon, and Semliki and Mt. Moroto are notable for having more than 1% unique species in four of the five taxa.

Based on this analysis, six sites are selected at this stage as ‘core’ forests for Nature Reserve establishment, namely: Mt. Kei, Sesse Islands, Kalinzu-Maramagambo, Sango Bay, Era and Kasyoha-Kitomi.



Table 3.5 Numbers of species within each taxonomic group unique to each forest, and their conservation significance

Forest	Trees			Butterflies			Birds			Mammals			Moths		
	Conserv. sign. spp.		All spp. (incl. endemics)	Conserv. sign. spp.		All spp. (incl. endemics)	Conserv. sign. spp.		All spp. (incl. endemics)	Conserv. sign. spp.		All spp. (incl. endemics)	Conserv. sign. spp.		All spp. (incl. endemics)
	AM/SM endemics	Ug/AR endemics		AM/SM endemics	Ug/AR endemics		AM/SM endemics	Ug/AR endemics		AM/SM endemics	Ug/AR endemics		AM/SM endemics	Ug/AR endemics	
<b>Mt Elgon</b>	8	0	18	0	0	1	4	0	5	0	0	1	2	0	3
<b>Rwenzori</b>	3	0	10	1	0	2	2	0	3	0	5	5	0	0	0
<b>Budongo</b>	3	1	32	0	0	2	1	0	4	0	0	0	0	0	4
<b>Kalinzu-M</b>	0	0	2	1	2	9	0	0	0	0	0	1	0	0	0
<b>Kibale</b>	0	0	3	0	0	2	0	1	1	0	0	0	0	0	1
<b>Mt Moroto</b>	1	0	3	7	0	9	7	0	13	2	0	3	4	0	8
<b>Labwor</b>	2	0	4	0	0	3	0	0	1	0	0	0	0	0	0
<b>Nyangae</b>	3	0	4	1	0	4	0	0	0	0	0	0	0	0	0
<b>Bugoma</b>	0	0	0	0	0	7	0	0	0	0	0	0	0	0	2
<b>Mt Kadam</b>	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0
<b>Kasyoha</b>	1	0	3	1	0	11	0	0	1	0	0	0	0	0	0
<b>Mt Kei</b>	0	0	3	1	0	7	2	0	4	0	0	1	0	0	2
<b>Mabira</b>	1	0		0	0	6	0	0	1	0	0	0	0	0	1
<b>Agoro-Agu</b>	4	0	7	0	0	0	0	0	0	0	0	0	0	0	0
<b>Semliki</b>	1	0	6	0	1	34	0	1	37	0	0	1	0	0	3
<b>Mt Napak</b>	0	0	2	0	0	2	0	0	0	0	0	0	1	0	1
<b>Otzi</b>	2	0	7	1	0	3	0	0	0	0	0	0	0	0	0
<b>S.Busoga</b>	1	0	2	0	0	2	0	0	0	0	0	0	0	0	1
<b>Bwindi</b>	1	0	6	1	6	10	0	4	9	0	0	1	0	1	1
<b>Sango Bay</b>	0	0	3	0	1	8	1	0	2	0	0	0	0	0	1
<b>Morongole</b>	2	0	8	1	0	2	0	0	0	0	0	0	0	0	0
<b>Timu</b>	5	0	6	2	0	5	0	0	0	0	0	0	0	0	0
<b>Kagombe</b>	0	0	1	0	0	3	0	0	0	0	0	0	0	0	0
<b>Rom</b>	1	0	3	0	0	0	0	0	0	0	0	0	0	0	0
<b>Kasagala</b>	1	0	2	0	0	1	0	0	0	0	0	0	0	0	0
<b>Bukaleba</b>	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0

Forest	Trees			Butterflies			Birds			Mammals			Moths		
	Conserv. sign. spp.		All spp. (incl. endemics)	Conserv. sign. spp.		All spp. (incl. endemics)	Conserv. sign. spp.		All spp. (incl. endemics)	Conserv. sign. spp.		All spp. (incl. endemics)	Conserv. sign. spp.		All spp. (incl. endemics)
	AM/SM endemics	Ug/AR endemics		AM/SM endemics	Ug/AR endemics		AM/SM endemics	Ug/AR endemics		AM/SM endemics	Ug/AR endemics		AM/SM endemics	Ug/AR endemics	
Rwoho	1	0	1	0	0	3	0	0	0	0	0	0	0	0	0
Itwara	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0
Aswa R.	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
Kabuika	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0
<b>Era</b>	1	0	3	0	0	0	0	0	0	0	0	1	0	0	1
Maruzi	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
Kijanabolola	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0
Zoka	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0
Mujuzi	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
Lwala	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0
Matiri	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Ogili	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Kitechura	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0
Bwezig-G	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Kasana-K	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
Opit	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0
Nsowe	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0
Echuya	2	1	5	1	2	4	0	0	1	0	0	0	0	0	0
Mafuga	0	2	3	1	0	1	0	0	0	0	0	0	0	0	0
West Bugwe	1	0	2	0	0	1	0	0	0	0	0	0	0	0	0
Igwe-Luvunya	0	0	1	0	1	1	0	0	0	0	0	0	0	0	0
Mpanga	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
Mpigi	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0
<b>Sesse</b>	0	0	8	0	1	3	0	0	0	0	1	1	0	0	1
Jubiya	0	0	0	1	1	3	0	0	0	0	0	0	0	0	0
Lokung	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0

18

figures in bold boxes denote totals exceeding 1% of species known from PA system

4

figures in light boxes denote totals representing 0.5 - 1% of species known from PA system

**Forests** shown in bold type qualify as 'core' forests for Nature Reserve establishment

AM/SM endemics - denotes Afromontane or Somalia-Masai endemics

Ug/AR endemics - denotes Uganda and/or Albertine Rift endemics



**STEP 6. Select additional ‘core’ forests for Nature Reserve establishment, based on their contribution to the national protected areas system***Rationale and justification:*

*The addition of these six ‘core’ sites brings the total number of sites (at this stage) to eighteen, including nine National Parks and nine Forest Reserves. Collectively these 18 sites support 93.6% of species represented in the entire protected area system. Step 6 therefore aims to identify sites that can add significantly to this total.*

*Procedure:*

A new complementarity analysis is carried out with sites at the top of the table arranged according to the sequence of their selection, and remaining unselected sites are examined to see which can contribute more than 1% of additional species within any taxon. These sites are then selected as additional ‘core’ forests and added to the table in the established way, calculating the average % added as the mean for all animals groups and for tree and shrubs.

*Outcome:*

The new complementarity table is presented as Table 3.6, and includes five additional sites selected as ‘core’ forests on the basis of adding at least 1% of species within at least one taxon. These are: Labwor Hills, Nyangea-Napore, Echuya, Bugoma and Mabira. Of these sites, only Labwor Hills exceeds the 1% threshold for more than one taxon, and the other four sites are all selected on the basis of their known butterfly faunas. The overall contributions of these sites to species complements is relatively minor, none of them reaching the 1% threshold overall. Collectively the five sites contribute 2.6% of the protected area total and increase the proportion of species represented (in 23 sites) to 96.2%.

**STEP 7. Based on the list of sites selected so far, assess the potential for equivalent/alternative sites where Nature Reserve status seems inappropriate.***Rationale and justification:*

*Although every possible effort has been made in the design of the site selection procedure to exclude sites where potential land-use conflicts would make Nature Reserve establishment difficult, some such sites have inevitably been included in the list of ‘prime’ and ‘core’ forests, because of the species represented at those sites. Since they have been selected on the basis of clearly defined criteria, it would obviously be best to establish Nature Reserves accordingly. However, it may also be beneficial to look for alternative ‘next-best’ sites which could, if necessary be used as ‘substitute’ areas for Nature Reserve establishment. Any decision over whether or not to use such substitutes would be a largely pragmatic, political decision, and with the information now available the consequences from a biodiversity perspective would be reasonably informed.*

*Procedure:*

Cluster analysis is used to sort all the protected areas into groups of similar sites based on species composition within each of the five indicator taxa. For the purposes of this analysis the TWINSpan procedure is used.

*Outcome:*

Dendrograms showing the relationships between sites based on this analysis are presented as Appendix 6 for each of the five taxa. The use of these dendrograms is illustrated by reference to the position of Kalinzu-Maramagambo and Mabira, since both these sites were classified as low ‘Nature Reserve suitability’ and might be possible candidates for substitution. Kalinzu-Maramagambo is grouped with 3-6 other forests depending on which taxon is considered. It is not grouped with any other forest consistently across all taxa, but is placed in the same group as Kasyoha-Kitomi and Kibale for four taxa, and these would therefore appear to be the best substitutes. Mabira is grouped with 4-9 other forests, and occurs most frequently alongside Bugoma (4 taxa) or Budongo, Kibale, Kagombe and Kalinzu-Maramagambo (3 taxa). Thus Bugoma would be the best substitute in this case.

Of the 14 forests selected as ‘prime’ and ‘core’ sites for Nature Reserve establishment, only the two mentioned above are classified as ‘low’ Nature Reserve suitability. In both these cases, there would appear to be realistic prospects of establishing appropriate Nature Reserves and substitution does not seem necessary.

The most problematic of the 14 selected forest sites are likely to be Budongo, the Sesse Islands and Echuya. In the case of Budongo, more than 80% of the forest has been logged and the prospects of protecting a substantial intact area are therefore rather limited, whilst both Sesse and Echuya are very small and heavily used. Examination of

TWINSPAN groupings for these forests suggest that Bugoma would be the best ‘substitute’ for Budongo; Jubiya might substitute for Sesse; and Rwenzori would be the closest substitute for Echuya. However it must be emphasised that in all cases there are significant differences between these sites, and such options should only be taken as a last resort.

**STEP 8. Select ‘secondary’ forest sites for Nature Reserve establishment, based on the occurrence of ‘significant’ species not found elsewhere.**

Rationale and justification:

*With 96.2% of species represented in the 9 National Parks and 14 forests already selected as ‘prime’ and ‘core’ sites, the contribution of remaining sites to the achievement of national biodiversity conservation objectives is obviously rather limited. Nevertheless, Uganda is committed (under the Biodiversity Convention) to protect all the country’s biodiversity, and this requires that additional sites are selected to ensure representation of the remaining 3.8% of species in the protected area system.*

*As previously (steps 5-6), there is justification in selecting sites with significant numbers of unique species prior to ones which contribute more widespread species as a result of complementarity analysis.*

Procedure:

This step involves re-examination of the minimum critical sites matrix compiled earlier (STEP 5, Table 3.5). The first batch of ‘secondary’ sites is added on the basis of having at least 0.5% of species within any taxon uniquely represented; and the second batch is added on the basis of having at least one species found nowhere else in Uganda’s protected areas that might be internationally threatened on account of its limited distribution (qualifying species are thought to be endemic to Uganda, the Albertine Rift, Afromontane or Somalia-Masai regional centres).

Outcome:

Three sites (Agoro-Agu, Morongole, Timu) qualify as ‘secondary’ Nature Reserves on the basis of having significant numbers of unique trees and shrubs (and butterflies in Timu’s case) (Table 3.5).

A further 15 sites support at least one unique species classified as ‘conservation significant’. These are: Mt. Kadam, Napak, South Busoga, Rom, Kasagala, Rwoho, Itwara, Kyalwamuka, Lwala, Mafuga, West Bugwe, Igwe-Luvunya, Mpigi group, Jubiya and Lokung (Table 3.5).

Table 3.6 Complementarity table for all National Parks and Forest Reserves qualifying as 'prime' and 'core' sites

Forest		Butterflies				Birds				Mammals				Moths				Plants				Fauna average			Combined	
Code	Name	Add	Add%	tot	tot%	Add	Add%	tot	tot%	Add	Add%	tot	tot%	Add	Add%	tot	tot%	Add	Add%	tot	tot%	Taxa	Add%	tot%	Add%	tot%
15	Semliki	309	41.98	309	42.0	435	45.36	435	45.4	31	34.44	31	34.4	81	38.94	81	38.9	336	34.11	336	34.1	4	40.18	40.18	37.15	37.15
72	Kidepo Valley NP			309	42.0	263	27.42	698	72.8	12	13.33	43	47.8			81	38.9	89	9.04	425	43.1	2	20.38	50.37	14.71	46.76
19	Bwindi	76	10.33	385	52.3	75	7.82	773	80.6	18	20.	61	67.8	36	17.31	117	56.3	115	11.68	540	54.8	4	13.86	64.24	12.77	59.53
70	Queen Elizabeth NP			385	52.3	98	10.22	871	90.8	2	2.22	63	70.0			117	56.3	65	6.6	605	61.4	2	6.22	67.35	6.41	64.38
1	Mt. Elgon	25	3.4	410	55.7	15	1.56	886	92.4	5	5.56	68	75.6	14	6.73	131	63.0	61	6.19	666	67.6	4	4.31	71.66	5.25	69.64
2	Rwenzori	12	1.63	422	57.3	3	0.31	889	92.7	8	8.89	76	84.4	5	2.4	136	65.4	21	2.13	687	69.7	4	3.31	74.97	2.72	72.36
5	Kibale	35	4.76	457	62.1	4	0.42	893	93.1			76	84.4	18	8.65	154	74.0	12	1.22	699	71.0	4	3.46	78.42	2.34	74.69
71	Murchison Falls NP			457	62.1	19	1.98	912	95.1			76	84.4			154	74.0	18	1.83	717	72.8	2	0.99	78.92	1.41	75.86
73	Lake Mburo NP			457	62.1	6	0.63	918	95.7	1	1.11	77	85.6			154	74.0	19	1.93	736	74.7	2	0.87	79.35	1.40	77.04
3	Budongo	46	6.25	503	68.3	11	1.15	929	96.9	2	2.22	79	87.8	21	10.1	175	84.1	71	7.21	807	81.9	4	4.93	84.28	6.07	83.11
17	Otzi	35	4.76	538	73.1	1	0.1	930	97.0	2	2.22	81	90.0	6	2.88	181	87.0	40	4.06	847	86.0	4	2.49	86.77	3.28	86.38
6	Moroto	31	4.21	569	77.3	17	1.77	947	98.7	3	3.33	84	93.3	10	4.81	191	91.8	17	1.73	864	87.7	4	3.53	90.30	2.63	89.01
12	Mt. Kei	16	2.17	585	79.5	5	0.52	952	99.3	1	1.11	85	94.4	4	1.92	195	93.8	8	0.81	872	88.5	4	1.43	91.74	1.12	90.13
62	Sese Islands	12	1.63	597	81.1			952	99.3	1	1.11	86	95.6	1	0.48	196	94.2	14	1.42	886	89.9	4	0.81	92.54	1.11	91.25
20	Sango Bay	15	2.04	472	83.2	2	0.21	954	99.5			86	95.6	3	1.45	199	95.7	5	0.51	891	90.5	4	0.92	93.47	0.72	91.96
11	Kasyoha - Kitomi	20	2.72	492	85.9	1	0.1	955	99.6			86	95.6			199	95.7	7	0.71	898	91.2	4	0.71	94.17	0.71	92.67
4	Kalinzu - Maramagambo	12	1.63	504	87.5			955	99.6	1	1.09	87	96.6			199	95.7	3	0.3	901	91.5	4	0.68	94.85	0.49	93.16
39	Era	2	0.27	506	87.8			955	99.6	1	1.09	88	97.7	1	0.48	200	96.2	5	0.51	906	92.	4	0.46	95.31	0.48	93.65
7	Labwor Hills	5	0.68	511	88.5	1	0.1	956	99.7	2	2.17	90	99.9			200	96.2	10	1.02	916	93.	4	0.74	96.05	0.88	94.52
8	Nyangea - Napore	10	1.36	521	89.8			956	99.7			90	99.9			200	96.2	8	0.81	924	93.8	4	0.34	96.39	0.58	95.10
55	Echuya	9	1.22	530	91.	1	0.1	957	99.8			90	99.9			200	96.2	6	0.61	930	94.4	4	0.33	96.72	0.47	95.57
13	Mabira	10	1.36	540	92.4	2	0.21	959	100.			90	99.9	2	0.97	202	97.1	1	0.1	931	94.5	4	0.63	97.36	0.37	95.94
9	Bugoma	11	1.49	551	93.9			959	100.			90	99.9	2	0.97	204	98.1			931	94.5	4	0.62	97.97	0.31	96.24

**STEP 9. Select additional ‘secondary’ forest sites for Nature Reserve establishment, based on the occurrence of vegetation types not otherwise represented.****Rationale and justification:**

*Biodiversity is represented at genetic, species and ecosystem level, and all three should (ideally) be taken into account in evaluating sites for biodiversity conservation. The emphasis in this analysis is given to consideration of importance for species conservation (see Chapter 2 for rationale), but it should also be recognised that similar suites of species may be represented in quite different proportions and combinations at different sites, giving different habitats their own unique and distinctive character. It is the complex of ecological interactions between species which provides natural ecosystems with inherent resilience and ability to adapt to environmental change, whether natural or man-made. Thus it is important to maximise the range of habitats, as well as species, represented in the national protected areas network.*

*This step serves as a ‘final check’ to ensure that the sites selected on species-based criteria are truly representative and comprehensive. There are three reasons why this may not be so:*

- a few vegetation types were not sampled during the inventory programme (because of insecurity and inaccessibility in places like Zulia) so no opportunity has been provided to select sites representing these types;*
- some of the less widespread vegetation types were under-sampled and characteristic species may not have been recorded from the sites concerned; and*
- some vegetation types may not be represented in the sites already selected because they have no unique species, and the species that occur are represented by larger, richer sites. They may nevertheless be highly distinctive vegetation types ecologically, such as certain mono-specific forest associations.*

**Procedure:**

The analysis is based on representation of the 92 vegetation types recognised by Langdale-Brown *et al.* (1964) in Uganda’s protected areas, including National Parks, Wildlife Reserves (excluding those of Karamoja, considered too heavily degraded to warrant consideration as protected areas) and Forest Reserves. A comprehensive matrix of vegetation types represented in each protected area was prepared at the start of the inventory programme (to select sites for inclusion in the programme, Chapter 2) and this matrix is re-examined at this stage. Each vegetation type represented by more than 50 km<sup>2</sup> within a National Park or Game Reserve is considered to be adequately represented, and all other vegetation types are considered as potential candidates for representation within forest Nature Reserves. A (sub) matrix is prepared, showing the areas of each of the under-represented vegetation types in Forest Reserves. Vegetation types which occur in any of the forests already selected on species-based criteria are identified for protection within those reserves, and the representation of other vegetation types in remaining unselected reserves is examined so that appropriate additional sites can be chosen.

Where an under-represented vegetation type occurs in more than one unselected forest, preference is given in the first instance to whichever site has most under-represented vegetation types. Where the choice is between a number of sites with the same number of under-represented vegetation types, the site with the largest area of the required type (within a single reserve) is selected. Where there is still a choice because several candidate sites have the same or similar areas of a required vegetation type, the site with the highest Nature Reserve suitability score is taken.

**Outcome:**

The areas of 32 vegetation types in Uganda's forest reserves that are not represented (or are under-represented) in the country's National Parks or Wildlife Reserves are provided in Table 3.7. Altogether 45 forests support at least one of these vegetation types, of which 22 forests have already been selected for Nature Reserve establishment on species-based criteria. These 22 forests account for 21 of the 32 under-represented vegetation types. The remaining 11 vegetation types might be protected by the addition of Zulia (which represents 6 types; N10, N12, Q7, R1, S1 and V5), Taala (protecting type N), Kyambogo (type W), Wabisi-Wajala (types V and W5), Ogili (type J2) and Kitechura (type X2). However, it should be noted that several of these sites present particular challenges from a management point of view, including insecurity and inaccessibility (Zulia), intensive long-term encroachment (Kyambogo) and army annexation (Wabisi-Wajala). Wabisi-Wajala could be substituted by Maruzi Hills and Kamusenene, but Zulia and Kyambogo represent vegetation types not found elsewhere in the protected area system.

**STEP 10. Select additional 'secondary' forests for Nature Reserve establishment, based on their contribution to the national protected areas system****Rationale and justification:**

*This final stage of the site selection process is intended to ensure inclusion of as many as possible of the remaining unrepresented species, by adding sites with significant numbers of species to contribute. An arbitrary minimum contribution threshold of 0.5% of the protected area system total within any taxon seems appropriate, equivalent to 5 species of tree/shrubs, 4 butterflies, 5 birds or 2 moths. To include sites with fewer additional species would appear unjustifiably inefficient in terms of anticipated site management costs.*

**Procedure:**

The complementarity table compiled at STEP 6 (Table 3.6) is continued with the addition of sites selected under STEPS 8 and 9, and any remaining sites that can contribute at least 0.5% of species within any taxon are added. These sites are then selected for designation of additional minor Nature Reserves.

**Outcome:**

The completed complementarity table, listing all sites selected during STEPS 4-10, and their respective contributions to the overall complement of species, is presented as Table 3.8. Forests were added at the final stage of the process, namely A, B and C.

**STEP 11. Allocate areas for designation as Nature Reserves and Buffer Zones.****Rationale and justification:**

Having selected and 'graded' a suitable set of sites for a national system of forest Nature Reserves, it is necessary to decide on an optimal allocation of land to different uses between these sites. There are many technical considerations in making these decisions, based on the science of conservation biology, as well as economic, social, political and management feasibility factors. On the one hand, conservation science has firmly established the need for biological reserves to be as large as possible to maintain viable populations of most species in the long-term, whilst on the other, the distributions of species dictate that a large number of widely dispersed reserves are necessary to protect the full range of biodiversity. Unfortunately, it is not possible for Uganda (or most other countries) to dedicate large numbers of large reserves to biodiversity conservation, so compromise is necessary. A realistic approach is likely to involve designation of a relatively small number of large reserves, and a large number of relatively small reserves. This can be achieved as detailed below:



Table 3.7 Representation in the principal Forest Reserves of Langdale-Brown vegetation types that do not occur (or are represented by less than 50 km<sup>2</sup>) in Uganda's National Parks or Wildlife Reserves (excluding Karamoja WRs)

Code	Name	Area	C1	C2	D1	D3	D4	G2	G3	G4	J2	L1	L3	N	N4	N6	N9	N10	N12	N14	Q2	Q7	R1	S1	T2	T3	V	V3	V5	W	W2	W5	X2	Y2
	Zulia FR	1,029																134	51			20	15	93	46	46		70	8					
6	Moroto FR	483															72								58	58		58						
7	Labwor Hills FRs	437											30		380																			
10	Kadam FR	399						4																										
11	Kasyoha-Kitomi FR	391				100																												
12	Mt.Kei FR	384										15	365																					
13	Mabira FR	300		8	292																													
14	Agoro-Agu FR	234											5		5																			
16	Napak FR	203														25			25		8													
17	Otzi FR	188											94																					
18	South Busoga FR	164					47																											
20	Sango Bay FRs	151																																151
23	Kagombe FR	113				95																												
25	Kasagala FR	103																													8			
26	Kilak FR	102											30																					
27	Luunga FR	97				48								48																				
29	Namwasa FR	96				48								48																				
30	Kibeka FR	98																													3			
31	Taala FR	92				46								46																				
32	Rwoho FR	91				45																												
33	Kyambogo FR	89																											5					
34	Wabisi-Wajala FR	87																								15					10			
36	Aswa River FR	85											12																					
37	Kabuika-Majwalanganda FR	83																												6				
38	Kazooba FR	74																		70														
39	Era FR	74											15																					

Code	Name	Area	C1	C2	D1	D3	D4	G2	G3	G4	J2	L1	L3	N	N4	N6	N9	N10	N12	N14	Q2	Q7	R1	S1	T2	T3	V	V3	V5	W	W2	W5	X2	Y2	
40	Maruzi Hills FR	71									5																5								
41	Kijanabolola FR	65																		49															
44	Kamusenene FR	62																														15			
45	Zoka FR	61											9																						
48	Matiri FR	54				30																													
49	Ogili FR	53									13		20		20																				
50	Kitechura FR	53				20																											3		
51	Bwezigolo-Gunga FR	53				26								26																					
54	Nsowe FR	51																		36															
56	Mafuga FR	38								9																									
57	West Bugwe FR	30					25																												
58	Igwe-Luvunya FRs	20					20																												
60	Mpanga FR	5		5																															
61	Mpigi group FRs	261		250																															
62	Sesse Islands FRs	43	43																																
63	Zika	1		1																															
64	Jubiya FR	46	23	23																															
65	Lokung FR	13							13																										
66	Mukono group FRs	84		84																															

Table 3.8 Complementarity table for all National Parks and Forest Reserves qualifying for inclusion in the national network of forest Nature Reserves

Forest		Butterflies				Birds				Mammals				Moths				Plants				Fauna average			Combined	
Code	Name	Add	Add%	tot	tot%	Add	Add%	tot	tot%	Add	Add%	tot	tot%	Add	Add%	tot	tot%	Add	Add%	tot	tot%	Taxa	Add%	tot%	Add%	tot%
15	Semliki	309	41.98	309	42.0	435	45.36	435	45.4	31	34.44	31	34.4	81	38.94	81	38.9	336	34.11	336	34.1	4	40.18	40.2	37.15	37.15
72	Kidepo Valley NP			309	42.0	263	27.42	698	72.8	12	13.33	43	47.8			81	38.9	89	9.04	425	43.1	2	20.38	50.4	14.71	46.76
19	Bwindi	76	10.33	385	52.3	75	7.82	773	80.6	18	20.	61	67.8	36	17.31	117	56.3	115	11.68	540	54.8	4	13.86	64.2	12.77	59.53
70	Queen Elizabeth NP			385	52.3	98	10.22	871	90.8	2	2.22	63	70.0			117	56.3	65	6.6	605	61.4	2	6.22	67.3	6.41	64.38
1	Mt. Elgon	25	3.4	410	55.7	15	1.56	886	92.4	5	5.56	68	75.6	14	6.73	131	63.0	61	6.19	666	67.6	4	4.31	71.7	5.25	69.64
2	Rwenzori	12	1.63	422	57.3	3	0.31	889	92.7	8	8.89	76	84.4	5	2.4	136	65.4	21	2.13	687	69.7	4	3.31	75.0	2.72	72.36
5	Kibale	35	4.76	457	62.1	4	0.42	893	93.1			76	84.4	18	8.65	154	74.0	12	1.22	699	71.0	4	3.46	78.4	2.34	74.69
71	Murchison Falls NP			457	62.1	19	1.98	912	95.1			76	84.4			154	74.0	18	1.83	717	72.8	2	0.99	78.9	1.41	75.86
73	Lake Mburo NP			457	62.1	6	0.63	918	95.7	1	1.11	77	85.6			154	74.0	19	1.93	736	74.7	2	0.87	79.4	1.40	77.04
3	Budongo	46	6.25	503	68.3	11	1.15	929	96.9	2	2.22	79	87.8	21	10.1	175	84.1	71	7.21	807	81.9	4	4.93	84.3	6.07	83.11
17	Otzi	35	4.76	538	73.1	1	0.1	930	97.0	2	2.22	81	90.0	6	2.88	181	87.0	40	4.06	847	86.0	4	2.49	86.8	3.28	86.38
6	Moroto	31	4.21	569	77.3	17	1.77	947	98.7	3	3.33	84	93.3	10	4.81	191	91.8	17	1.73	864	87.7	4	3.53	90.3	2.63	89.01
12	Mt. Kei	16	2.17	585	79.5	5	0.52	952	99.3	1	1.11	85	94.4	4	1.92	195	93.8	8	0.81	872	88.5	4	1.43	91.7	1.12	90.13
62	Sese Islands	12	1.63	597	81.1			952	99.3	1	1.11	86	95.6	1	0.48	196	94.2	14	1.42	886	89.9	4	0.81	92.5	1.11	91.25
20	Sango Bay	15	2.04	472	83.2	2	0.21	954	99.5			86	95.6	3	1.45	199	95.7	5	0.51	891	90.5	4	0.92	93.5	0.72	91.96
11	Kasyoha - Kitomi	20	2.72	492	85.9	1	0.1	955	99.6			86	95.6			199	95.7	7	0.71	898	91.2	4	0.71	94.2	0.71	92.67
4	Kalinzu - Maramagambo	12	1.63	504	87.5			955	99.6	1	1.09	87	96.6			199	95.7	3	0.3	901	91.5	4	0.68	94.9	0.49	93.16
39	Era	2	0.27	506	87.8			955	99.6	1	1.09	88	97.7	1	0.48	200	96.2	5	0.51	906	92.	4	0.46	95.3	0.48	93.65
7	Labwor Hills	5	0.68	511	88.5	1	0.1	956	99.7	2	2.17	90	99.9			200	96.2	10	1.02	916	93.	4	0.74	96.1	0.88	94.52
8	Nyangea - Napore	10	1.36	521	89.8			956	99.7			90	99.9			200	96.2	8	0.81	924	93.8	4	0.34	96.4	0.58	95.10
55	Echuya	9	1.22	530	91.0	1	0.1	957	99.8			90	99.9			200	96.2	6	0.61	930	94.4	4	0.33	96.7	0.47	95.57
13	Mabira	10	1.36	540	92.4	2	0.21	959	100.0			90	99.9	2	0.97	202	97.1	1	0.1	931	94.5	4	0.63	97.4	0.37	95.94
9	Bugoma	11	1.49	551	93.9			959	100.0			90	99.9	2	0.97	204	98.1			931	94.5	4	0.62	98.0	0.31	96.24
22	Timu	7	0.95	558	94.8			959	100.0			90	99.9			204	98.1	7	0.71	938	95.2	4	0.24	98.2	0.47	96.72
21	Morongole	2	0.27	560	95.1			959	100.0			90	99.9			204	98.1	8	0.81	946	96.	4	0.07	98.3	0.44	97.16
14	Agoro - Agu	1	0.14	561	95.2			959	100.0			90	99.9			204	98.1	5	0.51	951	96.5	3	0.05	98.3	0.28	97.43
16	Napak	2	0.27	563	95.5			959	100.0			90	99.9	1	0.48	205	98.6	3	0.3	954	96.9	4	0.19	98.5	0.25	97.68

Forest	Butterflies				Birds				Mammals				Moths				Plants				Fauna average			Combined	
Code    Name	Add	Add%	tot	tot%	Add	Add%	tot	tot%	Add	Add%	tot	tot%	Add	Add%	tot	tot%	Add	Add%	tot	tot%	Taxa	Add%	tot%	Add%	tot%
57 West Bugwe	1	0.14	564	95.7			959	100.0			90	99.9			205	98.6	3	0.3	957	97.2	4	0.03	98.5	0.17	97.85
56 Mafuga	1	0.14	565	95.8			959	100.0			90	99.9			205	98.6	3	0.3	960	97.5	4	0.03	98.6	0.17	98.01
32 Rwoho	3	0.41	568	96.2			959	100.0			90	99.9034			205	98.6	2	0.20	962	97.7	4	0.10	98.7	0.15	98.17
18 South Busoga	2	0.27	570	96.5			959	100.0			90	99.9	1	0.48	206	99.1	1	0.1	963	97.8	4	0.19	98.9	0.15	98.31
61 Mpigi	1	0.14	571	96.6			959	100.0			90	99.9			206	99.1	2	0.2	965	98.	4	0.03	98.9	0.12	98.43
25 Kasagala	1	0.14	572	96.7			959	100.0			90	99.9			206	99.1	2	0.2	967	98.2	4	0.03	98.9	0.12	98.55
24 Rom			572	96.7			959	100.0			90	99.9			206	99.1	2	0.2	969	98.4	4	0.00	98.9	0.10	98.65
41 Kijanabolola	1	0.14	573	96.9			959	100.0			90	99.9			206	99.1	1	0.1	970	98.5	3	0.05	99.0	0.07	98.72
64 Jubiya	4	0.54	577	97.4			959	100.0			90	99.9			206	99.1			970	98.5	4	0.14	99.1	0.07	98.79
58 Igwe - Luvunya	1	0.14	578	97.6			959	100.0			90	99.9			206	99.1	1	0.1	971	98.6	4	0.03	99.1	0.07	98.85
35 Itwara	1	0.14	579	97.7			959	100.0			90	99.9			206	99.1	1	0.1	972	98.7	4	0.03	99.2	0.07	98.92
10 Kadam	1	0.14	580	97.8			959	100.0			90	99.9			206	99.1			972	98.7	4	0.03	99.2	0.02	98.94
47 Lwala	1	0.14	581	98.0			959	100.0			90	99.9			206	99.1			972	98.7	4	0.03	99.2	0.02	98.96
49 Ogili			581	98.0			959	100.0			90	99.9			206	99.1	1	0.1	973	98.8	3	0.00	99.2	0.05	99.01
50 Kitechura	2	0.27	583	98.2			959	100.0			90	99.9			206	99.1			973	98.8	4	0.07	99.3	0.03	99.04
Zulia			583	98.2			959	100.0			90	99.9			206	99.1			973	98.8	4	0.00	99.3	0.00	99.04
65 Lokung			583	98.2			959	100.0			90	99.9			206	99.1			973	98.8	4	0.00	99.3	0.00	99.04
31 Taala			583	98.2			959	100.0			90	99.9			206	99.1			973	98.8	4	0.00	99.3	0.00	99.04
38 Kazooba			583	98.2			959	100.0			90	99.9			206	99.1			973	98.8	4	0.00	99.3	0.00	99.04
34 Wabisis-Wajala			583	98.2			959	100.0			90	99.9			206	99.1			973	98.8	4	0.00	99.3	0.00	99.04
33 Kyambogo			583	98.2			959	100.0			90	99.9			206	99.1			973	98.8	4	0.00	99.3	0.00	99.04
63 Zika			583	98.2			959	100.0			90	99.9	2	0.97	208	100.			973	98.8	4	0.24	99.5	0.12	99.16

According to the June 1994 list of gazetted forest reserves, the estate covers a total area of 1,460,000 ha and an additional 135,000 ha of protected forest lies within the Rwenzori, Bwindi and Mgahinga National Parks. Thus the country's total protected forest estate comprises an area of 1,595,000 ha, of which 319,000 ha (20%) is (theoretically) destined to become forest Nature Reserve and 478,000 ha (30%) will be used as low-impact 'Buffer Zones'. Approximately 414,700 ha (26% of the total) is already designated as National Parks, and a further 39,000 ha (2.4%) carries dual status as Forest and Game (Wildlife) Reserves. If these areas are considered to be part of the 50% of the country's forest estate destined for conservation management, the new forest Nature Reserves and associated Buffer Zones should occupy 344,500 ha (21.6%). The allocations described below, are based on this broad framework.

#### Procedure:

Based on the list of forests selected for Nature Reserve establishment (STEPS 4-10 above), and recognising the relative importance of the three categories (prime, core and secondary) to the achievement of national biodiversity conservation objectives, allocations are made as a proportion of a site's total area, subject to specified absolute minimum areas. The minima are necessary to ensure that smaller sites remain viable and are able to maintain their biodiversity in the long term:

- 30-35% of 'prime' forest sites is allocated to Nature Reserves, subject to an absolute minimum size of 10,000 ha.
- 20-30% of 'core' sites is allocated to Nature Reserves, subject to an absolute minimum size of 5,000 ha (not to exceed 70% of a site's total area).
- 10-20% of 'secondary' sites is allocated to Nature Reserves, subject to an absolute minimum size of 2,000 ha (not to exceed 70% of a site's total area)

Within these categories the proportion dedicated in any particular case is decided on the basis of 'Nature Reserve suitability' scores, with low, medium and high suitability ratings corresponding to 5% intervals in the Nature Reserve allocations (Table 3.9). The five National Parks are included in the 'prime' sites category, and 'notional' Nature Reserve allocations made (as if the planning process were being applied to these sites as well).

'Buffer Zone' allocations are made on the following basis (selecting whichever is the larger area):

- covering the balance of areas within National Parks and Game (Wildlife) Reserves (not already allocated as 'notional' Nature Reserves).
- covering an area equivalent to all land exceeding a 15° slope, less Nature Reserve allocations already made (on the assumption that all steep slopes will be dedicated to conservation, either as Nature Reserves or Buffer Zones).
- covering an area half the size of the Nature Reserve (so as to enhance Nature Reserve viability with 'supporting' low-impact uses in areas immediately adjacent).

#### Outcome:

Details of Nature Reserve and Buffer Zone allocations calculated on this basis are provided in Table 3.9. Altogether 326,600 ha (20.5% of Uganda's protected forest estate) is allocated to Nature Reserves in 44 sites, of which about a third of the area (107,400 ha) comprises 'notional' Nature Reserves within National Parks. Areas allocated to Buffer Zones total 487,800 ha (30.6% of the total estate), of which more than half falls within National Parks and Game (Wildlife) Reserves. The total area to be committed to protective management (as Nature Reserves and Buffer Zones) from the Forest Department's area of exclusive jurisdiction is 363,200 ha (based on 326,600 ha NR + 487,800 ha BZ - 451,200 ha dual status; Table 3.9). This is equivalent to 22.8% of the protected forest estate, or 31.7% of the 1,143,800 ha under exclusive departmental jurisdiction.

Table 3.9 List of forests selected for Nature Reserve establishment, criteria used and areas to be designated

Category	Forest	Area (km <sup>2</sup> )	Selection criteria								FR-limited veg.types	Nature Reserve Suitability	NR %	NR Area (km <sup>2</sup> )	Slope >15° (km <sup>2</sup> )	NP/WR Status	BZ Area (km <sup>2</sup> )
			1	2	3	4	5	6	7	8							
PRIME	Semliki	219	+	+			+					★★★	35	100	0	219	119
	Bwindi	321	+	+			+					★★	30	100	207	321	221
	Mt Elgon	1192	+	+			+					★★	30	358	569	1192	834
	Rwenzori	996	+	+			+					★★★	35	349	818	996	647
	Kibale	558	+				+					★★	30	167	223	558	391
	Budongo	825	+	+			+					★★	30	248	27	248	335
	Otzi	188	+				+					★★★	35	100	107	0	50
	Mt Moroto	483	+	+			+	+			N9,T2,T3,V3	★★★	35	169	258	0	85
<b>Sub-total</b>		<b>4782</b>												<b>1591</b>	<b>2209</b>	<b>3534</b>	<b>2682</b>
CORE	Mt Kei	384		+	+		+	+			L1,L3	★★	25	96	1	0	48
	Sesse Is.	43		+	+		+	+			C1	★★	25	30	1	0	13
	Kalinzu-M	584		+	+		+					★	20	117	37	443	485
	Sango Bay	151		+	+		+	+			Y2	★★	25	50	0	0	25
	Era	74		+	+		+					★★★★	30	50	14	0	25
	Kasyoha-K	390		+	+		+	+			D3	★★	25	98	162	0	65
	Labwor Hills	437			+		+	+			N4	★★★★	30	131	233	0	102
	Nyangea-N	417			+		+					★★★★	30	125	223	52	98
	Echuya	35			+		+					★	20	25	26	0	10
	Bugoma	401			+							★★	25	100	6	0	50
	Mabira	300			+		+	+			D1	★	20	60	6	0	30
<b>Sub-total</b>		<b>3216</b>												<b>882</b>	<b>709</b>	<b>495</b>	<b>951</b>
SECONDARY	Agoro-Agu	235				+	+					★★★★	20	47	136	0	89
	Morongole	151				+	+					★★★★	20	30	129	63	99
	Timu	118				+	+					★★★★	20	24	5	0	12
	Mt Kadam	399					+	+			G2	★★★★	20	80	306	0	226
	Mt Napak	203					+	+			N6,Q2	★★★★	20	41	103	0	62
	S. Busoga	163					+	+			D4	★★★★	20	33	0	0	17
	Rom	109					+					★★★★	20	22	79	0	57
	Kasagala	103					+	+			W2	★★★★	20	21	0	0	10
	Rwoho	90					+					★★	15	20	51	0	31
	Itwara	86					+					★★	15	20	20	0	10
	Kijanabolola	65					+					★★	15	20	11	0	10
	Lwala	59					+					★★★★	20	20	46	0	26
	Mafuga	38					+					★	10	4	35	0	0
	West Bugwe	30					+					★	10	20	0	0	10
	Igwe-Luvunya	20					+					★	10	14	1	0	6
	Mpigi gp	261					+					★	10	26	4	0	13
	Jubiya	36					+					★★	15	20	0	0	10
	Lokung	13					+					★★	15	9	0	0	4
	Zulia	1026						+			N10,N12,Q7,R1,S1,V5	★★★★	20	205		420	480
	Ogili	53						+			J2	★★★★	20	20	43	0	23
	Taala	92						+			N	★	10	20	6	0	10
	Kazooba	74						+			N14	★★	15	20	4	0	10
	Maruzi	61						+				★★★★	12	20	21	0	10
	Kamusenene	62						+				★★★★	8	13	0	0	9
	Kyambogo	89						+			W	★★	15	20		0	10
	Kitechura	53						+			X2	★★	15	20	10	0	10
<b>Sub-total</b>		<b>3689</b>												<b>809</b>	<b>1010</b>	<b>483</b>	<b>1254</b>
<b>TOTAL</b>		<b>11687</b>												<b>3282</b>	<b>3928</b>	<b>4512</b>	<b>4887</b>

Notes: Prime sites allocated 30-35% Nature Reserve (based on NR Suitability), subject to a minimum 100 km<sup>2</sup>  
 Core sites allocated 20-30% Nature Reserve, minimum 50 km<sup>2</sup> (but not to exceed 70% of forest)  
 Secondary sites allocated 10-20% Nature Reserve, minimum 20 km<sup>2</sup> (but not to exceed 70% of forest)

★★★ = High; ★★ = Medium; ★ = Low Nature Reserve Suitability (see Table 3.2)

Criteria:

- 1: Site contributes > 2% of national PA system species complement
- 2: Within any taxon > 1% of species unique to forest
- 3: Site contributes 1-2% of national PA system complement
- 4: Within any taxon 0.5-1% of species unique to forest
- 5: Site supports at least one unique species of conservation significance (i.e. broadly endemic)
- 6: Site supports vegetation type not otherwise represented in PA system
- 7: Site contributes 0.5-1% of national PA system complement
- 8: Site contributes >1% of species under Forest Department exclusive jurisdiction

### 3.3 Guidelines for management zone planning for specific sites

Having selected an appropriate network of sites for Nature Reserve establishment, and decided on an optimal allocation of land to different uses between sites, it is necessary to translate these theoretical considerations into operational forest management programmes. One of the most important aspects of this is to decide on appropriate management zones within each forest.

Some of the principles involved in management zonation were discussed in Chapter 1, and considerations in Nature Reserves site selection detailed in Chapter 2. The Man and Biosphere concept of reserve design, on which the zonation of Uganda's forests is being based, involves the strict protection of a centrally located 'core' area, and designation of other management zones for specified uses elsewhere, with increasingly intensive use permitted towards the peripheral areas of each reserve. This theoretical model provides a useful framework for management zoning decisions, but can rarely be applied in its idealised conceptual form. Instead, it has to be moulded and adapted to fit the landscape, management history, social and cultural environment in which each reserve is located.

When the Nature Reserve planning exercise was initiated in 1991, it was anticipated that decisions on the definition of management zones within each forest would be based on detailed assessments of the biological and human-use values of different areas of each reserve. At that stage, a major inventory of timber resources in the country's natural forests was underway, and biological inventory field staff were being trained to undertake detailed assessments of biodiversity and human-use values based on data collection from 0.1 ha plots located systematically throughout each forest on a 450 m grid. Unfortunately, rising costs and an acute shortage of management staff meant that these programmes became increasingly difficult to justify, and by 1994 had to be abandoned. The timber inventory was completed in Mabira, Budongo and some of the Sesse Island reserves, whilst the biological inventory teams completed assessment work in Itwara, Semliki and Kalinzu and started in Kasyoha-Kitomi. The idea was to use the data to generate a series of 'maps' of each reserve, showing the geographical distribution of factors relevant to management planning, such as timber resources, biodiversity and community-use. These could then be super-imposed as computer data fields, and used to define appropriate management zones.

In view of the failure of this approach, management zones have to be defined on a less technical basis, using the detailed 'expert' knowledge of each forest available within the department, and the data available as a result of the biodiversity inventory work. Zoning regimes originated in this way must be viewed as a 'best guess' approach to management, and should be applied as part of an adaptive management strategy subject to improvement and upgrading in the light of experience, as new information becomes available to make it technically more robust. The management zoning plans that appear in the Forest Profiles annexed to this report are generated in this way, and seek to satisfy as many as possible of the following criteria.

#### 3.3.1 Locating Nature Reserves:

Ideally, the area designated as Nature Reserve within each forest should:

- be centrally located in the least accessible part of the reserve, where it is provided a high degree of inherent 'protection';
- cover an area of undisturbed natural vegetation, representing ecological climax communities;
- be as biologically diverse as possible encompassing as many forest/vegetation types and habitats as possible. Practically, this is most likely to be achieved by covering the widest possible range of altitude, and ensuring that slopes of difference aspect are included;

- be a single area, of a compact shape (preferably more-or-less circular) to minimise the ratio of boundary to area protected;
- have clearly defined boundaries, following obvious natural features such as major streams or rivers, cliffs or ridges;
- cover areas of the reserve that are known to support species of special interest (such as endemics, threatened species or species unique to the forest concerned), or considered likely to do so because of known altitudinal/habitat preferences of those species.
- encompass 'keystone' resources which play a critical role in the life-history of certain species, (perhaps seasonally) such as roosting and nesting sites, feeding areas or seasonally important water sources.
- address the specific selection criteria used to identify the need for a Nature Reserve in that forest, and pay particular attention to the protection of species and/or vegetation types the forest was selected to represent.

### **3.3.2 Locating Protection (Buffer) Zones**

The area designated for low-impact use under the broad category of 'Protection' or 'Buffer Zones' should encompass three distinct categories of area, namely:

- areas of forest reserves which falls within gazetted National Parks or Wildlife Reserves, where logging would compromise this status;
- areas of steeply sloping land (exceeding 15° slope) where protection of the vegetation cover is important to prevent erosion and maintain water catchment values;
- areas immediately adjacent to Nature Reserves (especially where these are small), which need to be maintained in a relatively natural state to shelter the Nature Reserve against 'edge effects' such as invasion by exotic vegetation, exposure to fire risk, and so on. In general any Nature Reserve of 1,000 ha or less should be surrounded by a protective Buffer Zone at least 500m-1000m wide. Where it is possible to use such an area for non-consumptive uses such as tourism, recreation, education or research, this protective role could be further enhanced by increasing the size of the zone. In general tourism, recreation, education and (some) research should be managed as 'conservation support' activities, and should be spatially arranged by appropriate juxtaposition of Nature Reserves and ecotourism/education/research zones. Larger Nature Reserves are less vulnerable to edge effects (because the edge to area protected ratio is relatively small), and provision of a protective Buffer Zone is not as critical in this case.

In small reserves, with significant biodiversity values, the entire reserve may be designated as a 'Protection Zone' thereby allowing some community use, but excluding the possibility of commercial scale exploitation of timber and other forest products.

### **3.3.3 Locating Production Zones:**

Areas designated as production zones within each forest should be selected to satisfy the country's sawn timber requirements, industry needs for other forest products such as firewood, and the needs of local communities for a wide range of wood and non-wood products. In general these areas should:

- be located in the most accessible parts of the reserve, where necessary forest labour is readily available, and forest products can easily be removed.
- cover flat or gently undulating terrain, where soil erosion and watershed degradation is unlikely to become a problem.
- include the most heavily degraded parts of the reserve, since these areas are of least value for biodiversity conservation, and have probably become degraded because of their relatively high inherent quality and regenerative capacity. Rehabilitation and restoration of such areas will ensure they contribute to the nation's requirements for forest products, whilst preventing further degradation and/or conversion.
- encompass areas which are most heavily stocked with timber, provided these are not required as Nature Reserves or associated Buffer Zones.



- include peripheral areas close to towns, villages and rural communities, which can satisfy community needs for building poles and firewood. Where necessary (due to local wood shortages, land pressure, or proximity of Nature Reserve) a plantation belt 20m-50m wide along selected lengths of forest boundary should be actively developed to satisfy local demand and reduce pressure for wood products further from the boundary.
- include grasslands in high rainfall areas which can be developed as highly productive plantations at relatively low cost.
- avoid areas which are best suited to Nature Reserve establishment (see above).

### 3.4 Zoning plans for selected conservation forests

Based on these criteria, and the knowledge and experience of Departmental staff and advisors, provisional zoning plans have been developed for many of the 44 forest reserves selected for Nature Reserve establishment. The areas of the provisional zones were based on digitised maps that in some cases may deviate from the area of the forest reserves in the statutory instrument (SI-1998-No.3). In such cases the area of the Statutory Instrument (SI-1998-No.3) should be taken as the legal area. As the FD is to undertake forest boundary resurveys, these new areas will be taken into account for the zoning plans. It is assumed that, at least for the time being, all other forest reserves will be designated as production reserves, and managed accordingly (see Chapter 4). These zoning plans fall into three broad categories.

- **Large tropical high forest reserves (exceeding 5,000 ha).** Reserves in this category include Budongo, Kalinzu-Maramagambo, Sango Bay, Kasyoha-Kitomi, Bugoma, Mabira, South Busoga, Itwara and the Mpigi group. These reserves have important biodiversity conservation and commercial timber production roles; are relatively well-known; tend to be quite well-staffed; and have been receiving management support under the EC-financed project for almost a decade. Zoning proposals for these reserves are relatively 'firm' and ready for implementation. Four of these reserves (Budongo, Mabira, Kasyoha-Kitomi and Mpigi/Mpanga) have significant ecotourism potential, and the zoning plan in each case involves development of a recreation (buffer) zone adjacent to (and supportive of) the Nature Reserve. All reserves in this category have received considerable support for external boundary demarcation and there is little risk of 'confusion' if internal boundaries are demarcated at this stage. The implementation of the zoning proposals should involve demarcation of internal management zone boundaries by ring-painting trees as described in Chapter 4.
- **Large savanna reserves (exceeding 5,000 ha).** Reserves in this category include Otzi, Mt. Moroto, Mt. Kei, Era, Labwor Hills, Nyangea-Napore, Agoro-Agu, Morongole, Timu, Kadam, Napak, Rom, Kasagala, Rwoho, Kijanabolola, Lwala, Zulia, Ogili, Taala, Wabisi-Wajala, Kyambogo and Kitechura. These reserves have important biodiversity conservation roles and many are mountains or hill ranges requiring a high degree of protection. None of these areas produces natural forest timber or other forest products on a commercial scale, although two (Kasagala and Rwoho) have major softwood plantations, and others are suitable for plantation development. Some of the reserves in this category are heavily used by cattle herders (e.g. Kasagala, Kijanabolola, Rwoho, Taala, Kyambogo); others are subject to agricultural encroachment (e.g. Mt. Kei, Otzi, Era, Labwor Hills, Agoro-Agu, Timu, Taala) and the South Karamoja mountains (Moroto, Kadam, Napak) are occupied by the Tepeth people who live and earn their livelihoods within the reserves. Most of these reserves have received little or no previous support from the EC-financed project in recent years; are staffed at very low levels; have no infrastructure; are relatively unknown and unmanaged. In most cases the external reserve boundaries have not been maintained or patrolled for more than three decades, although substantial stone boundary cairns may still exist in some cases. Priority management actions in these reserves must therefore be directed at securing the integrity of the reserves, rather than developing elaborate zoning plans. Indeed it would probably prove counter-productive, at this stage, to demarcate and develop internal boundaries in these reserves as these may be misinterpreted by local people to represent a re-alignment of the forest boundary and be taken as an invitation to encroach up to the 'new' line, if there is inadequate awareness.
- **Small reserves (up to 5,000 ha).** Reserves in this category include the Sesse Islands, Echuya, Mafuga, West Bugwe, Igwe-Luvunya, Jubiya and Lokung. Most of these areas were classified as being of 'low' nature reserve suitability because they are small in densely populated areas, and often with significant timber resources. However, their unique biological values provide strong justification for managing them as far as possible for nature conservation. Zoning plans for these reserves are therefore designed to provide maximum protection to the majority of the reserve, with defined areas dedicated to 'conservation support' activities such as provision of building poles, firewood and bamboo to local communities. These 'community use' zones should be demarcated on the ground by ring-painting and sign-boarding, and will normally comprise about 30% of a forest's total area. Development of *Eucalyptus* boundary shelterbelts for community use would be appropriate.

## Chapter 4

### Implementation

#### 4.1 Introduction

The aim of this chapter is to provide practical guidelines on all aspects of the implementation of the nature conservation programme, including management activities to be undertaken at each reserve, and broader strategic actions. It is intended primarily for the use of forest managers seeking guidance on ‘approved’ procedures applicable to particular local situations. These standard procedures are reflected in the ‘proposed management’ sections of the individual ‘forest profiles’ annexed to this Master Plan, and will subsequently be incorporated into management plans for specific reserves, when these are prepared.

The chapter is divided into two broad sections, dealing with individual site management and broader institutional issues. The site management section describes:

- development and establishment of locally-acceptable zoning regimes;
- the roles and responsibilities of different stakeholders in management decision-making and implementation;
- general management procedures, including boundary demarcation, patrolling, community outreach, research and monitoring, ecosystem management;
- requirements for management of infrastructure and facilities;
- specific requirements for Nature Reserve designation, demarcation and management;
- protection and management procedures for other conservation areas; and
- conservation aspects of management within timber production zones.

The review of broader institutional arrangements addresses issues that require attention at a national level, particularly:

- training and capacity development within the Forest Department;
- development of collaborative management arrangements with local communities, District authorities, Uganda Wildlife Authority, and private sector concessionaires;
- publicity and public relations;
- financing mechanisms; and
- legislation and policy requirements.

The chapter concludes by considering the further development of the nature conservation programme.

#### 4.2 Integrated site management

This section deals with the management of individual sites, and addresses the concerns of forest managers in the implementation of their day-to-day forest management activities.

##### 4.2.1 Zoning

Many of the zoning proposals shown in the forest profiles (see Annexes) are of a preliminary nature, based on ‘best available’ information. In these cases further work is required to confirm the suitability of the proposals, modify them, or develop alternatives. Before the zoning plans are implemented, the following additional work should be undertaken:

- in some cases confirmation is required that areas selected as Nature Reserves are sufficiently undisturbed to justify their selection and ensure that there is no better alternative site available. This confirmation can probably be done most cost-effectively from the air, as long as it is carried out by personnel with sufficient experience (of the sites concerned, and aerial map-reading/navigation) to make this kind of rapid assessment. Of the forests identified

for Nature Reserve establishment, re-confirmation is particularly important in the case of Sesse islands, Mpigi group forests, Jubiya, Kijanabolola, Rwoho, Taala, Kazooba and Kyambogo - all of which are known to be heavily degraded and under heavy pressure.

- the South Karamoja mountains (Mts Moroto, Kadam and Napak) require much more detailed consideration than has hitherto been possible. Ideally, a full aerial photographic survey (1:10,000) would be carried out, so that areas of human settlement and activity can be ascertained before a provisional zoning plan for each reserve is devised.
- at each proposed Nature Reserve site, it is important to consult with local people over proposals, before any attempt is made to demarcate internal management zones, and finalise Nature Reserve designation. The purpose of such consultations is twofold: first, to ensure that the area selected as Nature Reserve does not exclude local people from important resources that are not available elsewhere, such as a sacred site, important dry season water source, or the only known location of an important medicinal herb. Second, as a means of gaining understanding and support of local people for the implementation of the programme. Such consultations should clearly involve local authorities, as well as village communities in the immediate vicinity of the forests.
- once the above assessments and consultations have been completed, it will be desirable for Departmental staff to visit and survey each site, (on foot, camping where necessary) with a view to understanding the management issues which need to be addressed. There is no substitute for first-hand local field experience of this kind, which should be carried out by site-based management staff. Such surveys could be combined with local village-level consultations (see above), and would most usefully include an appointed local community representative to accompany the survey team in the field. During the survey, the team will consider management needs, and in particular the need for boundary demarcation, by examining portions of the reserve's external boundary, and the location of the proposed internal boundaries.
- a participatory management planning process should be commenced as soon as possible after these initial assessments, consultations and surveys have taken place. This will, amongst other things, ensure that the Forest Department establishes a conspicuous presence in the area, and local people are sensitized to the special importance of their area to the achievement of national (and international) conservation goals.

#### 4.2.2 Management roles and responsibilities

It is now widely appreciated from experience in many countries that the traditional approach to reserve management, involving 'land expropriation' and 'control' by a remote centralised authority (in this case the Forest Department or any other relevant agency), has largely failed to ensure sustainable resource use. Increasingly, the focus of conservation programmes is shifting towards local rural communities, and the development of 'strategic partnerships' between different interest groups aimed at more equitable distribution of the costs and benefits of reserve management. The aim is to transfer many of the rights and responsibilities from a centralised authority to local communities and other partners, so that they can take a larger share of the benefits and at the same time assume greater responsibility for protection activities. Self-policing of this kind has the obvious advantage of reducing the centralised authority's management costs, and providing the necessary incentive to local people to manage resources on a sustainable basis, for their own long-term benefit.

Implementation of this Masterplan provides an opportunity to incorporate this philosophy into the Department's programmes. New approaches should be piloted in different areas, and progressively adapted in the light of experience. There is no 'blueprint' for successful collaborative management, and it will be necessary to define the roles and responsibilities of each interest group in each particular situation. It may not be possible to transform existing management practices overnight: there will inevitably be a long transition to more participatory forms of management. As a general guide, however, the roles of some key players may include the following:

**Forest Department** is likely to retain ultimate responsibility for reserve management policy, and ensuring that broad policy objectives are being met.

**Local authorities** are likely to play an increasingly important role in coordinating local level decision-making, and financing and supervising implementation of reserve management programmes. Local government will raise revenue from forest user fees, and can be expected to invest increasingly large amounts in forest management activities.

**Forest-adjacent rural communities** are likely to become increasingly involved in management decision-making, and in the day-to-day management of the reserves. Responsibility for regulating off-take will increasingly rest with communities, who should police themselves, as well as excluding non-licensed outsiders from using the resources.

**Concessionaires/private sector** should deal increasingly with decentralised decision-making, tendering and negotiating concession terms with district authorities and even community groups.

### 4.2.3 General management programmes

#### 4.2.3.1 Demarcation

Uganda's experience during the 1970s and 80s, when many poorly demarcated reserves suffered serious encroachment, illustrated the importance of maintaining clearly marked forest boundaries. As a 'first line of defence' the boundary is of paramount importance, and there should be no opportunity for ambiguity over its location. Wherever possible the boundary line should be kept clear and maintained as a footpath, thereby facilitating patrol work.

##### a) External boundary demarcation

External boundary demarcation should always precede any internal demarcation of management zones, and aim to ensure that the boundary is clearly visible at all times, and remains so at minimum cost. The demarcation method used will vary according to local conditions, combining use of stone and earth cairns, concrete marker posts, direction trenches, cut-lines and planted marker trees.

The '*minimum requirement*' is that the entire length of all external boundaries should be marked with 'corner cairns' on every corner, and intermediate cairns at 500 metre intervals, regardless of locality. Where such demarcation is not already in place, this should receive immediate priority.

Additional demarcation is important, and requirements will depend on local environmental conditions, as well as management pressures. The following are guidelines as to the 'preferred' method of demarcation for reserves in forested and savanna areas, which should be used wherever funds and local conditions allow. In addition, 'special' demarcation procedures may be necessary in areas of former encroachment, or where boundary infringements are otherwise likely.

Forested environments:

In forested areas, the '*preferred method*' of boundary demarcation is to satisfy the minimum requirements outlined above, and in addition to:

- dig direction trenches of dimensions 3m x 0.3m x 0.3m either side of each cairn;
- place steel-reinforced concrete corner beacons, which should be 60 cm long, of square section tapering from 10 cm at the base to 7 cm at the top and should be reinforced with four twisted iron rods, one in each corner and well welded (or tied with wire), together with small crossbars so as to form a tapering down the centre;
- plant marker trees at 30 m intervals, using conspicuous indigenous species such as *Ficus* (cuttings), *Spathodea*, *Markhamia*, or non-invasive exotics such as *Eucalyptus* or *Cupressus* (depending on local conditions). Potentially invasive exotic species, such as *Cassia* or *Broussonetia*, must be avoided.

'*Special demarcation*' methods should be used in areas of former encroachment, short stretches of boundary which are considered particularly vulnerable to encroachment and boundaries adjacent to highly wood-deficient communities. Here a strip of land up to 50m wide should be developed and maintained as a boundary belt of fast-growing trees (that can be harvested on short rotation and used as building poles and firewood, if required). Such tree belts would typically be *Eucalyptus*, and may be planted and managed privately under local lease arrangements.

Savanna environments:

In savanna areas the '*preferred method*' of boundary demarcation is to satisfy the minimum requirements outlined above, and in addition:

- mark external boundaries with intervisible stone cairns at intervals less than 500 m, each 1.5 m high and 2 m diameter. The stones will be heaped around a dry pole of 10 cm diameter and 3.8m long with the last 20 cm of the pole painted red with the cairn number and bearing to the next cairn written in black;
- construct straight stone burrows on either side of each cairn, aligned to indicate the direction of the neighbouring cairn;
- plant indigenous marker trees (species which are not invasive) at 30m intervals wherever the climate is not too arid. Fire-resistant local species, such as *Erythrina*, or *Acacia* are preferred; drought-tolerant markers such as sisal may be used in arid areas;

- erect earth cairns at 50 m intervals as intermediate cairns in areas where stones and rocks are not easy to come by;
- erect concrete corner beacons with specifications as above.

The most cost-efficient method of boundary demarcation should always be sought, and opportunities to 'contract out' portions of boundary to local community members or groups should be followed.

#### **b) Internal boundary demarcation**

Demarcation of internal management zones should be carried out wherever it can serve a useful management function by reminding forest users of limitations imposed in particular areas of the forest. Thus it is useful and necessary to demarcate internal management zones in most closed canopy forest situations, so that those harvesting timber are aware of 'closed' areas. On the other hand, internal demarcation of management zones in most of the savanna reserves is unnecessary, and might cause confusion amongst local communities.

Forested environments:

In forested areas, internal boundaries between management zones should be demarcated according to the following guidelines:

- Boundaries will as much as possible follow natural features such as rivers, streams, ridges, forest/grassland edges, and the edges of swamps. These boundaries will be identified by ring-painting trees and/or erecting metal sign-boards.
- Trees of diameter at breast height (dbh) equal to or more than 30 cm will be painted with a band of paint 25 cm wide from 1.3 to 1.8 m above ground level. However, in forests where bigger trees cannot be located along the zone boundary, trees of dbh 20 cm or less shall be painted. The number of trees to be painted will depend on the forest's characteristics, but the aim should be to ensure that a belt of trees at least 5 m wide is affected.
- Species with high bark peeling rates should be avoided; painting should be carried out in the dry season; and the bark should be cleaned with a wire brush before applying paint to improve adhesion and longevity. The paint should be of a non-toxic variety, thinned to ensure maximum penetration.
- The boundary between any two management zones should be marked with two colours on corresponding sides of the line: Red paint will be used to indicate Nature Reserves; yellow for 'Buffer' zones (including recreation, wildlife protection, environmental protection and Nature Reserve support zones); and sky blue for Production zones. Thus an internal boundary between a Nature Reserve and adjoining Buffer Zone will have a 2.5 m-wide belt of trees painted red on the Nature Reserve side of the line, and a parallel belt 2.5 m-wide on the Buffer Zone side painted yellow.
- Nature Reserve sign plates will be erected wherever people commonly cross into a Nature Reserve. These will indicate the area's designation and state that harvesting or removal of any timber, firewood, poles, or other forest product is prohibited. Signs will be bilingual, using English and the relevant local language.

Savanna environments:

In savanna environments, internal management zones will only be demarcated on the ground where it is absolutely necessary to improve adherence to agreed management practices. Thus, for example, it may be necessary to demarcate an area (Nature Reserve or 'Buffer' Zone) that has been closed to grazing, in which case the following methods will be used:

- Internal boundaries should as much as possible be made to follow natural features (i.e. ridges, edges of swamps, rivers, streams, etc).
- Along those boundaries sign posts will be erected, preferably at footpath crossing points, watering points and other entry points. These will be metallic, at least 20 by 10 cm, red in colour with white lettering, and must be weather and fire resistant.

- Where possible (for example along riverine/gallery forests) ring-painting of trees will be carried out (as above). However this will not be possible in most areas because paint will be burnt off most savanna trees during the frequent fires.
- Where internal boundaries follow rocky ridges, cliffs or similar features, the rocks can be marked with the appropriate colour.

#### 4.2.3.2 Protection

If Nature Reserves are to remain intact, as representative samples of undisturbed forest communities, it is obviously essential that they are afforded adequate protection. A combination of approaches will be used, dependent on traditional policing activities and increasingly reliant on local interest, understanding and commitment to the programme.

- Forest patrolmen will assume individual responsibility for defined 'beats' close to their stations, and undertake boundary and protection work according to work programmes agreed with the Forest Ranger-in-charge.
- In the larger forests, where staff numbers allow, patrol groups (of 4-5 men) will be constituted to undertake patrol work in the forest interior, camping overnight as necessary. Patrols will be conducted along established patrol routes including (where feasible) regular Nature Reserve perimeter path inspections.
- Effective monitoring of patrols will involve the use of strategically located date stamping posts/check-points in the forest interior, where patrol staff will be expected to 'register' on each occasion they pass. These checkpoints may be visited independently at any time by a ranger or more senior member of staff to verify that patrols are being carried out as scheduled.
- In the savanna reserves, and forests with sufficient grassland patches and other openings in the canopy, use should be made of GPS (Geographic Positioning System) equipment, which records precise time and location 'waypoints' from satellite triangulation. Suitable small hand-held GPS instruments are now available for less than \$400, and can be used as a simple means for supervisory staff to ensure that forest patrols are being carried out to the areas reported.
- In order to minimise the possibility of connivance between Forest Department staff or any other relevant agency staff and others in illegal activities, patrol group membership will be subject to frequent change, and different groups will be required to patrol different areas of the forest. It is important that an element of surprise is maintained in patrol work, and for this reason, only the patrol group leader should have advance knowledge of the area of operation on any occasion.
- Effective supervision is crucial to the success of patrol work, and patrols will invariably involve a Forest Ranger, as well as 3-4 Forest Guards/Patrolmen. All major areas of a reserve should be visited by one or other patrol group at least once a month, avoiding too much repetitive patrolling of areas without significant management problems. Patrol staff will be expected to spend at least 10 days per month on 'long' patrols, involving at least eight hours walking and including several overnight operations.
- Detailed monthly patrol reports with maps showing sites visited and detailing management problems encountered shall be submitted to the DFO by the patrol team.
- Smaller reserves, and those with insufficient staff to constitute effective patrol groups, will be patrolled periodically by (temporarily constituted) mobile patrol groups, brought in for relatively short periods from another nearby forest under the direction of the Site Managers. In many respects, these patrol groups will operate by making surprise visits to areas that are not otherwise subject to effective law enforcement work. As a general guideline, such patrols should be carried out at least once a quarter, but more frequently where significant numbers of forest offenses occur.
- Ideally, Departmental patrol activities, as described above, will become increasingly redundant as the effects of community education and collaborative management programmes are felt. The transition from departmental patrolling to community-based policing of forest use may be difficult, but the aim should be to phase out departmental patrols as soon as possible.

#### **4.2.3.3 Community outreach**

Community education and participation in forest management will be undertaken to benefit the population surrounding each forest by:

- Conducting seminars and public education through the local councils;
- Encouraging local participation in management activities such as boundary planting and allowing local people to harvest building poles and fuelwood from mature boundary markers,
- Involving local councils in the regulation of timber exploitation and giving them primary responsibility for regulating the movement of timber;
- Establishing local forest conservation education centres in selected principal forest reserves and developing them to provide comprehensive visitor information and interpretation services as well as extension services;
- Developing projects which foster sustainable, productive agricultural systems in areas bordering the Nature Reserves, and providing goods and services that would otherwise be extracted from the forest;
- Encouraging local community involvement in ecotourism enterprises, and other income-generating projects related to forest protection and Nature Reserve establishment.

#### **4.2.3.4 Provision of management infrastructure and facilities**

Implementation of this Master Plan will inevitably necessitate substantial investment in management infrastructure and facilities, as detailed for individual forests in the annexed Forest Profiles.

#### **4.2.3.5 Habitat management**

- Wherever feasible, exotic plant species will be removed from the Nature Reserves.
- Indigenous species will be used (where necessary) for restoration planting in areas degraded by encroachment and over-logging.
- Whenever restoration planting is carried out, efforts should be made to maximise the wildlife value of the replanted area by planting in mixed species stands, or small single species blocks with different species in adjacent blocks.

#### **4.2.3.6 Wild animal management**

- The protection of forest animals falls under the jurisdiction of the Uganda Wildlife Authority (UWA), but it may be desirable to rationalise the protection of all forest wildlife by either re-designating all wildlife and Forest Guards as environmental guards charged with upholding both Wildlife and Forest Acts, or concentrate effort in a few carefully selected reserves where a high degree of success can be achieved by posting Wildlife guards there and increasing the efficiency of their patrols.
- A memorandum of understanding should be sought between the Forest Department or any other relevant agency and UWA to (amongst other things) ensure collaborative management of wildlife in forest reserves.
- Control of crop pests and problem animals such as baboons and elephants will be a collaborative responsibility of UWA, FD or any other relevant agency and the local authority.
- All forms of hunting, and any other activity which may directly or indirectly affect the welfare of wildlife will be prohibited in Nature Reserves.

#### **4.2.3.7 Grazing and fire management**

- In exceptional circumstances (e.g. for the protection of vulnerable isolated remnant forest patches) fire breaks will be established along Nature Reserve boundaries, and/or around specific sites.
- Early burning of specific susceptible areas will be carried out to reduce high fire damage associated with (hotter) late season fires.

- Community education will be used to inform the population of the dangers that uncontrolled burning poses to ecosystem and biodiversity conservation.
- Where possible, local communities will be encouraged to participate in fire control, especially where they are permitted to maintain beehives inside a reserve.

#### **4.2.3.8 Nature Reserve management**

- Local community social groups and school pupils may be permitted entry to Nature Reserves for educational purposes
- Visitors will be permitted for nature-based tourism, although only basic visitor infrastructure (e.g. paths, walkways) will be provided within a Nature Reserve, while accommodation, catering, picnic and toilet facilities will be provided in adjacent recreation zones.
- Non-destructive research projects will be permitted at the discretion of the Commissioner for Forestry (CFF).
- Controlled seed collection for ex-situ conservation and non-commercial collection of medicinal plants may be permitted by the CFF only if such plants do not occur anywhere else in the forest.
- Public access to Nature Reserves will only be granted by permits. Special access forms will be designed to specify purpose of access, time of validity for the permit, etc.
- Consumptive use of resources, including timber, and non-timber forest products, dead and alive will not be permitted within any Nature Reserve (except as specified above). This includes 'wind-thrown' trees, which should be allowed to decay where they fall inside a Nature Reserve.
- Any existing logging roads in the Nature Reserves will be permanently closed.
- No grazing will be permitted in the Nature Reserves.
- Deliberate setting of fires in Nature Reserves is strictly prohibited.

#### **4.2.3.9 Management of other protected zones:**

- 'Buffer' Zones (i.e. Nature Reserve Support, Wildlife Protection, Environmental Protection, and Recreation Zones) will be managed to maintain the ecological characteristics of a natural community.
- Buffer Zones will be closed to all large and medium-scale extractive exploitation of any resource and disturbance will be minimised by limiting human activities.
- Management will be based on the realisation of those economic and social benefits that do not involve commercial timber extraction including:
  - the development of nature-based tourism;
  - the commercialisation of minor forest products such as crafts materials, medicines, butterflies, honey, etc.
- Local people will be licensed to collect non-timber products for commercial and subsistence use, and may be allowed to collect building poles and firewood for their own personal domestic use.
- Local community projects (especially ecotourism) will be encouraged wherever these can benefit local communities without biodiversity loss or disruption of natural ecological processes.
- Enrichment and restoration planting of degraded areas may be undertaken where it is considered desirable to facilitate the return of a more natural forest community, using indigenous species.
- There will be no introduction of non-indigenous species, except as external boundary markers in areas where the species concerned has proven non-invasive.
- Charcoal burning will not be permitted in Buffer Zones.



#### **4.2.3.10 Management of timber production zones**

The importance of effective management of Uganda's timber resources in the implementation of this Master Plan cannot be over-emphasised. With one of the fastest-growing economies in Africa, and corresponding growth in demand for timber, it is clear that Uganda's existing timber resources will be insufficient to satisfy the country's needs by the early part of 21<sup>st</sup> century. Inevitably, this will create demands to utilise any remaining timber resources, whether or not they are contained within designated protected areas. Uganda is faced with the prospect of choosing between expensive imported timber, or utilisation of the few remaining natural forest resources from designated protected areas.

There is no easy solution to this predicament, but urgent attention must clearly be given to (i) the establishment of major industrial plantations of fast-growing species for general purpose sawnwood, and (ii) improvements in the efficiency of utilising existing timber resources. Clearly, these concerns are beyond the scope of this Master Plan, but they must receive priority attention if the nature conservation programme is to be successfully implemented and maintained in the long term.

Within the forests identified for Nature Reserve establishment, there are substantial areas designated as 'Production Zones', where sustainable harvesting of quality natural forest hardwoods will be undertaken, or timber plantations established. As noted earlier (Section 2.2), the country's entire requirement for general purpose sawn timber could be satisfied from softwood plantations on about 2% of the reserved forest land, so land availability is not a problem: there is unlikely to be pressure on proposed conservation areas for this purpose. It is also important to note that whilst 39 Forest Reserves have been identified in this plan for Nature Reserve establishment, this leaves more than 600 reserves elsewhere potentially suitable as 'production' forests.

Improving the efficiency of timber harvesting and utilisation from the natural forests is clearly a major concern, and the following guidelines are provided in this respect. The aim should be to achieve a maximum sustainable yield from productive areas of natural forest, without causing excessive disruption to forest wildlife and natural processes. It is likely that natural forest timber production in Uganda will be a relatively small-scale enterprise, perhaps involving community-based co-operatives, using (semi-) portable milling equipment - a stage beyond pitsawing, but certainly nothing on the scale seen elsewhere in the tropics.

It is beyond the scope of this plan to evaluate the suitability of different institutional arrangements and regulatory mechanisms governing natural forest timber harvesting, but it is worth commenting on the fact that present arrangements are wholly inadequate. At the very least, felling should only be permitted in areas that have been thoroughly inventoried (for timber and biodiversity); where an environmental assessment has been carried out on the proposed felling operation; and where a proper concession agreement has been negotiated (whether it be with a sawmiller or pitsawyers' cooperative). Such an agreement would include an environmental management plan, which would set out the environmental safeguards to be employed by the concessionaire. Ideally, the concessionaire would be required to deposit a substantial sum by way of a Performance Bond, at the time of award of the concession, which would later be refunded (if performance was satisfactory, and environmental safeguards upheld), or used to put right any wrong.

As a matter of course, natural forest logging activities should ensure that the following measures are taken in the interests of maintaining biodiversity and environmental values:

- Comprehensive inventories of timber and other resources (including biodiversity) should be made prior to exploitation.
- Trees of proven value to wildlife (some 'keystone' species) and seed-bearing trees of species that are selectively harvested (at least one per 10 ha) will be left standing when timber harvesting takes place.
- No logging will take place within 20 m of a stream or river bank.
- No logging will be permitted on natural forest land exceeding a 15° slope.
- Where feasible, management compartments should be felled in a sequence which maximises the age differences between adjacent stands.
- Controls over pitsawing activities, including marking tree stumps, logs and boards, and limiting pitsawing to one or two management compartments in any given forest at any one time will be described in the forest management plans and/or concession agreements, and must be implemented.

- Regeneration of logged areas must be ensured by matching felling intensities to regeneration techniques, whether natural or by planting and with or without tending.
- Only logging techniques and technology that are compatible with sustainable natural forest management will be permitted.
- Logging in dense stands will be by directional felling.
- Clearance of undergrowth during logging will be minimised.
- Commercial charcoal production, using logging waste and/or non-commercial species in the concession area may be permitted, under strict supervision.
- Use of arboricides will be strictly forbidden.
- Where mechanised harvesting is undertaken, skidding trails will be planned to avoid unnecessary disturbance and compaction of the soil by machines, and trails will follow contours on steep sites.
- Log winching will be done with minimum damage to regeneration and creation of erosion tracks.
- Fuel and lubricants will be handled in as few spots as possible.
- All waste such as drums, tyres, filters and domestic refuse from labour camps should be disposed of in such a way that they do not contaminate the soil and water.
- Education programmes should be instituted for the people involved in logging.

#### **4.3 Institutional arrangements**

##### **4.3.1 Forest Department or any other relevant agency capacity development**

###### **4.3.1.1 Forest Department or any other relevant agency headquarters capacity**

- The existing nature conservation activities should be strengthened.
- A multi-disciplinary approach involving foresters, botanists, zoologists, sociologists and other specialists should be adopted.
- The approach will be an integral part of the management system of the Forest Department or any other relevant agency .
- Nature conservation work should be spearheaded by a Senior or Principal Forest Officer, working under the Assistant Commissioner for Forestry in-charge of Natural Resource Management, based at Nakawa headquarters.

###### **4.3.1.2 Field Programme management**

- A network of Site Managers will be maintained to provide supervision and management of field programme activities. They will be expected to visit each site within their respective Management Areas at least once each quarter, to review and supervise works.
- Districts or forests with major Nature Reserves that offer a wide range of multiple-use facilities (such as Budongo, Mabira) will have a Forest Officer in-charge of Nature Conservation or Eco-tourism posted at those sites.
- Depending on the number and sizes of Nature Reserves in each district, one or two Forest Rangers may (at the discretion of the DFO) be made in-charge of the Nature Reserves. They will supervise all nature conservation activities alongside their other official responsibilities.
- Forest Guards may be recruited by the DFO with permission of the CFF and will primarily be in-charge of protection work.

#### **4.3.1.3 Training**

- Postgraduate training in nature conservation will be provided to as many Forest Officers as possible.
- Curricula at all forestry training institutions, recently revised to encompass nature conservation, need to be regularly reviewed and revised.
- The on-going in-service training of Forest Rangers, Assistant Forest Officers and Forest Officers, will be extended to include other categories of staff, until most staff have undergone basic training in nature conservation.

#### **4.3.2 Collaborative Management**

##### **4.3.2.1 Collaboration with local communities**

The success of this plan will undoubtedly depend to a large extent on the understanding and involvement of local communities in the areas where Nature Reserves are to be established. Far too little has been done during the planning stages to foster the sort of collaboration that will be required, and there is now an urgent need to give this issue priority attention. Some remarks about what needs to be done initially to involve local people around each Nature Reserve were made above (Section 4.2.1). In areas where collaborative forestry resources management will be implemented, provisions in this Master Plan will be adjusted to suit the terms of the Memorandum of Understanding between the different interested parties.

In the longer term, the Forest Department should co-operate closely with the local authorities and work out ways to operationalise collaborative resource management with local communities at each site. Considerations should include:

- Participation of local communities in resource protection, management and planning.
- Consultation over the design, selection and management of Nature Reserves, and other management zones.
- Revenue collection and methods of benefit-sharing.
- Community education and awareness.
- Establishment of ecotourism and other joint forest management projects.
- Establishment of community-based projects to substitute resources traditionally taken from areas brought under strict protection (e.g., village woodlots, medicinal plant nurseries, etc).
- Research related to the socio-economic impact of forest protection on the community; conservation and management of forest wildlife; and the integration of wildlife conservation with other forest management activities.

##### **4.3.2.2 Collaboration with Uganda Wildlife Authority**

There are strong arguments for improving collaboration between the relevant agency (currently FD) and the Uganda Wildlife Authority (UWA). Not only do the two organisations share legal responsibility for the management of several important protected areas, but they also have complementary mandates, and a common goal. With the creation of the new authority, and a change of top management, a window of opportunity would seem to exist to develop a much closer working relationship between the two organisations. As a starting point, senior officers of the two organisations need to sit together to discuss areas of common interest, and possible methods of collaboration. Such discussions may lead to the adoption of a formal memorandum of understanding, which could help allay traditional fears over territorial jurisdiction, and foster closer integration of complementary management programmes. Important areas for discussion would include:

- agreement on the zonation of the various forests/wildlife reserves especially those under dual management;
- management and protection of animal populations in Forest Reserves, especially those being designated as Nature Reserves;
- management of National Parks and Wildlife Reserves, where these carry dual status as Forest Reserves, especially where they include substantial industrial softwood plantations;

- co-ordination and optimising management efficiency in neighbouring protected areas;
- development of ecotourism in Forest Reserves and areas of dual status;
- control of problem animals on farmlands bordering forests;
- sharing expertise and experience in areas of mutual interest, such as community-based management, forest-based ecotourism, development of a national protected areas systems plan, and reserve management planning; and
- access to information.

#### **4.3.2.3 Collaboration with other institutions and organisations**

It is now common knowledge that forestry resources conservation requires a multi-disciplinary approach involving as many interested parties as possible. The Forest Department will work out ways of collaborating with other institutions and formulate a Memorandum of Understanding as necessary. These institutions may include the Forestry Research Institute (FORI), Makerere University, NGOs, NAADs, Local governments and other agencies.

#### **4.3.3 Publicity and public relations**

Although the nature conservation aspects of natural forest management are now comparatively well understood at the professional and technical levels of the Forest Department, much remains to be done to spread this appreciation more widely. In many respects, the Department's biodiversity conservation programme is exemplary, and it will undoubtedly attract support from a broad cross-section of interest groups if it is adequately publicised and understood. It is therefore important that an effective awareness programme be instituted, involving regular radio presentations, newspaper reports, and the production and distribution of printed materials. This would complement the community outreach and education activities undertaken around each forest (Section 4.2.3.3).

#### **4.3.4 Financing mechanisms**

Conservation programmes can only succeed if they are adequately resourced. To a large extent it is expected that the Forest Departments' (or any other relevant agency's) nature conservation programme, as described in this plan, will be 'subsidised' by other aspects of the Department's programme, as direct revenue generation from forest Nature Reserves is unlikely to be sufficient to cover management costs. However, some possible approaches to enhancing the financial viability of the programme include:

- Establishment of a Trust Fund which can provide a long-term source of funds from a substantial initial investment, provided by the international community.
- Transfer of funds from the international community, in recognition of the fact that many of the benefits of biodiversity conservation accrue internationally, whilst most of the costs are borne locally.
- Revenue collected from visitor centres and eco-tourism activities should be retained as a revolving fund to run other activities.
- Some of the Nature Reserves might be leased to conservation firms or non-governmental organisations who will manage them on behalf of government (and possibly pay fees).
- Bio-prospecting rights could be licensed as a source of revenue.
- Local communities should bear some management costs for services which directly benefit them.
- The development of income-generating, community-based projects from which taxes and interest from loan schemes would be used to finance other activities.

#### 4.3.5 Legislation and policy requirements

Effective implementation of the nature conservation programme will require revision of forestry legislation in a number of areas, the most important being:

- legal recognition of Nature Reserves (and perhaps other designated conservation forests), and appropriate legal provisions to ensure that they are sufficiently safeguarded against possible future change of status (at present they exist without effective legal recognition, as an internal designation of the Forest Department, making use of paragraph 13 of the Forests Act, which allows a senior Forest Officer to close any area of forest to cutting and removal of forest produce);
- legal provision for local communities to become involved in management programmes, and receive a share of the benefits/revenues derived from conservation forests. Provision for revenue retention will be an important aspect of this.

In more general terms, the laws of Uganda relating to the management of natural resources and protection of the environment should be revised. Special consideration should be given to:

- vesting the responsibility for the country's forest resources in a (parastatal) Forest Commission or authority;
- providing for the protection of unreserved forest on public land;
- increasing penalties for violation of the law;
- re-designating forest and game guards as environmental guards, charged with upholding both the Wildlife Statute and Forests Act;
- enacting new legislation to provide for the existence of eco-tourism sites and Nature Reserves;
- enacting legislation to control pollution, pesticide and arboricide use, and charcoal-burning in natural forests; and
- enacting legislation to provide for mandatory environmental impact assessments for major development projects in forest reserves, including all timber concessions, plantation developments, and proposed infrastructure.

#### 4.3.6 Research and Monitoring

Research and monitoring will be carried out in close collaboration with the Forestry Research Institute (FORI), equivalent overseas institutions and other partners in order to benefit from research being carried out elsewhere. Scientists from outside the Forest Department or any other relevant agency, working in tropical forests, will be encouraged to liaise more closely with the Department and FORI so that research projects are designed to provide information which will be of maximum benefit to forest management. The following broad research areas are considered a priority and will be encouraged in support of forest nature conservation:

- Species inventories of particular 'indicator groups'.
- Assessment of population densities of selected 'flagship' species, the plight of which can be used to generate public awareness and concern.
- Monitoring of wildlife populations and dynamics of forest ecosystems.
- Field inspection of research permanent sample plots, to determine whether or not they can still be located or are of any use.
- Forest regeneration, including monitoring of forest regrowth by establishment of permanent research plots in recently exploited forest, and research to determine the maximum levels of exploitation that are possible when forest management plans are based on unassisted regeneration.
- The effect of logging and other form of habitat disturbance on wildlife
- The environmental impact of forest management on water flow, hydrology, nutrient cycling, soil erosion and weather patterns.

- Invasive species: ecology, impact on natural forest dynamics, methods of control.
- Development of non-timber products, including medicines, resins, dyes, natural fibres, fruits, nuts.
- Relationships between the forest ecosystems and adjacent communities.
- Value of biodiversity resources to local and national economies.

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# Appendix 1: Representation of Langdale-Brown et al. vegetation types in Uganda's National Parks, principal Forest Reserves and Wildlife (Game) Reserves (excluding Karamoja)

Code	Name	Area	A1	A2	B1	B2	B3	B4	C1	C2	C3	D1	D2	D3	D4	F	F1	F2	G1	G2	G3	G4	H	H1	H2	
19	Bwindi NP	321			202			4			115															
2	Rwenzori NP	996	180	230	286	150		150																		
71	MFNP	4015											8					16						465	465	
70	QENP(excl.Maram.)	1687											47						220							
72	KVNP(excl Zulia)	907																								
73	LMNP	250																								
74	MGNP	35		7		14		14																		
75	Toro GR	548											2					6								
76	Katonga GR	207																								
77	Kibale FCGR (excl. Kibale)	206											30					10								
78	Kyambura GR	155																	23							
79	Kigezi' GR	176											12													
80	Karuma GR (excl. Bud)	605											8					180					195	194		
81	Bugunga GR (excl. Bud)	618											2													
82	Ajai's GR	156																								
1	Mt. Elgon FR/NP	1,192	170	200	250	180	50	180									161									
	Zulia FR	1,029					62										62									
3	Budongo FR	825											420													
4	Kalinzu/Maramagambo FR	584									200		299						70							
5	Kibale FR/NP	558									300		130													
6	Moroto FR	483					58										58									
7	Labwor Hills FRs	437																								
8	Nyangea-Napore FR	417															42									
9	Bugoma FR	401											321													
10	Kadam FR	399		5			190										190		10	4						
11	Kasyoha-Kitomi FR	391									220			100												
12	Mt.Kei FR	384																								
13	Mabira FR	300								8		292														
14	Agoro-Agu FR	234					48										100									
15	Semliki FR/NP	219											190													
16	Napak FR	203					140																			
17	Otzi FR	188																	94							
18	South Busoga FR	164													47				47							
20	Sango Bay FRs	151																								
21	Morongole FR	151					25										25									
22	Timu FR	118					59																			
23	Kagombe FR	113												95				13								
24	Rom FR	109					19																			
25	Kasagala FR	103																								
26	Kilak FR	102																								
27	Luunga FR	97												48												
28	Bukaleba FR	97																87								
29	Namwasa FR	96												48												
30	Kibeka FR	98																								
31	Taala (Mubende)	92												46												
32	Rwoho (Mbarara)	91												45												
33	Kyanbogo (Mubende)	89																								
34	Wabisi-Wajala (Luwero)	87																	30							
35	Itwara	86																10								
36	Aswa River	85									67															
37	Kabuika-Majwalanganda	83																								
38	Kazooba (Masaka)	74																								
39	Era	74																	15							
40	Maruzi Hills FR	71																								
41	Kijanabolola FR	65																								
42	Wiceri FR	65																						27	28	
43	Kapimpini FR	62																								
44	Kamusenene FR	62																								
45	Zoka FR	61												12												
46	Mujuzi FR	61											61													
47	Lwala FR	59					7											7								
48	Matiri FR	54												30					14							
49	Ogili FR	53																								
50	Kitechura FR	53												20				7								
51	Bwezigolo-Gunga FR	53												26												
52	Kasana-Kasambya FR	51																								
53	Opit FR	51																								
54	Nsowe FR	51																								
55	Echuya FR	35				17		18																		
56	Mafuga FR	38			20																9					
57	West Bugwe FR	30														25		9								
58	Igwe-Luvunya FRs	20														20										
59	Kisangi FR	54											20													
60	Mpanga FR	5								5																
61	Mpigi group FRs	261								250																
62	Sesse Islands FRs	43							43																	
63	Zika	1								1																
64	Jubiya FR	46							23	23																
65	Lokung FR	13																			13					
66	Mukono group FRs	84								84																
TOTAL			22,788	350	442	758	361	658	366	66	371	902	292	1,562	458	92	0	654	329	523	4	13	9	0	687	738



Note: where areas carry dual status, these are attributed to the relevant Forest Reserve, and excluded from the total area shown for the corresponding National Park or Game Reserve.

Code	Name	Area	H3	H4	J1	J2	K	L1	L2	L3	M1	M2	N	N1	N2	N3	N4	N5	N6	N7	N8	N9	N10	N11	N12
19	Bwindi NP	321																							
2	Rwenzori NP	996																							
71	MFNP	4015					525							92	160			310		85					
70	QENP(excl.Maram.)	1687																							
72	KVNP(excl.Zulia)	907										65						80						70	
73	LMNP	250																							
74	MGNP	35																							
75	Toro GR	548					6					226			200										
76	Katonga GR	207														107									
77	Kibale FCGR (excl. Kibale)	206			100											25									
78	Kyambura GR	155			8																				
79	Kigezi' GR	176																							
80	Karuma GR (excl. Bud)	605					28																		
81	Bugunga GR (excl. Bud)	618					45							19	20				25						
82	Ajai's GR	156								2				14											
1	Mt. Elgon FR/NP	1,192																							
	Zulia FR	1,029										20									144		134	257	51
3	Budongo FR	825					380							15	10										
4	Kalinzu/Maramagambo FR	584																							
5	Kibale FR/NP	558																							
6	Moroto FR	483																			121	72			
7	Labwor Hills FRs	437								30							380	27			375				
8	Nyangea-Napore FR	417																							
9	Bugoma FR	401					40							5	35										
10	Kadam FR	399																							
11	Kasyoha-Kitomi FR	391																							
12	Mt.Kei FR	384						15		365				4											
13	Mabira FR	300																							
14	Agoro-Agu FR	234								5							5				71				
15	Semliki FR/NP	219																							
16	Napak FR	203																	25						25
17	Otzi FR	188								94															
18	South Busoga FR	164					47									11									
20	Sango Bay FRs	151																							
21	Morongole FR	151																			95				
22	Timu FR	118																						59	
23	Kagombe FR	113																							
24	Rom FR	109																			90				
25	Kasagala FR	103												95											
26	Kilak FR	102					40			30								32							
27	Luunga FR	97											48												
28	Bukaleba FR	97														10									
29	Namwasa FR	96											48												
30	Kibeka FR	98					14				3				75										
31	Taala (Mubende)	92											46												
32	Rwoho (Mbarara)	91																							
33	Kyanbogo (Mubende)	89															84								
34	Wabisi-Wajala (Luvero)	87														32									
35	Itwara	86					9																		
36	Aswa River	85								12				8				65							
37	Kabuika-Majwalanganda	83												20	57										
38	Kazooba (Masaka)	74													4										
39	Era	74								15								44							
40	Maruzi Hills FR	71				5								31	30										
41	Kijababola FR	65			4																				
42	Wiceri FR	65					10																		
43	Kapimpini FR	62												22	40										
44	Kamusenene FR	62												5	42										
45	Zoka FR	61					20			9								20							
46	Mujuzi FR	61																							
47	Lwala FR	59																5			35				
48	Matiri FR	54																							
49	Ogili FR	53				13				20															
50	Kitechura FR	53															5								
51	Bwezigolo-Gunga FR	53											26				20								
52	Kasana-Kasambya FR	51			51																				
53	Opit FR	51																							
54	Nsowe FR	51																							
55	Echuya FR	35																							
56	Mafuga FR	38																							
57	West Bugwe FR	30																							
58	Igwe-Luvunya FRs	20																							
59	Kisangi FR	54			9																				
60	Mpanga FR	5																							
61	Mpigi group FRs	261																							
62	Sesse Islands FRs	43																							
63	Zika	1																							
64	Jubiya FR	46																							
65	Lokung FR	13																							
66	Mukono group FRs	84																							
TOTAL		22,788	0	0	172	18	1,164	15	0	582	0	314	168	330	705	282	405	608	25	85	931	72	134	386	76

Note: where areas carry dual status, these are attributed to the relevant Forest Reserve, and excluded from the total area shown for the corresponding National Park or Game Reserve.

[illegible]

Note: where areas carry dual status, these are attributed to the relevant Forest Reserve, and excluded from the total area shown for the corresponding National Park or Game Reserve.

[illegible]

## Appendix 2: Description of IUCN Protected Area Categories

**Category I**      **Strict Nature Reserve/Wilderness Area: protected area managed mainly for science or wilderness protection**

**Category 1a**      Strict Nature Reserve: protected area managed mainly for science

*Definition:* Area of land and/or sea possessing outstanding or representative ecosystems, geological or physiological features and/or species, available primarily for scientific research and/or environmental monitoring.

*Objectives of management:*

- to preserve habitats, ecosystems and species in as undisturbed a state as possible
- to maintain genetic resources in a dynamic and evolutionary state
- to maintain established ecological processes
- to safeguard structural landscape features or rock exposures
- to secure examples of the natural environment for scientific studies, environmental monitoring and deduction, including baseline areas from which all avoidable access is excluded
- to minimise disturbance by careful planning and execution of research and other approved activities
- to limit public access

*Guidance for selection:*

- The area should be large enough to ensure the integrity of its ecosystems and to accomplish the management objectives for which it is protected.
- The area should be significantly free of direct human intervention and capable of remaining so.
- The conservation of the area's biodiversity should be achievable through protection and not require substantial active management or habitat manipulation (cf. Category IV)

*Equivalent category in IUCN (1978):* Scientific Reserve/Strict Nature Reserve

**Category 1b**      Wilderness Area: protected area managed mainly for wilderness protection

*Definition:* Large area of unmodified or slightly modified land, and/or sea, retaining its natural character and influence, without permanent or significant habitation, which is protected and managed so as to preserve its natural condition.

*Objectives of management:*

- to ensure that future generations have the opportunity to experience understanding and enjoyment of areas that have been largely undisturbed by human action over a long period of time.
- to maintain the essential natural attributes and qualities of the environment over the long term.
- to provide for public access at levels and of a type which will serve best the physical and spiritual well-being of visitors and maintain the wilderness qualities of the area for present and future generations.
- to enable indigenous human communities living at low density and in balance with the available resources to maintain their lifestyle.

*Guidance for selection:*

- The area should possess high natural quality, be governed primarily by the forces of nature, with human disturbance substantially absent, and be likely to continue to display those attributes if managed as proposed.

- The area should contain significant ecological, geological, physio-geographic, or other features of scientific, educational, scenic or historical value.
- The area should offer outstanding opportunities for solitude, enjoyed once the area has been reached, by simple, quiet, non-polluting and non-intrusive means of travel (i.e. non-motorised).
- The area should be of sufficient size to make practical such preservation and use.

**Category II      National Park: protected area managed mainly for ecosystem protection and tourism**

*Definition:* Natural area of land and/or sea, designated to (a) protect the ecological integrity of one or more ecosystems for present and future generations, (b) exclude exploitation or occupation inimical to the purposes of designation of the area, and (c) provide a foundation for spiritual, scientific, educational, recreational and visitor opportunities, all of which must be environmentally and culturally compatible.

*Objectives of management:*

- to protect natural and scenic areas of national and international significance for spiritual, scientific, educational, recreational or tourist purposes
- to perpetuate, in as natural a state as possible, representative examples of physiographic regions, biotic communities, genetic resources, and species, to provide ecological stability and diversity
- to manage visitor use for inspirational, educational, cultural and recreational purposes at a level which will maintain the area in a natural or near natural state
- to eliminate and thereafter prevent exploitation or occupation inimical to the purpose of designation
- to maintain respect for the ecological, geomorphologic, sacred or aesthetic attributes which warranted designation
- to take into account the needs of indigenous people, including subsistence resource use, in so far as these will not adversely affect the other objectives of management.

*Guidance for selection:*

- The area should contain a representative sample of major natural regions, features or scenery, where plant and animal species, habitats and geomorphological sites are of special scientific, educational, recreational and tourist significance.
- The area should be large enough to contain one or more entire ecosystems not materially already affected by current human occupation or exploitation.

*Equivalent category in IUCN 1978:* National Park

**Category III      Natural Monument protected area managed mainly for conservation of specific natural features**

*Definition:* Area containing one, or more, specific outstanding natural/cultural feature which is of outstanding or unique value because of its inherent rarity, representative or aesthetic qualities or cultural significance.

*Objectives of management:*

- to protect or preserve in perpetuity specific outstanding natural features because of their natural significance, unique or representational quality, and/or spiritual connotations
- to an extent consistent with the foregoing objective, to provide opportunities for research, education, interpretation and public appreciation
- to eliminate and thereafter prevent exploitation or occupation inimical to the purpose of designation

- to deliver to any resident population such benefits as are consistent with the other objectives of management.

*Guidance for selection:*

- The area should contain one or more features of outstanding significance (appropriate natural features include spectacular waterfalls, caves, craters, fossil beds, sand dunes and marine features, along with unique or representative fauna and flora; associated cultural features might include cave dwellings, cliff-top forts, archaeological sites, or natural sites which have heritage significance to indigenous peoples).
- They should be large enough to protect the integrity of the feature and its immediately-related surroundings.

**Category IV      Habitat/Species Management Area:    protected area managed mainly for conservation through management intervention**

*Definition:* Area of land and/or sea subject to active intervention for management purposes so as to ensure the maintenance of habitats and/or to meet the requirements of specific species.

*Objectives of management:*

- to secure and maintain the habitat conditions necessary to protect significant species, groups of species, biotic communities or physical features of the environment where these require specific human manipulation for optimum management
- to facilitate scientific research and environmental monitoring as primary activities associated with sustainable resource management
- to develop limited areas for public education and appreciation of the characteristics of the habitats concerned and of the work of wildlife management
- to eliminate and thereafter prevent exploitation or occupation inimical to the purpose of designation
- to deliver such benefits to people living within the designated area as are consistent with the other objectives of management.

*Guidance for selection:*

- The area should play an important role in the protection of nature and the survival of species (incorporating, as appropriate, breeding areas, wetlands, coral reefs, estuaries, grasslands, forests or spawning areas, including marine feeding beds).
- The area should be one where the protection of the habitat is essential to the well-being of nationally or locally important flora, or to resident or migratory fauna.
- Conservation of these habitats and species should depend upon active intervention by the management authority, if necessary through habitat manipulation (cf. Category IA).
- The size of the area should depend on the habitat requirements of the species to be protected and may range from relatively small to very extensive.

*Equivalent category in IUCN (1978):* Nature Conservation Reserve/Managed Nature Reserve/Wildlife Sanctuary

**Category V      Protected Landscape/Seascape: protected area managed mainly for landscape conservation and recreation**

*Definition:* Area of land, with coast and sea as appropriate, where the interaction of people and nature over time has produced an area of distinctive character with significant aesthetic, ecological and/or cultural value, and often with high biological diversity. Safeguarding the integrity of this traditional interaction is vital to the protection, maintenance and evolution of such an area.

*Objectives of management:*

- to maintain the harmonious interaction of nature and culture through the protection of landscape and /or seascape and the continuation of traditional land uses, building practices and social and cultural manifestations
- to support lifestyles and economic activities which are in harmony with nature and the preservation of the social and cultural fabric of the communities concerned
- to maintain the diversity of landscape and habitat, and of associated species and ecosystems
- to eliminate where necessary, and thereafter prevent land uses and activities which are inappropriate in scale and/or character
- to provide opportunities for public enjoyment through recreation and tourism appropriate in type and scale to the essential qualities of the areas
- to encourage scientific and educational activities which will contribute to the long term well-being of resident populations and to the development of public support for the environmental protection of such areas
- to bring benefits to, and to contribute to the welfare of, the local community through the provision of natural products (such as forest and fisheries products) and services (such as clean water or income derived from sustainable forms of tourism).

*Guidance for selection:*

- The area should possess a landscape and/or coastal and island seascape of high scenic quality, with diverse associated habitats, flora and fauna along with manifestations of unique or traditional land use patterns and social organisations as evidenced in human settlements and local customs, livelihoods and beliefs.
- The area should provide opportunities for public enjoyment through recreation and tourism within its normal lifestyle and economic activities.

**Category VI      Managed Resource Protected Area: protected area managed mainly for the sustainable use of natural ecosystems**

*Definition:* Area containing predominantly unmodified natural systems, managed to ensure long-term protection and maintenance of biological diversity, while providing at the same time a sustainable flow of natural products and services to meet community needs. The area must also fit the overall definition of a protected area.

*Objectives of management:*

- to protect and maintain the biological diversity and other natural values of the area in the long term
- to promote sound management practices for sustainable production purposes
- to protect the natural resource base from being alienated for other land use purposes that would be detrimental to the area's biological diversity
- to contribute to regional and national development.

*Guidance for selection:*

- At least two-thirds of the area should be in, and planned to remain in, a natural condition, although it may also contain limited areas of modified ecosystems; large commercial plantations are not to be included.

- The area should be large enough to absorb sustainable resource uses without detriment to its overall long-term natural values.
- A management authority must be in place.



### **Appendix 3: Derivation of scores used in assessing ‘Nature Reserve Suitability’**

#### ***Potential for compatible non-consumptive uses (maximum score 10)***

##### Rationale and weighting:

Nature Reserves are more likely to be valued (and receive the necessary protection) if they contribute in a direct, immediate and conspicuous way to the well-being of people locally and nationally. Thus where Nature Reserves can provide direct economic benefits from tourism and recreation, watershed protection, or environmental research and education, they are more likely to be sustainable in the long term. These factors should therefore play an important role in evaluating the suitability of different sites for the establishment of Nature Reserves.

The maximum score of 10 for complimentary-use potential represents a quarter of the weighting favouring Nature Reserve selection. Thus it is perceived to be only half as important as species evaluation in site selection, because the primary objective of the Nature Reserve system is biodiversity conservation, whereas these complimentary uses are a secondary consideration. Where these uses become the primary objective, National Park status is more appropriate, and several of Uganda's forests have recently been designated accordingly.

##### Scoring method:

*This score is derived from consideration of each forest's potential to provide economically important non-consumptive benefits, that are fully compatible and complimentary to biodiversity preservation. Three uses are scored, namely tourism and recreation; watershed protection; and education and research.*

##### Tourism and recreation:

*Each forest is assessed and scored for:*

- *special inherent visitor attractions (e.g. apes, other animals, scenery) (max 3 points)*
- *availability and/or proximity of accommodation, other visitor facilities (max 3 points)*
- *potential for integration with existing/potential tourist circuits (max 2 points)*
- *potential for popular local recreational use (max 2 points)*

##### Watershed protection:

*Each forest is scored (from 0-10) for its importance in watershed protection determined as a function of slope, rainfall and dependence of local people on water from the reserve.*

##### Education and research

*Each forest is scored for its present and potential value as a centre for environmental forestry, education and research. A score of 0-5 is given, depending on existing facilities (scored 0-3 depending on size of establishment, its past achievements and present influence), and the likely future demand for educational opportunities (scored 0-2 depending on forest accessibility and the size and proximity of urban centres).*

*The three component scores for complimentary-use potential are summed for each forest and adjusted by a factor of 10/25 so as to give complimentary-use a maximum score of 10.*

#### ***Commercial forestry prospects (maximum score 20)***

##### Rationale and weighting

Although many ecologists would argue that Nature Reserve site selection should be based entirely on intrinsic conservation values, there are compelling arguments in favour of a more pragmatic approach which recognises that biodiversity conservation and timber production are each legitimate and necessary alternative land uses. Decisions over which of these should prevail at any particular site are best determined on the basis of the relative suitability of that site for these alternative uses. Past experience in Uganda's forests has shown that it is extremely difficult to protect timber-rich areas of natural forest from illegal harvesting, and exploitation pressures are likely to escalate as the impending timber shortages begin to be felt. Nature Reserve protection will become increasingly expensive and/or ineffective in such areas, and it is essential that the Nature Reserve planning exercise takes this into account. High management costs can only be justified where the biodiversity ‘stakes’ are exceptional.

The maximum score of 20 for commercial forestry prospects represents half of the weighting detracting from Nature Reserve site selection. The weighting is the same as that given for species conservation value, so that even if a site is

of exceptional biodiversity value its overall suitability for Nature Reserve establishment would be effectively 'neutralised' by high commercial forestry potential. Thus, a forest like Budongo which has exceptional biodiversity and timber values, becomes 'average' in terms of its overall Nature Reserve suitability rating.

Scoring method:

*The score is derived from consideration of each forest's potential for sustainable timber production, and is based on consideration of standing timber volumes; accessibility; harvesting costs and existing facilities; proportion of area suitable for harvesting (when steep slopes, mountain tops, river banks and swamps are excluded); regenerative potential and/or suitability for plantation establishment. The basis for scoring each of these factors is as follows:*

Standing timber volumes: *The most up-to-date timber inventory data available for each site are used, supplemented where necessary with estimates of standing volumes based on 'expert opinion' (for sites where inventory data are lacking).*

Proportion of area suitable for harvesting: *All forested areas, below 2500m, on land of less than 25° slope, excluding permanent swamps and a 50m strip either side of all permanent rivers and streams, is taken to be potentially suitable for timber harvesting.*

*Half of the score for 'commercial forestry prospects' (i.e. 10 points) is derived directly as the product of standing volume and proportion of area suitable for harvesting. The highest scoring forest is given a score of 10, and all others are scaled down accordingly.*

*The other 10-point contribution to commercial forestry prospects is derived as the sum of scores for other factors as follows:*

- *Accessibility and harvesting costs (evaluated on a scale of 0-3)*
- *Existing investments in sawmilling equipment (on a scale of 0-3)*
- *Proportion of area suitable for possible future plantation development (taken as all non-forested land below 2500m of less than 25° slope, experiencing at least 1000mm of rainfall pa) (on a scale of 0-4 where 1=1-25%; 2=26-50%; 3=51-75% and 4=76-100%).*

**Community-use potential (maximum score 20)**

Rationale and weighting:

As the land outside reserves comes under more intensive use, forest-adjacent communities become increasingly dependent on resources from within the country's forest reserves. This subsistence use of resources is not only a recognised legal right of all Ugandans, but also makes an important contribution to rural economies. As with commercial forestry, this important alternative to biodiversity conservation needs to be fully recognised in the planning of forest Nature Reserves. To a large extent, community needs are greatest in densely populated parts of the country, where the smaller reserves come under particularly intense user pressure.

The maximum score of 20 for community-use potential represents half the weighting detracting from Nature Reserve site selection. The weighting is the same as that given for species conservation value, so that even where a site is of exceptional biodiversity value its overall suitability for Nature Reserve establishment would be effectively 'neutralised' by high community-use potential. The score tends to detract from the Nature Reserve suitability scores of smaller forests in densely populated areas, where it would anyway be difficult and expensive to provide adequate long-term protection.

Scoring method:

*The score is derived by considering the likely present and future demands on forest products by adjacent communities, taken to be directly proportional to the number of people living next to the forest boundary, and the proportion of the forest that is accessible to them. Recent studies in Uganda and Kenya (P. Scott, C. Hunter and L. Emerton, pers. comm.) have shown that most widely-used products are under most intense pressure along the forest edges within 2 km of the boundary, and that people rarely travel more than 5 km into a forest in search of products (except highly specialised items of limited distribution such as certain medicinal plants, etc). Since no data are available on the extent of community-use requirements in each forest, a score is derived for each forest from measures of population density in adjacent areas (from 1991 census statistics) and consideration of the ratio of community/reserve boundary to area protected, within each reserve.*

*The score for community-use potential is derived as the product of average population density in each forest-adjacent community (based on sub-county units) and forest/community boundary: area ratio. The highest ranking forest is given a score of 20, and all others are scaled down accordingly.*

**Appendix 4: Scoring system for ecological integrity used in the forest profiles**

<b>Settlement:</b>	0 =	None
	1 =	Temporary home(s), less than 2 years old, recorded inside reserve, but never further than 1 km from boundary; no more than 2% of 1 km <sup>2</sup> grid cells affected.
	2 =	Temporary and/or permanent homesteads inside reserve, in 2-5% of 1 km <sup>2</sup> grid cells affected.
	3 =	Homesteads in more than 5% of 1 km <sup>2</sup> grid cells
<b>Cultivation:</b>	0 =	None
	1 =	Signs of past cultivation, 5-15 years ago, affecting up to 10% of 1 km <sup>2</sup> grid cells. Current cultivation, if any, affecting less than 2% of grid cells.
	2 =	Signs of past cultivation, 5-15 years ago, affecting 11-25% of 1 km <sup>2</sup> grid cells. Current cultivation, if any, affecting less than 5% of 1 km <sup>2</sup> grid cells.
	3 =	Signs of past cultivation, 5-15 years ago, affecting more than 25% of 1 km <sup>2</sup> grid cells. Current cultivation, if any, affecting less than 5% of 1 km <sup>2</sup> grid cells.
	4 =	Present cultivation affects 5-10% of 1 km <sup>2</sup> grid cells.
	5 =	Present cultivation affects more than 10% of 1 km <sup>2</sup> grid cells.
<b>Hunting Pressure:</b>	0 =	No evidence of hunting, widespread ungulate spoor.
	1 =	Evidence of hunting affecting large areas, but signs of large mammals frequently seen in remoter areas.
	2 =	Heavy hunting pressure, but still some signs of large mammals.
	3 =	Heavy hunting pressure. No evidence of large mammals.
<b>Livestock grazing:</b>	0 =	None
	1 =	Occasional, seasonal use of reserve for grazing and/or access to water sources, affecting no more than 25% of area; and/or use of areas within 1 km of boundary for small numbers of domestic stock.
	2 =	Frequent use of reserve for grazing, affecting 25-50% of area.
	3 =	Frequent use of reserve for grazing, affecting 50-75% of area.
	4 =	Frequent use of reserve for grazing, affecting 50-75% of area.
	5 =	Frequent use of reserve for grazing affecting more than 75% of area.
<b>Timber harvesting:</b>	0 =	None
	1 =	Small-scale harvesting, affecting less than 5% of 1 km <sup>2</sup> grid cells in past 10 years.
	2 =	Small-scale harvesting, affecting 6-15% of 1 km <sup>2</sup> grid cells in past 10 years.
	3 =	Significant impact of timber harvesting, affecting prime timber trees in 6-25% of 1 km <sup>2</sup> grid cells in past 10 years; and/or up to 50% of closed canopy forest heavily logged (removal of > 70% of trees > 50 cm dbh) in preceeding period.
	4 =	Significant impact of timber harvesting affecting a wide spectrum of targets, species/sizes in 16-25% of 1 km <sup>2</sup> grid cells in past 10 years; and/or majority of forest logged previously.
	5 =	Widespread timber harvesting affecting a wide spectrum of target species/sizes in more than 25% of 1 km <sup>2</sup> grid cells over past 10 years and/or majority of timber class trees already exploited throughout forest.
<b>Fire:</b>	0 =	None
	1 =	Infrequent fires affecting small areas of reserve.
	2 =	Occasional widespread burning affecting more than 50% of reserve.
	3 =	Frequent fires/affecting majority of reserve at least once annually.
<b>Community use/access:</b>	0 =	Low population densities in surrounding areas and no/little use of resources within reserve.
	1 =	(low-medium population densities and) significant use of resources from up to 20% of 1 km <sup>2</sup> grid cells.
	2 =	Widespread use of a range of products from 20-50% of 1 km <sup>2</sup> grid cells.
	3 =	Heavy community use of a wide range of products from at least 50% of 1 km <sup>2</sup> grid cells.

<b>Mining:</b>	0 =	None
	1 =	Occasional small-scale operations, involving no more than 20 people, and no more than 2% of 1 km <sup>2</sup> grid cells.
	2 =	Mining operations widespread, affecting 2-5% of grid cells, and involving 20-100 people.
	3 =	Mining operations throughout reserve, in more than 5% of grid cells with significant impact on vegetation and water quality.

**Appendix 5: List of Uganda's vegetation types (after Langdale-Brown, *et al.*, 1964)****HIGH ALTITUDE HEATH & MOORLAND**

- A1 *Alchemilla-Helichrysum* moorland  
A1 *Ericaceae-Stoebe* heath

**B HIGH ALTITUDE FOREST**

- B1 *Pygeum (Prunus)* moist montane forest  
B2 *Hagenia-Rapanea* moist montane forest  
B3 *Juniperus-Podocarpus* dry montane forest  
B4 *Arundinaria* montane bamboo forest

**C MEDIUM ALTITUDE MOIST EVERGREEN FOREST**

- C1 *Piptadeniastrum-Uapaca* forest  
C2 *Piptadeniastrum-Albizia-Celtis* forest  
C3 *Parinari* forest

**D MEDIUM ALTITUDE SEMI-DECIDUOUS FOREST**

- D1 *Celtis-Chrysophyllum* forest  
D2 *Cynometra-Celtis* forest  
D3 *Albizia-Markhamia* forest  
D4 *Albizia-Chlorophora (Milicia)* forest

**F FOREST/SAVANNA MOSAIC**

- F Undifferentiated  
F1 Forest/Savanna mosaic at high altitudes  
F2 Forest/Savanna mosaic at medium altitudes

**G MOIST THICKET**

- G1 Undifferentiated semi-deciduous thicket  
G2 Riparian thicket  
G3 Lowland bamboo thicket  
G4 Montane thicket

**H WOODLAND**

- H Undifferentiated  
H1 *Vitex-Phyllanthus-Sapium-Terminalia* woodland  
H2 *Terminalia* woodland  
H3 *Isobertina-Daniellia* woodland  
H4 *Albizia-Combretum* woodland

**WELL-DRAINED SAVANNA****J MOIST ACACIA SAVANNA**

- J1 *Acacia-Albizia-Beckeropsis-Cymbopogon*  
J2 *Acacia-Albizia-Panicum-Chloris*

**K MOIST COMBRETUM SAVANNAS**

- K *Combretum-Terminalia-Albizia-Hyparrhenia rufa*

**L BUTYROSPERMUM SAVANNAS**

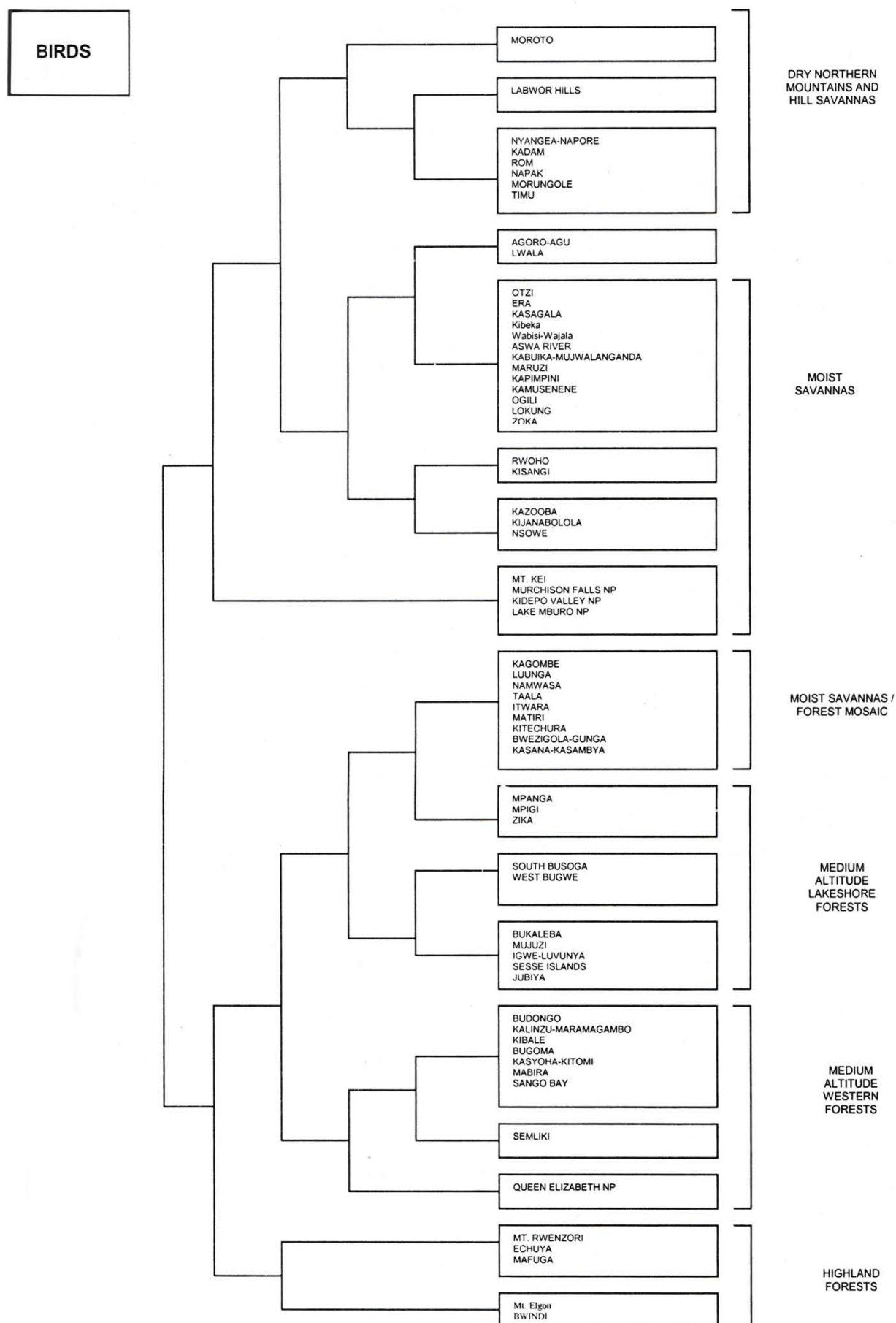
- L1 *Butyrospermum-Daniellia-Hyparrhenia*  
L2 *Butyrospermum-Hyparrhenia rufa*  
L3 *Butyrospermum-Hyparrhenia dissoluta*

M	PALM SAVANNAS
M1	<i>Borassus-Hyparrhenia rufa</i>
M2	<i>Borassus-Hyparrhenia dissoluta</i>
N	DRY <i>COMBRETUM</i> SAVANNAS
N	Undifferentiated
N1	<i>Combretum-Terminalia-Loudetia</i>
N2	<i>Combretum-Hyparrhenia</i>
N3	<i>Combretum-Cymbopogon</i>
N4	<i>Combretum-Oxytenanthera-Hyparrhenia</i>
N5	<i>Combretum-Acacia-Hyparrhenia</i>
N6	<i>Combretum-Acacia-Lasiurus</i>
N7	<i>Combretum-Acacia-Heteropogon</i>
N8	<i>Combretum-Acacia-Themeda</i>
N9	<i>Combretum-Acacia-Commiphora</i>
N10	<i>Boswellia-Fagara-Heeria</i>
N11	<i>Acacia-Combretum</i>
N12	<i>Acacia-Heeria-Terminalia</i>
N13	<i>Lannea-Combretum-Lonchocarpus</i>
P	DRY <i>ACACIA</i> SAVANNAS
P1	<i>Acacia-Cymbopogon/Themeda</i> complex
P2	<i>Acacia-Themeda-Setaria</i> savanna
Q	GRASSLAND SAVANNAS
Q	Undifferentiated
Q1	Moist <i>Hyparrhenia</i> grass savanna
Q2	<i>Hyparrhenia</i> grass savanna derived from <i>Butyrospermum</i> savanna
Q3	Dry <i>Hyparrhenia</i> grass savanna
Q4	<i>Themeda-Chloris</i> grass savanna
Q5	<i>Themeda-Loudetia</i> grass savanna
Q6	<i>Themeda-Heteropogon</i> grass savanna
Q7	<i>Eragrostis-Loudetia</i> grass savanna
R	TREE AND SHRUB STEPPE
R1	<i>Acacia</i> tree and shrub steppe
R2	<i>Lannea-Acacia</i> tree and shrub steppe
S	GRASS STEPPE
S1	<i>Chrysopogon</i> grass steppe
T	BUSHLAND
T1	<i>Acacia-Lannea</i> bushland
T2	<i>Acacia-Commiphora-Lannea</i> bushland
T3	<i>Acacia-Commiphora</i> bushland
T4	<i>Acacia reficiens-Commiphora</i> bushland/thicket
T5	<i>Commiphora-Euphorbia-Lannea</i> bushland
T6	<i>Lannea-Acacia-Balanites</i> bushland
T7	<i>Acacia-Albizia-Dichrostachys</i> bushland
T8	<i>Acacia mellifera</i> bushland
T9	<i>Acacia seyal-Acacia nilotica-Pennisetum mezianum</i> bushland
V	DRY THICKET
V	Undifferentiated dry thicket

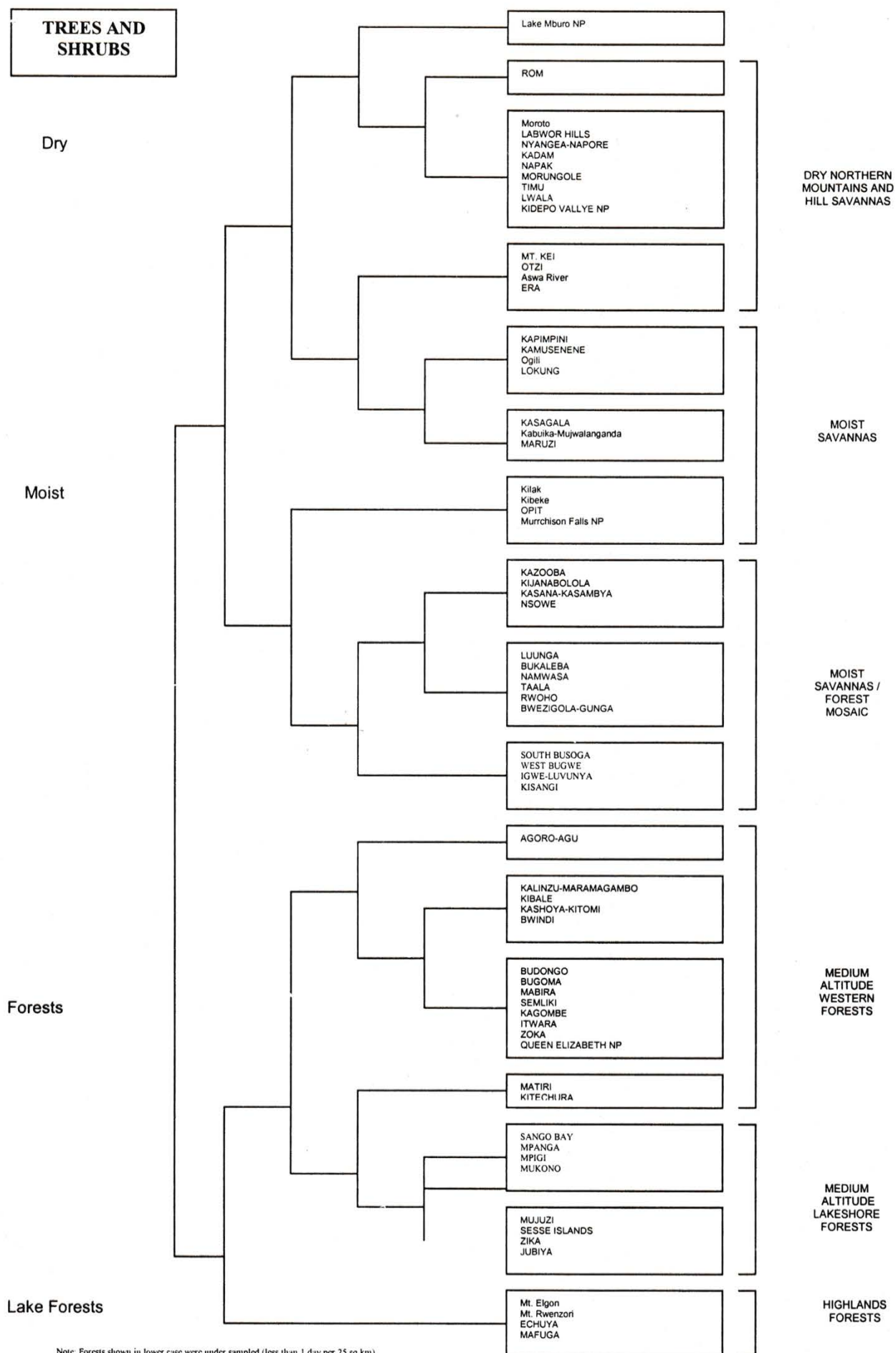
V1	Undifferentiated deciduous thicket
V2	<i>Acacia-Euphorbia</i> thicket
V3	<i>Acacia-Commiphora</i> thicket
V4	<i>Acacia nubica</i> thicket
V5	<i>Acacia mellifera</i> thicket
W	COMMUNITIES ON SITES WITH IMPEDED DRAINAGE
W	Undifferentiated
W1	<i>Echinochloa</i> grassland
W2	<i>Sorghastrum</i> grassland
W3	<i>Brachiaria-Hyparrhenia</i> grassland
W4	<i>Acacia-Imperata</i> savanna
W5	<i>Combretum-Acacia-Hyparrhenia</i> savanna (1)
W6	<i>Combretum-Acacia-Hyparrhenia</i> savanna (2)
W7	<i>Acacia-Themeda</i> savanna
W8	<i>Acacia-Setaria</i> savanna
X	SWAMP
X	Undifferentiated
X1	<i>Cyperus papyrus</i> swamp
X2	<i>Miscanthidium</i> swamp
Y	SWAMP FOREST
Y1	<i>Rauvolfia-Croton</i> seasonal swamp forest
Y2	<i>Baikiaea-Podocarpus</i> seasonal swamp forest
Z	POST CULTIVATION COMMUNITIES
Z	Undifferentiated
Z1	<i>Imperata-Panicum-Hyparrhenia</i>
Z2	<i>Cymbopogon-Imperata</i>
Z3	<i>Hyparrhenia-Pteridium</i>
Z4	<i>Eragrostis-Chloris-Hyparrhenia</i>



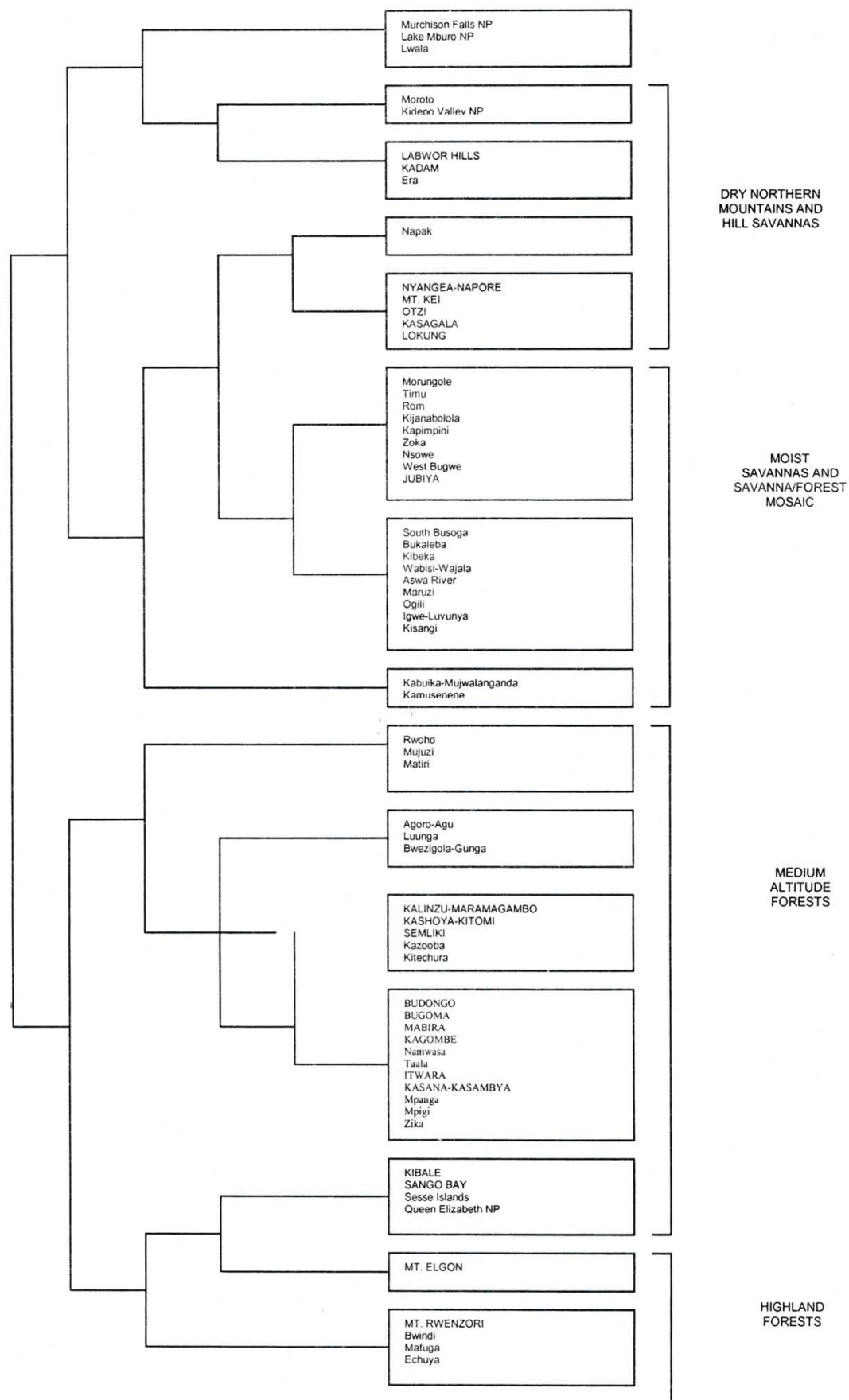
**Appendix 6. Relationships between forests based on TWINSpan analysis of species represented in each forest for five different indicator taxa.**



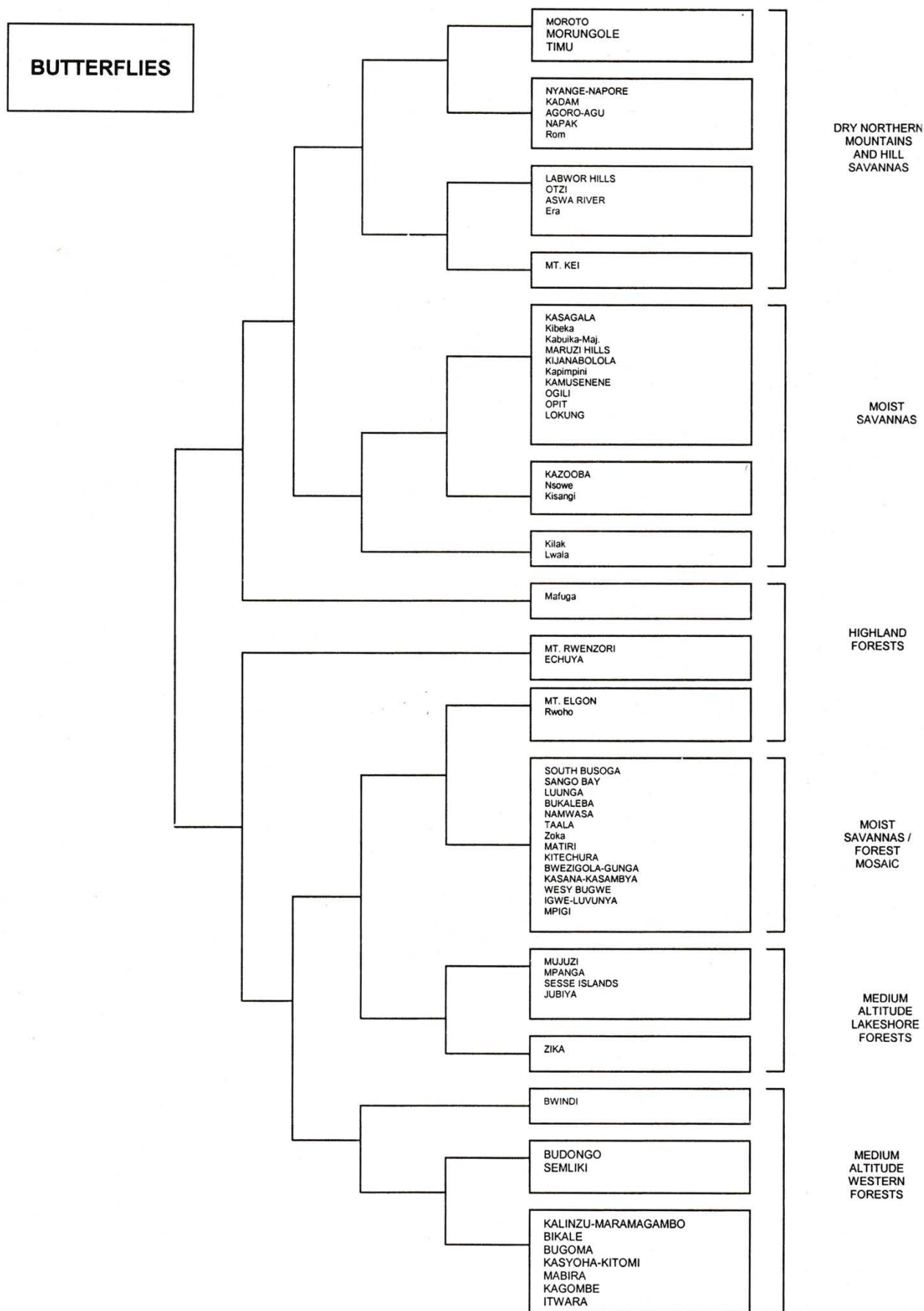
Forests shown in lower case were under sampled (less than 1 day sampling effort per 25)



**SMALL  
MAMMALS**



Note: Forests shown in lower case were under sampled (fewer than 100 individuals captured)



Note: Forests shown in lowercase were under sampled (fewer than 100 individuals captured)



## APPENDIX 7: BUDONGO FOREST PROFILE

(Category: PRIME conservation forest)

### 1 Basis for selection

The forest was selected for Nature Reserve establishment in recognition of its considerable biodiversity importance, especially because:

- the site contributes more than 2% of the national Protected Area system species complement
- the forest supports 32 species of trees unique to it (more than 1% of the species known from the protected area system of Uganda)
- the site supports at least one unique species of conservation importance

### 2 Physical description

**Area and demarcation:** The forest covers 825 km<sup>2</sup> with a total boundary length of 287 km of which approximately 200 km adjoins rural communities and about 87 km adjoins Murchison Falls National Park and Wildlife Reserves. Of the 287 km of external boundary, approximately 116 km follows streams, roads and the escarpments and 171 km is an artificial boundary maintained as planted cutlines with earth corner cairns, beacons and directional trenches.

**Establishment:** In parts from 1932 to 1968.

**Location:** The forest lies above the escarpment North East of Lake Albert in the district of Masindi (Buliisa, Bujenje and Buruli counties) and Hoima (Bughaya county). Its geographical location is between latitude 1°37' and 2°03' N and between 31°22' and 31°46' E, covered by the Uganda Department of Lands and Surveys map sheets 30/3, 30/4, 38/2, 39/1, 39/2, 38/4 and 39/3 (series Y732) at 1:50,000.

**Physical features:** The reserve occupies gently undulating terrain with a general slope NNW towards the rift valley, at an altitude from 700 m to 1270 m above sea level. Only 3.3% of the reserve exceeds 15° slope and about 81% of the reserve is less than 5° slope. The forest is bisected by four small rivers (Sonso, Waisoke, Wake and Bubwa) which drain into Lake Albert.

### 3 Vegetation and forest condition

The majority of the area (420 km<sup>2</sup>; 50%) 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* savanna, 380 km<sup>2</sup>). The remainder comprises N1 (*Combretum-Terminalia-Loudetia*; 15 km<sup>2</sup>) and N2 (*Combretum-hyparrhenia*, 10 km<sup>2</sup>; Langdale-Brown et al., 1964).

The vegetation type D2 has changed considerably following 60 years of selective logging and silvicultural treatment which favoured growth of valuable timber species especially mahogany. The original D2 (before the 1950s) has been replaced by 'mixed forest' type which was estimated at 65% of the whole forest area (Eggeling, 1947) and stood at 85% of the whole forest area (Plumptre, 1996). A detailed forest type map is available at the Forest Department Headquarters, based on the 1950s aerial photography and reproduced in Howard (1991).

The forest is partially degraded (overall condition score 3) mainly because of pitsawing and saw milling which has been going on over the years. There are a few cases of hunting and gathering of forest produce by the local people neighbouring the Forest Reserve (FR), for domestic use.

**Forest integrity scores:** Settlement = 0; Cultivation = 0; Hunting = 2; Livestock = 1; Timber = 3; Fire = 2; Community Use = 2 (see appendix 4 for explanation).

### 4 Economic importance

**Community use value:** The forest is situated in an averagely dense populated part of the country (107 people/km<sup>2</sup> in 1991). Therefore pressure on the forest for fuelwood, building poles and other non timber forest products is correspondingly low giving a community use value of 1.9. However, there is a large immigrant population living adjacent to the boundary of the forest that is not contiguous with the National Park or Wildlife Reserves especially around Siba block, and with increasing pressure for land this could potentially lead to encroachment in the future.

**Timber production:** The forest is the richest in timber production in Uganda and is well endowed with high quality mahogany trees. Timber production, by pitsawyers (who formed an association) and sawmillers provided an average annual offtake of 11,522.82 m<sup>3</sup> of round wood over the 1991-1996 period (Table 7.1) as well as large volumes of timber cut illegally, which peaked during 1992-94 when there was a ban on pitsawing.

The standing volume of merchantable timber exceeding 50 cm dbh is estimated at 1,366,280 m<sup>3</sup> from 15 different species with an Annual Allowable Cut (AAC) of 17,078 m<sup>3</sup> over an 80 years rotation.

**Table 7.1 Round wood extraction from Budongo forest reserve (m<sup>3</sup>) – 1990-96**

	91	92	93	94	95	96	Total
Pitsawyers	-	-	-	-	402.44	4,812.97	5,215.41
Sawmillers	52,843.3	5,163.7	3,242.4	871.4	669.80	1,130.93	63,921.53
<b>Total</b>	<b>52,843.3</b>	<b>5,164.7</b>	<b>3,242.4</b>	<b>871.4</b>	<b>1,072.24</b>	<b>5,943.9</b>	<b>69,136.94</b>

Source: Budongo Forest Office File, Nyabyeya, Masindi

Approximately 2 acres of *Tectona grandis* was established near the royal mile in 1946 for trial. Its scope for expansion is limited due to poor growth.

**Other economic values (ecotourism):** The reserve has great potential for nature-based tourism, a potential that is being developed at Busingiro and Kaniyo Pabidi. Its location on a major tourist circuit and with rare animals such as the chimpanzee, as well as ideal spots for watching forest birds, ease of accessibility by road and presence of basic infrastructure make it ideal for tourism.

The forest is also of exceptional biodiversity value (see below) and offers a good scope for education and research work.

## 5 Biodiversity values

Of the 65 forest reserves investigated for biodiversity, Budongo forest reserve ranks 3rd in overall importance with a score of 15. It ranks 6th in terms of the rarity value of the species represented. In terms of species diversity it ranks 9<sup>th</sup> overall. The forest is of exceptional botanical importance and supports 42 species found in no other Ugandan forest (including 32 trees, 4 birds, 4 moths and 2 butterflies). Three species of butterflies and three of trees are endemic to the Albertine rift region (Table 7.4). It represents the largest block of medium altitude semi-deciduous forest type D2 (Langdale Brown et al., 1964) in the protected area system. It probably shares most of its species with other medium altitude forests along the Albertine rift.

## 6 Present management

The reserve is managed from Budongo station (based at Nyabyeya Forestry College), by the Forest Officer in charge of the Working Plan Area and is assisted by two Forest Officers. They are supervised by the District Forest Officer, Masindi. The reserve is divided into 8 blocks.

**Table 7.2: Existing and proposed staff deployment at Budongo Working Plan area**

Forest station	Existing and proposed number of staff by category					Total
	Forest Officer	Assistant Forest Officer	Forest Rangers	Forest Guards	Patrolmen	
Nyabyeya	1(1)	0(0)	0(1)	0(1)	4*(0)	5(3)
Nyakafunjo	0(0)	0(1)	1(1)	1(1)	4*(0)	6(3)
Kasenene	0(0)	0(0)	1(1)	0(1)	2*(2)	3(4)
Busingiro	1(0)	0(0)	1(0)	0(0)	0(3)	2(3)
Kabalye	0(1)	0(0)	1(1)	0(1)	3*(0)	4(3)
Siba	0(0)	0(0)	0(1)	0(1)	3*(3)	3(5)
Biiso	0(0)	0(0)	1(0)	0(1)	3*(3)	4(4)
Kaniyo Pabidi	1(0)	0(0)	1(1)	0(1)	3*(3)	5(5)
Research	0(1)	0(0)	1(0)	0(0)	0(2)	1(3)
<b>Total</b>	<b>3(3)</b>	<b>0(1)</b>	<b>7(6)</b>	<b>1(7)</b>	<b>22*(16)</b>	<b>33(33)</b>

\* represent number of staff employed under the EU, NFM & C Project  
 Number in brackets indicate proposed staffing.

The department has 22 residential houses, one office and a store built with FD funds. Seven of the residential houses are 2-3 bedroom houses; while the other are 'unihuts' (Finnemore buildings). All the buildings are in poor state. 20 of them need urgent renovation and two are uneconomic to renovate. There are 7 incomplete houses (constructed under the Forest rehabilitation programme) at different stages towards completion (see Table 7.3). There is need for constructing three more residential houses and expanding the office of the Working Plan Area.

**Table 7.3: Existing and (proposed) staff housing within the Budongo Working Plan Area**

Station	FD Detached	Unihut/ uniport	FD Detached Incomplete	FD Semi-detached	Private
1. Nyabyeya	2*	4*	0 (2)	0 (0)	1
2. Nyakafunjo	5*	6*	1 (0)	0 (0)	1
3. Kasenene	1	0	1* (0)	0 (0)	2
4. Busingiro	2* + 1	0	0 (0)	0 (0)	0
5. Kabalye	0	0	1 (0)	1 (0)	3
6. Biiso	0	0	1 (1)	0 (1)	3
7. Siba	1	0	0 (1)	0 (1)	2
8. Kaniyo Pabidi	0	0	1 (1)	1 (1)	3
<b>Total</b>	<b>12</b>	<b>10</b>	<b>5 (5)</b>	<b>2 (3)</b>	<b>15</b>

Note: Numbers in brackets indicate proposed housing units.  
 \* indicate houses currently being occupied

Management is facilitated by two vehicles (in good running condition) and four motorcycles in poor mechanical condition. Most parts of the forest are quite accessible by vehicle up to the boundary, however 3/4 of the 80 km of road network within the forest reserve is not motorable due to lack of maintenance.

A new 10-year Forest Management Plan will come into effect into 1998 and prescribes for the conservation ("in-situ") of the forest biodiversity and ecological conditions, the economic production of hard wood timber on a sustainable basis, the integration of the communities living near the forest reserve in collaborative management, the development and provision of recreational facilities and carrying out research on the various aspects of the forest ecosystem dynamics.

Since 1990, with support from the EU financed Natural Forest Management & Conservation Project, approximately 120 km of boundary has been redemarcated by cutline and corner beacons.

Illegal pitsawing is currently under control due to intensification of patrols, benefit sharing with the local communities, dialogue with the local authorities and community extension/education work.



## 7 Proposed zonation

Figure A7.1 shows the proposed zonation of the reserve, with 3 Strict Nature Reserves (250.6 km<sup>2</sup>), two recreation zones (35.16 km<sup>2</sup>), Production Zone (462.68 km<sup>2</sup>), Protection (buffer) Zone (51.19 km<sup>2</sup>) and a site of Special Scientific Interest (6.24 km<sup>2</sup>).

The proposed zonation of areas has been influenced by:

- the SW-NE gradient, change in vegetation type and biodiversity;
- silvicultural and arboricide treatment during earlier management;
- consideration of areas under dual management arrangements (i.e. UWA and FD);
- remoteness from local population;
- degree of slope and network of rivers.

### Strict Nature Reserves (SNR)

**SNR1**; comprises compartments S4 and S5 in Siba block (15.8 km<sup>2</sup>), and has been selected to represent a community typical of that forest, which is different in type and composition from the main Budongo Block.

**SNR2**; middle portion of the forest, comprising compartment N15 (7.47 km<sup>2</sup>), of Nyakafunjo block, is the oldest Nature Reserve in the country and was established in 1944 with the objective of tracing succession in the forest in order to show how “timber species colonise savanna type of grassland before a high forest state is reached”; it is a good base for studying succession and forest ecology dynamics. Associated with SNR2 is N3 (6.24 km<sup>2</sup>) which is a Site of Special Scientific Interest.

**SNR3**; North of the forest, is the largest (93.95 km<sup>2</sup>) and comprises 14 compartments; N14, WW16, WW17, WW18, WW20, EW28, EW29, EW30, EW31, EW32, EW33, EW34, EW35, EW36. This part of the forest was not treated with arboricide between the 1950s and 1970s and had little illegal activities in them due to remoteness; it has no local community interface and has fairly steep-sided valleys and a network of streams and is therefore not very suitable for timber production. About 22 km<sup>2</sup> of the area is under Joint Management with UWA.

Associated with SNR3, is a substantial area (133.38 km<sup>2</sup>) of grassland that falls under the Joint Management with Uganda Wildlife Authority and this will be part of the Strict Nature Reserve.

### Protection zones (Buffer Zones):

**SNR1** will be buffered and protected by S2 from the south and S7 (12.67 km<sup>2</sup>) where there is a community interface. Bubwa sawmill, which is located below the Strict Nature Reserve will be supplied by timber from Busaju block (just above the sawmill).

**SNR2** will be protected (buffered) by N1, N4 and compartment B2

**SNR3** will be protected by the areas of Murchison Falls National Park and Kaniyo Pabidi (see Figure A7.1).

**Ecotourism zone:** The ecotourism zone (35.16 km<sup>2</sup>) will comprise of compartments KP11, KP12, KP13 in the north of the forest. This isolated block of forest, with all-year-round resident chimpanzees, rare forest birds (e.g., Puvels Illadapsis, not known from nowhere else in Uganda nowhere else in Uganda), and big impressive trees with buttresses and twisted vines will live up to the expectation of visitors. In the south, compartments S8, B1 and B4 will form part of the tourism zone. Although this part of the forest has been logged, it is of great interest for birdwatchers and general ecotourism. The Royal Mile, dividing N1 and N2, will be part of the ecotourism zone because it is the best place for forest birdwatching in the whole country.

**Production zone:** This will be the biggest part of the reserve covering 462.675 km<sup>2</sup> of which 239.82 km<sup>2</sup> will be within the seven blocks having closed forest with 6 compartments in Busaju block, 4 compartments in Siba block, 3 compartments in Biiso block, 11 compartments in Nyakafunjo Block; 9 compartments in West Waibira Block, 6 compartments in East Waibira block and 3 compartments in Kaniyo Pabidi block. These blocks still have a substantial quantity of timber despite having been logged more than once over the last 80 years. The area has 62.595 m<sup>3</sup>/ha of timber trees > 50cm dbh of various classes. The remaining 222.855 km<sup>2</sup> will be in the Kitigo grassland area for plantation establishment.

## 8 Proposed management programme

**Staffing:** The present established staff (3 Forest Officers, 7 Forest Rangers and 1 Forest Guard) is not adequate to manage the forest reserve. Although 22 patrol men were recruited with funds from the EU project, not much was achieved. Recruitment and redeployment is necessary in order to take on the tasks of the various management zones effectively.

The entire reserve will continue to be under the management of the Forest Officer of the Working Plan Area based at Nyabyeya, but will be assisted by 5 other Forest Officers, 1 Assistant FO, 13 Rangers and 8 Forest Guards. 38 patrolmen and 5 nursery workers will be required to assist in field operations. A radio linkage will be required to facilitate their work.

**Infrastructure:** The incomplete houses financed under the FRP should be completed and those financed by FD that can be improved upon should be renovated immediately. New ones should be built at Nyabyeya, Biiso, Siba and Kaniyo Pabidi ecotourism site (Table 7.3).

Three patrol huts capable of accommodating 6-8 people should be constructed in the forest (Figure A7.1) for over night use by patrol teams. They should be located at S1, N9 and W26.

Most of the 80 km road network that exist in the forest should be reopened except that which comes close to the northern Strict Nature Reserve, SNR 3.

**Demarcation:** External boundary planting needs careful consideration since previous planting did not prove successful. The use of corner beacons and directional trenches is ideal. Where there is a community interface, their involvement in planting live markers (under a permit arrangement) for their own use may prove successful.

All internal management zone boundaries shall be demarcated by ring painting of trees in a standard way. Red paint will be used to indicate Strict Nature Reserve; yellow for 'buffer' zones including recreation areas. Sign boards will be erected whenever prominent roads or foot paths cross internal or external boundaries.

**Patrol and protection activities:** One mobile patrol team of 6 people under the FO Budongo WPA will constitute the striking force and will check on other patrol teams. 7 other patrol teams each comprising of 2-3 Forest Guards and patrol men will be constituted with the responsibility of safeguarding the ranges. This will follow a regular pattern. However, there will be emergency patrols whenever -deemed necessary and there will be rotation of patrolmen between teams. In order to keep the morale of the patrol team high, a system of incentives for work well done will be instituted. Protection activities should also involve dialogue with the local people on the user rights and the role of the community in controlling illegal activities within the forest reserve (see below).

**Public access and community needs:** One Forest Officer and 2 Forest Rangers based at Busingiro and Kaniyo Pabidi will take the lead in community out-reach programmes including the development of collaborative forest management programmes within the forest reserve and an integrated approach to conservation outside the reserve. A programme of community meetings will be instituted in order to explain and discuss management of the reserve and its management zones, the community user rights and their role in collaborative management.

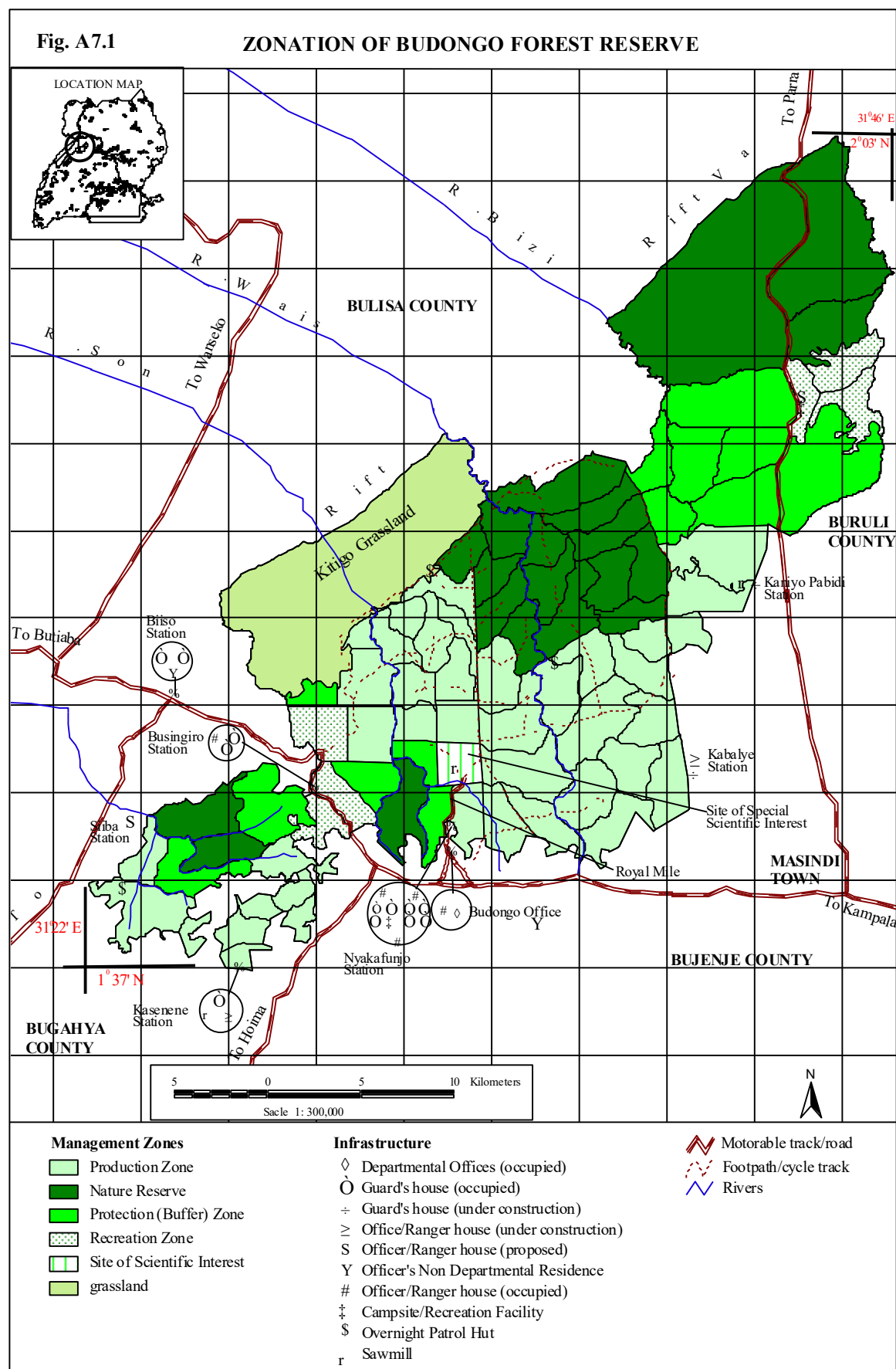
**Table 7.4 Summary table of biodiversity values for Budongo**

Criterion	Trees & Shrubs	Birds	Mammals	Butterflies	Moths	Overall
No. of known spp.	465	359	24	289	130	1267
No. of restricted range spp (<5 forests)	93	59	0	43	23	218
Spp. Unique to the forest	<i>Acacia pentagona</i> <i>Adhatoda ongherana</i> <i>Adhatoda schimperiana</i> <i>Allophylus kivuensis</i> <i>Anisotes macrophyllus</i> <i>Artabotrys lastoursvillensis</i> <i>Barleria brownii</i> <i>Cremaspora triflora</i> <i>Crossonephelum africanus</i> <i>Crotonogynopsis usambarica</i> <i>Dichapetalum angolense</i> <i>Eremospatha haullevilleana</i> <i>Eriosema flemingioides</i> <i>Erythrina mildbraedii</i> <i>Lepisanthes senegalensis</i> <i>Macrorungia pubinervia</i> <i>Macrosphyra longistyla</i> <i>Monanthotaxis gillettii</i> <i>Mussaenda elegans</i> <i>Mussaenda erythrophylla</i> <i>Ochna monantha</i> <i>Ouratea morsoni</i> <i>Oxyanthus lepidus</i> <i>Pseuderanthemum ludovicianum</i> <i>Psychotria brevipaniculata</i> <i>Psychotria penduncularis</i> <i>Rutidae smithii</i> <i>Tetracera potatoria</i> <i>Thunbergia erecta</i> <i>Thunbergia vogeliana</i> <i>Vitex ferruginea</i> <i>Ziziphus pubescens</i>	<i>Lesser moorhen</i> <i>Lemon-bellied crombec</i> <i>Yellow-fooled flycatcher</i> <i>Ituri Batis</i>	-	<i>Colotis halimede</i> <i>Abantis contigua</i>	<i>Athletes albicans</i> <i>Cinabra hyperbia</i> <i>Decachorda? talboti/ ? aspersa</i> <i>Orthogoniopitulum sp.A.</i>	
Uganda Endemism	None	None	None	<i>Euphaedra peculiaris</i>	-	1
Albertine Rift Valley endemics	<i>Grewia pubescens</i> <i>Ochna monantha</i> <i>Rhytigynia beniensis</i>	None	None	<i>Cymothoe ochreatea</i> <i>Neptis intermedia</i>	-	5
Species diversity (score & rank)	7(17=)	7.7(11)	6.1(34)	10(1)	9.6(2)	7.3(8)
Species rarity value (score & rank)	9.1(3)	6.8(12=)	4.9(33=)	5.7(12=)	8.1(2=)	7.7(7)

Overall biodiversity score 15.4

## **9 Principle reference material**

1. Howard, P.C. (1991). Nature Conservation in Uganda's Tropical Forest Reserves. IUCN, Gland, Switzerland.
2. Langdale Brown, I., Osmaston, H.A and Wilson, J.G. (1964). The vegetation of Uganda and its Bearing on Land-Use. Uganda Government Printer, Entebbe.
3. Uganda Forest Department (1996). Biodiversity Report, Budongo Forest Reserve. Forest Department, Kampala, Uganda.
4. Uganda Forest Department (1997). Preliminary Management Plan for Budongo Forest Reserve. Forest Department, Kampala, Uganda.



## APPENDIX 8: KALINZU– MARAMAGAMBO FOREST PROFILE

(Category: CORE conservation forest)

### 1 Basis for selection

The forest was selected for Nature Reserve establishment in recognition of its considerable importance especially because:

- it supports unique species of flora and fauna including; 9 species of butterfly, 2 species of tree and 1 species of mammal (representing more than 1% of the country's PA total) not known from any other protected area in Uganda.
- it supports 2 species endemic to Uganda and 10 species endemic to the Albertine Rift Region (Table 8.4).
- the forest contributes 1-2% of the national PA system complement.

### 2 Physical description

**Area and demarcation:** 584 km<sup>2</sup>: 291 km<sup>2</sup> North Maramagambo; 152 km<sup>2</sup> South Maramagambo; 141 km<sup>2</sup> Kalinzu. Total boundary length: 166 km of which 66 km adjoins rural community lands, 3 km adjoins Kasyoha-Kitomi Forest Reserve, and the rest adjoins Queen Elizabeth National Park.

**Establishment:** 1932

**Location:** On the floor of the Western Rift Valley to the east of Lake Edward, stretching in a continuous belt up the escarpment and onto the plateau overlooking the valley. The forest is shared between Bushenyi (Bunyaruguru, Igara and Ruhinda counties) and Rukungiri (Rujumbura county). The area lies between 0°17'-0°36' N and 29°47'-30° 11' E and is covered by the Uganda Department of Lands and Surveys map sheets 75/3, 75/4 and 84/2 (series Y732) at 1:50,000.

**Physical features:** 75% of the forest occupies flat land on the floor of the rift valley. It has an altitudinal range of 915-1845 m with 6.3% exceeding 15° slope. Rivers drain westwards off the edge of the escarpment to flow into Lake Edward. The most important of these are the Nchwera, Rwempunu and Nyamweru rivers.

### 3 Vegetation and forest condition

The majority of the area (499 km<sup>2</sup>; 86%) is occupied by tropical high forest communities, classified as types C3 (*Parinari* forest, 200 km<sup>2</sup>) and D2 (*Cynometra-Celtis* forest, 299 km<sup>2</sup>). The remainder (81 km<sup>2</sup>; 12%) comprises of type G1 (Undifferentiated semi-deciduous thicket), (Langdale-Brown et al., 1964).

The forest is largely intact (overall condition score 4). There has been mechanized timber harvesting, but no agricultural encroachment. There have been cases of illegal pitsawing. Hunting is widespread.

**Forest integrity scores:** Settlement = 1; Cultivation = 1; Hunting = 1; Livestock = 1; Timber harvesting = 1/2; Fire 1; Mining = 1; Community use = 1 (see Appendix 4 for explanation).

### 4 Economic importance

**Community-use values:** The forest is situated in a densely populated area; (328 people per km<sup>2</sup> in 1991), especially along the eastern and southern parts of the reserve. Therefore there is high demand for timber, firewood, building poles and other non-timber forest products. The West and Northwest of the boundary is surrounded by Queen Elizabeth National Park, giving a low interface: area ratio. The potential valuable resources in many areas remain under utilized giving a 'community use' value of 4.3 (see Appendix 3 for explanation).

**Timber production:** The Kalinzu portion of the forest is an important source of timber which is being exploited by one sawmill (Nkombe sawmill) providing a registered annual offtake of 72 m<sup>3</sup> of sawn timber over the period 1992-95 (Table 8.1); as well as large volumes of timber cut illegally. The Maramagambo portion is entirely under dual management with the Uganda Wildlife Authority, and timber extraction is only done illegally.

**Table 8.1** Nkombe Sawmill Sawn Timber Volumes harvested from Kalinzu over the 1992-95 period

Year	1992	1993	1994	1995	Total	Annual Average
Volume (m <sup>3</sup> )	112	106	15	59	292	72

A 2% enumeration was carried out in 1953 from which an estimated stocking of 82 m<sup>2</sup>/ha for trees exceeding 50 cm dbh was derived (Lockwood Consultants, 1973).

Approximately 199 ha of Eucalyptus plantation have been established since 1991 under a private leasehold arrangement to Uganda Tea Growers Corporation (UTGC) (179 ha, Southern Kalinzu and 20 ha on Kisunju hill).

**Other economic values:** The reserve serves a vital watershed role protecting the waters of Lake Edward. It is located close to the main western tourist circuit. The reserve's extraordinary biodiversity interest (see below) offers scope for the development of a research and education role.

## 5 Biodiversity values

Of the 65 forest reserves investigated for biodiversity, Kalinzu-Maramagambo ranks fourth in overall importance with a score of 14.5. It ranks 5th in terms of species diversity and tenth in terms of 'rarity' value of the species represented. The forest supports 12 species found in no other Uganda forest (including 9 butterflies, one mammal and 2 trees), 2 species endemic to Uganda and 10 species endemic to the Albertine rift region (Table 8.4).

## 6 Present management

Maramagambo Forest Reserve is being managed jointly by the Uganda Wildlife Authority (299 km<sup>2</sup>) and Forest Department (144 km<sup>2</sup>). Kalinzu (137 km<sup>2</sup>) is managed from the Bushenyi District Forestry offices. There is one Forest Officer stationed at Nkombe station, who will soon move to Kalinzu Forests station. South Maramagambo is managed from Rukungiri district forest office and a local office at Bikurungu.

1 Assistant Forest Officer at Bitereko Station (North Maramagambo), 5 Forest Rangers (2 Nkombe, 1 Kalinzu, 1 Bitereko, 1 community extension), and 2 Forest Guards at Kalinzu Station. (Table 8.2). There are also 15 patrolmen (5 per station) and 3 Nurserymen at Nkombe and 1 Forest Ranger and 2 Forest Guards in South Maramagambo (Table 8.2).

**Table 8.2 Staffing status in Kalinzu-Maramagambo forest reserve**

Station	Existing and proposed number of staff by category						Remarks
	FO	AFO	FR	FG	PM	Total	
Kalinzu	1(0)	0(0)	1(1)	1(2)	5(0)	8(3)	FG at Bikurungu is on contract
Nkombe (Kayanga)	0(0)	0(1)	2(0)	1(1)	8(0)	11(2)	
Bitereko	0(1)	1(0)	1(0)	0(1)	5(0)	7(2)	
Bikurungu	0(0)	0(0)	1(0)	1(0)	0(5)	2(5)	
Ruhinda	0(0)	0(0)	0(0)	1(0)	0(5)	1(5)	
<b>Total</b>	<b>1(1)</b>	<b>1(1)</b>	<b>5(1)</b>	<b>4(4)</b>	<b>18(10)</b>	<b>29(17)</b>	

Note: FO = Forest Officer; AFO = Assistant Forest Officer; FR = Forest Ranger;  
FD = Forest Guard; PM = Patrolmen Nos. in brackets indicate proposed staffing.

The department has 2 duplex houses for rangers and 1 single for a Forest Officer at Nkombe station (Table 8.3). 1 duplex and 1 single are under construction at Bitereko station. Kalinzu station has 8 buildings (permanent and semi permanent) that are being renovated. There is one Land Rover for the reserve. Motorable tracks run to Kayanga-Nkombe Sawmill (approximately 3 km, seasonal), Butare-Kalinzu station to the UTGC Woodlot (all weather) (see Fig. A8.1). The Kalinzu portion is very well served by footpaths many of which follow overgrown timber extraction roads. Maramagambo is much less accessible.

**Table 8.3 Existing and proposed staff housing at Kalinzu-Maramagambo**

	Existing and proposed staff housing					Total
	FD detached		FD semi		Private	
	Complete	Incomplete	Complete	Incomplete		
Kalinzu	8(0)	-	0(0)	-	0(0)	8(0)
Nkombe (Kayanga)	1(0)	-	4(0)	-	0(0)	5(0)
Bitereko	-	1	-	2	0(0)	3
Bikurungu	1(0)	-	2(0)	-	0(0)	3(0)
Ruhinda	0(1)	-	0(0)	-	1(0)	1(1)
<b>Total</b>	<b>10(1)</b>	<b>1</b>	<b>6(0)</b>	<b>2</b>	<b>1(0)</b>	<b>20(1)</b>

Note: Numbers in brackets indicate proposed staff housing units

The Kalinzu management plan expired in 1968 and Maramagambo management plan expired 1980 but a new 10 year management plan is due in mid 1998.

Approximately 10 km boundary has been planted with Eucalyptus. External surveying is being done in the Kilambi encroached areas of about 10,000 m<sup>2</sup>, with the help of the EC funds. Patrols have intensified their activities since July 1996. Kaizi and Nyamusingire ranger posts under the Uganda Wildlife Authority (Fig. A8.1) are also involved in the patrols.

## 7 Proposed Zonation

Fig. A8.1 shows the proposed zonation of the Kalinzu reserve, with 2 Strict Nature Reserves (approximately 30 km<sup>2</sup>), 2 protection zones (27 km<sup>2</sup>; two recreation zones (25 km<sup>2</sup>) and a Production Zone (55 km<sup>2</sup>).

### Strict Nature Reserves

The proposed Strict Nature Reserves have been selected to:

- protect the species unique to the forest.
- encompass the highest possible range of altitudes with the corresponding vegetation types.
- cover the terrain not suitable for production of timber and which is less accessible.

### Protection Zones

The proposed protection zones have been selected:



- to offer protection to the Strict Nature Reserves;
- to provide non-consumptive forestry products to the adjacent communities.

### **Recreation (Ecotourism) Zones**

The proposed recreation zones have been selected:

- because of the existence of possible tourist attractions such as Chimpazees
- because of accessibility from the roads
- to provide opportunity for non-consumptive use of the southern Kalinzu forest
- in the case of Kisunju hill, the protection zone will also double as the Recreation Zone

### **Production Zones (Buffer Zones)**

The proposed Production Zone has been selected to:

- to provide sustainable timber resources
- to provide a maximum sustainable yield of forest products such as medicines, building poles and firewood, so long as they are compatible with biodiversity conservation and environmental conservation

## **8 Proposed management programmes**

**Staffing:** The present staff number is inadequate. One Forest Officer is required to be stationed at Bitereko Forest Station, for duties including extension work for Kalinzu and areas surrounding Maramagambo.

Two Forest Guards, one Forest Ranger on ecotourism are necessary at Kalinzu Station. 1 Forest Guard for patrols at Nkombe and 1 Assistant Forest Officer (Community awareness) will also be necessary (see Table 8.2).

**Infrastructure:** All housing units at Kalinzu Station should be renovated. Uncompleted houses at Bitereko should be completed. One tourist camp should be developed in southern Kalinzu. There is need for a radio communication system to be established and linked to Kasyoha-Kitomi forest reserve for more effective coordination. One patrol hut will be constructed in the centre of the reserve as an overnight facility.

**Patrol and Protection Activities:** 5 patrol teams will be based at the 5 stations, each constituting one Forest Guard and 5 patrolmen. Patrol checkpoints will be established throughout the reserve.

**Public access and community needs:** 1 Forest Officer and 1 AFO will assume responsibility for community outreach programmes and 1 Forest Ranger will be specifically responsible for ecotourism. 1 new Land Rover for general purpose work will be provided to the Forest Officer, 3 motorcycles to Rangers and 8 bicycles to the Forest Guards.

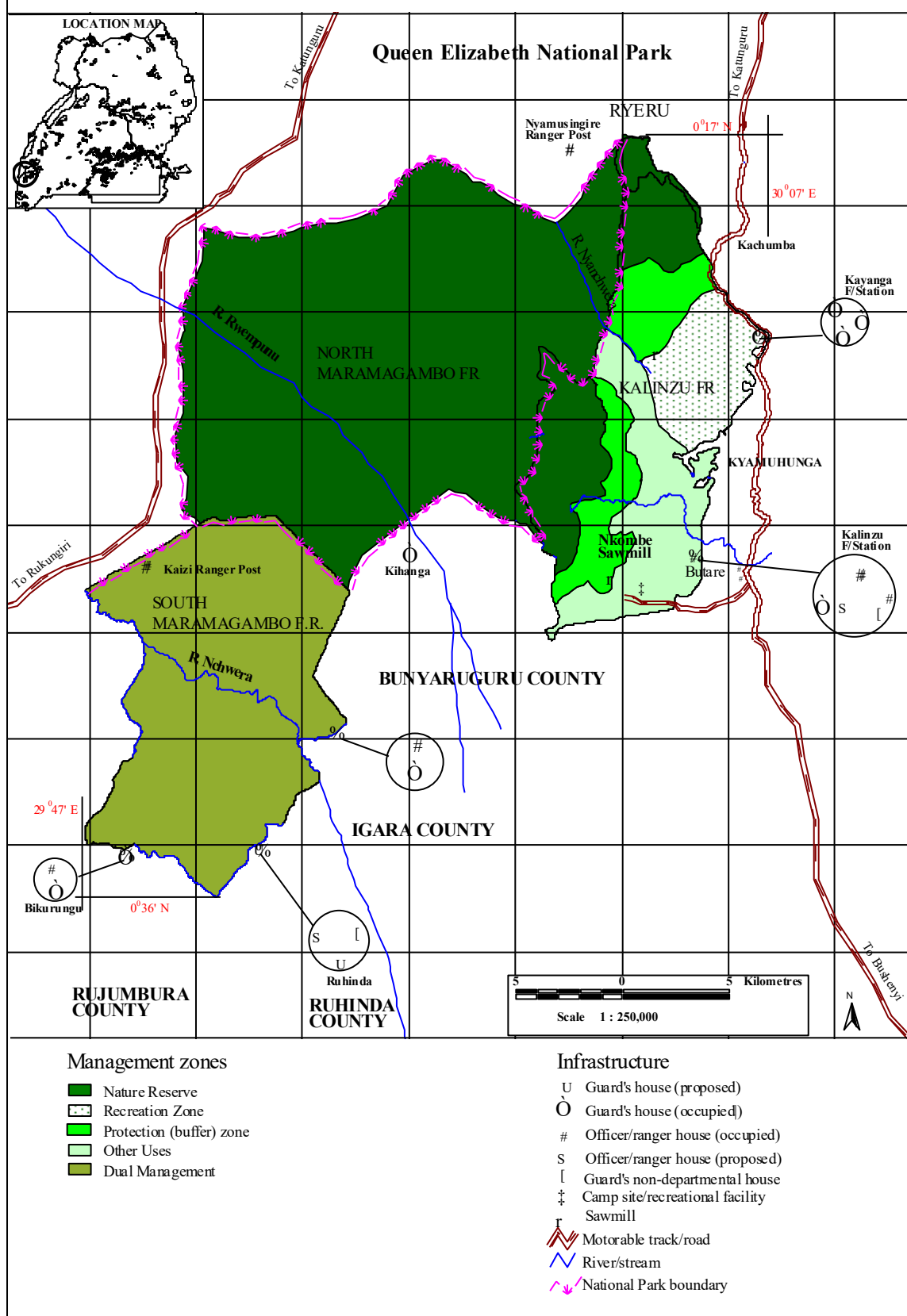
**Table 8.4 Summary table of Biodiversity Values for Kalinzu-Maramagambo**

Criterion	Trees & Shrubs	Birds	Mammals	Butterflies	Moth	Overall
No. of species known	414	374	30	262	97	-
No. of restricted range species (<5 forests)	43	65	3	36	5	-
Uganda endemics	-	-	-	<i>Euphaedra christyi</i>	-	2
Albertine Rift endemics	<i>Grewia pubescens</i> <i>Musanga leo-errerae</i> <i>Philippia johnstonii</i> <i>Rhytigynia beniensis</i>	Rwenzori Turaco Purple breasted sunbird White-collared olive-back	-	<i>Acraea alcipoides</i> <i>Euphaedra peculiaris</i> <i>Acraea kalinzu</i> <i>Neptis intermedia</i>	-	10
Species unique to forest	<i>Crassocephalum africans</i> <i>Viscum decurrens</i>	-	<i>Crocidura littoralis</i>	<i>Papilio interjecta</i> <i>Mylothris sjostedti</i> <i>Bicyclus dorothea</i> <i>Ypthima pupillaris</i> <i>Acraea alcipoides</i> <i>Acraea kalinzu</i> <i>Acraea pentapolis</i> <i>Pardaleodes bule</i> <i>Pardaleodes tibullus</i>	-	12
Species diversity (score and rank)	7.1(16)	7.1(15=)	7.2(17)	9.9(2)	7.8(7)	7.4(5)
Species rarity value (score & rank)	7.9(10=)	7.3(9)	5.6(20=)	6(9)	6.7(17)	7.2(10)
Biodiversity Importance Overall						14.5(4)

## **9 Principle reference material**

- 1 Howard, P.C. (1991). Nature Conservation in Uganda's Tropical Forest Reserves. IUCN, Gland, Switzerland.
- 2 Uganda Forest Department (1968). Kalinzu-Maramagambo Working Plan (1968-1978), Forest Department, Kampala, Uganda.
- 3 Uganda Forest Department (1980). Kalinzu-Maramagambo Management Plan, 1980. Forest Department, Kampala, Uganda.
- 4 Uganda Forest Department (1996). Biodiversity Report Series No. 4; Kalinzu-Maramagambo Forest Reserves. Forest Department, Kampala, Uganda.

Fig. A8.1 ZONATION OF KALINZU - MARAMAGAMBO FOREST RESERVE



## APPENDIX 9: MT. MOROTO FOREST PROFILE

(Category: PRIME conservation forest)

### 1 Basis for selection

The forest was selected for Nature Reserve establishment in recognition of its considerable biodiversity importance, especially because:

- it supports 9 species of butterflies, 13 species of birds, 3 species of mammals and 8 species of moths (representing more than 1% of the country's PA total) known from no other protected area in Uganda (see Table 3.5, pp.35).
- it supports one species of tree, 7 of butterflies, 7 of birds, 2 of mammals and 4 species of moths, not found elsewhere in Uganda's PA system that are of conservation concern on account of being endemic to the afro-montane or Somalia-Maasai region (see Table 3.5, pp 35).
- it is representative of a vegetation type N9 and having over 50% of each of T2 and T3 and approximately 40% of V30 not otherwise represented in Uganda's protected area system (see Appendix 5).

### 2 Physical description

**Area and demarcation:** 483 km<sup>2</sup>; total boundary length 128 km, all adjoining public land. Most of it (113 km) is an artificial boundary while approximately 15 km is natural (R. Kongorok = 6.7 km; R. Nakabati = 8.3 km). Though it has not been maintained for a long time, some old corner cairns and directional trenches still exist. Boundary resurvey and reopening have begun.

**Establishment:** 1940

**Location:** In Matheniko county in the administrative district of Moroto, 2°24'-2°42' N and 34°39'-34°56' E. It is perched on the top of the escarpment of the Eastern Rift, directly behind and to the east of Moroto town. Its eastern boundaries are those of the Ugandan border with Kenya. Covered by the Uganda Department of Lands and Surveys map sheets 27/3, 27/4, 36/1 and 36/2 (series Y732) at 1:50,000.

**Physical features:** Over half of the reserve occupies steep terrain at altitudes of 960-3084 m above sea level with 258 km<sup>2</sup> (53%) exceeding 15% slope. The reserve occupies Mt. Moroto.

### 3 Vegetation and forest condition

The reserve has various vegetation communities, classified as types N8 (121 km<sup>2</sup>-25%, of *Combretum-Acacia-Themedra* savanna); N9 (72 km<sup>2</sup>, of *Combretum-Acacia-Commiphora* savanna), B3 (58 km<sup>2</sup>, of *Juniperus-Podocarpus* dry montane forest); F1 (58 km<sup>2</sup> of forest/savanna mosaic at high altitudes); T2 (58 km<sup>2</sup>, *Acacia-Commiphora-Lannea* Bushland) and V3 (58 km<sup>2</sup> of *Acacia-Commiphora* Thicket). A detailed forest type map is available at Forest Department headquarters, based on 1950s aerial photography. A great part of the vegetation is affected by burning.

The forest is heavily degraded (overall condition score 1), mainly due to grazing and firing. There has been no timber harvesting but agricultural encroachment is intensifying as the soils are considered more fertile than the surrounding areas. Hunting and mining are common.

**Forest integrity scores:** Settlement = 2, Cultivation = 4, Hunting Pressure = 2/3, Livestock grazing = 4, Timber = 0 Fire = 3, Community Use = 0 and Mining = 1 (see Appendix 4 for explanation).

### 4 Economic importance

**Community use values:** The reserve is situated in a relatively low population density area (28 people per km<sup>2</sup> in 1991), so pressure on the peripheral areas of the forest for firewood, building poles and other non-timber forest products is correspondingly low. However, large areas of the forest are so inaccessible that potentially valuable resources in some areas remain underutilized, giving a 'community use' value of 0.5 (see Appendix 3 for explanation). Nomadic cattle grazing remains the main activity.

**Timber production:** The forest is a less important source of timber, with only 2% forested area and 5m<sup>3</sup>/ha volume of timber potential according to the early 1970s timber inventory (Lockwood Consultants, 1973). The reserve has a poor plantation potential.

**Other economic values:** The reserve serves a vital watershed role. It is located close to the main eastern tourist circuit and has potential for tourism development based on attractions such as landscape, scenery and accessibility. The reserve offers an averagely high scope for development of research and education because of its high biodiversity values (see below).

## 5 Biodiversity values

Of the 65 forests investigated for biodiversity, Mt. Moroto ranks fifth in overall importance, with a score of 14.3 (Chapter 3, Table 3.1). It is the fortieth in terms of species diversity, but ranks third in terms of 'rarity' value of species represented. The forest supports 36 species found in no other Ugandan forest although with no species endemic to Uganda or the Albertine Rift region (Table 9.3). It is the only reserve with N9 (Langdale-Brown et al., 1964) savanna type and has over 50% of each of T2 and T3 and about 40% of V3 in the protected area system; these are non-existent in any of the country's National Parks or Wildlife Reserves.

## 6 Present management

The reserve is managed from Moroto District Forest Office in Moroto Municipality, located at the periphery of the reserve. There is one Forest Officer, one Assistant Forest Officer, one Forest Guard and three nursery men (Table 9.1).

**Table 9.1 Existing and proposed staff deployment at Mt. Moroto**

Station	Existing and proposed staff by category						Remarks
	FO	AFO	FR	FG	PM	Total	
Moroto	1(0)	1(0)	0(1)	1(0)	0(2)	3(3)	
Tapach	0(0)	0(0)	0(1)	0(1)	0(2)	0(4)	
Nakilororo	0(0)	0(0)	0(0)	0(0)	0(2)	0(2)	
<b>Total</b>	<b>1(0)</b>	<b>1(0)</b>	<b>0(2)</b>	<b>1(1)</b>	<b>0(6)</b>	<b>3(9)</b>	

NB	Nos. in brackets indicate proposed number of staff.	FO = Forest Officer;
	AFO = Assistant Forest Officer; FR = Forest Ranger, FG = Forest Guard,	PM = Patrolman

All are stationed in Moroto town, (Fig. A9.1). The Department has 3 permanent staff houses (all require renovation), a wooden store getting dilapidated and nine uniports (Table 9.2).

**Table 9.2 Existing and proposed staff housing at Mt. Moroto**

Station	Existing and proposed staff housing*						Remarks
	FD Detached	FD semi-detached	FD semi-Detached	FD Uniport	Private	Total	
Moroto	3(1)	0(0)	0(1)	9(0)	1(0)	13(2)	
Tapach	0(1)	0(0)	0(0)	0(2)	0(0)	0(3)	
Nakiloru	0(0)	0(0)	0(0)	0(2)	0(0)	0(2)	
<b>Total</b>	<b>3(2)</b>	<b>0(0)</b>	<b>0(1)</b>	<b>9(4)</b>	<b>1(0)</b>	<b>13(7)</b>	

NB: Nos. in brackets indicate proposed staff housing units.

However, the station lacks pit latrines. The DFO is accommodated in a “pool house”. Management is facilitated by one pick up. There are two roads running close to the western boundary within 1½ km of the reserve, both leading from Moroto town, one to Nakiloru and another to Lakitanyal (see Fig. A9.1). They run close to over 1/3 of the total boundary length and the reserve is therefore accessible. Some rough, motorable tracks run to local communities high up the mountain. There is no Nature Reserve.

Since September, 1996, resurveying of the boundary has been going on under the EC financed Natural Forest Management and Conservation Project. A total of approximately 12 km has been resurveyed so far.

## 7 Proposed zonation

Zonation of Mt. Moroto Forest Reserve is difficult given the hostile and armed nature of the communities living around and within the reserve. Those that live up the mountain (and so live most of their time in the reserve) are almost restricted to the mountain top and have therefore to depend almost entirely on it for their livelihood. It is thus inappropriate putting up any restriction through zoning before education and sensitization on conservation is done. Afterwards relocation of the communities to other places can be sought together with alternative ways of earning a living.

However, Fig. A9.1 shows the ‘preliminary’ zonation of the reserve, with one Strict Nature Reserve (approximately 168 km<sup>2</sup>), four protection Buffer Zones (approximately 87 km<sup>2</sup>), and the remaining area as production zone (approximately 228 km<sup>2</sup>).

The proposed Strict Nature Reserve (168 km<sup>2</sup>) has been selected to:

- encompass the widest possible range of altitude, from above 2500 m to below 1500 m.
- protect some of the remaining block of relatively intact highland forest
- protect a viable area of *Combretum-Acacia-Commiphora* savanna (N9 vegetation type), *Acacia-Commiphora-Lannea* bushland and *Acacia-Commiphora* bushland and *Acacia-Commiphora* thicket, vegetation types not found elsewhere in the country’s PA system.

The proposed protection zones cover some areas of steep land adjacent to the Strict Nature Reserve, that are generally unsuitable for production purposes (on account of soil erosion hazards), but which can serve to enhance the long-term viability of the Strict Nature Reserve.

The proposed production zones cover a large part of the reserve including peripheral areas of the reserve that have already been cultivated and the hilly areas more accessible to grazers.

## 8 Proposed management

**Staffing:** The present staff number is inadequate. Some redeployment will be necessary to create 3 effective patrol teams, with responsibility for newly defined beats/ranges as shown in Fig. A9.1. Two Forest Rangers and another Forest Guard are necessary. The entire reserve will be brought under the responsibility of one single Forest Officer, and one Assistant Forest Officer (see Table 9.1). One ranger will be stationed at Moroto Municipality and the other at Tapach with one Forest Guard each. Moroto district being remote from Kampala necessitates a departmental radio communication system with headquarters. Field stations also require radio communication with the district office.

**Infrastructure:** One detached house will be built for the DFO at Moroto Forest Station. The 3 permanent houses should be renovated and pit latrines constructed. One semi-detached house to accommodate one ranger and one guard will be constructed at Moroto and one for another Forest Ranger and Guard at Tapach. There is need to construct a concrete store and a ground water tank at Moroto.

**Demarcation:** The whole extent of the artificial boundary (128 km), requires reopening and planting. However, because of the rampant fires and grazing, establishment of live markers may not be successful, and so more use should be made of corner beacons. All internal management zone boundaries will be demarcated by ring-painting in a standard way. Sign boards will be erected wherever prominent footpaths and tracks cross (external and internal) boundaries.

**Patrol and protection activities:** Protection patrols will be complemented with community education and participation until a later date as patrol work is not effective since the encroachers are nomadic and armed. Three patrol teams, 2 comprising of one Forest Guard and two patrolmen, the third comprising of two patrol men and either a ranger or a guard, will be constituted, with responsibility for safeguarding ranges as shown in Figure A9.1. These ranges will be based at Moroto, Tapach and Nakiloro. Men will be rotated between patrol teams and teams will be moved periodically between ranges. Patrol routes and checkpoints will be established throughout the reserve. An incentive scheme will be instituted to reward success in curbing illegal activities.

**Public access and community needs:** The communities high up in the mountains pose a big problem to conservation since it will be easy to have them evicted. It is therefore important that they are integrated into the conservation process.

The Assistant Forest Officer and one Forest Ranger will assume responsibility for community out-reach programmes, including the development of joint forest management programmes both outside and within the reserve boundaries, community tree planting programmes outside the boundary as well as community development initiatives. Each of these will be provided with a motorcycle and the guards and patrolmen with bicycles to support their work. A programme of village meetings will be instituted to explain and discuss management of the reserve.



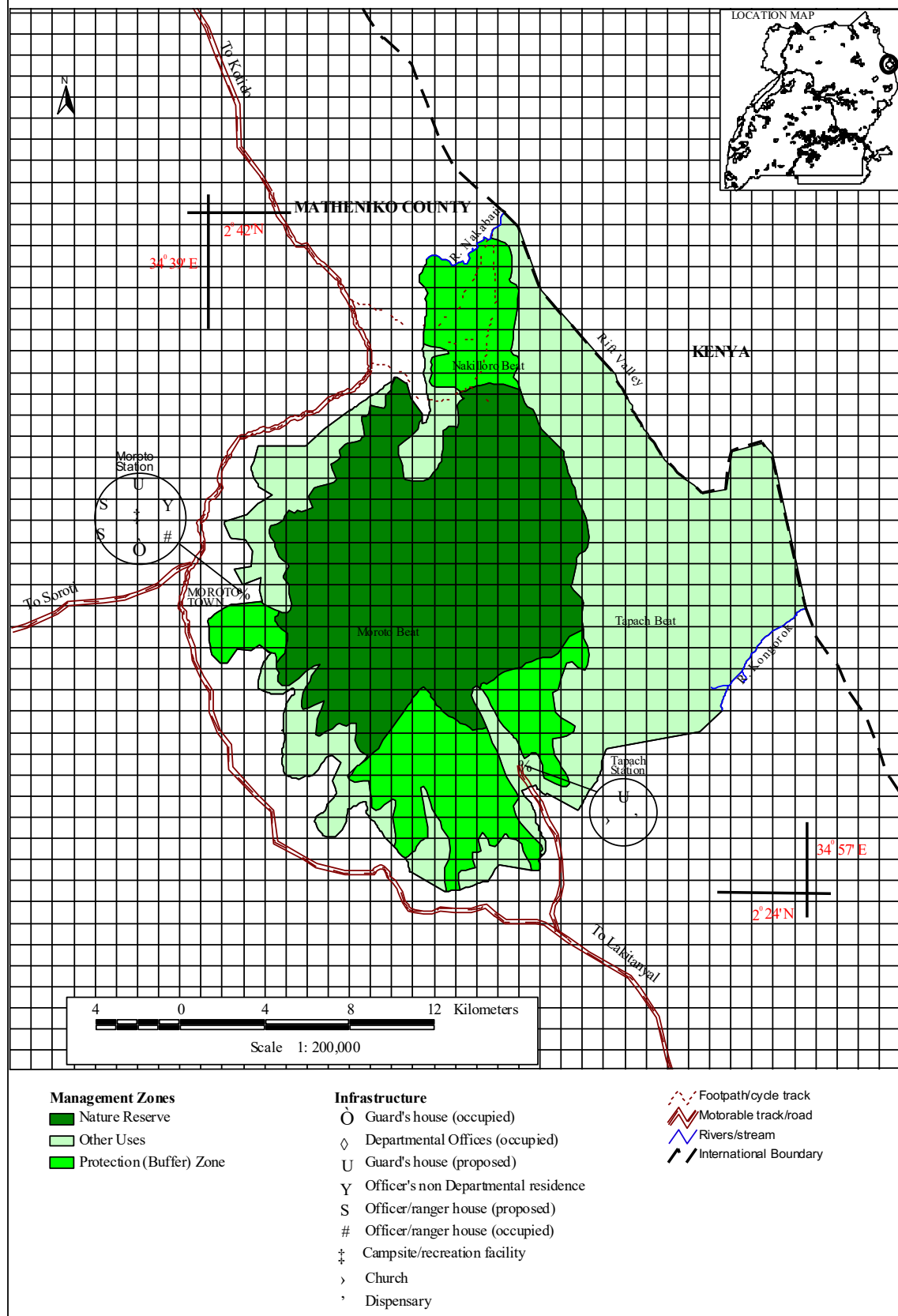
**Table 9.3: Summary table of Biodiversity Values for Mount Moroto**

Criterion	Trees & Shrubs	Birds	Mammals	Butterflies	Moths	Overall
<b>Total No. of spp. Known</b>	203	220	22	106	45	
<b>No. of restricted range spp. (&lt; 5 forests)</b>	27	73	7	26	12	
<b>Spp. Unique to forest (list)</b>	<i>Commiphora samharensis</i> <i>Commiphora schimperi</i> <i>Sterculia rhynchocarpa</i>	Buff-crested Bustard Black Swift Hemiprick's Hornbill Black-throated Barbet Fischer's sparrow lark Grey Tit Grey Wren-Warbler Pale Prinia Grey-headed Batis Pygmy Batis Bristle-crowned Starling Shining Sunbird White-bellied Canary	<i>Saccostomus campestris</i> <i>Crocidura macarthurii</i> <i>Tatera nigricauda</i>	<i>Colotis calais</i> <i>C. chrysonome</i> <i>Mylothris sagala</i> <i>Lolaus jacksoni</i> <i>Tarucus grammicus</i> <i>Euchrysops kabrosae</i> <i>Lepidochrysops neonegus</i> <i>Acraea braesia</i> <i>Acraea chilo</i>	<i>Heniocha dyops</i> <i>Imbrasia sp.</i> <i>Imbrasia sp.</i> <i>Ludia arguta</i> <i>Callosphingia circe</i> <i>Hippotion rosae</i> <i>Hippotion sp. nr. rebeli</i> <i>Parusta thelxinoe</i>	36 spp
<b>Uganda endemics (list)</b>	-	None	none	None	-	None
<b>Albetine Rift endemics (list)</b>	-	None	none	None	-	None
<b>Species diversity (score &amp; rank)</b>	6.5(26=)	6.5(24=)	6.7(22=)	5.5(48=)	4.8(38)	5.8(40=)
<b>Species rarity value (score &amp; rank)</b>	8.4(7=)	10(1)	8.1(4=)	6.6(6)	10(1)	8.5(3)
<b>Biodiversity importance value</b>						14.3(5)

## **9 Principle reference material**

1. Langdale Brown, I., Osmaston, H.A. and Wilson, J.G. (1964). The vegetation of Uganda and its Bearing on Land-Use. Uganda Government Printer, Entebbe.
2. Lockwood Consultants (1973). Forest Resource Development Study for the Republic of Uganda. Lockwood Consultants, Toronto, Canada.
3. Uganda Forest Department (1996). Biodiversity Report, Series No. 6; Moroto, Kadam and Napak Forest Reserves. Forest Department, Kampala, Uganda.

**Fig. A9.1      ZONATION OF MOUNTAIN MOROTO FOREST RESERVE**



## APPENDIX 10: LABWOR HILLS FOREST PROFILE

(Category: CORE conservation forest)

### 1 Basis for selection

The forest, which consists of several reserves (Fig. A10.1), was selected for Nature Reserve establishment in recognition of its considerable biodiversity importance, especially because:

- it supports 8 species known from no other Protected Area in Uganda (including 4 trees, 3 butterflies and one bird, the Bush Petronia).
- it represents the largest block of a vegetation type N4, *Combretum-Oxytenanthera-Hyparrhenia* savanna) in Uganda's protected area system.

### 2 Physical description

**Area and Demarcation:** The reserves have a total area of 437 km<sup>2</sup> and a total boundary length 303 km. All of the boundary adjoins rural community lands. The entire boundary is artificial with cut-lines, stone corner cairns and directional trenches on both sides.

**Establishment:** 1943

**Location:** The reserves lie on or near the western border of the north-eastern district of Kotido in Labwor county between 2°25'-2°60'N and 33°30'-33°60'E. Uganda Department of Lands and Surveys. Covered by Uganda Department of Lands and Surveys map sheets 25/1, 25/2, 25/3, 25/4, 34/1 and 34/2 (Series Y372) at 1:50,000.

**Physical features:** Labwor Hills consists of large inselbergs (Nangolebwal, Akur, Alerek, Ating and Kano Forest Reserves) with alluvial valleys between these blocks surrounded by the flat plain of central Karamoja to the north, east and south, with gently undulating country. The reserves are at altitudes of 1050-1950m with 53% of the area exceeding 15° slope. Some seasonal streams flow from these hills and drain into the Agago and Okok rivers.

### 3 Vegetation and forest condition

The majority of the area (407 km<sup>2</sup>, 94%) is occupied by savanna woodland of N4 and N5 (*Combretum-Oxytenanthera-Hyparrhenia* and *Combretum-Acacia-Hyparrhenia* savannas) and the remainder (30 km<sup>2</sup>, 6%) is made up of L3 (*Butyrospermum-Hyparrhenia dissoluta* savanna) (Langdale-Brown et. al., 1964).

The forest is partially degraded (overall condition score 3) with some settlements restricted to the fringes of the hills due to insecurity. There is agricultural encroachment in the gallery forests along the alluvial fans. Livestock grazing/browsing and fires are frequent. In a few parts (Alerek and Kano) fuelwood and bamboo cutting have been a problem of recent.

**Forest integrity** scores: Settlement = 1; cultivation = 3; Hunting = 3; Livestock = 1; Timber = 0; Fire = 3; Community use = 1; Mining = 1 (see Appendix 4 for explanation).

### 4 Economic importance

**Community-use value:** The forest is situated in a sparsely-populated part of the country (23 people per km<sup>2</sup> in 1991). So pressure on the forest for firewood, building poles and non timber forest products is low. Most of these hills have steep slopes restricting access except to peripheral areas and valleys.

Insecurity in the lower plains has led to settlements at the foot of these hills. The "community use value" of this reserve is 1.6 (see Appendix 3 for explanation).

**Timber production:** Labwor is a protection forest dominated by a savanna woodland with almost no merchantable timber species except a few gallery forest patches. There are no registered pitsawyers in this forest. The Forest Department established a 15 ha pole and fuelwood *Eucalyptus* plantation at Abim.

**Other economic values:** Labwor Hills Forest Reserves are important in protecting the water catchments of the rivers and streams arising within the reserves and sustaining the permanent settlements in the lowlands around.

## 5 Biodiversity values

Of the 65 forests investigated for biodiversity, Labwor ranks twenty-seventh in overall importance, with a score of 12.8 (Chapter 3, Table 3.1). It is 39th in terms of species diversity and ranks 19th in terms of the 'rarity' value of the species represented. The forest supports 8 species found in no other Ugandan forest (including 4 tree spp, 3 butterflies and one bird, the Bush Petronia). It represents the largest block of Dry *Combretum* savanna type N4 (*Combretum-Oxytenanthera-Hyparrhenia* Savanna) in the Protected Area system, a vegetation association that occurs only in two other reserves (Ogili and Agoro-Agu Forest Reserves). 71 of the species occurring in Labwor are of restricted range (see Table 10.3).

## 6 Present management

The reserves are managed from Kotido District Forest Office and a local office at Abim (Labwor county). There is one Forest Ranger (stationed at Abim) and three Forest Guards (stationed at Abim A, Awach B and Koya C) (See map). The department has one Rangers' house at Abim. The other 2 Forest Guards at Awach and Koya live in their personal houses. There is one motorcycle at Abim. The latest Working Plan covers period 1958-1967 and prescribes for protection of water catchments of the rivers and streams arising within the reserves.

Since late 1992, with the support of EC-financed Natural Forest Management and Conservation Project, approximately 174 km of external boundary has been resurveyed and re-demarcated by intervisible stone or earth cairns 4 feet high with a long pole on each of them and on either side of every stone cairn a stone directional burrow aligned to indicate the direction of the neighbouring cairn. 'Forest Reserve' sign plates have been fixed in several vantage points along the boundary.

## 7 Proposed zonation

Figure A10.1 shows the proposed zonation of Labwor Hills with four Strict Nature Reserves (approximately 135 km<sup>2</sup>) and the remaining parts of the reserves are protection (buffer) zone (approximately 302 km<sup>2</sup>). Since Labwor comprises of five separate blocks which are conveniently considered as one unit it is necessary to have Strict Nature Reserves which are representative of all the different vegetation types and habitats in those blocks. The proposed Strict Nature Reserves have been selected to:

- protect a viable area of the Dry *Combretum* savanna woodland of N4 (*Combretum-Oxytenanthera-Hyparrhenia*).
- to encompass the widest range of altitude from below 1100 to above 1900m.
- protect steep slopes which are inaccessible.

The proposed protection (buffer) zones have been designated on lower slopes of the reserves which are relatively accessible and have been partially degraded.

## 8 Proposed management programmes

**Staffing:** One more Forest Ranger will be stationed at Katabok/Morulem to take charge of Nangolebawal and Alerek Forest Reserves while the other remains at Abim in-charge of Kanu, Akur and Ating Forest Reserves.

There will be 4 Forest Guards stationed at Abim, Awach, Alerek and Katabok. The Ranger at Katabok will be provided with one motorcycle and the 4 guards with bicycles.

**Table 10.1 Existing and proposed staff deployment at Labwor Hills**

Station	Existing and proposed No. of staff by category						Remarks
	FO	AFO	FR	FG	PM	Total	
Kotido	1(0)		0(0)	0(0)	0(0)	1(0)	
Abim	0(0)		1(0)	1(0)	0(3)	2(3)	
Awach	0(0)		0(0)	1(0)	0(3)	1(3)	
Koya	0(0)		0(0)	1(0)	0(0)	1(0)	
Katabok	0(0)		0(1)	0(1)	0(3)	0(5)	
Alerek	0(0)		0(0)	0(1)	0(3)	0(4)	

Total	1(0)	1(1)	3(2)	0(12)	5(15)
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Note: FO = Forest Officer; AFO = Assistant Forest Officer; FR = Forest Ranger;  
FG = Forest Guard; PM = Patrolmen, Nos. in brackets indicate proposed staffing

**Infrastructure:** One Rangers' house should be constructed at Katabok, 4 guard houses be constructed at Abim, Kanu, Koyu and Alerek (ref. to map). One store for all equipment and tools should be constructed at Abim.

**Table 10.2 Existing and proposed staff housing at Labwor**

Station	Existing and proposed staff housing					Remarks
	FD Detached	FD semi-Detached	FD Uniport	Private	Total	
Kotido	0(0)	0(0)	0(0)	0(0)	0(0)	
Abim	1(0)	0(0)	0(0)	1(0)	2(0)	
Awach	0(1)	0(0)	0(0)	1(0)	1(1)	
Koya	0(1)	0(0)	0(0)	1(0)	1(1)	
Katabak	0(1)	0(0)	0(0)	0(0)	0(1)	
Alerek	0(1)	0(0)	0(0)	0(0)	0(1)	
<b>Total</b>	<b>1(4)</b>	<b>0(0)</b>	<b>0(0)</b>	<b>3(0)</b>	<b>4(4)</b>	

Note: Nos. in brackets indicate proposed staff housing units

**Demarcation:** Completion of boundary re-opening and redemarcation of approximately 123 km of external boundary (Nangolebwal and Alerek) will be done and planted with live markers. The already re-opened boundary (174 km) should also be planted. Concrete beacons will be fixed at all corner cairns and directional trenches made throughout the reserve.

**Patrol and protection activities:** Four patrol teams each comprising one Guard and three patrolmen will be constituted and stationed at Abim, Awach, Katabok and Alerek. Patrols will be intensified in relatively densely populated areas and during peak periods. Application of unnecessary force will be avoided due to presence of firearms among the population. Extension education will be used to promote community participation in conservation.

**Public access and community needs:** As part of their responsibilities the two Rangers will carry out community extension programmes to increase awareness on the important role of the reserves and the promotion of tree planting by the communities to reduce pressure on the reserves which are the main sources of building poles and fuelwood.

**Table 10.3 Summary of biodiversity values for Labwor Hills**

Criterion	Trees & Shrubs	Birds	Mammals	Butterflies	Moths	Overall
<b>Total No. of species known</b>	239	139	15	109	43	-
<b>No. of restricted range species (known from ≤ 5 forests)</b>	28	19	2	15	7	-
<b>Species unique to forest (list)</b>	<i>Balanites</i> <i>Pedicellaris</i> <i>Dracaena deremensis</i> <i>Loranthus uhehensis</i> <i>Maerua</i>	<i>Petronia dentata</i> (Bush Petronia)	-	<i>Tuxentius calice</i> <i>Abantis paradisea</i> <i>Abantis tettensis</i>	-	8 spp

*crassifolia*

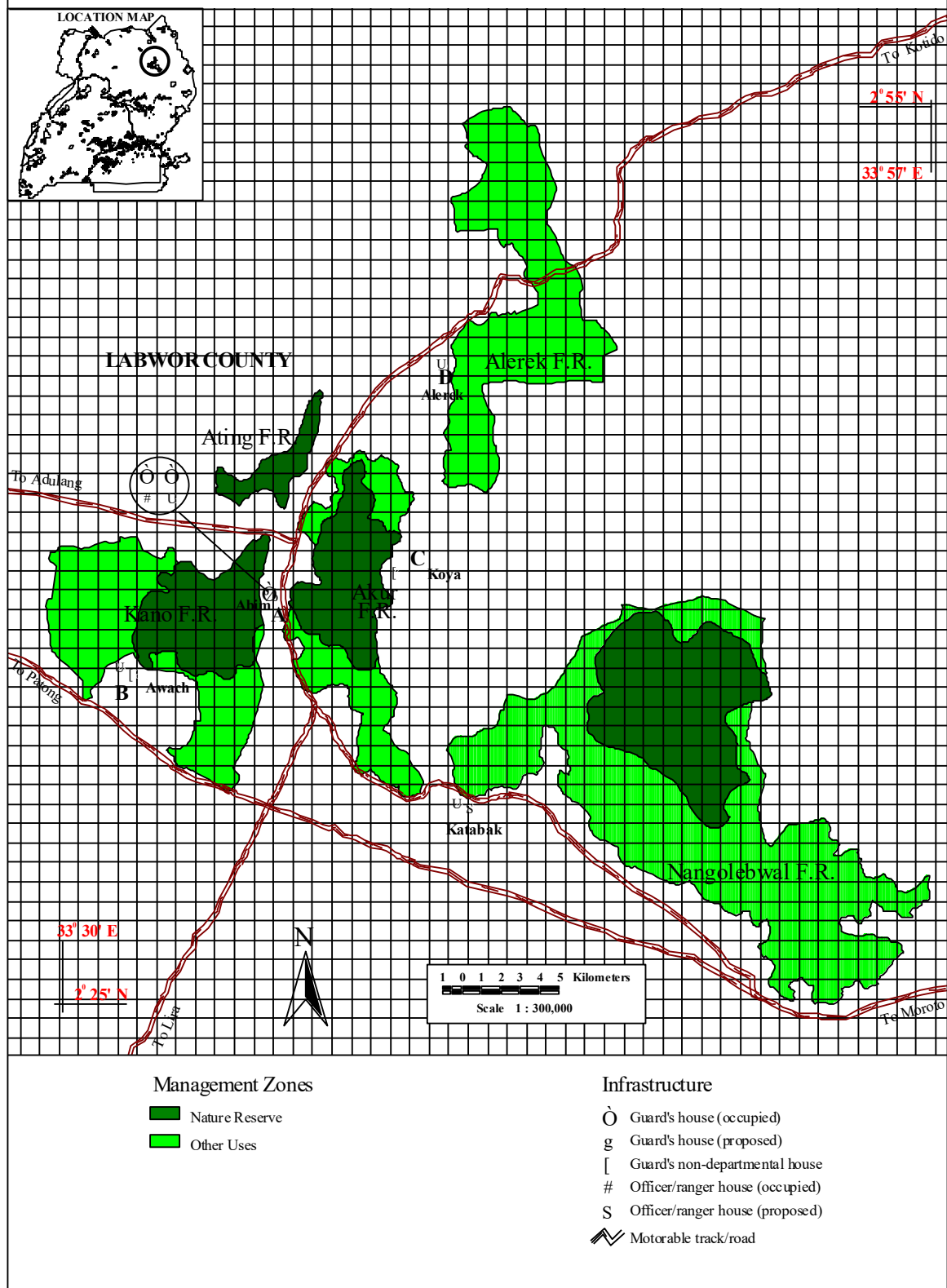
<b>Uganda endemics (list)</b>	None	None	None	None	None	None
<b>Albertine Rift endemics (list)</b>	None	None	None	None	None	None
<b>Species diversity (score and rank)</b>	6.7 (21=)	4.2 (51=)	5.2 (41=)	7 (22=)	5.3 (33=)	5.6 (39=)
<b>Species rarity value (score and rank)</b>	7.7 (18=)	6.1 (20*)	5.4 (22=)	5.1 (22=)	6.5 (21=)	6.7 (19=)
Overall biodiversity importance = 12.8						

**9 Principle reference material**

1. Langdale-Brown, I.; Osmaston, H.A. and Wilson, J.G. (1964). The Vegetation of Uganda and its Bearing on Land-Use. Uganda Government Printer, Entebbe.
2. Uganda Forest Department (1958). Working Plan for Labwor Hills Central Forest Reserves, 1958-67. Forest Department, Kampala, Uganda.
3. Uganda Forest Department (1996). Biodiversity Report Series No.7; Labwor Hills Forest Reserve. Forest Department, Kampala, Uganda.

Fig. A10.1

## ZONATION OF LABWOR HILLS FOREST RESERVE





**APPENDIX 11: NYANGEA-NAPORE FOREST PROFILE**

(Category: CORE conservation forest)

**1 Basis for selection**

The forest was selected for Nature Reserve establishment due to its considerable biodiversity importance, especially because:

- it supports 4 species of butterfly (representing 1% of the country's Protected Area total) known from no other Protected Area in Uganda (see Table 3.5, pp. 33).
- it represents the largest block of a vegetation type N8, (*Combretum-Acacia-Themeda* savanna) in Uganda's Protected Area system.

**2 Physical description**

**Area and demarcation:** The area of the reserve is 417 km<sup>2</sup>, with a total boundary length of 145 km of which 118 km adjoins rural community lands; and 37 km lies within the boundary of Kidepo Valley National Park.

**Establishment:** 1942

**Location:** The reserve lies between 33°30'-33°46'E and 3°18'-3°50'N. The forest is shared between Kotido (Dodoth county) and Kitgum (Chua county) Districts. It is covered by Department of Lands and Surveys map sheets 9/1, 9/3 17/1, 17/2 and 8/4 (Series Y732) at 1:50,000.

**Physical features:** The reserve is constituted by a narrow chain of hills running south from the Uganda/Sudan border with the northern Napore range (highest peak; Lonyili - 2284m) and the southern Nyangea range (highest peak; Kaleri- 2233m). The altitudinal range is 1060 to 2284m with 53% exceeding 15° slope.

**2 Vegetation and forest condition**

The majority of the area (375 km<sup>2</sup>, 90%,) is occupied by dry savanna woodland vegetation type N8 (*Combretum-Acacia-Themeda* savanna) while higher altitudes with higher rainfall have a Forest/Savanna mosaic, type FI, covering 42 km<sup>2</sup>, (10%) (Langdale-Brown et al., 1964).

The forest is largely intact (overall condition score 4) mainly due to the sparse population and the rough terrain and altitude which naturally fortify the reserve and discourage extensive encroachment. There is, however, evidence of agricultural encroachment around Karenga and along the road passing through the reserve to Kitgum. Hunting and honey collection within the reserve are common.

**Forest integrity scores:** Settlement = 1; Cultivation = 1; Hunting = 2; Livestock = 1; Timber = 0; Fire = 2; Community Use = 1; Mining = 0 (see Appendix 4 for explanation).

**3 Economic importance**

**Community use values:** The forest is situated in a sparsely populated area (15 people per km<sup>2</sup> in 1991), so pressure on the forest for fuelwood, building poles and non-timber forest products is correspondingly low; although the people have traditionally been hunting for game in the forest, considerably reducing the number of large mammals. Community use value is 0.2 (see Appendix 3 for explanation).

**Timber production:** The forest is unsuitable for timber production and there are no pitsawyers.

**Other economic values:** Nyangea-Napore protects the water catchment of the rivers originating within the reserve and sustains permanent settlements around its boundaries.

#### 4 Biodiversity values

Of the 65 forests investigated for biodiversity, Nyangea ranks 21st in both overall importance and species diversity (with score of 13.2) and ranks 20th in terms of the 'rarity' value of species represented. Nyangea-Napore provides high altitude wet habitats that are otherwise scarce in this generally dry and flat area of Uganda. The forest supports 8 species found in no other Ugandan forest (including 4 tree/shrubs and 4 butterflies (Table 11.3). It is therefore of value to the conservation of a complete assemblage of Uganda's known species. It represents the largest block of dry savanna woodland vegetation type N8 (*Combretum-Acacia-Themeda* Savanna) in the protected area system.

#### 5 Present management

Nyangea-Napore Forest Reserve is managed from the Kotido and Kitgum Districts Forest Offices and local offices at Karenga (Kotido). Part of the reserve (approx. 62 km<sup>2</sup>) lies in Kidepo Valley National Park, under park management at Apoka (Kotido). There is one Forest Guard based at Karenga and living in his personal house with no official transport. The Kaabong-Kitgum road passes across the reserve from Karenga to Pire. A disused park road from Apoka Rest Camp to Lonyili is no longer motorable due to lack of maintenance. The latest Working Plan covers the period 1.1.64 to 31.12.73 and prescribes for protection of water catchments of rivers arising from within the reserve and sustaining the permanent settlements around its boundary.

Due to insecurity, the decline in law and order and low levels of funding, effective protection of the reserve from illegal activities has been lacking since the late 1970s. However, some preliminary work has started to resurvey and redemarcate the overgrown cutline with the support of the EC Natural Forests Management and Conservation Project.

#### 6 Proposed zonation

Figure A11.1 shows the proposed zonation of Nyangea-Napore with one Strict Nature Reserve (approx. 124 km<sup>2</sup>) one Protection (buffer) Zone (164 km<sup>2</sup>) and one Recreation Zone (129 km<sup>2</sup>). The proposed Kaleri Strict Nature Reserve (124 km<sup>2</sup>) has been selected to:

- protect the high altitude areas of wetter closed forest and the water catchment of the Kaleri mountain and basin;
- encompass a wide range of altitude, from 2230m to below 1100 m.

The proposed northern (Napore) recreation zone encompasses the Napore hills up to Lonyili mountain at the Sudan/Uganda border. It also overlaps with the Kidepo National Park. There is an old park road running across the proposed recreation zone from Apoka Rest Camp to Lonyili. It has been proposed because of its scenery and accessibility and its dual status.

The proposed southern (Nyangea) protection (buffer) zone covers the continuous ridge from the southern part of the proposed Kaleri Strict Nature Reserve to the Southern most end of the reserve. It is a watershed with uniformly steep slopes along its entire length. The steep slopes restrict accessibility to most parts of the reserve and therefore inherently offer protection to the Nature Reserve.

#### 7 Proposed management programmes

**Staffing:** The present staff is inadequate and it will be necessary to recruit one Forest Ranger to be based at Karenga to be in charge of the entire reserve. In addition to the Guard currently based at Karenga, two more Guards will be based at Pire, (see map), to be in-charge of the western side of the reserve and another based at Opotipoti, in charge of the recreation zone and the northern part of the reserve (Table 11.1).

**Table 11.1 Existing and proposed staff deployment at Nyangea-Napore**

Station	Existing and proposed No. of staff by category						Remarks
	FO	AFO	FR	FG	PM	Total	
Karenga	0(0)	0(0)	0(1)	1(0)	0(2)	1(3)	
Pire	0(0)	0(0)	0(0)	0(1)	0(2)	0(3)	
Opotipoti	0(0)	0(0)	0(0)	0(1)	0(2)	0(3)	
<b>Total</b>	<b>0(0)</b>	<b>0(0)</b>	<b>0(1)</b>	<b>1(2)</b>	<b>0(6)</b>	<b>1(9)</b>	

Note: FO = Forest Officer; AFO = Assistant Forest Officer; FR = Forest Ranger;  
FG = Forest Guard; PM = Patrolmen., Nos. in brackets indicate proposed staffing

**Infrastructure:** One Ranger's house and a store are needed at Karenga (A) and three Guards' houses are necessary at A, B and C. In collaboration with the Wildlife Authority, the Opotipoti-Lonyili park road will be improved to open the recreation zone to tourists up to the Sudan border (Table 11.2).

**Table 11.2 Existing and proposed staff housing at Nyangea-Napore**

Station	Existing and proposed staff housing					Remarks
	FD Detached	FD semi-Detached	FD Uniport	Private	Total	
Karenga	0(1)	0(1)	0(1)	1(0)	1(3)	
Pire	0(1)	0(0)	0(0)	0(0)	0(1)	
Opotipoti	0(1)	0(0)	0(0)	0(0)	0(1)	
<b>Total</b>	<b>0(3)</b>	<b>0(1)</b>	<b>0(1)</b>	<b>1(0)</b>	<b>1(5)</b>	

Note: Nos. in brackets indicate proposed staff housing units

**Demarcation:** 145 km of external boundary will be resurveyed, re-opened, redemarcated and planted with live markers and concrete beacons. Sign boards will be erected wherever prominent footpaths or tracks cross (external and internal) boundaries.

**Patrols and protection activities:** Three patrol teams, each comprising one Guard and 2 Patrolmen will be constituted and will be based at Karenga, Pire and Opotipoti and responsible for the Kaleri Strict Nature Reserve, southern (Napore) Protection Zone and the northern Recreation Zone respectively.

**Public access and community needs:** The Forest Ranger at Karenga will also be responsible for community outreach programmes, including community tree-planting programmes outside the boundary and liaison with park management on collaborative management of the Recreation Zone. Three bicycles for the Guards and a motorcycle for the Ranger will be provided to facilitate community extension work.

**Table 11.3 Summary of biodiversity values for Nyangea-Napore**

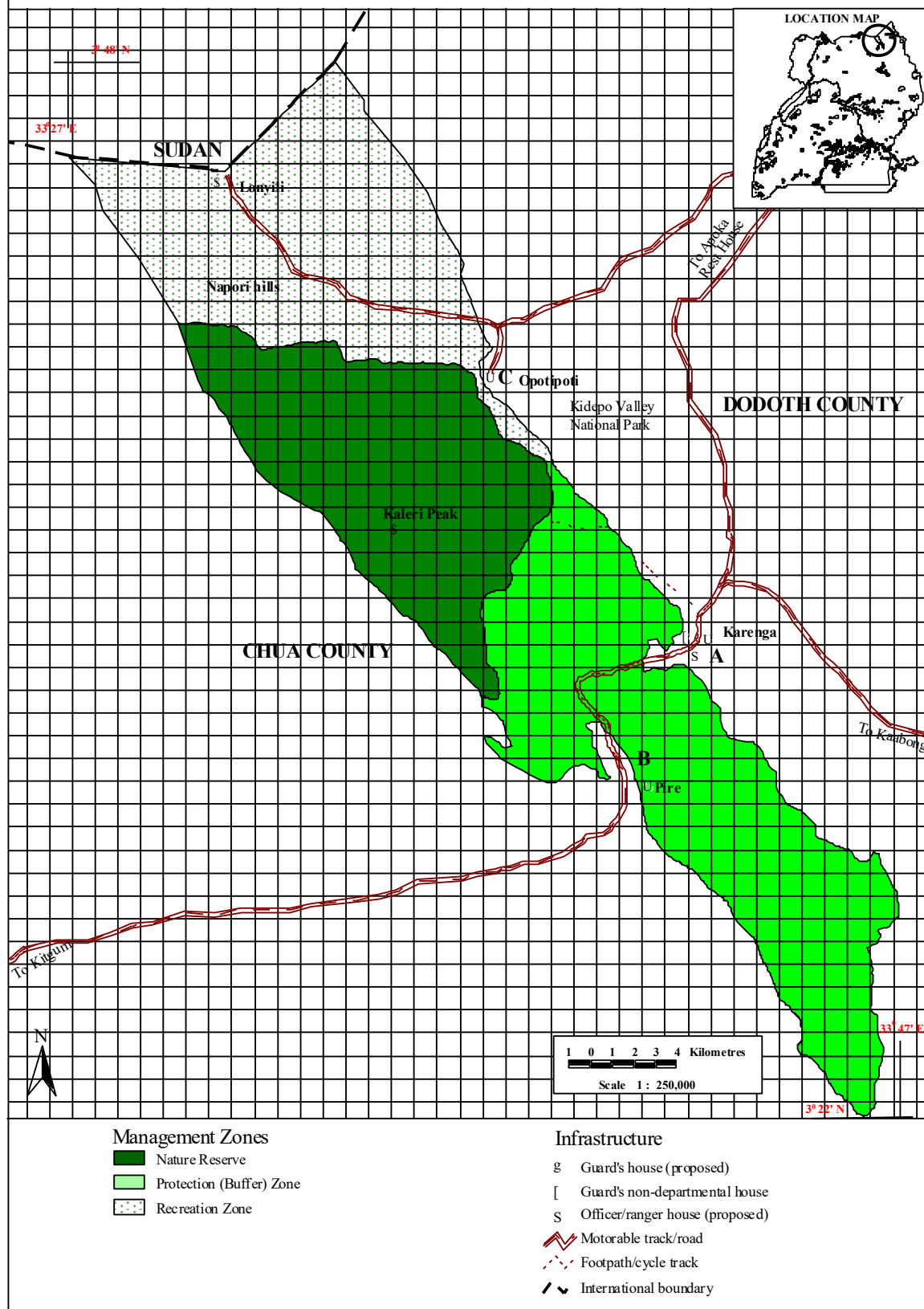
Criterion	Trees & Shrubs	Birds	Mammals	Butterflies	Moths	Overall
<b>Total No. of species known</b>	261		154	129	39	
<b>No. of restricted range species known from 5 forest</b>	24		17	16	5	
<b>Species unique to forest (list)</b>	<i>Aloe amudatensis</i> <i>Combretum hereroense</i> <i>Rubus freisiorum</i> <i>Vernonia syringiodes</i>			<i>Deudorix livia</i> <i>Terucus ungemachi</i> <i>Euchrysops cyclopterus</i> <i>Kedestes rogersi</i>		8 spp-
<b>Uganda endemics (list)</b>	-	-	-	-	-	-
<b>Albertine Rift endemics (list)</b>	-	-	-	-	-	-
<b>Species diversity (score &amp; rank)</b>	7.2(14=)	7(17=)	7(17=)	5.9(43=)	4.5(40=)	6.5(21=)
<b>Species rarity value (score and rank)</b>	7.9(11=)	6.6(14=)	4.7(36=)	4.9(28=)	6.1(26=)	6.7(20=)

Overall biodiversity importance = 13.4

**9 Principle reference material**

1. Uganda Forest Department (1963). Working Plan for the North Karamoja Central Forest Reserves. Forest Department, Kampala, Uganda.
2. Uganda Forest Department (1996). Biodiversity Report, Series No. 8: Nyangea-Napore, Rom and Ogili Forest Reserves. Forest Department, Kampala, Uganda.

Fig. A11.1 ZONATION OF NYANGEA-NAPORE FOREST RESERVE



## APPENDIX 12: BUGOMA FOREST PROFILE

(Category: CORE conservation forest)

### 1 Basis for selection

The forest was selected for Nature Reserve establishment in recognition of its role in biodiversity conservation, especially because:

- the site contributes between 1 to 2% of the national protected area system complement
- the forest supports 7 species of restricted range butterflies representing 1% of the species known from the protected area system in Uganda
- the forest supports 2 regional endemics: one species of butterfly and one species of small mammal

### 2 Physical description

**Area and demarcation:** The forest reserve covers 401 km<sup>2</sup> with a total boundary length of 177 km all of which adjoins rural community land. Of the 177 km of the external boundary, 131 km is an artificial boundary maintained as planted outline with earth corner beacons, cairns and directional trenches; about 10 km follows a road and about 36 km follows rivers and streams.

**Establishment:** 1932

**Location:** The Forest Reserve is located in Hoima District (Bugahya & Buhaguzi counties) above the escarpment over-looking Lake Albert on the edge of the western Rift Valley. It is covered by Department of Lands and Surveys map sheets 42/2, 47/4, 48/1 and 48/3 (series Y732) at 1:50,000 between 1°07'-1°25' N and 30°48'-31°07' E.

**Physical features:** The reserve occupies a gentle rolling landscape of which 91.5% has <5° slope and 7% is between 6-15° slope. Its altitude range is 990-1300 m above sea level. The area is drained mainly by River Nkusi at the southern boundary which flows towards Lake Albert.

### 3 Vegetation and forest condition

The majority of the area (321 km<sup>2</sup>, 80%) is covered by Tropical High Forest, classified as D2 (*Cynometra-Celtis* forest), 40 km<sup>2</sup> classified as K (*Albizia-Combretum-Terminalia-Hyparrhenia rufa*) and 35 km<sup>2</sup> as N2 (*Combretum-Hyparrhenia* savanna) (Langdale Brown et. al 1964). The grasslands, which tend to be on hill tops and ridges, are frequently burnt by fire.

The forested parts of the reserve are largely intact (50-70%) despite timber extraction over several years by sawmillers and pitsawyers. 3 sawmills operated in Nkwaki Block before 1980. The same block was illegally pitsawn between 1980-1991 (it was creamed of mahogany) with the exception of the central part of the block.

Although most of the canopy is dominated by *Cynometra* trees and appears closed, the forest is partially degraded (overall condition score 3). Limited timber harvesting is still taking place.

**Forest integrity score:** Settlement =1; Hunting = 2; Livestock = 1; Timber = 3; Fire = 2 (see Appendix 4 for explanation).

### 4 Economic importance

**Community use values:** The forest is situated in a part of the country with a low population density (43 people/km<sup>2</sup> in 1991). Pressure on the forest for domestic requirements is correspondingly very low giving a "community use" value of 1.4 (see Appendix 3 for explanation). Due to its large area and remoteness, potentially valuable resources in many areas within the forest still remain unexploited.

**Timber production:** The forest is an important source of sawn timber with timber production potential being 55 m<sup>3</sup>/ha of trees exceeding 50 cm dbh. Despite that, little information was available for sawn/round wood timber over the 1990-95 period. However, extraction of round wood by pitsawyers between January-August 1996 stood at 113.949 m<sup>3</sup> (hardwoods and mahoganies) and 716.653 m<sup>3</sup> from pines.

The pinewood came from a 3.18 ha trial plot near Mwera forest station. There is scope for expansion and development of similar plantations in the grassland areas.

**Other economic values (ecotourism):** The forest has some potential for tourism and recreation. Karwata Fort, an historic Bachwezi defence and the relatively undisturbed forest around is ideal for nature tourism, a potential not yet exploited. Bugoma forest reserve is between Murchison Falls National Park and Queen Elizabeth National Park and would be an ideal stop-over. The reserve is of great biodiversity interest (see below).

## 5 Biodiversity values

Of the 65 forests investigated for biodiversity, Bugoma ranks 12th in overall importance with a score of 14.1. It is among the large tropical high forest reserves of western Uganda. In terms of species diversity value it ranks 12th, but ranks 17th in terms of species “rarity value”. This is probably because it shares most of its species with the large forests of western Uganda.

The forest supports 9 species found in no other forest in Uganda (7 species of butterflies and 2 of large moths). One species (a mammal) is endemic to Uganda and one butterfly is endemic to the Albertine rift (see Table 12.3).

## 6 Present management

The reserve is managed from Hoima District forest office and a local office at Kisindi Forest Station. There are six established staff (Table 12.1).

**Table 12.1 Staffing status in Bugoma forest reserve**

Station	Existing and proposed number of staff by category						Remarks
	Forest Officer	Ass. Forest Officer	Forest Ranger	Forest Guard	Patrolman	Total	
Kisindi	1(0)	0(0)	1(1)	1(1)	0(8)	3(10)	
Mwera	0(0)	0(1)	1(0)	1(1)	0(3)	2(5)	
Kibale	0(0)	0(0)	0(0)	1(0)	0(3)	1(3)	
Kyangwali	0(0)	0(0)	0(1)	0(1)	0(3)	0(5)	
<b>Total</b>	<b>1(0)</b>	<b>0(1)</b>	<b>2(2)</b>	<b>3(3)</b>	<b>0(17)</b>	<b>6(23)</b>	

Note: Numbers in brackets indicate proposed staffing

The department has 4 residential houses and one office at Kisindi station and 12 ‘residential houses’ in Mwera station. The Mwera station houses are not fit for occupancy. Those at Kisindi require urgent rehabilitation. Management is facilitated by two old motorcycles stationed at Kisindi and Mwera forest stations. Most roads passing through or by the forest reserve are now motorable. However, the one that passes through Mwera forest station to Kaseeta (8 km) is in a bad state and difficult to drive through especially during rainy seasons. There is a weak bridge within the Forest Reserve.

**Table 12.2 Existing (and proposed) staff housing**

Station	FD Detached	FD incomplete detached	FD semidetached	FD uniport/ Unihut	Private
Kisindi	4*(1)	1(1)	0(0)	0(0)	1
Mwera	5 - 2*	0(1)	0(2)	7(3)	0
Kibale	0	0(1)	0(1)	0(0)	1
Kyangwali	0	0(1)	0(1)	0(0)	0
<b>Total</b>	<b>9(1)</b>	<b>1(3)</b>	<b>0(4)</b>	<b>7(3)</b>	<b>2</b>

Numbers in brackets indicate proposed housing units

\* indicates houses being occupied

The latest working plan (1960-70) expired and a new interim management plan is being drafted with the objectives of conserving the forest biodiversity and ecological condition; production of hardwood timber on a sustainable basis; integration of communities living near the forest reserve in collaborative management, and carrying out research on various forest ecosystem dynamics.

Some timber trial plots (a pine plantation) were established near Mwera station and the results proved very promising with *Pinus caribaea* but not *P. patula*.

In recent years (1988-96), with the support of the EC-financed Natural Forest Management and Conservation Project, approximately 89 km (of the 131 km artificial boundary) has been planted (at 10 m intervals) with live markers (*Draceana* spp., *Eucalyptus* spp. and *Erythrina* spp). There are corner beacons and the boundaries are regularly maintained. 20-30% of the seedlings planted survived. Enrichment planting was carried out in Nkwaki block (1,103 ha) between 1990-94 with Mahogany, Lovoa, Musizi and Mvule seedlings. Illegal activities have been greatly reduced due to regular patrolling.

## 7 Proposed zonation

Figure A9.1 shows the proposed zonation of the reserve with two Nature Reserves (100 km<sup>2</sup>), one protection zone (50 km<sup>2</sup>), one production zone (240 km<sup>2</sup>) and one recreation zone (11 km<sup>2</sup>).

**Proposed Nature Reserves:** The proposed northern (Nkwaki) Strict Nature Reserve (39 km<sup>2</sup>) has been selected to:

- cover the largest area of the reserve with a vegetation close to its natural form (largely intact).
- include an area with many small streams, including R. Rutowa.
- include an area that is remote and hence has little interference from human activities.

The proposed southern (Kyangwali) Strict Nature Reserve (61 km<sup>2</sup>) which was slightly disturbed by pitsawing (1993-4) and encroached upon by the Rwandese refugees (between 1992-3), is a representative of the southern communities within the Forest Reserve. It is clearly marked by R. Nkusi (permanent), and is remotely located, hence making its management ideal. The presence of a relatively undisturbed closed forest environment will support a high population of butterflies, many of which are restricted range species.

**Proposed production zone:** This will cover the middle portion of the reserve (Isangwe, Rwempuno Musana blocks) and the northern part of Nkwaki block (248 km<sup>2</sup>).

Although these areas have been creamed by sawmillers and pitsawyers, there is still a substantial quantity of standing timber per hectare (55 m<sup>3</sup>/ha > 50 cm dbh) mainly *Chrysophyllum* spp, *Celtis* spp. and *Cynometra alexandri*. There are also a lot of timber resources on public lands (which is currently producing 80% of the timber in the district).

**Proposed recreation zone (3 km<sup>2</sup>):** The recreation zone is centred around the Karwata Fort located on the southern tip of Nkwaki block, about 6 km off the Hoima-Fort Portal Road (at Kabwoya Trading Centre). The area is of great interest because of its Bachwezi history, and the forest is relatively intact and easily accessible from the main road. Elephants commonly use this part of the reserve.

**Proposed protection zone (50 km<sup>2</sup>):** One protection zone will be in the north to buffer Nkwaki Strict Nature Reserve. This SNR is relatively small in size compared to the Kyangwali Strict Nature Reserve which needs no buffer.

## 8 Proposed management programme



**Staffing:** The present staffing (six) is not adequate. Some recruitment and redeployment will be necessary to manage the reserve effectively. Twenty-nine staff will be required (refer to Table 12.1)

**Infrastructure:** All houses in Kisindi forest station need rehabilitation and those of Mwera should be pulled down and new ones constructed.

**Demarcation:** 42 km of the external boundary (reopened) needs replanting and maintenance. All internal management zones will be demarcated by ring painting trees in the standard way. Red paint will be used to indicate Strict Nature Reserve and yellow paint for 'buffer' zones. Sign boards will be erected whenever a prominent road/path crosses external or internal boundaries.

**Patrol and protection activities:** Four patrol teams comprising one Forest Ranger and 3 Forest Guards at each of the stations or sub station will comprise regular patrol teams and be entrusted with safe-guarding the ranges. However, when deemed necessary, the Forest Officer in charge of the working Plan Area will call an emergency patrol. In order for the team to have commitment to work, a system of rewarding staff for work well done should be instituted.

**Public access and community needs:** The Forest Officer will assume the responsibility for community outreach programmes, including the development of collaborative management within the forest reserve and community conservation programmes (including tree planting) outside the Forest Reserve. A programme of village meetings will be instituted to explain the concept and management strategy for the Forest Reserve and in particular the management zones.

To facilitate proper management and the community work programme, the FO needs a 4WD vehicle, the Forest Rangers need 5 motorcycles, and 20 bicycles will be needed for Forest Guards and patrolmen.

Table 12.3 Summary table of biodiversity values

Criterion	Trees & Shrubs	Birds	Mammals	Butterflies	Moths	Overall
Total No. of known spp.	257	221	21	292	118	909
No. of restricted range spp. (known from $\leq 5$ forests)	7	22	1	65	13	108
Species unique to the forest (list)	None	None	None	<i>Leptosia marginea</i> <i>Falcuna orientalis</i> <i>Lachnocnema magna</i> <i>Bebearia plistonax</i> <i>Hypolimnas deceptor</i> <i>Osmodes omar</i> <i>Fresna netopha</i>	<i>Orthogonioptilum</i> sp.B. <i>Eustera</i> spp.	9
Uganda endemic (list)	None	None	<i>Crocidura selina</i> (shrew)	None	None	1
Albertine endemic (list)	None	None	None	<i>Cymothoe ochreata</i>	None	1
Species diversity (score and rank)	6.6(24=)	6.5(24=)	5.8(36=)	9.8(3=)	10(1)	7.0(12)
Species rarity value (score & rank)	7(35=)	6.5(17=)	6.1(15=)	6.3(8)	7.4(8=)	6.8(17=)

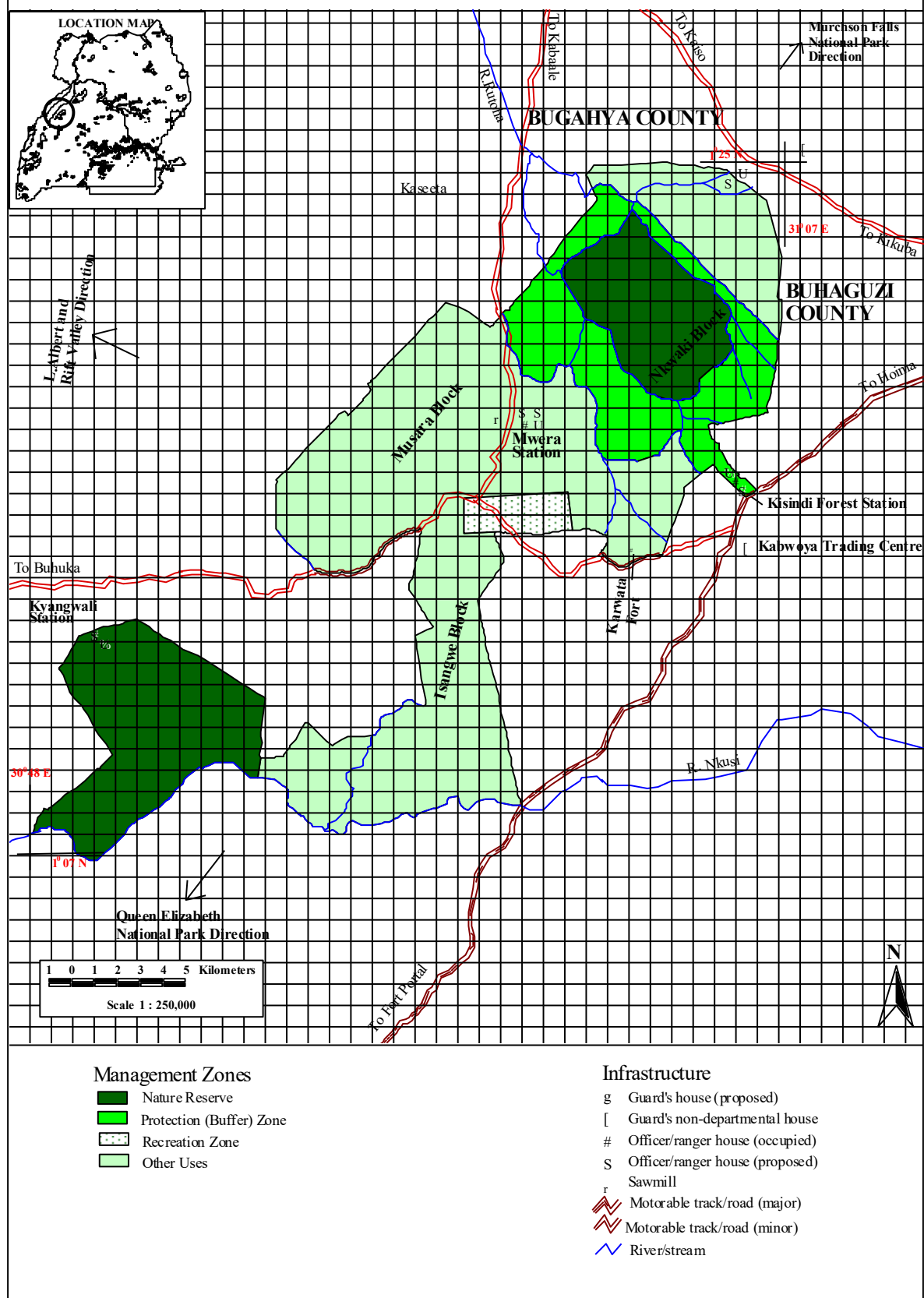
Overall biodiversity importance = 14.1

## 9 Principle reference material

- 1 Langdale Brown, I., Osmaston, H.A. and Wilson, J.G. (1964). The vegetation of Uganda and its bearing on land use. Uganda Government Printer, Entebbe.
- 2 Uganda Forest Department (1960). Working plan for Bugoma Forest Reserve, 1960-70. Forest Department, Kampala, Uganda.
- 3 Uganda Forest Department (1996). Biodiversity report series No. 9, Bugoma Forest Reserve, Biodiversity report. Forest Department, Kampala, Uganda.

Fig. A12.1

## ZONATION OF BUGOMA FOREST RESERVE



## APPENDIX 13: MT. KADAM FOREST PROFILE

(Category: SECONDARY conservation forest)

### 1 Basis for selection

The forest was selected for Nature Reserve establishment in recognition of its biodiversity importance, especially because:

- it supports one species of tree and one species of butterfly not found elsewhere in Uganda's protected area system that are of conservation concern on account of being broadly endemic (Table 3.9, pg. 45), the tree being endemic to the afro-montane or Somalia-Maasai region (table 3.5, pg. 35).
- it is representative of the G2 (Riparian thicket vegetation type), not otherwise represented in Uganda's protected area system.
- it supports 43 species (21 species of trees, 7 birds, 4 mammals, 8 butterflies and 3 species of moths) found in not more than five other Ugandan forests.

### 2 Physical description

**Area and demarcation:** 399 km<sup>2</sup>; total boundary length 125 km, approximately 121.5 km is artificial cutline with heaped cairns and 3.5 km is natural river (R. Alibamea). It all adjoins rural community lands. The boundary has not been maintained for a long time owing to previous insecurity.

**Establishment:** 1940

**Location:** In southern Karamoja in Kadam county Moroto District, eastern Uganda. It lies between 1°42' and 1°53' N and 34°35' and 34°52' E. It is located approximately 70 km north of Mt. Elgon, 80 km south of Moroto town and 85 km north east of Mbale. It borders Pian-Upe Wildlife Reserve and is covered by Department of Lands and Surveys map sheets 45/2, 45/3 and 45/4 (series Y732) at 1:50,000.

**Physical features:** The reserve occupies one of the ancient volcanic masses rising from the plains of southern Karamoja at altitudes of 1,160-3,068 m above sea level, with 76.7% (306 km<sup>2</sup>) exceeding a 15° slope. Seasonal rivers run down the mountain.

### 3 Vegetation and forest condition

The reserve has varied vegetation communities, classified as types B3 (*Juniperus-Podocarpus* dry montane forest) and F1 (Forest savanna mosaic at high altitudes), together covering 190 km<sup>2</sup> (47.6% total area). Other communities include G1 (10 km<sup>2</sup> of undifferentiated semi-deciduous thicket); A2 (5 km<sup>2</sup> of *Ericacea-Stoebe* High montane Heath) and G2 (4 km<sup>2</sup> of Riparian thicket). A detailed forest type map is available at Forest Department headquarters, based on 1950s aerial photography. A great part of the vegetation is affected by burning and grazing.

The forest is partially degraded (overall condition score 3) mainly due to seasonal grazing and burning. There is currently no timber harvesting but there are signs of previous pitsawing. Agricultural encroachment and mining are common. Hunting is moderately widespread.

**Forest integrity scores:** Settlement = 2; Cultivation = 1; Hunting pressure = 1; Livestock = 1; Timber Harvesting = 0; Fire = 3; Community Use = 1; Mining = 1 (see appendix 4 for explanation).

### 4 Economic importance

**Community use values:** The reserve is situated in an area of low population density (21 people per km<sup>2</sup> in 1991), so pressure on the peripheral areas of the forest for firewood, building poles and non-timber forest products is correspondingly low, except at places of community concentrations, like Kaiku and Napeded. Some areas of the reserve are so inaccessible that particularly valuable resources are under-utilised, giving a community use value of 0.5 (see Appendix 3 for explanation). Nomadic cattle grazing and agricultural encroachment are the major activities, mining and hunting being less common.

**Timber production:** Although 20% of the area is forested, the forest is not an important source of timber. A timber inventory in early 1970s (Lockwood Consultants, 1973) provided an estimate of 5 m<sup>3</sup> per ha standing volume of merchantable timber exceeding 50 cm dbh. The reserve has a poor plantation potential.

**Other economic values:** This reserve serves a vital watershed role protecting water of downward streams. It is located close to the main eastern tourist circuit, and has potential for tourism development based on attractions such as spectacular landscape scenery, cultural diversity and accessibility.

## 5 Biodiversity values

Of the 65 forests investigated for biodiversity, Mt. Kadam ranks tenth in overall importance, with a score of 13.9 (chapter 3, Table 3.1). It is the twelfth in terms of species diversity, and ranks twenty-fourth in terms of 'rarity' value of species represented. The forest supports two species (a tree and a butterfly) found in no other Ugandan forest, but has no species endemic to Uganda or the Albertine Rift region (see Table 13.3). It is the only reserve with G2, Riparian thicket (Langdale Brown et al., 1964), which although covering a small area (4 km<sup>2</sup>) is not found in any of the country's National Parks and Wildlife Reserves.

## 6 Present management

This reserve is managed from Moroto District Forest office in Moroto Municipality. There is a local forest station at Namalu trading centre. There is one Forest Officer and one Assistant Forest Officer (both in charge of all reserves in the district) stationed in Moroto municipality. One Forest Guard and three nurserymen under the Natural Forest Management and Conservation Project (NFMCP) are located at Namalu Trading Centre (see map Fig. A13.1). There is no Forest Ranger. Accommodation for the District Forest Officer and the Assistant Forest Officer is as for Mt. Moroto Forest Reserve (see Appendix 9). The guard is accommodated in a private house at Namalu trading centre. The local station at Namalu has one single departmental house which requires renovation. Management is facilitated by the DFO's pick-up. However, there are some motorable tracks within the reserve. The latest working plan covers the period 1957 to 1966, but was extended to 30-06-72. It prescribed for the protection and improvement of the vegetation in the reserve, in order to conserve and improve local water supplies. There is no Nature Reserve.

## 7 Proposed zonation

The whole of Mt. Kadam Forest Reserve will initially be treated as a Nature Reserve; zonation of the reserve would be complicated by the nomadic nature of the people living within and around the forest, most of them being armed. Since these communities regard the forest as theirs, it would be inappropriate making restrictions through zoning before approaches like education and sensitization of the communities on conservation is done.

However, Figure A13.1 shows the 'preliminary' zonation of the reserve, with one Nature Reserve (approximately 82 km<sup>2</sup>), two protection zones (approximately 223 km<sup>2</sup>) and 3 production zones (approximately 94 km<sup>2</sup>).

The proposed Nature Reserve has been selected to:

- encompass the widest possible range of altitude, from above 3000 m to below 1500 m.
- protect the largest remaining block of relatively intact highland forest which is on the high altitude slopes to the north of the main summit.
- protect a viable area of the Raparian thicket vegetation type, not found elsewhere in the country's protected areas system.

The proposed protection zones cover very steep lands, one North-east of the Nature Reserve and adjacent to the South Karamoja communal hunting area, the second zone stretching round the Nature Reserve, from south-east (also adjacent to the hunting area) to the north of it. The zones cover land unsuitable for production purposes (on account of soil erosion hazards), but which can serve to enhance the long-term viability of the Nature Reserve.

The proposed production zones cover the rest of the reserve, including areas that are much affected by overgrazing and cultivation. They also include easily accessible hill areas.

## 8 Proposed management

**Staffing:** The present staff is inadequate. Some deployment will be necessary to create 2 effective patrol teams, with responsibility for newly defined beats/ranges based at Namalu and Nakapiripirit as shown in Fig. A13.1. There is need for at least Assistant Forest Officer, one Forest Ranger and another Forest Guard. The three reserves Mt. Moroto, Mt. Napak and Mt. Kadam will be under the responsibility of a single District Forest Officer. The Assistant Forest Officer, Forest Ranger and one Guard are to be stationed at Namalu trading centre with the second guard at Nakapiripirit (Table 13.1).

**Table 13.1 Existing and proposed staff deployment at Mt. Kadam Forest Reserve**

Station	Existing and proposed staff by category						Remarks
	FO	AFO	FR	FG	PM	Total	
Moroto	1(0)	1(0)	-	-	-	2(0)	See also Table 10.1 Appendix 6
Namalu	0(1)	0(1)	0(1)	1(0)	0(2)	1(3)	
Kakapiripirit	-	-	-	0(1)	0(2)	0(3)	
<b>Total</b>	<b>1(1)</b>	<b>1(1)</b>	<b>0(1)</b>	<b>1(1)</b>	<b>0(4)</b>	<b>3(6)</b>	

NB Nos. in brackets indicate proposed number of staff. FO = Forest Officer; AFO = Assistant Forest Officer; FR = Forest Ranger; FG = Forest Guard, PM = Patrolman.

**Infrastructure:** The station house at Namalu should be renovated. One semi-detached and one detached house will be constructed at the same place for the Assistant Forest Officer, one Ranger and one guard, and another semi-detached at Nakapiripirit for the second Forest Guard.

**Table 13.2 Existing and proposed staff housing at Mt. Kadam**

Station	Existing and proposed staff housing						Remarks
	FD Detached	FD semi detached	FD semi Detached	FD uniport	Private	Total	
Moroto	-	-	-	-	-	-	Housing for DFO & AFO is as in Appendix 6. Detached house at Namalu to be used for storage and office work.
Namalu	1(1)	-	0(1)	-	1(0)	2(2)	
Nakapiripirit	-	0(1)	-	-	-	0(1)	
<b>Total</b>	<b>1(1)</b>	<b>0(1)</b>	<b>0(1)</b>	<b>-</b>	<b>1(0)</b>	<b>2(3)</b>	

NB: Nos. in brackets indicate proposed number of houses.

An underground water tank/water source should be constructed at Namalu. There is need for a radio communication system between the reserve and the district headquarters.

**Demarcation:** The whole extent of artificial boundary (125 km), will be reopened and planted. However, frequent fires and heavy grazing may be a setback to establishing livemarkers, and so much use will be made of corner beacons, although concrete corner cairns would be a better alternative. All internal management zone boundaries will be demarcated by ring-painting trees in a standard way. Sign boards will be erected wherever prominent footpaths cross (external and internal) boundaries.

**Patrol and protection activities:** Protection will mostly be through community education as patrol work is not effective since the encroachers are mostly nomadic and armed. Two patrol teams, comprising of two patrol men and a Forest Guard will be constituted. These ranges will be based at Namalu and Nakapiripirit. Men will be rotated between patrol teams and teams will be moved periodically between ranges. Patrols' routes and checkpoints will be established throughout the reserve. An incentive scheme will be instituted to reward success in curbing illegal activities.

**Public access and community needs:** The greater part of the population relying on the reserve are settling down to cultivation in and around the reserve. Many of these people are armed, a situation unfavourable to implementation of conservation activities. Therefore, integration of these communities into conservation will be attempted.

The Assistant Forest Officer and the Forest Ranger should assume responsibility for community out-reach programmes. A programme of meetings with the communities will be instituted to explain and discuss conservation and management of the reserve; community development initiatives will be encouraged. The Forest Officer will be

facilitated with a vehicle and the Assistant Forest Officer and Ranger at Namalu will each have a motorcycle to support their work. The patrolmen and Forest Guards will each be provided with a bicycle.

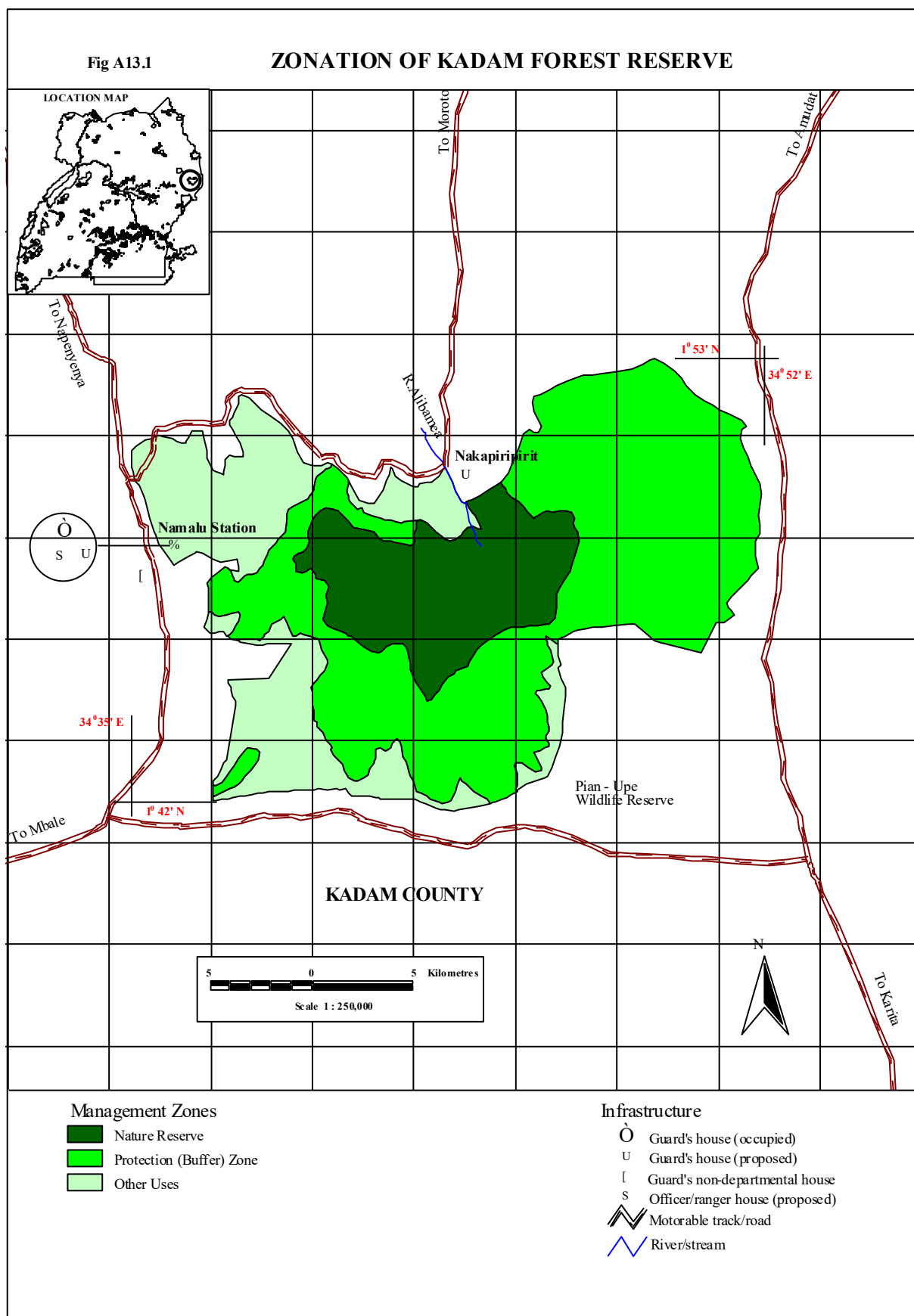
**Table 13.3 Summary Table of Biodiversity Values for Mt. Kadam**

Criterion	Trees & shrubs	Birds	Mammals	Butterflies	Moths	Overall
<b>Total No. of spp known</b>	291	126	22	92	37	
<b>No. of restricted range spp (&lt; 5 forests)</b>	21	7	4	8	3	
<b>Species unique to forest</b>	<i>Halleria lucida</i>	none	None	<i>Pontia glauconome</i>	none	2 spp
<b>Uganda endemics</b>	None	none	None	None	none	none
<b>Albertine Rift endemics</b>	None	none	None	None	none	none
<b>Species diversity (score &amp; rank)</b>	8.3(5=)	6.7(20=)	8.6(4)	6.6(30=)	5.3(33=)	7.3(12=)
<b>Species rarity (score &amp; rank)</b>	7.5(18=)	6.2(19)	5.7(17=)	4.5(38=)	6.0(28)	6.6(24)
<b>Biodiversity importance value</b>						13.9(10)
Overall biodiversity score = 14.1						

## **9 Principle Reference Material**

- 1      Langdale-Brown, I., Osmaston, H.A and Wilson, J.G. (1964). The Vegetation of Uganda and its Bearing on Land Use. Uganda Government Printer, Entebbe.
- 2      Lockwood Consultants (1973). Forest Resource Development Study for the Republic of Uganda. Lockwood Consultants, Toronto, Canada.
- 3      Phillip, M. S. (1957). Working plan for Kadam Central Reserve, Karamoja District, Northern Province, for the period of 1957-66. Uganda Forest Department, Kampala, Uganda.
- 4      Uganda Forest Department (1996). Biodiversity Report series No. 6; Mt. Moroto, Mt. Kadam and Mt. Napak Forest Reserves. Forest Department, Kampala, Uganda.





## APPENDIX 14: KASYOHA-KITOMI FOREST PROFILE

(Category: CORE Conservation Forest)

### 1 Basis for selection

The forest was selected for Nature Reserve establishment in recognition of its considerable biodiversity importance, especially because:

- it supports 11 species of butterflies (representing more than 1% of the country's PA total) known from no other Protected Area in Uganda (see Table 3.5, p. 33).
- it makes an important contribution to the protection of Uganda's biodiversity, adding 2.7% of butterfly species to the Protected Area total (see Table 3.8, p. 40) as well as some trees and a bird species.
- it supports one species of tree and one butterfly not found elsewhere in Uganda's PA system that are of conservation concern on account of being endemic to the Albertine Rift Region.
- it is representative of a vegetation type (D3, *Albizia Markhamia* forest) not otherwise represented in Uganda's Protected Area system.

### 2 Physical description

**Area and demarcation:** 399 km<sup>2</sup>; total boundary length 145 km, of which approximately 142 km adjoins rural community lands, and 3 km adjoins Kalinzu Forest Reserve. Of the 142 km of 'external' boundary, approximately 93.5 km follows rivers and streams while 48.5 km is an artificial boundary maintained as a planted cut-line with earth corner cairns, beacons and direction trenches.

**Establishment:** 1932, but with subsequent realignments until 1963.

**Location:** on the escarpment overlooking the Albertine Rift Valley in western Uganda, south of Lake George, between 0°05' - 0°25' S and 30°05' - 30°20' E. The forest is shared between Bushenyi (Bunyaruguru, Igara and Buhweju counties), Mbarara (Ibando county) and Kabarole Districts (Kibale county). Covered by Uganda Lands and Surveys map sheets 76/1, 76/2, 76/3 and 76/4 (series Y732) at 1:50,000.

**Physical features:** the reserve occupies steeply undulating terrain at altitudes of 975-2136 m, with 41% exceeding a 15° slope. The area is deeply dissected by two rivers, the Chambura and Buhindagi, which drain northwards into the Rift valley.

### 3 Vegetation and forest condition

The majority of the area (330 km<sup>2</sup>, 83%) is occupied by tropical high forest communities, classified as types C3 (*Parinari* medium-altitude moist evergreen forest, 230 km<sup>2</sup>) and D3 (medium altitude moist semi-deciduous *Albizia-Markhamia* forest, 100 km<sup>2</sup>). The remainder (69 km<sup>2</sup>, 17%) comprises tall *Pennisetum* grasslands (type P2), (Langdale-Brown *et al.*, 1964) which tend to occur on hilltops and ridges where they are maintained by frequent outbreaks of fire. A detailed forest type map is available at Forest Department headquarters, based on 1950s aerial photography, and reproduced in Howard (1991).

The forest is largely intact (overall condition score 4), mainly because of difficult access. There has been no mechanised timber harvesting, and no agricultural encroachment, although pitsawing activities have intensified in recent years. Hunting is widespread, and mining is common along stream and river beds.

**Forest integrity scores:** Settlement = 0; Cultivation = 1; Hunting = 2; Livestock = 1; Timber = 2/3 Fire = 1; Community-use = 1; Mining = 2 (see Appendix 4 for explanation).

#### 4 Economic importance

**Community-use values:** The forest is situated in one of the most densely populated parts of the country (207 people per km<sup>2</sup> in 1991), so pressure on the peripheral areas of the forest for firewood, building poles and non-timber forest products is correspondingly high. However, large areas of the forest are so remote and inaccessible that potentially valuable resources in many areas remain under-utilised, giving a 'community-use' value of 5.6 (see Appendix 3 for explanation).

**Timber production:** The forest is an important source of pitsawn timber, providing a registered average annual offtake of 876 m<sup>3</sup> of sawn timber over the 1986-90 period (Table 14.1) as well as large volumes of timber cut illegally. A timber inventory in the early 1970s (Lockwood Consultants, 1973) provided an estimate of 55 m<sup>3</sup> per ha standing volume of merchantable timber exceeding 50 cm dbh.

**Table 14.1 Annual timber offtake from Kasyoha-Kitomi (m<sup>3</sup>) for the period 1986-90**

Year (FY)	Class I	Class II	Class III	Total
1986/87	34	80	-	114
1987/88	229	577	100	906
1988/89	44	679	53	776
1989/90	482	264	78	824
<b>Total</b>	<b>789</b>	<b>1000</b>	<b>231</b>	<b>2620</b>

Approximately 400 ha of *Eucalyptus* plantation have been established since 1991 under a 5-year licensing arrangement on Lubare Ridge, and there is scope for expansion of this, and development of similar plantations in grasslands elsewhere.

**Other economic values:** The reserve serves a vital watershed role protecting the waters of Lake George, noted as one of the most productive fresh-water fisheries in the world. It is located close to the main western tourist circuit, and has potential for ecotourism development based on attractions such as chimpanzees and scenic Lake Kamunzuka. The reserve's extraordinary biodiversity interest (see below) offers scope for the development of a research and education role.

#### 5 Biodiversity values

Of the 65 forests investigated for biodiversity, Kasyoha-Kitomi ranks second in overall importance, with a score of 15.5 (Chapter 3: Table 3.1). It is the top-scoring forest in terms of species diversity, but ranks ninth in terms of the 'rarity' value of the species represented, presumably because many of its species are shared with other medium-altitude forests along the Albertine Rift. The forest supports 15 species found in no other Ugandan forest (including 11 butterflies and a waterbird), one species endemic to Uganda, and five species endemic to the Albertine Rift region (Table 14.4). It represents the largest block of medium-altitude semi-deciduous forest, type D3 (Langdale-Brown *et al.*, 1964) in the protected area system, a vegetation association that does not occur in any of the country's National Parks or Wildlife Reserves.

#### 6 Present management

The reserve is managed from the Bushenyi and Mbarara District Forest Offices and local offices at Ndekye (Bushenyi) and Rukiri (Mbarara). There are two Forest Officers (stationed at Ndekye and Rukiri), three Forest Rangers (stationed at Ndekye, Katerera and Rukiri), four Forest Guards (stationed at Rukiri (2), Ndekye (1) and Nyakashaka (1)) (see Table 14.2 and map). The department has three staff houses at Ndekye, and housing for six additional staff is under construction comprising: 2 detached houses (Table 14.3) (at Katerera, and Rukiri) and 4 semi-detached Guard houses (2 at Katerera, 2 at Rukiri).

Management is facilitated by two motorcycles stationed at Ndekye and Rukiri and a Land Rover stationed at Ndekye. However, there are no roads or motorable tracks within the reserve, and vehicular access to within 500 metres of the forest boundary is only possible at Ndekye, Katerera, Bihanga, and Ibanda. The latest Working Plan covers the period 1.7.68 to 30.6.78 and prescribes for the maximum sustained yield of hardwood timber, the production of timber from softwood plantations in the grasslands and the protection of the area's important water catchment role. There is no Nature Reserve. Some timber trial plots were established at the top of the Lubare Ridge near the main Katunguru-lshaka road in the 1960s.

In recent years (since 1990), with the support of the EC-financed Natural Forest Management and Conservation Project, approximately 48.5 km of boundary has been re-demarcated by cutline, of which 15.5 km has been successfully planted with marker trees (*Eucalyptus*, *Ficus* and *Erythrina*) at 20 m intervals (Figure A14.I). Protection patrols have been intensified, and a Peace Corps volunteer has been providing support to village tree planting activities near Ndekye since 1993.

## **7 Proposed zonation**

Figure A14.1 shows the proposed zonation of the reserve, with two Strict Nature Reserves (approximately 101 km<sup>2</sup>), two protection zones (approximately 59 km<sup>2</sup>), one recreation zone (approximately 8 km<sup>2</sup>), and three production zones (approximately 231 km<sup>2</sup>).

### **Strict Nature Reserves**

The proposed northern (Kitomi) Strict Nature Reserve (35 km<sup>2</sup>) has been selected to:

- encompass the widest possible range of altitude, from above 2000m to below 1000m.
- protect a viable area of moist semi-deciduous forest type D3 (Langdale-Brown *et al*, 1964), which is not otherwise represented in Uganda's protected area system.

The proposed southern (Kasyoha) Strict Nature Reserve (66 km<sup>2</sup>) has been selected to protect a substantial undisturbed core area comprising mature mixed forest on generally steep and inaccessible land.

### **Protection (buffer) zones**

The proposed protection zones cover areas of steep land adjacent to the southern Strict Nature Reserve, that are generally unsuitable for timber harvesting (on account of erosion hazards), but which can serve to enhance the long-term viability of the Nature Reserve. In addition, the south-eastern protection zone encompasses the only area of *Parinari*-forest in the reserve, a type increasingly threatened by timber harvesting elsewhere. The northern protection zone occupies steep land on the north side of the Chambura Gorge, and one of its major tributaries.

### **Recreation (eco-tourism zone)**

The proposed recreation zone is centred on Lake Kamunzuka, a scenic crater lake near the north-western boundary of the reserve. The zone encompasses the steep southern flank of the Chambura Gorge, adjoining the Nature Reserve, and thereby enhancing its protection and viability. This is one of the few parts of the reserve where vehicular access is possible close to the boundary. Chimpanzees are common and could be habituated. This will also be an important stop-over for tourists travelling to Queen Elizabeth, Rwenzori, Semuliki and Kibale National Parks.

### **Production Zones**

The proposed production zones cover the majority of the reserve including the areas that have already been heavily exploited by pitsawyers; the more accessible peripheral areas of the reserve; the grasslands of Lubare and Munyoni ridges, which have potential for plantation development, and most of the northern (Kitomi and Kakasi) parts of the reserve where the land is generally flatter, and more suitable for timber production.

## 8 Proposed management programmes

**Staffing:** The present staff number is inadequate, and some re-deployment will be necessary to create five effective patrol teams. The entire reserve will be brought under the responsibility of a single Forest Officer, based at Ndekye, with radio communication with each range station. Two additional Forest Rangers are necessary, one at Bihanga and another at Nyakashaka, as well as one AFO at Rukiri (Table 14.2).

**Table 14.2 Existing and proposed staff deployment at Kasyoha-Kitomi**

Station	Existing and proposed No. of staff by category						Remarks
	FO	AFO	FR	FG	PM	Total	
Ndekye	1(0)	0(0)	1(0)	1(0)	5(0)	8(0)	FG at Katerera paid by EU Project
Katerera	0(0)	0(0)	1(0)	1(0)	5(0)	7(0)	
Rukiri	1(0)	0(1)	1(0)	2(0)	6(0)	10(1)	
Bihanga	0(0)	0(0)	0(1)	1(0)	5(0)	6(1)	
Nyakashaka	0(0)	0(0)	0(1)	0(1)	0(5)	0(7)	
<b>Total</b>	<b>2(0)</b>	<b>0(1)</b>	<b>3(2)</b>	<b>5(1)</b>	<b>21(5)</b>	<b>31(9)</b>	

Note: FO = Forest Officer; AFO = Assistant Forest Officer; FR = Forest Ranger;  
FG = Forest Guard; PM = Patrolmen; Nos. in bracket indicates proposed staffing.

**Infrastructure:** The uncompleted houses at Katerera and Rukiri should be completed. Four additional Guard houses are necessary at Bihanga(2), Nyakashaka (2) (Table 14.4). Two patrol huts, capable of accommodating a patrol team of five men will be constructed in the centre of the reserve for overnight use by the patrol teams: one south of Munyoni peak, and the other near the southern boundary of the northern Strict Nature Reserve (see Figure A14.1).

**Table 14.3 Existing and proposed staff housing at Kasyoha-Kitomi**

Station	Existing and proposed staff housing					Remarks
	FD detached	FD semi Detached	FD Uniport	Private	Total	
Ndekye	3(0)	0(0)	1(0)	0(0)	4(0)	1 house needs repair, * houses not complete
Katerera*	1(0)	2(0)	0(0)	0(0)	3(0)	
Rukiri*	1(0)	2(0)	0(0)	0(0)	3(0)	
Bihanga	0(0)	0(2)	0(0)	1(0)	1(2)	
Nyakashaka	0(0)	0(2)	0(0)	0(0)	0(2)	
<b>Total</b>	<b>5(0)</b>	<b>4(4)</b>	<b>1(0)</b>	<b>1(0)</b>	<b>11(4)</b>	

Note: Nos. in brackets indicates proposed staff housing units.

**Demarcation:** 33 km of re-opened external boundary remains to be planted. All internal management zone boundaries will be demarcated by ring-painting trees in the standard way. Sign boards will be erected wherever prominent footpaths cross (external and internal) boundaries.

**Patrol and protection activities:** Five patrol teams, each comprising one Forest Guard and four patrolmen will be constituted. These ranges will be based at Ndekye, Katerera, Nyakashaka, Bihanga and Rukiri as shown in Figure A14.1. Men will be rotated between patrol teams and teams will be moved periodically between ranges. Patrol routes and checkpoints will be established throughout the reserve. An incentive scheme will be instituted to reward success in curbing illegal activities.

**Public access and community needs:** Two Rangers (based at Ndekye and Rukiri) will assume responsibility for community outreach programmes, including the development of Collaborative Forest Management programmes within the reserve, and community tree-planting programmes outside the boundary. A programme of village meetings will be instituted to explain and discuss management of the reserve, and in particular the management zones as they are established. Each of these Rangers will be provided with a motorcycle to support the work.

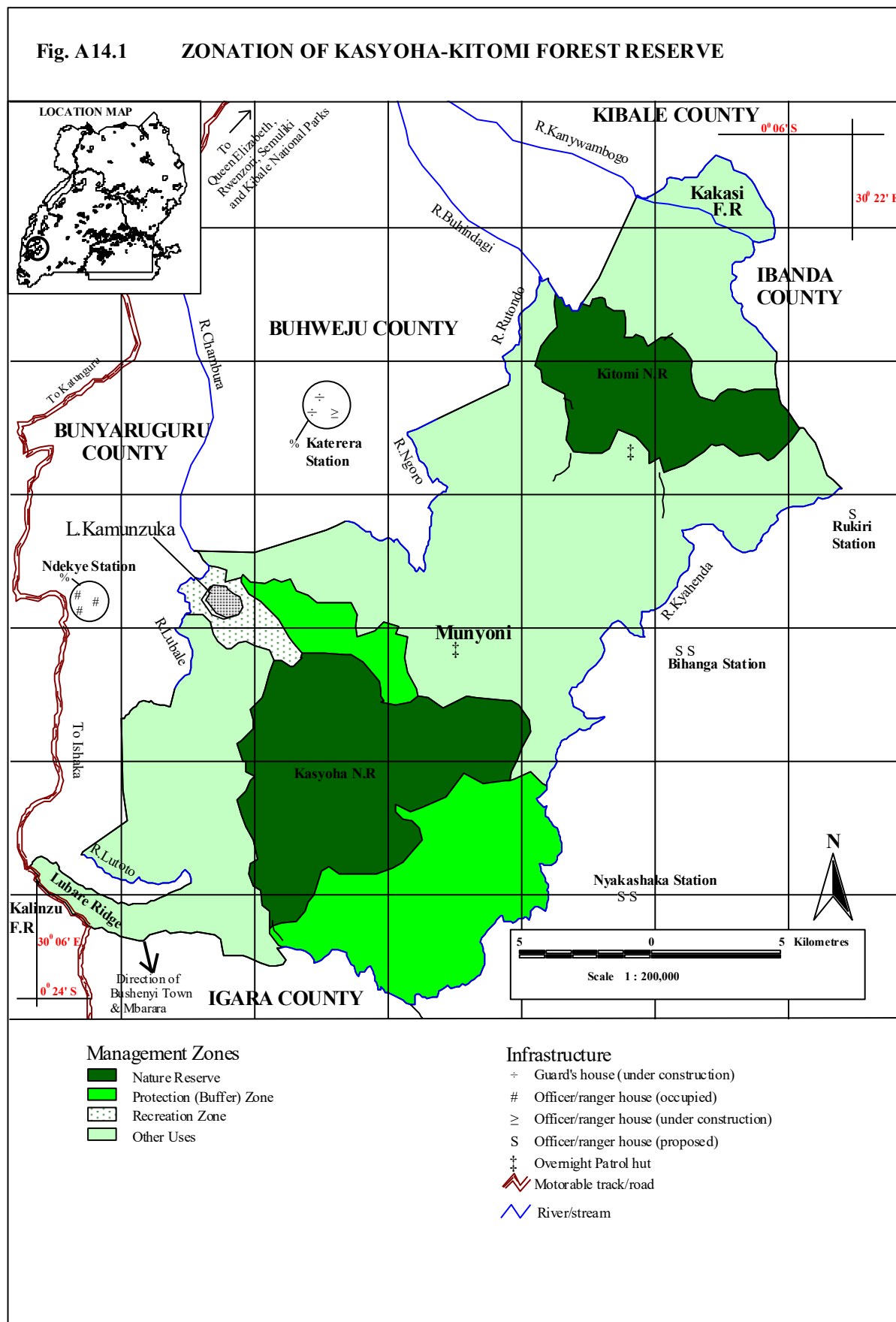
Table 14.4 Summary of biodiversity values for Kasyoha-Kitomi

Criterion	Trees & Shrubs	Birds	Mammals	Butterflies	Moths	Overall
<b>Total No. of species known</b>	376	276	25	237	73	
<b>No. of restricted range species (<math>\leq 5</math> forests)</b>	37	21	3	45	4	
<b>Species unique to forest (list)</b>	<i>Colutea abyssinica</i> <i>Eucephalartos hilderbrandtii</i> <i>Psychotria kirkii</i>	None	none	<i>Graphium ucalegon</i> <i>Megalopalpus metaleucus</i> <i>Anthene lysicles</i> <i>Abisara talantus</i> <i>Coenyropsis carcassoni</i> <i>Cymothoe indamora</i> <i>Euriphene tadema</i> <i>Acraea ntebia</i> <i>Gorgyra kalinzu</i> <i>Ceratrachia aurea</i> <i>Caenides lissa</i>	none	15 spp
<b>Uganda endemics (list)</b>	None	None	none	<i>Euphaedra christyi</i>	none	1 spp
<b>Albertine Rift endemics (list)</b>	<i>Musanga leoerrerae</i> <i>Rhytigynia beniensis</i>	White-collared Olive-back	<i>Lophuromys wossnami</i>	None	<i>Temnora scheveni</i>	5 spp
<b>Species diversity (score and rank)</b>	8.3(5=)	8.3(5=)	8.5(6)	7.5(12=)	8.0(6)	8.2(4)
<b>Species rarity value (score and rank)</b>	7.9(11=)	6.5(17)	6.6(10=)	6.4(7)	7.0(13=)	7.3(9)

Overall biodiversity importance score = 15.6

## **9 Principle reference material**

1. Howard, P.C. (1991). Nature Conservation in Uganda's Tropical Forest Reserves. IUCN, Gland, Switzerland.
2. Langdale-Brown, I., Osmaston, H.A. and Wilson, J.G. (1964). The Vegetation of Uganda and its Bearing on Land Use. Uganda Government Printer, Entebbe.
3. Lockwood Consultants (1973). Forest Resource Development Study for the Republic of Uganda. Lockwood Consultants, Toronto, Canada.
4. Uganda Forest Department (1968). Kasyoha-Kitomi Working Plan 1968-78. Forest Department, Kampala, Uganda.
5. Uganda Forest Department (1996). Biodiversity Report Series No. 11, Kasyoha-Kitomi Forest Reserve. Forest Department, Kampala, Uganda.

**Fig. A14.1 ZONATION OF KASYOHA-KITOMI FOREST RESERVE**



**APPENDIX 15: MT. KEI FOREST PROFILE**

(Category: CORE conservation forest)

**1 Basis for selection**

The forest was selected for Nature Reserve establishment in recognition of its considerable biodiversity importance, especially because:

- it supports 1 species of mammal known from no other Protected Area in Uganda (see Table 3.5 p 33).
- it supports 7 species of butterflies and 2 species of moths (ranging between 0.5%-1% of the country's PA total) known from no other protected area in Uganda.
- it represents 63% of the vegetation type L3 (*Butyrospermum-Hyparrhenia dissoluta* savanna) and vegetation type L1 (*Butyrospermum-Daniellia-Hyparrhenia* savanna).

**2 Physical description**

**Area and demarcation:** Area is 407 km<sup>2</sup>; total boundary length 109 km of which 70 km is adjacent to rural communities. Of the 109 km of the boundary 60 km follows rivers and 14.8 km is marked by a cutline and corner cairns. The North East corner is marked by the international boundary (approximately 33 km) between Uganda and Sudan.

**Establishment:** 1938

**Location:** The forest (formerly the White Rhino Sanctuary) is in Arua District within the West Nile Region between 3°34'-3°48'N and 31°00'-31°18'E. The reserve lies partly in Aringa and Koboko counties and is covered by Uganda Department of Lands and Surveys map sheets 4/3, 4/4 (series 732) at 1:50,000.

**Physical features:** The reserve has an altitudinal range of 915-1332m which consists of undulating ridges separated by valleys and swamps; with 99.2% not exceeding slope 5°.

Rivers and streams in the reserve all drain in North and North Easterly directions. Rivers Kechi, Kaya and Cupiri form natural boundaries of the reserve.

**3 Vegetation and forest condition**

The majority of the reserve (365 km<sup>2</sup>, 95%), is covered by vegetation classified as type L3 (*Butyrospermum - Hyparrhenia dissoluta* savanna); 15 km<sup>2</sup> (4%) as LI (*Butyrospermum-Daniellia-Hyparrhenia* savanna) and 4 km<sup>2</sup> (1%) covered by NI (*Combretum-Terminalia-Loudetia* savanna) (Langdale-Brown et. al., 1964).

The forest is generally intact (overall condition score 4). It is largely undisturbed with small scale human activities affecting no more than 10% of the area. There is some agricultural encroachment along the southern boundary, not exceeding 3 km inside.

**Forest integrity score:** Settlement = 1, Cultivation = 1, Hunting = 1, Livestock = 1, Timber = 1, Fire = 3, Community use/access = 1, Mining = 0 (see Appendix 4 for explanation).

**4 Economic importance**

**Community use values:** Although the forest is situated where there is a low population density (37 people per km<sup>2</sup> in 1991), there is some threat of agricultural encroachment. Seasonal hunting, the civil war in the Sudan and movement of refugees and traders between Uganda and Sudan are also pressures to this forest; but this does not cause intensive use of the reserve by the communities, giving "Community Use Value Score of 0.5" and thus indicating no immediate pressure to the reserve (see Appendix 3 for explanation).

**Timber production:** Timber production, concentrating on mainly *Khaya senegalensis* and *Khaya grandifolia* by illegal pitsawyers has been reported.

The timber inventory carried out in the early 1970s (Lockwood consultants) provides an estimate of only 5m<sup>3</sup> per ha standing volume of merchantable timber exceeding 50 cm dbh. However, there is a high potential for establishment of plantations for the tobacco industry in the district.

A trial plot of 6ha was established between 1961-64 with *Pinus caribea*, *Pinus patula* and *Eucalyptus camadulensis* and these are potential timber production species proven to grow well in the reserve.

**Other Economic Values:** The forest is of undoubted importance locally as a source of fuelwood, building poles, medicinal plants and honey. Being formerly a game sanctuary, if the game population is re-introduced, the reserve would be suitable for ecotourism.

## 5 Biodiversity values

Out of 65 forests investigated for biodiversity, Mt. Kei ranks 14th in overall importance with a score of 13.2. In species diversity it ranks 16<sup>th</sup>, but 10th in terms of “rarity” value of species represented (see Chapter, 3, Table 15.1).

The forest supports 15 unique species (see Table 15.3) three species of trees, four of birds, one species of mammal, seven butterflies and one moth species.

It represents a large block of dry northern mountains and hill savanna (365 km<sup>2</sup>) of *Butyrospermum-Hyparrhenia dissoluta* savanna type L3, (Langdale-Brown, et al., 1964) which is 63% of the protected area total.

## 6 Present management

The reserve is managed by the District Forest Officer, Arua and the Forest Ranger in charge of Aringa County with Forest Guard for Upper Aringa. There are two patrol men who operate from their homes at Midigo and Lobe respectively (Table 15.1).

**Table 15.1 Existing and proposed staff deployment at Mt. Kei**

Station	Existing and proposed No. of staff by category						Remarks
	FO	AFO	FR	FG	PM	Total	
Arua	1(1)	-	-	-	-	1(1)	Also DFO
Yumbe	-	0(1)	1(1)	-	-	1(2)	
Kei	-	-	-	1(1)	2*(3)	3(4)	
<b>Total</b>	<b>1(1)</b>	<b>0(1)</b>	<b>1(1)</b>	<b>1(1)</b>	<b>2(3)</b>	<b>5(7)</b>	

<p>Note</p> <p>FO = Forest Officer; FG = Forest Guard</p>	<p>* denotes EU project staff, not government employee.</p> <p>AFO = Assistant Forest Officer; Nos. in brackets indicate proposed staff.</p>	<p>FR = Forest Ranger; PM = Patrolman,</p>
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**Table 15.2 Existing and (proposed) staff housing**

Station	FD detached	FD semi detached	FD uniport	Private	Total
Yumbe	0(1)	0(0)	0(0)	0(0)	0(1)
Kei	0(0)	0(1)	0(0)	0(0)	0(1)
Ludara	0(0)	0(0)	0(0)	0(1)	0(1)
<b>Total</b>	<b>0(1)</b>	<b>0(1)</b>	<b>0(0)</b>	<b>0(1)</b>	<b>0(3)</b>

Note: Nos. in brackets indicate number of proposed houses.

The only transport facility is the pick-up for the District Forest Officer. The Forest Ranger and the Guards use their personal bicycles. The forest is accessible by motorable road from Midigo to Lobe which joins the one from Koboka via Keri.

The last working plan for the reserve covered the period 1955-64 which prescribed the objects of management of the reserve as to protect the woody vegetation in order to minimize surface run off and to provide in perpetuity a maximum possible supply of firewood and other forest produce required by the local population and the tobacco industry.

Moderate agricultural encroachment has been noticed along the southern boundary particularly near Midigo Trading Centre but this does not exceed 3 km inside the reserve boundary.

In 1996 with the support of the EC-financed Natural Forest Management and Conservation Project, a total of 14.8 km of the cutline was resurveyed, re-opened and cairns restacked. Protection patrols by the Guard and Patrolmen were also re-instituted.

The reserve is affected by annual bush fires during the dry season.

## 7 Proposed zonation

Figure A15.1 shows the preliminary zonation of the reserve with one Strict Nature Reserve (approximately 96 km<sup>2</sup>); the protection (buffer) zone of approximately 48 km<sup>2</sup> and production zone of approximately 263 km<sup>2</sup>.

The proposed Strict Nature Reserve has been selected in the north-eastern part of the reserve to :

- protect a viable population of all species represented within the forest particularly the species that may be threatened by human interventions;
- cover a significant part of the vegetation type L3 *Butyrospermum-Hyparrhenia dissoluta* savanna;
- encompass areas which are remote to the community surrounding the reserve.

The proposed protection (buffer) zone will cover areas adjacent to the Strict Nature Reserve which will enhance the long term viability of the Strict Nature Reserve.

The proposed production zone will cover the rest of the reserve including the trial plots which have a great potential for plantation development.

## 8 Proposed management programmes

**Staffing:** The present staffing is inadequate. Patrolmen should be organized to patrol along the Southern, Eastern and Western external boundaries which should form beats as shown in Figure A15.1. One Forest Officer, one Assistant Forest Officer, one Forest Ranger, one Forest Guard and three Patrolmen will be recruited (see Table 15.1).

**Infrastructure:** One house should be built near Kei Primary School which will act as a forest station instead of the old station inside the reserve. A house will be built at Yumbe, the county headquarters. Patrolmen will operate from their homes (Table 15.2).

The Forest Officer, Assistant Forest Officer and Forest Rangers should be supplied with motorcycles while the Guards require bicycles.

**Demarcation:** The outline of the external boundary, covering 14.8 km, should be clearly demarcated by cairns, beacons and reinforced with live markers. Sign plates enameled 'Forest Reserves' will be fixed where foot paths and roads enter the reserve.

Internal boundaries of the various zones will as much as possible follow natural features (streams and rivers) and sign posts or plates indicating the Strict Nature Reserve will be placed along the boundary. Ring painting of trees along the boundaries of the zones will be done in the standard way, especially on trees which are not seriously affected by fires.

Arising from pressure due to increase in population surrounding the reserve, trees along the external natural boundary (River Kechi and Cupiri) above 50 cm dbh should be marked by ring-painting to indicate the natural boundary clearly. Sign posts should be erected at the road and paths that cross the reserve boundary.

**Patrol and protection activities:** The three patrolmen and a Forest Guard will be responsible for supervision of Eastern, Southern and Western parts of the boundary i.e. Midigo, Kei and Ludara respectively.

During inspections, details including sketch maps showing the route covered should be written and patrol forms filled in. Incentives will be given to all the categories of staff working in the reserve for effective patrols.

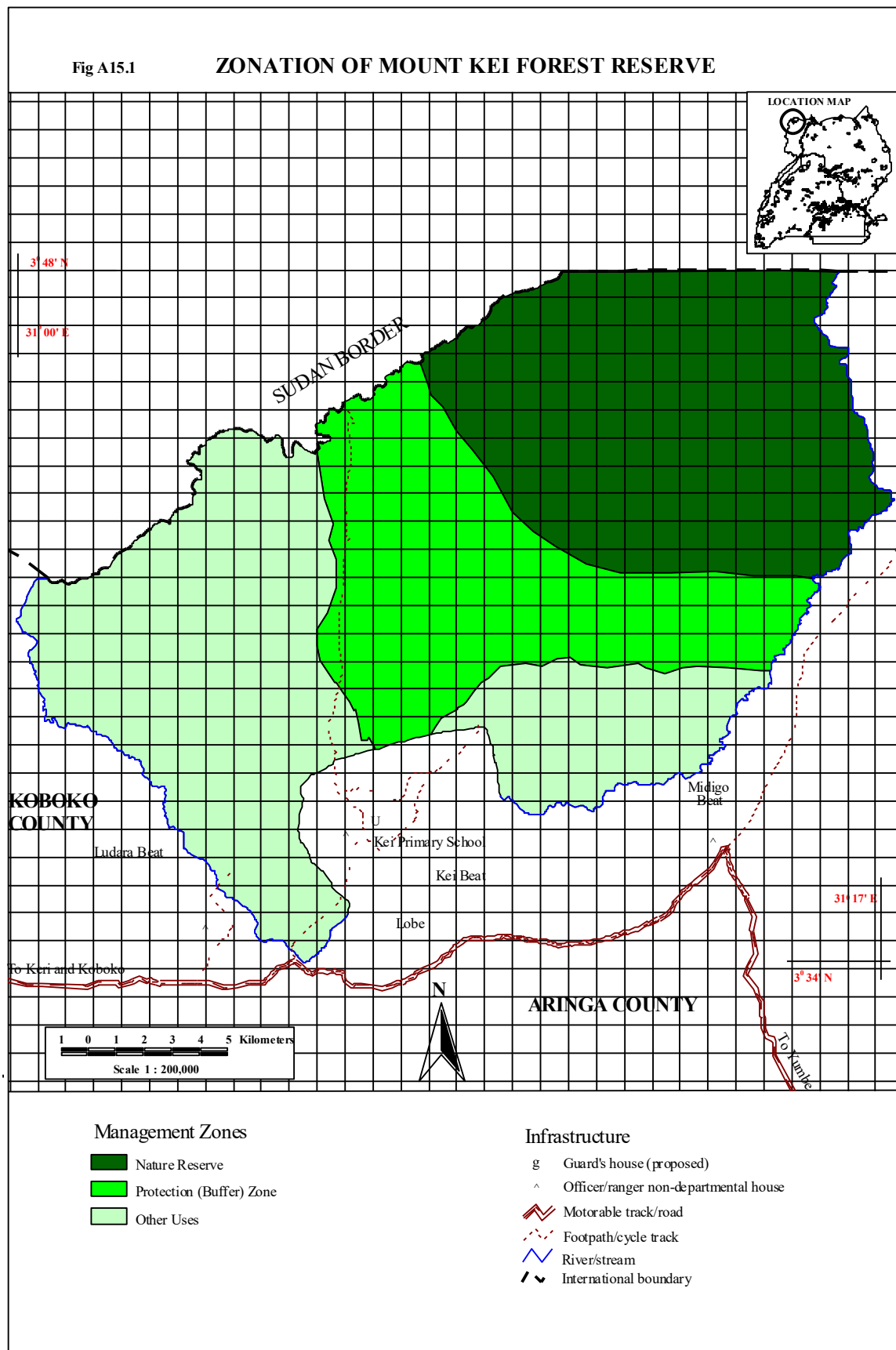
**Public access and community needs:** The Forest Rangers and the Guards will institute community out-reach programmes including education and awareness programmes for the community surrounding the reserve. The station if built near Kei Primary School should provide a good site for coordination. The Ranger will closely link with the local administration at Kei sub-county for success of such programmes, including promotion of tree-planting in schools and churches as part of forest extension work.

**Table 15.3 Summary biodiversity values for Mt. Kei**

Criterion	Trees & Shrubs	Birds	Mammals	Butterflies	Month	Overall
Total no. species known	229	175	22	126	54	
No of restricted range species $\leq 5$ forests	32	36	1	28	11	
Species unique to forest	<i>Aeschynomene schimperi</i> <i>Combretum racemosum</i> <i>Morinda titanophylla</i>	Levant sparrowhawk Dusky Babbler Palestine sunbird Heuglin's Masked Weaver	<i>Crocidura somalica</i>	<i>Tetrarhanis diversa</i> <i>Euchrysops albistriatus</i> <i>Lepidochrysops pterou</i> <i>Metisella formosa</i> <i>Astictopterus punctulatus</i> <i>Acacia biseriatus</i> <i>Paramodes Moranti</i>	<i>Theretra perkeo</i> <i>Rohaniella pygmaea</i>	17 spp
Uganda endemics	None	None	None	None	None	None
Albertine Rift endemic	None	None	None	None	None	None
Species diversity (score and rank)	6.2 (16=)	4.9 (27)	6.6 (17)	6.5 (25)	6.3 (15)	7.1 (10=)
Species rarity Value (score and rank)	7.9 (11=)	7 (8=)	4.7 (20=)	5.7 (10=)	7.1 (12=)	7.0 (10=)

## 9 Principal reference material

1. Langdale Brown, I., Osmaston, H.A. and Wilson, J.G. (1964). The vegetation of Uganda and its Bearing on Land Use. Uganda Government Printer, Entebbe.
2. Lockwood Consultants (1973). Forest Resource Development Study for the Republic of Uganda. Lockwood Consultants, Toronto, Canada.
3. Uganda Forest Department (1944). Working Plan for Mt. Kei Forest Reserve, 1945-54. Forest Department, Kampala, Uganda.
4. Uganda Forest Department (1954). Working plan for Mt. Kei Forest Reserve, 1955-64. Forest Department, Kampala, Uganda.
5. Uganda Forest Department (1996). Biodiversity Report Series No. 12; Mt. Kei Forest Reserve, Forest Department, Kampala, Uganda.



## APPENDIX 16: MABIRA FOREST PROFILE

(Category: CORE conservation forest)

### 1 Basis for selection

The forest was selected for Nature Reserve establishment in recognition of its biodiversity importance, especially because:

- the site contributes more than 1% of the national protected area system complement.
- the site supports at least one unique species of tree of conservation importance.
- the site supports vegetation type D1 (Langdale - Brown et al., 1964) otherwise not represented in protected area system of Uganda.

### 2 Physical description

**Area and demarcation:** Area: 306 km<sup>2</sup>; (311 km<sup>2</sup>, with Namananga/Namawanyi); with a total boundary length 347.4 km, all adjoining community lands. The boundary is largely artificial, maintained as a cut-line with corner cairns and directional trenches.

**Establishment:** First established, under the Buganda Agreement (1900) and later formally gazetted in 1932.

**Location:** On the Kampala-Jinja highway at about 54 km from Kampala and 26 km from Jinja, 20 km north of the Lake Victoria shoreline, in central Uganda, between 0°24'-0°35' N and 32°52'-33°07' E. The reserve occupies part of counties of Ntenjeru, Nakifuma, Buikwe, and Mukono, all in Mukono District. Covered by Uganda Department of Lands and Surveys map sheets 61/4, 62/3, 71/2 and 72/1 at 1:50,000.

**Physical features:** The reserve occupies gently undulating terrain with numerous flat-topped hills, with altitudes of 1070-1340 m a.s.l., with less than 10% exceeding 5° slope. The area is drained by two main rivers, the Musamya and Sezibwa, which flow northwards into Lake Kyoga.

### 3 Vegetation and forest condition

The majority of the area (292 km<sup>2</sup>; 95%) is occupied by Tropical High Forest communities, classified as type D1 (*Celtis-Chrysophyllum* medium altitude moist semi-deciduous forest) and the remainder (5%) by *Piptadeniastrum-Albizia-Celtis* medium altitude moist evergreen forest (Langdale - Brown et al., 1964). Human activities have greatly influenced the forest condition, making some areas characteristic sub-climaxes. Sub-types of vegetation present are young or colonising mixed forest, dominated by *Maesopsis eminii* (25%), young mixed *Celtis holoptelea* (60%), and mixed forest of wet valley bottoms dominated by *Baikaea insignis*.

A detailed forest type map is available at Forest Department headquarters, based on the 1950s aerial photography, and also reproduced in Howard (1991).

The forest is largely disturbed by human activity (overall condition score 2), mainly because it is located between the two largest urban centres in Uganda, and the area is largely accessible. There has been extensive pitsawing activity and agricultural encroachment (1973-1987). Hunting is widespread.

**Forest integrity scores:** Settlement = 2, Hunting = 2 Livestock = 1; Timber = 4 Fire = 0; Community = 3 Mining = 1.

### 4 Economic importance

**Community use values:** The forest is situated in one of the most densely populated parts of the country (235 people per km<sup>2</sup> in 1991). Pressure on the peripheral areas of the forest for firewood, building poles and non-timber forest products is correspondingly high. The forest is largely accessible because of the presence of village enclaves and roads leading to them. The 'community-use' value of the reserve is 20, and it is thus potentially very important economically to the communities around, and for the two nearest towns; Jinja and Kampala.

**Timber production:** The forest is an important source of pitsawn timber, providing a registered annual off take of about 4,284 m<sup>3</sup> of sawn timber over the period 1994-96 (Table 16.1), as well as large volumes of illegally cut timber. A timber inventory by Forest Department (in 1992) provided an estimate of 60 m<sup>3</sup> per ha. standing volumes of

merchantable timber exceeding 50 cm dbh. Records showing the number of registered pitsawyers do not exist. However, timber volumes over the period 1964-1996 are indicated in Table 16.1.

**Table 16.1 Timber production in Mabira: 1964-1996**

Period	Sawmill	Volume (m <sup>3</sup> )
1964-1974	Sick Sawmill & Ginners Ltd.	15,694
1973-1980	Kiira Sawmill & Plywood Factory	16,321
1981-1989	Kiira Sawmill & Plywood Factory	19,041
1990- 1993	Kiira Sawmill & Plywood Factory	-
1994-1996 (July)	Nile Plywood (U) Ltd	2,907
1994- 1996 (July)	Jinja Construction and Joinery Ltd.	1,377
<b>Total</b>		<b>55,340</b>

Nadagi compartment (479 ha) has been put aside for the establishment of eucalyptus plantations with temporary permits being issued to potential farmers, and there is potential for expansion of this programme.

**Other economic values:** The reserve has been locally important as a source of building poles, firewood and medicinal compounds. It has also been important for the production of charcoal. It is located between two of the major urban centres in Uganda, and has potential for ecotourism development based on such attractions as the luxurious flora and fauna, and the scenic rivers Musamya and Sezibwa (on which falls are located). The reserve is important for biodiversity (see below) and thus offers scope for the development of a research and education role.

## 5 Biodiversity values

Of the 65 forest reserves investigated for biodiversity, Mabira does not score among the highest in terms of overall biodiversity, ranking 24th (score =13.1), but ranks 19th in terms of the rarity value of species represented. The forest supports 9 species found in no other Ugandan forest (including 6 butterflies, 1 moth, 1 bird and 1 tree) and one species endemic to Uganda (Table 16.4). It presents the only block of medium altitude moist semi-deciduous forest type D1 (Langdale-Brown et al., 1964) in the protected area system, a vegetation type that does not occur in any of the country's National Parks or Wildlife Reserves.

## 6 Present management

The reserve is managed from Lwankima Forest Station, by a Forest Officer. The Mukono District forest office plays a supervisory role. Table 16.2 shows the staffing position for Mabira Forest Reserve. There are three Forest Officers, stationed at Lwankima, Maliata and Najjembe. The one at Najjembe works specifically on tourism development. In addition, a total of 3 Assistant Forest Officers, 8 Forest Rangers and 9 Forest Guards assist in the management of this important forest, and are based at various forest stations as indicated in Table 16.2.

The department has six staff houses at Lwankima Forest Station, the local headquarters of the reserve, and has endeavoured to offer ample housing at all the 12 forest stations on this reserve as indicated in Table 16.3.

**Table 16.2 Existing and proposed staff deployment at Mabira forest**

Station	Existing (proposed) number of staff by category					Total
	FO	AFO	F.R	F.G	PM	
Lwankima	1 (0)	1 (0)	1* (1)	1* (2)	4 (0)	8 (3)
Maligita	1 (0)	0 (0)	0 (1)	1 (0)	2 (0)	4 (1)
Namawanyi	0 (0)	0 (0)	0 (0)	1 (0)	1 (1)	2 (1)
Naluvule	0 (0)	0 (0)	0 (0)	0 (1)	1 (0)	1 (1)
Kyabana	0 (0)	0 (0)	1 (0)	1* (0)	1 (0)	3 (0)
Buwoola	0 (0)	0 (0)	1 (2)	1 (0)	1 (0)	3 (2)
Najjembe	1 (0)	0 (0)	1* (0)	1 (0)	0 (1)	3 (1)



Wanende	0 (0)	0 (0)	1* (0)	0 (1)	4 (0)	5 (1)
Nandagi	0 (0)	1 (0)	1* (0)	0 (1)	0 (1)	2 (2)
Nagojje	0 (0)	1 (0)	1* (0)	1 (0)	2 (0)	5 (0)
Namulaba	0 (0)	0 (0)	1 (0)	1 (0)	1 (1)	3 (1)
Nazigo	0 (0)	0 (0)	0 (0)	1 (0)	0 (2)	1 (2)
<b>Total</b>	<b>3 (0)</b>	<b>3 (0)</b>	<b>3 + 5* (4)</b>	<b>7 + 2* (5)</b>	<b>17 (6)</b>	<b>40(15)</b>

Note:	FO - Forest Officer	FG - Forest Guard	AFO - Assistant Forest Officer	PM - Patrol Man	
	FR - Forest Ranger,	* denotes temporary employment on EU Project, not Government employee.			

Table 16.3 shows the status of housing in Mabira Forest Reserve and the proposed requirements in order to offer accommodation to all staff.

**Table 16.3 Existing (proposed) staff housing**

Station	FD old houses.	FD detached	FD semi	Uniport	Total
Lwankima	6(0)	0(0)	0(1)	2(0)	8(1)
Najjembe	1(0)	1(0)	1(1)	0(0)	3(1)
Wanende	0(0)	1(0)	2(0)	0(0)	3(0)
Buwoola	0(0)	0(0)	1(0)	0(0)	1(0)
Kyabaana	0(0)	1(0)	1(0)	0(0)	2(0)
Maligita	1(0)	1(0)	1(1)	4(0)	7(1)
Naluvule	0(0)	0(0)	1(0)	0(0)	1(0)
Namawanyi	0(0)	0(0)	1(0)	0(0)	1(0)
Nandagi	0(0)	0(0)	1(1)	2(0)	3(1)
Nazigo	1(0)	0(0)	0(0)	0(0)	1(0)
Namulaba	0(0)	1(1)	2(0)	0(0)	3(1)
Nagojje	5(0)	0(0)	0(0)	0(0)	5(0)
	<b>14(0)</b>	<b>5(1)</b>	<b>11(4)</b>	<b>8(0)</b>	<b>38(5)</b>

There are no bicycles or motorcycles to facilitate the management of the forest, inspite of the availability of a road network in the forest reserve. The latest (Interim) Management Plan covered the period (1994-1995) and prescribed for the conservation of the forest biodiversity, the protection of the area's important water catchment role and the maximum yield of hardwood timber. Although a Nature Reserve was proposed, actual demarcation did not take place and discussions were still going on for further changes to the zones. A detailed management plan to cover the period 1997-2007 is now under preparation.

In recent years (since 1990), with the support of the EU-financed Natural Forest Management and Conservation Project, some parts of the boundary have been redemarcated and few sections planted with live markers (see Fig. A16.1). An ecotourism project has also been established and further tourism development is expected.

## 7 Proposed zonation

Figure A16.1 shows the proposed zonation of the reserve, with one Nature Reserve (approximately 73 km<sup>2</sup>) one protection zone (approximately 30 km<sup>2</sup>), recreation zone (approximately 40 km<sup>2</sup>) and the rest of the reserve (Approximately 170 km<sup>2</sup>) as production zones.

### The proposed Nature Reserve

It will cover the central portion of the forest reserve which is relatively intact. This has been selected to protect a viable area of semi-deciduous forest type D1 (Langdale Brown et. al., 1964), which is important because this is the only protected area in the country in which this forest type is represented.

### The proposed protection zone

This will cover the area adjacent to the Nature Reserve with the aim of enhancing the long term viability of the latter. The proposed recreation zone is expected to centre around Najjembe (to the South) and around Musamya river (to the north, near the boundary). The zone encompasses the river and marshes called Musamya, which are a valuable habitat for a number of species of plants and animals, and are some of the most scenic areas of the forest.

### The proposed production zones

These cover the majority of the reserve, including the areas that have already been heavily exploited by pitsawyers, the more accessible peripheral areas of the reserve; and most of the south-central parts of the reserve which adjoin a number of enclaves and are more suitable for timber production.

## 8 Proposed management programme

**Staffing:** The present staff is inadequate, and redeployment may also be necessary. Most areas lack forest workers; only patrolmen and Forest Guards occur, resulting in inadequate control, and not much labour work on the ground such as planting and boundary maintenance. The Forest Officer at Maligita does not have a Ranger to assist him in his duties. Furthermore, the Forest Guards at the various stations do not have properly motivated and facilitated patrolmen under them. Each guard would need at least four workers and two patrolmen to assist him/her.

Transport will be required as follows: 1-4 wheel drive vehicle for the FO and 3 motorcycles; 1 for Maligita to facilitate operation on the Eastern axis and another for Nagojje for the western part of the reserve, and finally, one for Lwankima forest station. Each Forest Ranger and FG should be facilitated with bicycles. The FO tourism needs to be facilitated with a 4-wheel drive vehicle to enable community outreach programmes, and the running of the visitor's centre. The Forest Officers in charge should be facilitated with transport to carry out effective patrols of the reserve as well as with a radio communication system.

**Infrastructure:** Four houses will be required for staff, at Lwankima (1 duplex), Najjembe (1 duplex), Namulaba (1 replacement), Maligita (1 duplex) and Nandagi (1 duplex). Details are indicated in Table 16.3.

**Demarcation:** Over 250 km of reopened external boundary lacks maintenance. Only a few short scattered sections have any remaining live markers. It is urgent that all these boundaries are attended to in this densely populated area. All internal management zone boundaries should be demarcated by ring-painting trees in the standard way. Red paint will be used to indicate Nature Reserve; yellow for 'buffer' zones. Sign boards will be erected wherever prominent footpaths cross (external and internal) boundaries.

**Patrol and protection:** Twelve patrol teams each comprising one Forest Guard and two patrolmen will be constituted with responsibility for safeguarding ranges as per the twelve forest stations. Men will be rotated between patrol teams and teams will be moved periodically between ranges. Patrol routes and checkpoints will be established throughout the reserve. An incentive scheme will be instituted to reward success in curbing illegal activities.

**Public access and community needs:** One Forest Officer and two Forest Rangers (based at Najjembe and Maligita) will assume responsibility for community outreach programmes including the development of tourism activities, Joint Forest Management programmes within the reserve and community tree-planting programmes outside the boundary. A programme of village meetings should be instituted and developed to explain and discuss management of the reserve, and in particular the management zones as they are established. The staff will be facilitated as indicated under infrastructure.

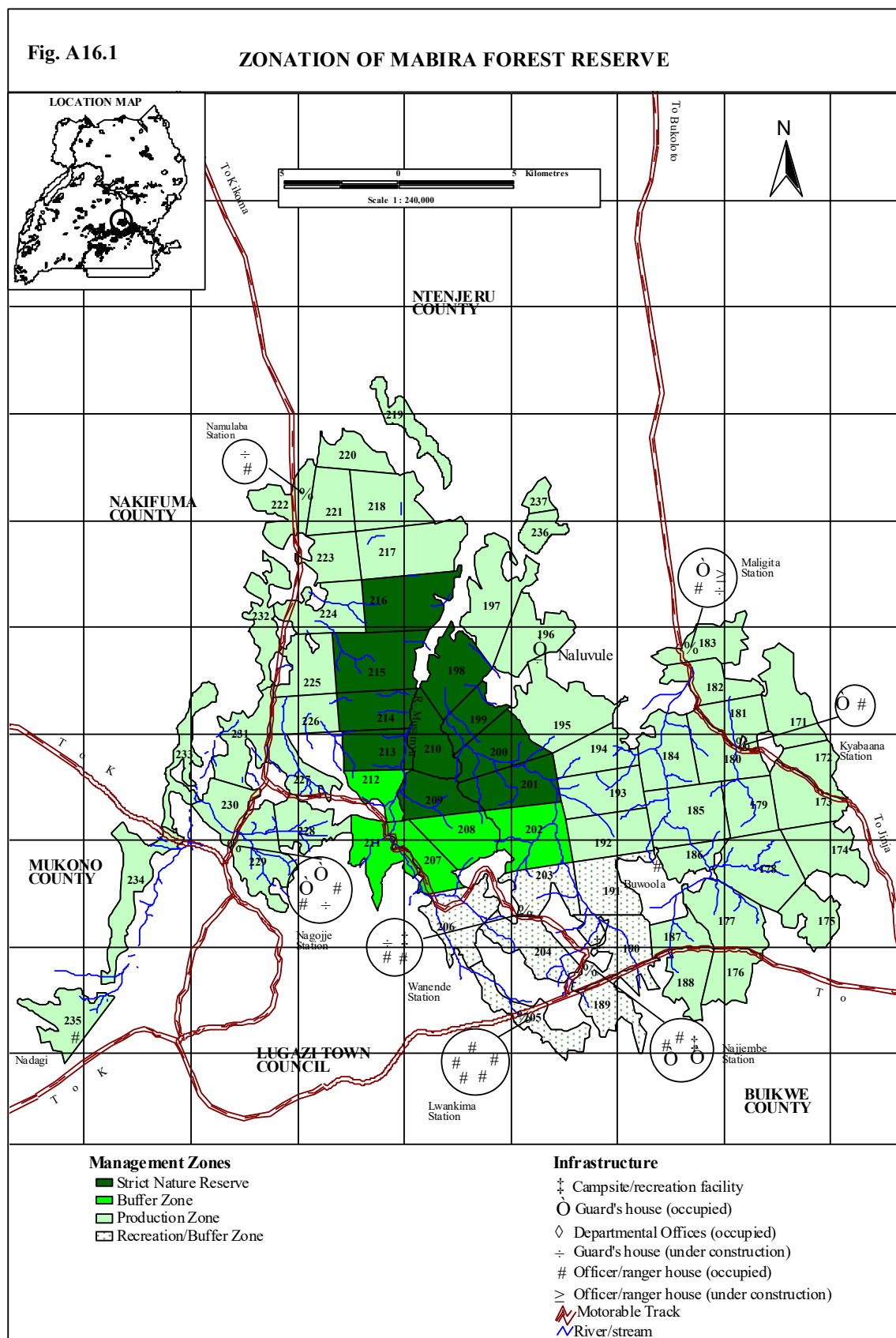
**Table 16.4: Summary Table of biodiversity values for Mabira Forest Reserve**

Criteria	Trees & Shrubs	Birds	Mammals	Butterflies	Moths	Overall
Total No of species known	312	287	23	199	97	
No. of restricted range species (< 5 forests)	9	37	-	27	7	

<b>Species unique for forest (list)</b>	<i>Caesalpinia volkensii</i>	Tit Hylia	None	<i>Epitola catuna</i> <i>Pseudathyma plutonica</i> <i>Neptis trigonophora</i> <i>Sallya natalensis</i> <i>Acraea rogersi</i> <i>Caenides dacena</i>	<i>Orthogonioptilum</i> sp. C.	9 spp
<b>Uganda endemics (list)</b>	None	none	<i>Crocidura selina</i>			4 spp
<b>Albertine Rift endemics (list)</b>	<i>Grewia pubescens</i>	none	None	none	None	1 spp
<b>Species diversity (score and rank)</b>	6.5 (26=)	6.5 (24=)	5.4 (4.0)	6.9 (25=)	5.8 (30=)	6.4(22=)
<b>Species rarity value (Score &amp; rank)</b>	7.2 (29=)	6.6 (14=)	5.4 (22=)	5.6 (15=)	6.8 (+5=)	6.7(19=)
Overall biodiversity score 13						

## **9 Principal reference material**

1. Howard, P.C. (1991). Nature Conservation in Uganda's Tropical Forest Reserves. IUCN Gland, Switzerland.
2. Langdale Brown, I., Osmaston, H.A. and Wilson, J.G. (1964). The Vegetation of Uganda and its bearing on landuse. Uganda Government printer, Entebbe.
3. Uganda Forest Department (1992). Budongo and Mabira Forest Inventory. Forest Department, Kampala, Uganda.
4. Uganda Forest Department (1996). Biodiversity report series No. 13, Mabira Forest Reserve. Forest Department, Kampala, Uganda.
5. Uganda Forest Department (1997). Mabira Forest Reserve Management Plan (1997-2007). Forest Department, Kampala; Uganda.



**APPENDIX 17: AGORO-AGU FOREST PROFILE**

(Category: SECONDARY conservation forest)

**1 Basis for selection**

The forest was selected for Nature Reserve establishment in recognition of its biodiversity importance, especially because:

- it supports 7 species of unique trees and shrubs representing 0.5-1% of species known from the Protected Area system;
- it has one species of tree found nowhere else in Uganda's Protected Area system and which is endemic to the Albertine Rift.

**2 Physical description**

**Area and demarcation:** 265 km<sup>2</sup>; total boundary 182 km, of which approximately 135 km adjoins rural community lands. Of the 135 km, 110 km is artificial boundary maintained as a cutline and the rest is a natural boundary. The northern boundary is marked by the international border between Uganda and Sudan.

**Establishment:** 1937 (1946 Legal Notice 229)

**Location:** Agoro-Agu is situated entirely within Lamwo County in the extreme north of Kitgum District, approximately 60 km from Kitgum town between 03°40'-03°53' N and 32°42'-33°04' E (Fig. A17.1). It is covered by Uganda Department of Lands and Surveys map sheets 7/1,2,4 and 8/1 (series Y732) at 1:50,000.

**Physical features:** The reserve, with an altitudinal range between 1100-2840 m is a series of hills which are a continuation of the Imatong Mountains of the Sudan with 38% (100 km<sup>2</sup>) having slopes of 16-25% and the rest with slope of less than 5%. The highest peak, Modole is 2,840 m above sea level.

**3 Vegetation and forest condition**

About 100 km<sup>2</sup> (38%) of the reserve is occupied by vegetation type F1 (Forest/savanna mosaic at high altitudes) and about 71 km<sup>2</sup> (29%) is occupied by vegetation type N8 (*Combretum-Acacia-Themeda*) savanna. Another vegetation type, B3 (*Juniperus-Podocarpus*, dry montane forest) occupies 48 km<sup>2</sup> (20%), X1 (*Cyperus-papyrus* Swamp) 10 km<sup>2</sup> (4%); P1 (*Acacia-Cymbopogon-Themeda* Complex) 6 km<sup>2</sup> (2%); and L3 (*Butyrospermum-Hyparrhenia dissoluta* savanna 5 km<sup>2</sup> (2%).

This forest is extensively encroached (overall condition score 4) at the lower and medium altitudes in the southern and eastern sections and this is further compounded by the existence of an enclave of approximately 18 km<sup>2</sup> within the reserve.

The forest is used by the local community for building poles (especially bamboo), honey, bush meat and medicinal plants.

**Forest integrity score:** Settlement = 2, Cultivation = 2, Hunting = 1, Livestock = 1, Timber = 0, Fire = 3, Community use access = 1 and Mining = 0 (see Appendix 4 for explanation).

**4 Economic importance**

**Community use value:** Although the reserve is situated in a sparsely populated area (20 people/km<sup>2</sup> in 1991), there is high pressure on the peripheral areas of the reserve in the southern and eastern parts for cultivation, building poles, hunting and medicinal plants. Large parts with difficult terrain at high altitudes are remote to the community, especially towards Sudan border, and utilisation of resources there is very low giving "Community Use Value Score of" 0.8 (see Appendix 3 for explanation).

**Timber production:** A timber inventory in early 1970s (Lockwood consultants) provided an estimate of 5 m<sup>3</sup> per ha stand volume of merchantable timber exceeding 50 cm dbh. Due to poor accessibility and only a medium potential for plantation establishment, the reserve is not very significant for timber production.

**Other economic values:** With an improved security situation, the terrain of the reserve provides potential attraction for tourists and is important for water catchment, but has no facilities and access routes.

## 5 Biodiversity importance

Of the 65 forests investigated for biodiversity, Agoro-Agu ranks 19th in overall importance with a score of 12.8. It ranks 14th with a score of 6.5 for species diversity and 16th (score 6.3) for species “rarity” value (see Chapter 3, Table 3.5). The reserve is custodial to seven unique species and has one tree species listed as an Albertine Rift endemic. Twenty species (11 of trees, four of birds, one of small mammal and four of butterflies) have a restricted range in the forests of Uganda (Table 17.3).

The reserve represents 15% (100 km<sup>2</sup>) of the vegetation type classified as F1 in Uganda (forest/savanna mosaic at high altitudes) (Langdale-Brown et al., 1964), which is only represented in Mt. Elgon and Kadam in any significant percentage.

## 6 Present management

The reserve is managed from the District Forest Offices at Kitgum. The Forest Ranger for Lamwo county stationed at Padibe, 46 km from Lututuru, is responsible for activities in the reserve with a Forest Guard who is based at Lututuru (Table 17.1).

The only means of transport available is the pick-up for the DFO and motorcycle for his assistant. The Forest Ranger and the Forest Guard have no means of transport. The reserve is accessible by the roads to Lututuru and Agoro trading centres with continuations into the reserve by paths and hunting tracks.

The mud houses which were built in the 1960s have collapsed and are not of any use now. The Forest Ranger resides in a rented house at Padibe and the Guard resides in his personal home.

The only available Work Plan ever written is for the period 1/01/1963 - 31 /12/1972 for Acholi Plantation Reserves.

With support of the EC-financed Natural Forest Management and Conservation Project, the boundary has been redemarcated.

## 7 Proposed zonation

Figure A17.1 shows the preliminary zonation of the reserve with two Strict Nature Reserves (approximately 47 km<sup>2</sup>); Buffer Zones (approximately 89 km<sup>2</sup>) and a production zone (approximately 99 km<sup>2</sup>).

The proposed Strict Nature Reserve in the southern part of the reserve (Lotuturu Nature Reserve) has been selected to:

- cover an area of undisturbed natural vegetation representing ecological climax communities;
- cover areas of the reserve that are known to support species of interest unique to the forest and because of the known altitudinal preferences of the species;
- cover an area of the reserve which is least accessible due to the terrain.

The proposed northern Strict Nature Reserve at the north-eastern corner of the reserve (Lipulingi) has been selected to:

- cover the undisturbed vegetation type F1 (Forest/savanna mosaic at high altitude) representing the climax community therein.
- be as biologically diverse as possible, encompassing as many forest/vegetation types and habitats as possible.
- cover areas least accessible and provide a high degree of inherent “protection”.

The proposed Buffer Zones (environmental protection zones) (89 km<sup>2</sup>) will encompass areas adjacent to the Nature Reserves that are designated for low impact use (exceeding 15% slope) where protection of vegetation cover is important to prevent erosion and maintain water catchment values.

The proposed production zones (99 km<sup>2</sup>) will cover the rest of the reserve where a wide range of wood and non-wood products can easily be removed. This will include areas which are close to the encroached areas around the enclaves;

areas accessible by the community and the peripheral areas close to the villages which can satisfy the community needs for firewood and building poles.

## 8 Proposed management programmes

**Staffing:** The present staffing is inadequate. The boundary will be organised in two beats eastern and western with three groups of workers and patrolmen (see Table 17.1). There is need to recruit one Forest Officer, one Forest Ranger, 2 Forest Guards and one Patrolman.

The Forest Ranger should be facilitated with a motorcycle and the Guard with a bicycle to ensure frequent supervision.

**Table 17.1 Existing and proposed staff deployment at Agoro Agu**

Station	Existing and proposed No. of staff by category						Remarks
	FO	AFO	FR	FG*	PM*	Total	
Kitgum	1(1)	0(0)	0(0)	0(0)	0(0)	1(1)	Also DFO Kitgum
Padibe	0(0)	0(0)	1(1)	0(0)	0(0)	1(1)	Ranger i/c county
Lotuturu	0(0)	0(0)	0(0)	1(1)	1(0)	1(2)	
Agoro	0(0)	0(0)	0(0)	0(0)	0(1)	0(1)	
Lobule	0(0)	0(0)	0(0)	0(1)	-	0(1)	
<b>Total</b>	<b>1(1)</b>	<b>0(0)</b>	<b>1(1)</b>	<b>1(2)</b>	<b>0(2)</b>	<b>3(6)</b>	

Note: \* denotes staff not employed by government but under EU project.  
 FO = Forest Officer; AFO = Assistant Forest Officer; FR = Forest Ranger;  
 FG = Forest Guard PM = Patrolman, Nos. in brackets indicates proposed staffing

**Infrastructure:** One house should be constructed at Padibe from where the Forest Ranger can supervise both Agoro-Agu and Lokung Forest Reserves, while three Guards houses should be built at Lotuturu, Agoro and Lobule respectively.



**Table 17.2 Existing and proposed staff housing\***

Station	FD detached	FD semi Detached	FD uniport/hot	Private	Total	Remarks
Padibe	0(1)	-	-	-	0(1)	
Lotuturu	0(1)	-	-	-	0(1)	
Agoro	0(1)	-	-	-	0(1)	
Lobule	0(0)	-	0(1)	-	0(1)	
<b>Total</b>	<b>0(3)</b>	<b>-</b>	<b>0(1)</b>	<b>-</b>	<b>0(4)</b>	

Note: Nos. in brackets indicates proposed no. of housing units

**Demarcation:** 135 km of the external boundary should be clearly demarcated with cutlines and beacons, supported by live markers. Signposts should be erected where there are prominent foot paths through the reserve. The internal boundaries of the different management zones will as much as possible follow natural features. The Nature Reserve will be reinforced with sign plates reading “Nature Reserve”, and ring-painting of trees and hill outcrops that follow the boundary with appropriate colours.

**Patrol and protection activities:** Two patrol teams based at Lotuturu for western and Agoro for eastern beats should be organised. These should be able to educate and convince the encroachers to leave the reserve. Another team will be based at Lobule.

**Public access and community needs:** The Forest Ranger will initiate a community out reach programme including development of Collaborative Forest Management Programmes with the community within the reserve and those neighbouring the reserve. Local Councils will be involved in regulation of production activities in the production zone, while efforts will be made to promote tree planting in the areas bordering the reserve and the enclaves. Publicity and conservation awareness will be part of these programmes.

**Table 17.3 Summary biodiversity values for Agoro-Agu**

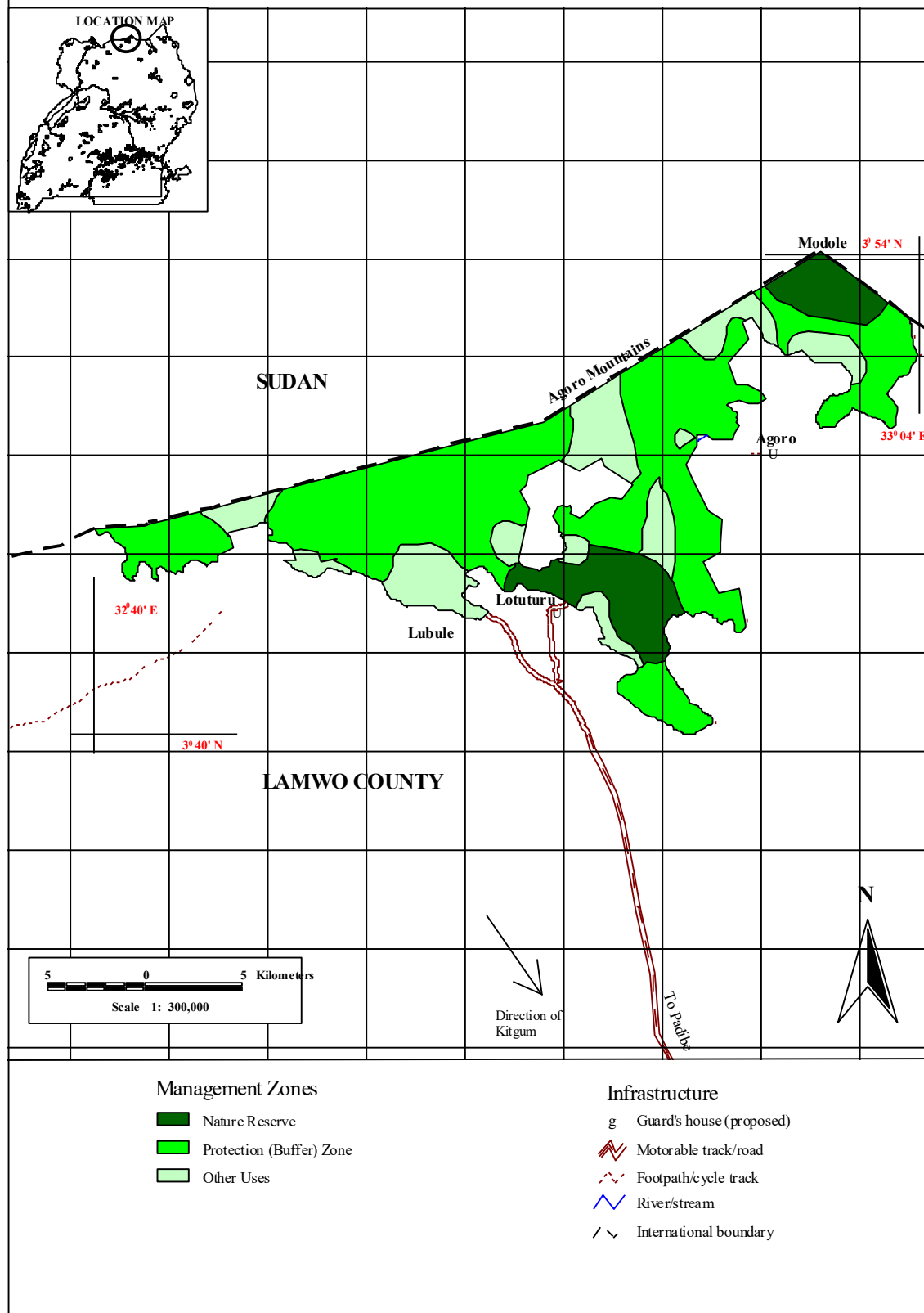
Criterion	Trees & Shrubs	Birds	Small Mammals	Butterflies	Moth	Overall
<b>No. of species known from forest</b>	254	76	11	16	-	-
<b>No. of restricted range species <math>\leq 5</math> forests</b>	11	4	1	4	-	-
<b>Species Unique to forest list</b>	<i>Crossonephelum africanus</i> <i>Halleria lucida</i> <i>Hypericum lanceolatum</i> <i>Lepisanthes senegalensis</i> <i>Ocotea kenyensis</i> <i>Rauvolfia coffra</i> <i>Terminalia laxiflora</i>	None	None	none	None	7 spp
<b>Uganda Endemics (list)</b>	None	None	None	none	None	-
<b>Albertine Rift Endemics (list)</b>	<i>Rytigynia beniensis</i>	None	None	none	None	1 spp
<b>Species Diversity (score and rank)</b>	6.5(19=)	55.9(21)	6.9(15=)	6.7(28=)	-	6.5(14=)
<b>Species rarity value (score &amp; rank)</b>	7.4(17=)	6(14=)	5.4(16=)	4.4(20=)	-	6.3(16=)

Overall biodiversity score = 12.8

## 9 Principle reference material

1. Langdale-Brown, I., Osmaston, H.A. and Wilson, J.G (1964). The Vegetation of Uganda and its Bearing on Land Use. Uganda Government Printer, Entebbe.
2. Lockwood Consultants (1973). Forest Resource Developmnt Study for the Republic of Uganda. Lockwood Consultants, Toronto, Canada.
3. Uganda Forest Department (1995). Project Report of EC funded Natural Forest Management and Conservation Project, 1988-95. Forest Department, Kampala, Uganda.
4. Uganda Forest Department (1996). Biodiversity Report Series No. 14; Agoro-Agu and Lokung Forest Reserves. Forest Departmen; Kampala, Uganda.

**Fig. A17.1 ZONATION OF AGORO-AGU FOREST RESERVE**



**APPENDIX 18: MT. NAPAK FOREST PROFILE**

(Category: SECONDARY Conservation forest)

**1 Basis for selection**

The forest was selected for Nature Reserve establishment in recognition of its biodiversity importance, especially because:

- it supports 2 species of trees, 2 species of butterflies and 1 species of moth not found elsewhere in Uganda's Protected Area system that are of conservation concern on account of being broadly endemic.
- it represents two vegetation types, N6 (*Combretum-Acacia-Lasiurus* savanna) and Q2 (*Hyperrhenia* grass savanna derived from *Butyrospermum* savanna) not otherwise represented in Uganda's Protected Area system.
- it supports 22 species that occur in not more than five other Ugandan forests (see Table 18.3).

**2 Physical description**

**Area and demarcation:** 203 km<sup>2</sup>; total boundary length 59 km, all artificial and adjoining community lands. It has not been maintained for a long time but some old concrete cairns and directional trenches still exist.

**Establishment:** 1948; regazetted in 1963.

**Location:** In Bokora county in the administrative district of Moroto, 2°00'–2°09' N, and 34°15'–34°25' E. It lies adjacent to the trading centre of Iriiri, approximately 60 km south west of Moroto town and 80 km north east of Soroti town. It borders Pian Upe Wildlife Reserve and is covered by Uganda Department of Lands and Surveys map sheets 35/3 and 35/4 (series Y732) town at 1:50,000.

**Physical features:** Half of the reserve occupies steep terrain and is at altitudes of 1,200–2,537 m above sea level with 103 km<sup>2</sup> (50%) exceeding a 15% slope. The rest of the area is a gently undulating plain. The reserve occupies Mount Napak.

**3 Vegetation and forest condition**

The majority of the area (140 km<sup>2</sup>; 69%) is occupied by *Juniperus-Podocarpus* dry montane forest classified as type B3 (Langdale Brown et. al. 1964). The remainder comprises N6 (*Combretum-Acacia-Lasiurus* savanna, 25 km<sup>2</sup>; 12%), N12 (*Acacia-Heeria-Terminalia* savanna, 25 km<sup>2</sup>; 12%), Q2 (*Hyparrhenia* Grass Savanna derived from *Butyrospermum* savanna, 8 km<sup>2</sup>; 4%) and W8 (*Acacia setaria* savanna, 5 km<sup>2</sup>; 2%). A detailed forest type map is available at Forest Department headquarters, based on 1950s aerial photography. A great part of the vegetation is affected by bush burning, grazing and agricultural encroachment, especially in the northern, southern and western parts of the reserve.

The forest is partially degraded (overall condition score 3), mainly due to human settlement, agricultural encroachment, grazing, fires and collection of “Mairungi” (*Catha edulis*). There is no timber harvesting but there are signs of past harvesting near Muchokho. Agricultural encroachment is widespread at the lower sides of the northern, southern and western parts of the reserve, while hunting and mining are low.

**Forest integrity scores:** Settlement = 3; cultivation = 5; hunting pressure = 1; livestock = 1; timber = 0; fire = 3; community use = 1; mining = 1 (see Appendix 4 for explanation).

**4 Economic importance**

**Community use values:** The reserve is situated in a very low population density area (12 people per km<sup>2</sup> in 1991) implying pressure on the peripheral areas of the forest for firewood, building poles and non-timber forest produce is correspondingly low, giving a ‘community use’ value of only 0.2 (see Appendix 3 for explanation). However, this is likely to increase as these lower areas are the most fertile, which is likely to induce increased settlement in the reserve for farming.

**Timber production:** With only 8% of the reserve as a forested area, Mt. Napak Forest Reserve is of low importance as a source of timber (score 0.6), with an estimated 5 m<sup>3</sup> per ha standing volume (Lockwood Consultants, 1973) of merchantable timber, and it not readily accessible. The reserve has a low forest plantation potential.

**Other economic values:** The reserve serves a watershed role protecting water of downward streams; serving the population at Iriiri and also protecting permanent streams of River Muchokho and River Kadike. Mt. Napak forest reserve is located close to the main eastern tourist circuit and has potential for tourism development based on attractions such as landscape scenery, cultural diversity and accessibility.

## 5 Biodiversity values

Of the 65 forest reserves investigated for biodiversity, Mt. Napak ranks twenty-first in overall importance, with a score of 13.2 (Chapter 3, Table 3.1). It is the nineteenth in terms of both species diversity and rarity value of species represented. The forest supports 5 species (tree/shrubs = 2; butterflies = 2; and moths = 1) found in no other Ugandan forest (see Table 18.3). It is the only reserve with N6 (*Combretum - Acacia - Lasiurus* savanna) and Q2 (*Hyparrhenia* Grass savanna derived from *Butyrospermum* savanna) vegetation types (Langdale-Brown et al., 1964) in the Protected Area system; they are not represented in any of the country's National Parks or Wildlife Reserves.

## 6 Present management

The reserve is managed from Moroto District Forest Office in Moroto Municipality, located at the periphery of Mt. Moroto Forest Reserve. There is no local forest station at the reserve. There is one Forest Officer and one Assistant Forest Officer (both in charge of all reserves in the district) stationed at Moroto Municipality, one Forest Guard and three nurserymen (under the Natural Forest Management and Conservation Project) stationed at Iriiri Trading Centre. There is no Forest Ranger. The Forest Guard is accommodated in his own house, while the District Forest Officer (DFO) and the Assistant Forest Officer are accommodated at Moroto Municipality (see Appendix 6). Management is facilitated by the DFO's pick-up. A few roads/motorable tracks are found in and around the reserve (Fig. A18.1). The most recent working plan covers the period of 1955-59 but it was later amended and extended to cover the period of 1/1/64 to 31/12/68. It prescribed for protection of soil erosion, to thicken tree cover on the hills and maintain the tree cover on the plains in order to induce more frequent orographic rains; and to control the development of permanent settlement on the plains. The reserve was managed under one working circle called the 'Protection Working Circle' and no division into compartments. Sinking of concrete corner beacons is underway.

## 7 Proposed zonation

The whole of Mount Napak Forest Reserve will be treated as a single reserve. Zonation of the reserve is complicated by the nomadic nature of most of the population living within and around the forest, many of them armed with guns. However, settlement in the reserve is less than in Mts. Moroto and Kadam Reserves. Since these communities regard the reserve as more fertile than the surrounding areas, it is looked at as the best place locally for farming. It is therefore improper putting up any restrictions through zoning before education and sensitization on conservation is done.

However, Fig. A18.1 shows the 'preliminary' zonation of the reserve, with one Strict Nature Reserve (approximately 42 km<sup>2</sup>), one protection Buffer Zone (approximately 64 km<sup>2</sup>) and a production zone (approximately 97 km<sup>2</sup>).

The proposed Strict Nature Reserve has been selected to:

- encompass the widest possible range of altitude, from above 2500 m to below 1500 m.
- protect some of the remaining block of relatively intact highland forest.
- protect a viable area of *Combretum-Acacia-Lasiurus* savanna and *Hyparrhenia* grass savanna derived from *Butyrospermum* savanna, vegetation types not found elsewhere in the country's Protected Area system.

The proposed protection (buffer) zone covers most of the remaining steep land (between the Strict Nature Reserve and the production zone) that is generally unsuitable for production purposes (on account of soil erosion hazards), but which can serve to enhance the long-term viability of the Strict Nature Reserve.

The proposed production zone covers the remaining (mainly gentle) land surrounding both the Strict Nature Reserve and protection (buffer) zones. It includes areas that are much affected with overgrazing and cultivation.

## 8 Proposed management

**Staffing:** Is inadequate; some deployment will be necessary, to create 2 effective patrol team. One Assistant Forest Officer, a Forest Ranger and 2 Forest Guards are required. The three reserves: Mt. Moroto, Mt. Kadam and Mt. Napak will be under the responsibility of a single District Forest Officer, stationed at Moroto Municipality. The staff for Napak Forest Reserve will be stationed at Iriiri Trading Centre. There is need for radio communication between the reserve and the district headquarters.

**Infrastructure:** Two duplex houses will be constructed at Iriiri Trading Centre to accommodate the Assistant Forest Officer, Forest Ranger and the Guards. A water source or underground tank and a store should also be constructed at the site.

**Demarcation:** The whole of the artificial boundary (59 km), requires reopening and planting. However, the frequent fires and grazing are a setback to establishing live markers and so more use will be made of corner beacons. All internal management zone boundaries will be demarcated by ring-painting trees in the standard way. Sign boards will be erected wherever prominent foot paths and tracks cross a boundary.

**Patrol and protection activities:** Protection patrols will be complemented by community education and sensitization, as most people using the reserve are nomadic and armed. Two patrol teams comprising of two patrolmen, and a guard, will be constituted. These ranges will be based at Iriiri and Nabwali. Men will be rotated between patrol teams, and teams will be moved periodically between ranges. Patrol routes will be established throughout the reserve. An incentive scheme will be instituted to reward success in curbing illegal activities.

**Public access and community needs:** The greater part of the population relying on the reserve are nomadic pastoralists while some are settling down to cultivation in and around the reserve. Many of these people are armed, a situation unfavourable to implementation of conservation activities. Therefore, integration of these communities into conservation planning should be attempted.

The Assistant Forest Officer and the Ranger should assume responsibility for community outreach programmes, including Collaborative Forest Management. A programme of meetings with the communities should be instituted to explain and discuss conservation and management of the reserve. Community development initiatives will be encouraged.

The Assistant Forest Officer in Moroto and the Ranger at Iriiri should each be facilitated with a motorcycle each to support their work. The Forest Guards should be provided with bicycles.

**Table 18.1 Existing and proposed staff deployment at Mt. Napak**

Station	Existing and proposed staff by category						Remarks
	FO	AFO	FR	FG	PM	Total	
Moroto	1(0)	1(0)	-	-	-	1(0)	
Iriiri	-	-	0(1)	1(1)	0(2)	1(5)	
Nabwali	-	-	-	-	0(2)	0(2)	
<b>Total</b>	<b>1(0)</b>	<b>0(1)</b>	<b>0(1)</b>	<b>1(1)</b>	<b>0(4)</b>	<b>2(7)</b>	

Note: Nos in brackets indicate proposed number of staff, FO = Forest Officer; AFO = Assistant Forest Officer; FR = Forest Ranger; FG = Forest Guard PM = Patrol man

**Table 18.2 Existing and proposed staff housing at Mt. Napak**

Station	Existing and proposed staff housing					Remarks
	FD Detached	FD semi (detached)	FD Uniport	Private	Total	
Nabwali	-	-	-	-	-	
Moroto	-	-	-	-	-	
Iriiri	-	0(2)	0(1)	1(0)	1(3)	
<b>Total</b>	<b>-</b>	<b>0(2)</b>	<b>0(1)</b>	<b>1(0)</b>	<b>1(3)</b>	

NB: Nos in bracket indicate proposed number of houses

**Table 18.3 Summary table of biodiversity values for Mt. Napak**

Criterion	Trees/shrubs	Birds	Small mammals	Butterflies	Moths	Overall
Total No. of species known	224	105	21	129	22	
No. of restricted of range species ( $\leq 5$ forests)	2	5	1	12	2	
Species unique to forest (list)	<i>Clitandra cymulosa</i> <i>Diospyros natalensis</i>	none	None	<i>Iolaus bowkeri</i> <i>Tarucus rosacea</i>	<i>Leucophlebia neumanni</i>	5 spp
Uganda endemics (list)	None	none	None	None	none	none
Albertine Rift endemics (list)	None	none	None	None	none	none
Species diversity (score and rank)	7(17=)	6.4(27=)	8.1(7)	6.1(39=)	4.1(41)	6.6(19=)
Species rarity value (score and rank)	7.4(22=)	6.6(14=)	4.9(33=)	4.9(28=)	7.2(10=)	6.7(19=)
Biodiversity importance value						13.2(21=)

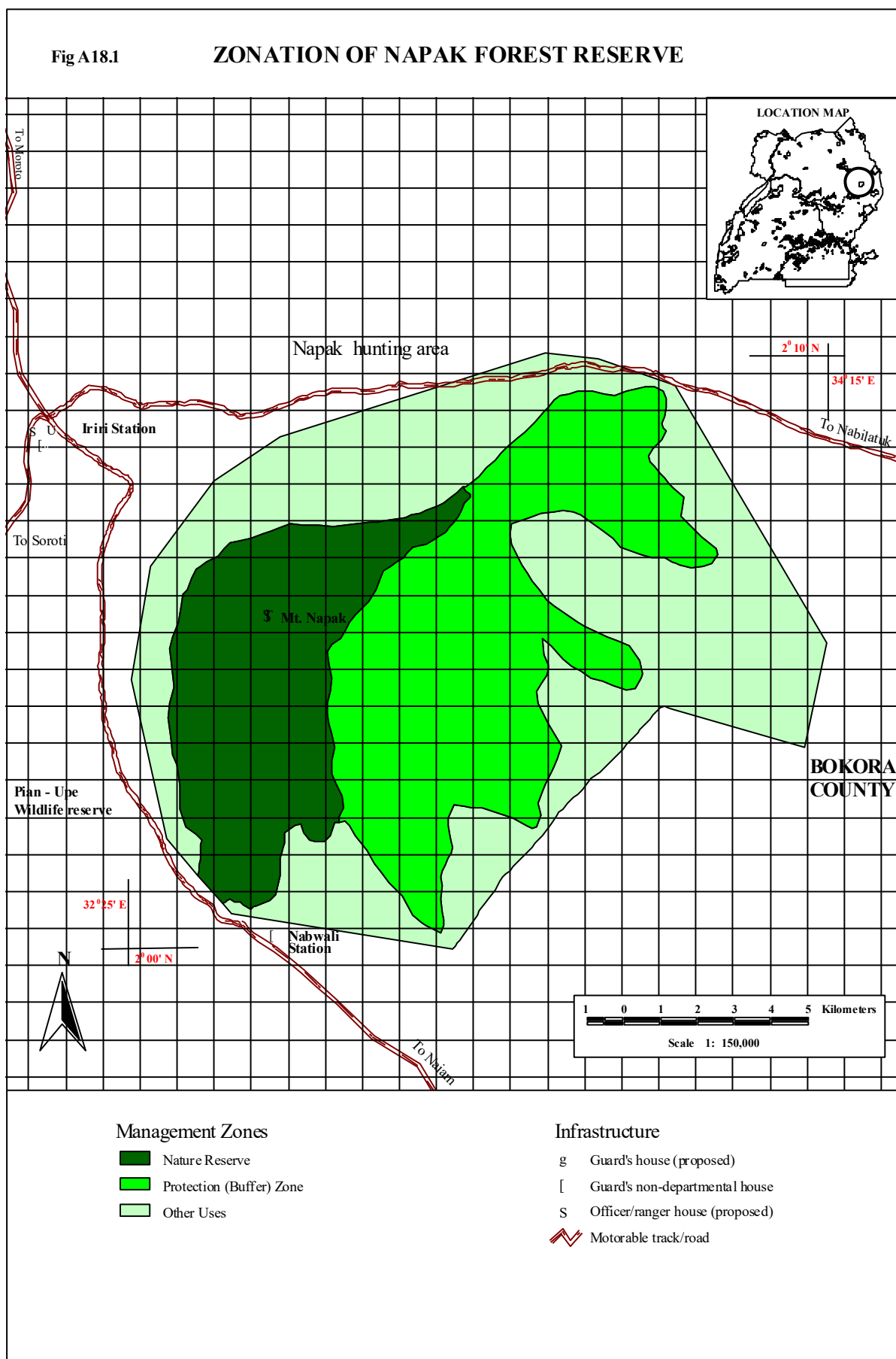
Overall biodiversity score = 13.2

## 9 Principle reference material

1. Langdale-Brown, I., Osmaston, H.A. and Wilson, J.G. (1964). The Vegetation of Uganda and its bearing on Land-use. Uganda Government Printer, Entebbe.

2. Lockwood Consultants (1973). Forest Resource Development Study for the Republic of Uganda. Lockwood Consultants, Toronto, Canada.
3. Uganda Forest Department (1955). Working Plan for Karamoja Forests for the period of 1955-59 (extended to Jan. 1964-68). Forest Department, Kampala, Uganda.
4. Uganda Forest Department (1996). Biodiversity Report, Series No. 16; Moroto, Kadam and Napak Forest Reserves. Forest Department, Kampala, Uganda.





## APPENDIX 19: MT. OTZI FOREST PROFILE

(Category: PRIME conservation forest)

### 1 Basis for selection

The forest was selected for Nature Reserve establishment in recognition of its considerable biodiversity importance especially because:

- it supports 7 unique tree species and 3 unique butterfly species (representing more than 1% of the country's protected area total) known from no other protected area in Uganda (see Table 3.5, pp. 33).
- it supports two tree species and one butterfly species that are of conservation concern on account of being endemic to the afro-montane and Somali-Masai region.
- it contributes to more than 2% of the national protected area system species complement.

### 2 Physical description

**Area and demarcation:** 188 km<sup>2</sup>; total boundary length 130 km, of which approximately 100 km adjoins rural community lands. Of the 130 km of external boundary, 41.2 km follows rivers and streams while 88.8 km is an artificial boundary maintained as a cutline with cairns made of heaped stones at heights of 1 m and corner beacons. To the North East is Uganda's International boundary with Sudan.

**Establishment:** 1946

**Location:** The forest is located on the escarpment overlooking the confluence of the Achwa River with the White Nile as it enters into the Sudan. It lies between 03°35'–03°49'N and 31°47'–31°57'E.

The forest is in Metu and Dufile Sub-Counties of Moyo District, North Eastern Uganda and it is covered by the Uganda Department of Lands and Surveys maps sheets 5/4 and 13/2 (series Y732) at 1:50,000.

**Physical features:** The reserve occupies the escarpment at altitudes of 760m - 1667m above sea level with 58% exceeding a 15% slope. A number of streams and rivers originate within the reserve draining into the river Nile through Amua River in the South; Leya in the North and smaller streams in the Eastern part that drain into the Nile in the Sudan.

### 3 Vegetation and forest condition

94 km<sup>2</sup> (50%) of the vegetation of the reserve is classified as GI (undifferentiated semi-deciduous thicket) and 94 km<sup>2</sup> (50%) *Butyrospermum-Hyparrhenia dissoluta* Savanna (Langdale-Brown et al., 1964).

The Forest is generally intact (overall condition score 4) except for light encroachment surrounding the enclaves and to lesser extent at the lower altitude around Awado. The steep slopes and rugged terrain of much of the reserve limit cultivation.

The vegetation is affected by fires which occur annually throughout the reserve during dry season.

The local communities collect building materials particularly bamboo poles (*Oxytenathera abyssinica*), honey and medicinal plants. Hunting by traps and snares occurs mainly during the dry season

**Forest integrity scores:** Settlement = 1; Cultivation = 1; Hunting = 1; Livestock = 0; Timber = 0; Fire = 3; Community, use/access = 1; Mining = 1 (see appendix 4 for explanation).

#### 4 Economic importance

**Community use values:** The Forest is situated where the population is not very dense (64 people per km<sup>2</sup> 1991), so the pressure on the peripheral areas is not a serious threat except for building poles (mainly the bamboos) and non-timber forest products such as medicines.

Large parts of the reserve have steep slopes and rugged terrain rendering it inaccessible and therefore the valuable resources are under-utilised; the "Community - Use" value score is 2.5.

**Timber production:** The forest is not of importance for timber production although the potential from trees along the streams exists, especially for conversion of the *Khaya* and *Afzelia* spp.

A timber inventory in the early 1970s (Lockwood Consultants, 1973) provides an estimate of 5 m<sup>3</sup> per ha standing volume of merchantable timber exceeding 50 cm dbh.

A 4 ha of Trial Plot was established in 1968 with *Pinus patula-Cuppressus lusitanica* and *Gmelina arborrea* but it is only the pines which have done well, and are a potential for development in future to cater for timber production.

**Other economic values:** The reserve is important for water catchment as most local streams and rivers originate within. The potential for tourism and recreation exists because of attractions such as the Chimpanzees, although there are no facilities and access circuits. One group of Chimpanzees (*Pan troglodytes*) appears to be surviving in the reserve (Davenport and Howard, 1993), which renders it a special attraction.

#### 5 Biodiversity importance

The Biodiversity reports ranks Mt. Otzi Forest Reserve eighth, with a score of 14.1 in overall importance out of the 65 Forests investigated. As for species diversity, it ranks tenth, and also 10th for the "rarity" value of the species represented (Table 19.3) (for explanation see chapter 3, Table 3.5).

The Forest has 10 species which do not occur in any other forest in Uganda (including seven trees and 3 butterflies). It has one species of small mammal endemic to Uganda and 1 tree endemic to the Albertine rift region.

#### 6 Present management

The reserve is managed by the District Forest Offices based in Moyo and assisted by two Forest Rangers who are also based in Moyo Town. There are three patrolmen who operate from their homes but are organised along cairns Nos. 45-60, 61-77, and 1 in the South.

**Table 19.1 Existing and proposed staff deployment at Mt. Otzi**

Station	Existing proposed No. of staff by category						Remarks
	FO	AFO	FR	FG*	PM	Total	
Moyo	1(1)	0(0)	2(0)	1*(0)	0(0)	4(1)	Most of the workers under the EC Forestry Project are on contract and are therefore not shown here.
Metu	0(0)	0(0)	0(1)	0(1)	*1(1)	1(3)	
Gweri	0(0)	0(0)	0(0)	0(1)	0(2)	0(3)	
Dufele	0(0)	0(0)	0(0)	0(1)	0(2)	0(3)	
<b>Total</b>	<b>1(1)</b>	<b>0(0)</b>	<b>2(1)</b>	<b>1(3)</b>	<b>1(5)</b>	<b>5(10)</b>	

Note: \* denotes EU project staff not government employee, FO = Forest Officer  
AFO = Assistant Forest Officer, FR = Forest Ranger FG = Forest Guard, PM = Patrolman

**Table 19.2 Existing and proposed staff housing at Mt. Otzi**

Station	FD detached	FD semi Detached	FD uniport/hut	Private	Total	Remarks
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Moyo	1(0)	0(0)	0(0)	3(0)	4(0)
Metu	0(0)	0(1)	0(0)	0(0)	0(1)
Gweri	0(0)	0(0)	0(1)	0(0)	0(1)
Dufeke	0(0)	0(0)	0(1)	0(0)	0(1)
<b>Total</b>	<b>1(0)</b>	<b>0(1)</b>	<b>0(2)</b>	<b>3(0)</b>	<b>4(3)</b>

Note: Nos. in brackets indicate proposed staff housing units.

The transport facilities for management include the Pick-Up in the District Forest office and one Motorcycle shared by the rangers. There is a road that passes through the Reserve from Metu to Aya but it is only motorable by 4 wheel drive vehicles because of the terrain.

The Reserve was gazetted as a Protection reserve and no working Plan has ever been written. A trial plot for softwoods was established at Eremi with *Pinus patula*, *Cupressus lusitanica* and *Gmelina arborrea*. The pines have grown well, while the other species have not, due to persistent fires. There is no Nature Reserve.

Since 1991, with support of the EC-financed Natural Forest Management and Conservation Project, a total of 88.8 km of the boundary was re-opened and cairns restocked with stones to a height of 1.5 m. Directional trenches were also maintained and concrete corner beacons have been erected. Attempts were made to plant live markers of *Tectona grandis* and Castor oil but the survival rate was very low due to the annual fires. Sisal has been tried out on the boundary and the survival rate has been much better than the other species.

Agricultural encroachment along the Amua valley and the enclaves has been noticed but the people are being persuaded to vacate. Bamboo harvesting in the reserve is high and hunting is common in the dry season.

## 7 Proposed zonation

Figure A19.I shows the proposed zonation of the reserve with one Strict Nature Reserve (approximately 96 km<sup>2</sup>); one protection zone (approximately 46 km<sup>2</sup>) and one production zone (approximately 46 km<sup>2</sup>).

### Strict Nature Reserve

The proposed Otzi Strict Nature Reserve has been selected to:

- cover an area of undisturbed natural vegetation representing ecological climax communities.
- cover the least accessible part of the reserve where a high degree of protection can be provided.
- protect the area with unique species of conservation significance.
- protect a fairly undisturbed area which is generally steep, rugged and inaccessible.

### Protection (Buffer Zone)

The proposed protection zone covers all the steep slopes of the escarpment adjacent to the Strict Nature Reserve on the Western and Southern range which on account of its ruggedness may help to protect the Strict Nature Reserve from becoming more accessible.

## **Production Zone**

The production zone covers the rest of the reserve, which is on a fairly gentle slope and has often been used by the people as a source of bamboo and other building materials.

## **8 Proposed management programmes**

**Staffing:** The present staffing is inadequate. Beats should be created to cover Eremi, Metu, Gbari and Dufile. The reserve can be managed by the DFO assisted by 3 Forest Rangers and 4 Forest Guards (Table 19.1).

**Infrastructure:** A Forest Ranger's house should be built at Metu to guarantee close supervision and Forest Guards' uniports should be put at Gweri and Dufele. The patrolmen will operate from their homes (see Table 19.2).

**Demarcation:** The external boundaries covering the cutline (88.8 km) will be demarcated with concrete corner beacons. Sisal planting, if proved to be successful, should be continued to reinforce the demarcation on the cutline. Internal boundaries of the zones should be demarcated by ring painting of trees in the standard way, and sign posts should be placed at strategic points, indicating the management zones of the areas.

**Patrol and protection activities:** Four patrol teams, supervised by Forest Guards will be constituted for the supervision of the beats of Dufile, Eremi, Metu and Gbari. Patrol routes will be established and an incentive scheme will be developed to guarantee commitment in management.

**Public access and community needs:** The Forest Rangers will ensure orderly harvest of the bamboo under licence from the proposed protection and production Zones. Collaborative management will be promoted through extension and conservation education for the communities surrounding the reserve. The recreational potential of the reserve should be promoted through the establishment of camp sites at the Trial Plots and a hiking route to the highest peak at Otzi. The chimpanzee migrations in the reserve as reported in the Biodiversity Report should be monitored.

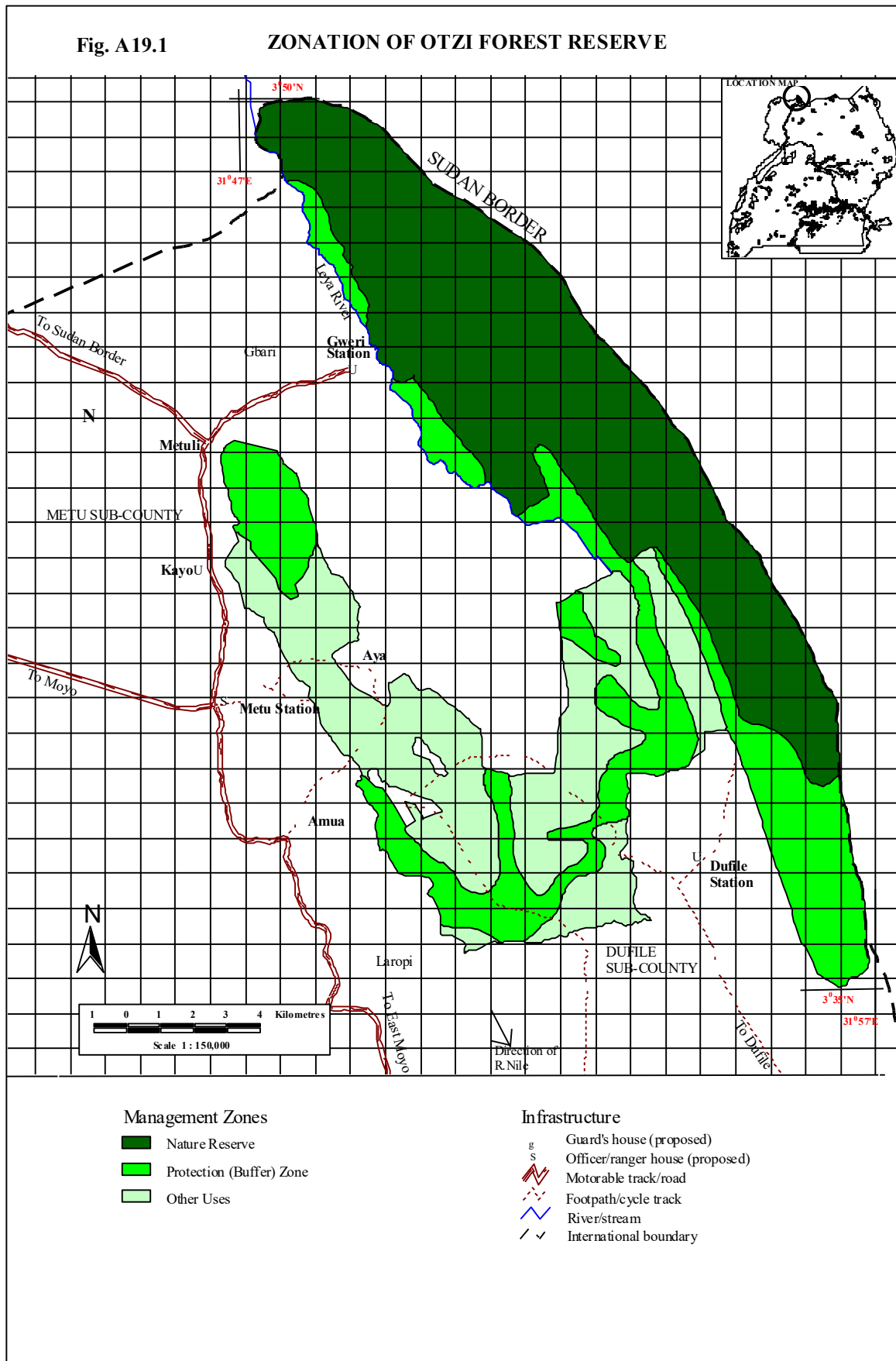
**Table 19.3 Summary biodiversity values for Mt. Otzi Forest Reserve**

Criterion	Trees & shrubs	Birds	Small mammals	Butterflies	Moths	Overall
<b>Total number of species known</b>	261	168	21	94	44	-
<b>No. of restricted range spp. (<math>\leq 5</math> forests)</b>	44	24	2	15	7	-
<b>Species unique to forest (list)</b>	<i>Adenodolichos paniculatus</i> <i>Canthium zanzibaricum</i> <i>Dalbergia nitidula</i> <i>Euphorbia venenifera</i> <i>Maerua subcordata</i> <i>Ochna alba</i> <i>Phyllanthus muellerianus</i>	-	-	<i>Acraea baxteri</i> <i>Acraea buettneri</i> <i>Acraea insignis</i>	-	-
<b>Uganda endemics (list)</b>	-	-	<i>Crocidura selina</i>	-	-	-
<b>Albertine Rift Endemics (list)</b>	<i>Grewia pubescens</i>	-	-	-	-	-
<b>Species diversity (score &amp; rank)</b>	7.1(10)	6.7(15=)	6.4(19)	6.1(21=)	5.8(18=)	7.1(10)
<b>Species rarity value (score &amp; rank)</b>	8.2 (10)	6.0(14)	5.6(14=)	5.3(13=)	6.5(13=)	7.0(10=)

Overall biodiversity score = 14.1

**9 Principle reference material**

1. Davenport, Tim and Howard, P.C. (1993). Field Reports to Commissioner for Forestry. Forest Department, Kampala, Uganda.
2. Duli, David (1992). Field Report to the Commissioner for Forestry. Forest Department, Kampala, Uganda.
3. Langdale-Brown, I., Osmaston, H.A. and Wilson, J.G. (1964). The Vegetation of Uganda and its Bearing on Land Use. Uganda Government Printer, Entebbe.
4. Lockwood Consultants (1973). Forest Resource Development Study for the Republic of Uganda. Lockwood Consultants, Toronto Canada.
5. Uganda Forest Department (unpublished). Quarterly Reports of DFO Moyo as from 1990-1966. Forest Department, Kampala, Uganda.
6. Uganda Forest Department (1996). Biodiversity Report Series No. 17, Mt. Otzi and Era forest reserves. Forest Department, Kampala, Uganda.



## APPENDIX 20: SOUTH BUSOGA FOREST PROFILE

(Category: SECONDARY Conservation forest)

### 1 Basis for selection

The forest was selected for Nature Reserve establishment in recognition of its biodiversity importance, especially because:

- it supports one species of moth, 2 species of trees and 2 species of butterflies not known from elsewhere in Uganda's Protected Area system and which are of conservation concern on account of being unique to the forest and broadly endemic.
- it supports one species of tree not found elsewhere in Uganda's Protected Area system and which is of conservation concern on account of being endemic to the afro-montane area.
- it is representative of a vegetation type D4 (medium altitude semi-deciduous forest) not otherwise represented in Uganda's Protected Area system.

### 2 Physical description

**Area and demarcation:** The area of the reserve is 164 km<sup>2</sup>, with a total boundary length of 94 km, of which approximately 25 km adjoins rural community lands and 69 km is along the shores of Lake Victoria and the river Kamirantumbu. 25 km of boundary is artificial, of which 18 km has been previously maintained as a planted cutline with earth corner cairns and directional trenches.

**Establishment:** 1963.

**Location:** The reserve lies in Bunya county in the administrative district of Iganga, on the northern shores of Lake Victoria between 0°09'–0°20' N and 33°27'–33°39' E. It lies approximately 33 km south of Iganga and 24 km South East of Jinja, and is covered by Uganda Department of Lands and Surveys map sheets 72/24 and 73/13 (series Y732) at 1:50,000.

**Physical features:** The reserve is generally a low-lying forest, and has an extensive shore fringe of papyrus swamp with scattered rock outcrops. There are several hills within the reserve which are mostly rocky and soils are shallow. The reserve's altitudinal range is 1140–1300 m a.s.l., with 98.8% of the area having slopes of below 5° and 1.2% with slopes between 6–15°.

### 3 Vegetation and forest condition

The vegetation of the reserve can be broadly classified as medium altitude moist semi-deciduous forest with 47 km<sup>2</sup> (28.9%) of each of three types: D4 (*Albizia-Chlorophora* forest); G1 (undifferentiated semi-deciduous thicket); and K (moist *Combretum* savanna). The remainder comprises types N3 (*Combretum-Cymbopogon*) and W4 (*Acacia-Imperata* grassland), each occupying 6.7% (11 km<sup>2</sup>) of the total reserve area. A great part of the vegetation has been altered by human activities like agricultural encroachment, pitsawing and bush burning. A detailed forest type map is available at Forest Department headquarters based on 1950s aerial photography.

The forest is seriously degraded (overall condition score 2), mainly because of the long history of unchecked illegal activities and being relatively flat with motorable tracks, making it easily accessible. There has been no mechanized timber harvesting but illegal pitsawing activities are evident. There is agricultural encroachment and some sand mining along the Kitukiro/Bwonda Road.

**Forest integrity:** Settlement = 0; Cultivation = 1; Hunting = 0; Livestock = 1; Timber = 2/3; Fire = 1; Community use = 2; Mining = 1 (see Appendix 4 for explanation).

### 4 Economic importance

**Community use values:** The forest is situated in one of the most densely populated parts of the country (271 people per km<sup>2</sup> in 1991), so pressure on the peripheral areas of the forest for firewood, building poles and non-timber forest products is correspondingly high. Large areas of the forest are very accessible (except in the south east of the reserve where it is very rocky and where the forest is relatively intact and interspersed with many areas of shrubs and some



savanna grassland) and this has resulted in degradation giving a 'community use' value of only 3 (see Appendix 3 for explanation).

**Timber production:** The forest has an important commercial timber production role but that may be unsustainable because the integrity of the remaining areas of closed forest within the reserve remains under serious threat from illegal activities, especially on the Lake Victoria side. The forest has over 50% of forested area as still relatively intact forest patches. A timber inventory in the early 1970s (Lockwood Consultants, 1973) provided an estimate of 10 m<sup>3</sup> per ha of standing volume of merchantable timber exceeding 50 cm dbh.

2950 ha of the reserve have already been allocated to plantation development by agreement under private leasehold arrangements. This covers previously degraded areas (partly indicated on map Fig. A 20.1).

**Other economic values:** It is accessible to the main Jinja-Tororo highway and therefore to the main eastern tourist circuit. It also has good tourism and recreation potentials such as the scenic shores of Lake Victoria and its landing sites of Bwondha, plus some infrastructure like roads.

## 5 Biodiversity values

Of the 65 forest reserves investigated for biodiversity, South Busoga ranks thirtieth in overall importance, with a score of 12.5 (chapter 3, Table 3.1). It is twenty-sixth in terms of species diversity and also ranks thirty-fourth in terms of 'rarity' value of the species represented, presumably because most of its species are shared with other medium altitude moist semi-deciduous forests in the country. The forest supports 5 species found in no other Ugandan forest (including 2 trees, 2 butterflies and 1 moth), it has one species endemic to the afromontane region but no species endemic to either Uganda or to the Albertine Rift region (Table 20.3). It represents the largest block of medium altitude semi-deciduous forest type D4 (Langdale Brown et al., 1964) in the protected area system, a vegetation association that does not occur in any of the country's National Parks or Wildlife Reserves, and only in two other forest reserves; West Bugwe and Igwe/Luvunya.

## 6 Present management

The reserve is managed from the Iganga District Forest Office and a local office at Kityerera Forest Station. There are three Forest Officers (stationed at Iganga) with responsibility for south Busoga Forest reserve (also see Appendix 34). Additionally there is an Assistant Forest Officer (stationed at Kityerera), no Forest Guards, 2 patrol men and six nurserymen (stationed at Iganga). The department has two housing units (one detached, the other semi-detached) at Iganga, housing two Forest Officers; the third is accommodated in a private house. There is one detached and one semi-detached house, and a wooden office structure at Kityerera (see Fig. A20.1). Management is facilitated by one vehicle stationed at Iganga. There are two motorable tracks and numerous footpaths through the reserve, creating good vehicular access.

In recent years (since 1990), with the support of the EC-financed Natural Forest Management and Conservation Project, approximately 18 km of boundary has been re-demarcated by cutline, of which 8 km has been successfully planted with marker trees (*Euphorbia* spp, *Ficus* spp. and *Burmatoteak*) at 3 m intervals (Fig. A20.1). Protection patrols have not been very effective especially with areas adjacent Lake Victoria.

**Table 20.1 Existing and proposed staff deployment for South Busoga**

Station	Existing and proposed staff by category						Remarks
	FO	AFO	FR	FG	PM	Total	
Iganga	3(0)	0(0)	0(0)	0(0)	0(0)	3(0)	All 3 Forest Officers are in charge of Igwe/Luvunya and S. Busoga FRs (see Appendix 34)
Kityerera	0(0)	1(0)	0(1)	0(1)	0(3)	1(5)	
Malongo	0(0)	0(0)	0(0)	0(1)	1(2)	1(3)	
Bwondha	0(0)	0(0)	0(0)	0(1)	1(2)	1(3)	
<b>Total</b>	<b>3(0)</b>	<b>1(0)</b>	<b>0(1)</b>	<b>0(3)</b>	<b>2(7)</b>	<b>6(11)</b>	

Note: FO = Forest Officer; AFO = Assistant Forest Officer; FR = Forest Ranger;  
FG = Forest Guard; PM = Patrolmen, Nos. in brackets indicate proposed staffing.

**Table 20.2 Existing and proposed staff housing at South Busoga**

Station	Existing and proposed staff housing*						Remarks
	FD Detached	FD Semi-detached (incomplete)	FD Semi-detached (complete)	FD Unipor t	Private	Total	
Iganga	1(0)	0(0)	1(0)	0(0)	1(0)	3(0)	
Kityerera	1(0)	0(0)	1(0)	0(0)	0(0)	2(0)	
Malongo	0(1)	0(0)	0(0)	0(0)	1(0)	0(2)	
Bwondha	0(1)	0(0)	0(0)	0(0)	1(0)	0(2)	
<b>Total</b>	<b>2(2)</b>	<b>0(0)</b>	<b>2(0)</b>	<b>0(0)</b>	<b>3(0)</b>	<b>5(4)</b>	

NB: \* figures represent No. of staff families accommodated

## 7 Proposed zonation

Figure A20.1 shows the proposed zonation of the reserve with two Nature Reserves (approximately 36 km<sup>2</sup>), two protection zones (approximately 18 km<sup>2</sup>) and one large production zone (approximately 110 km<sup>2</sup>).

The proposed south eastern corner (at Bwagwe) Nature Reserve (19 km<sup>2</sup>) has been selected to:

- protect the remaining area of relatively intact forest on rocky, steep and inaccessible land.
- protect an area of medium-altitude moist semi-deciduous forest of type D4 (Langdale Brown et al, 1964), which is not otherwise represented in Uganda's National Parks and Wildlife Reserves.

The proposed south-western corner (at Bwembe Bay) Nature Reserve (17 km<sup>2</sup>) has been selected to:

- additionally protect some of the remaining area of relatively intact forest.
- protect extensive areas of undisturbed lake shore vegetation and papyrus swamp, representative of the lake shore vegetation, which form interesting habitat complexes.

The proposed protection zone north of the south-eastern Nature Reserve is generally unsuitable for timber harvesting (on account of being steep), but it can enhance the long-term viability of the Nature Reserve. The south-western protection zone is also generally unsuitable for timber harvesting (an account of its swampy nature and because most timber trees are already depleted) but it can also enhance the long-term viability of the south-western Nature Reserves, which is close to the main Bumwena-Bwondha access road.

The proposed production zone covers the majority of the reserve including the areas that have been heavily exploited by illegal pitsawyers; the more accessible peripheral areas of the reserve; abandoned agricultural land with scattered

forest trees; and some open areas of semi-natural grassland, some of which is suitable for plantation development. Approximately 30 km<sup>2</sup> of this has been allocated to private developers, so far.

## **8 Proposed management programmes**

**Staffing:** The present staff number is inadequate. Recruitment of a Forest Ranger is necessary plus 3 Forest Guards to create three effective patrol teams, with responsibility for newly defined beats/ranges. The entire reserve will be brought under the responsibility of a single Forest Officer, based at Iganga. Recruitment of 3 guards is appropriate due to the great human threat to the forest.

**Infrastructure:** The existing houses at Kityerera and Iganga Forest Stations require renovation. Two additional Guards' houses are necessary, one each at Malongo and Bwondha.

**Demarcation:** 7 km of re-opened external boundary remains to be planted. All internal management zone boundaries will be demarcated by ring-painting trees in the standard way. Sign boards will be erected wherever prominent foot paths cross (external and internal) boundaries.

**Patrol and protection activities:** 3 patrol teams, each comprising one Forest Guard and 3 patrolmen will be constituted, with responsibility for safeguarding ranges, to be defined. These ranges will be based at the three forest stations. Men will be rotated between patrol teams and teams will be moved periodically between ranges. Patrol routes and check points will be established throughout the reserve. An incentive scheme will be instituted to reward success in curbing illegal activities. Forest Guards will each be provided with a bicycle.

**Public access and community needs:** One Ranger (based at Kityerera station) will assume responsibility for community outreach programmes, including the development of Collaborative Forest Management programmes within the reserve and community tree planting programmes outside and along the boundary. A programme of village meetings will be instituted to explain and discuss management of the reserve, and in particular the management zones as they are established. The Ranger will be provided with a motorcycle. A motor boat will also be provided for patrol along the lake.

**Table 20.3 Summary of biodiversity values for South Busoga**

Criterion	Trees & Shrubs	Birds	Small mammals	Butterflies	Large Moths	Overall
<b>Total No. of spp. Known</b>	173	123	16	127	82	-
<b>No. of restricted range spp. (<math>\leq 5</math> forests)</b>	8	16	0	8	3	-
<b>Species unique to forest</b>	<i>Bixa orellana</i> <i>Synadenium grantii</i>	None	none	<i>Spindasis crustaria</i> <i>Anthene alberta</i>	<i>Imbrasia zambesina</i>	5 spp
<b>Uganda endemics</b>	none	None	none	None	None	none
<b>Albertine Rift endemics</b>	none	None	none	None	None	none
<b>Species diversity (score &amp; rank)</b>	5.9(35)	5.7(37)	7.7(21)	7.1(21)	7.3(10)	6.4(26=)
<b>Species rarity value (score and rank)</b>	7.0(35=)	5.8(25=)	3.8(56=)	4.6(34=)	6.3(25)	6.1(34=)
<b>Biodiversity importance value (score &amp; rank)</b>	-	-	-	-	-	12.4(30)

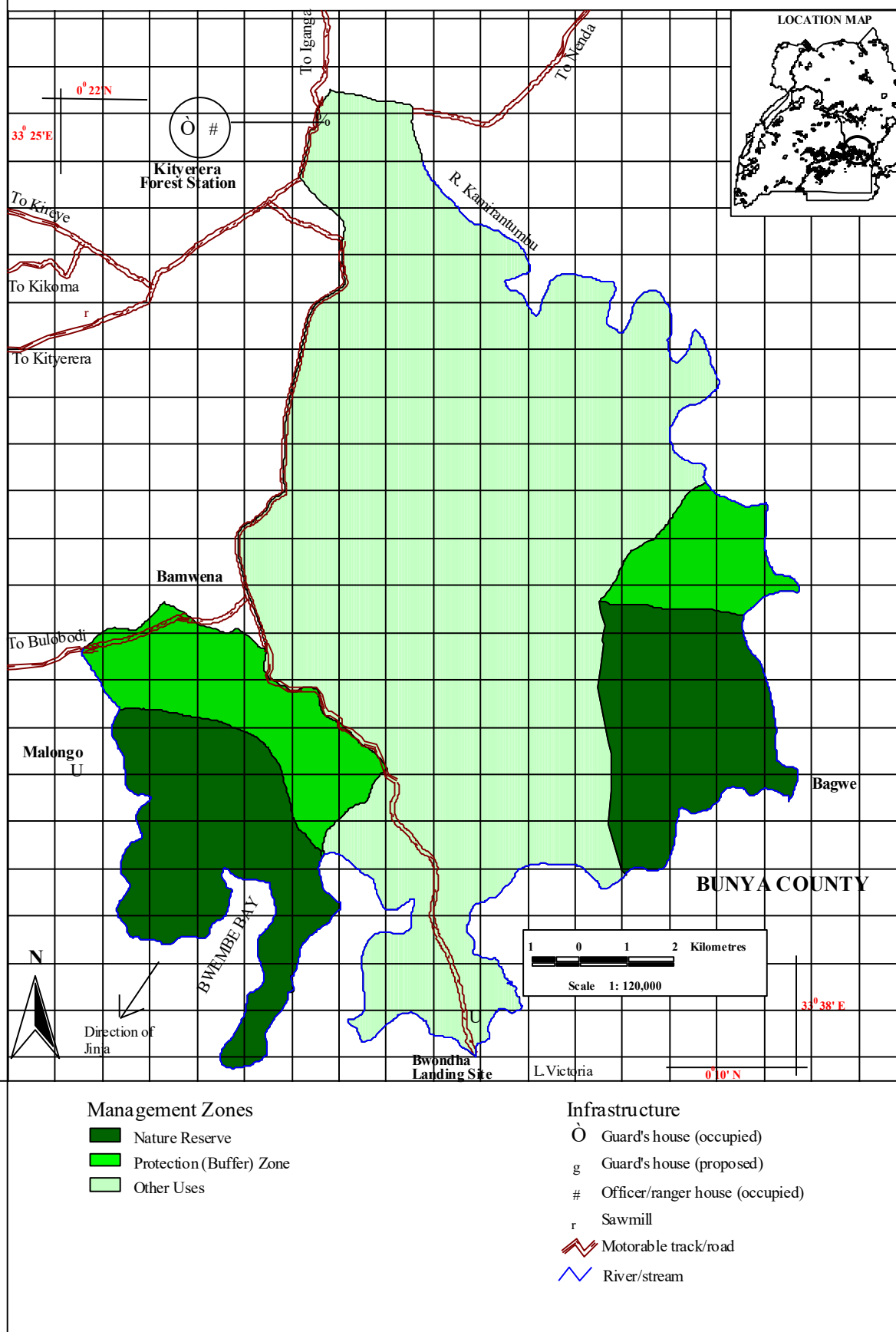
Overall biodiversity score = 12.5

**9 Principle reference material**

1. Langdale Brown, I., Osmaston, H.A. and Wilson, J.G. (1964). The Vegetation of Uganda and its bearing on Land Use. Uganda Government Printer, Entebbe.
2. Lockwood Consultants (1973). Forest Resources Development Study for the Republic of Uganda. Lockwood Consultants, Toronto, Canada.
3. Uganda Forest Department (1996). Biodiversity Report, Series No. 18; South Busoga Forest Reserve. Forest Department; Kampala, Uganda.

Fig. A20.1

## ZONATION OF SOUTH BUSOGA FOREST RESERVE



## APPENDIX 21: SANGO BAY FOREST PROFILE

(Category: CORE conservation forest)

### 1 Basis for selection

The forest was selected for Nature Reserve establishment in recognition of its considerable biodiversity importance, especially because:

- it supports 14 species found in no other Ugandan forests (including 8 of butterflies, 2 birds, 3 trees and 1 moth).
- it represents the largest block of swamp forest, type Y2 (Langdale-Brown et al., 1964).
- it represents a unique 'relict' forest community of considerable biogeographic interest with many species of montane plants and animals occurring outside their main ranges.

### 2 Physical description

**Area and demarcation:** 151 km<sup>2</sup> of five forest blocks; Kaiso, Malabigambo, Tero East and West, and Namalala; with a total boundary length of 187 km of which approximately 157 km adjoins rural community lands and 8 km (of Malamabigambo) and 3 km (of Kaiso) adjoin the Minziro forest of Northern Tanzania. Of the 187 km of external boundary, 176 km is swamp edge undemarcated boundary, and 11 km is an artificial boundary maintained as a cutline with earth cairns and directional trenches along the Tanzania border (3 km on Kaiso block and 8 km on Malabigambo block).

**Establishment:** not clear but perhaps gazetted for the first time in 1950.

**Location:** On the Western shores of Lake Victoria near the Tanzania border between 0°47'-1°00' S, and 31°28' - 31°43' E. The forests lie in the administrative district of Rakai (Kakuuto county) covered by Uganda Department of Lands and Surveys map sheet 88/3 (series Y732) at 1:50,000.

**Physical features:** The forests occupy part of the Kagera River floodplain, and are surrounded by swamp and seasonally flooded grassland communities, at an altitude of about 1160 m above sea level, with the whole area below 5% slope.

### 3 Vegetation and forest condition

The entire area (151 km<sup>2</sup>) is tropical swamp forests, classified as type Y2 (*Baikiaea-Podocarpus* seasonal swamp forest, (Langdale Brown et al., 1964). A detailed forest type map is available at the Forest Department headquarters, based on 1950s aerial photography, and reproduced in Howard (1991).

The forest is only partially affected by human activity (overall condition score 3) - mainly because it is swampy and unsuitable for cultivation and much of it has no easy access. There was mechanized harvesting of timber in the 1950s and forest patches are at various stages of regeneration and development. There has however been no agricultural encroachment, although pitsawing activity has intensified in recent years mainly for *Podocarpus milanjanus*. Abandoned hunting traps are common.

**Forest integrity:** Settlement = 0, Cultivation = 0, Hunting = 1, Livestock = 2, Timber 2/3, Fire = 1 and Community Use = 1 (see Appendix 4 for explanation).

### 4 Economic importance

**Community use values:** The forests lie in one of the less populated parts of the country (50 people per km<sup>2</sup> in 1991), so pressure on the peripheral areas of the forest for firewood, building poles and non-timber forest products is correspondingly low. However, large areas of the forests have potentially valuable resources which are underutilized giving a "community use" value of 3.6 (see Appendix 3 for explanation). The forest is also important for the high value timber of *Podocarpus milanjanus*.

**Timber production:** The forest was an important source of timber, mainly of *Podocarpus milanjanus*, which is almost exhausted. The remainder is presently being illegally cut.

**Other economic values:** As one of the only lowland forests with a unique combination of highland species, the forest has great potential for ecotourism development. The reserve's biodiversity values (see below) offer scope for the development of a research and education role.

## 5 Biodiversity values

Of the 65 forests investigated for biodiversity, the Sango Bay blocks rank fourteenth in overall importance, with a score of 13.7. They are thirteenth in terms of species diversity, and rank fifteenth in terms of the rarity value of the species represented; presumably because many of its unique combination of species are shared with some high altitude forests, others with the medium altitude forests along the Albertine rift, and others with the lowland forests such as the lake shore forests of Jubiya and Mujuzi. The forest supports 14 species found in no other Uganda forests (including 8 butterflies, 2 birds, 3 trees and 1 moth). One bird species and one butterfly species are endemic to the Albertine region and the forest ranks 4<sup>th</sup> in moth diversity (Table 21.3). It presents the largest block of swamp forest, type Y2 (Langdale Brown et al., 1964) in the protected area system, a vegetation association that does not occur in any of the country's National Parks or Wildlife Reserves.

## 6 Present management

The block of forests is managed from the Rakai district forest office with local offices at Katera, where there is a Forest Guard. There is one Assistant Forest Officer stationed at Katera. There are two other Forest Guards, one stationed in a rental house at Kakuuto and looking after the Kaiso and Malabigambo blocks, and the other stationed at Kasasa (own premises), who is supposed to look after Tero East and West blocks. There are no forest workers or nursery men (Table 21.1).

The department has two wooden staff houses at Katera, one for a Forest Ranger and another for a Forest Guard (Table 21.2). There are no transport facilities except the DFO's vehicle stationed about 60 km away in Rakai.

There are no motorable tracks during the wet season, except the one main road which passes between Tero West and Malabigambo and proceeds to Kasensero landing site on Lake Victoria. Vehicular access to the reserve is therefore limited. However, during the dry season vehicles can move to Kaiso and Malabigambo blocks, and up to Minziro hill. The latest Working Plan for the area covered the period 1955-65 and was based on very scanty information and had no major management prescriptions except for timber enumeration, vegetation assessment and research, but it is unlikely that the work was actually carried out. There is no Nature Reserve.

In recent years (since 1991), with the support of the EC-financed Natural Forest Management and Conservation Project, approximately 8 km of boundary has been redemarcated by cutline, and protection patrols have been intensified for the Kaiso and Malabigambo blocks.

## 7 Proposed zonation

Figure A21.1 shows the proposed zonation with two Strict Nature Reserves, Tero East (10 km<sup>2</sup>) and part of Malabigambo (40 km<sup>2</sup>) and one protection (buffer) zone, the Namalala 25 km<sup>2</sup>. The proposed Strict Nature Reserves have been selected to:

- protect a viable area of the swamp forest type Y2 (Langdale Brown et al, 1964) which is not otherwise represented in Uganda's Protected Area system.
- protect a substantial undisturbed core area comprising mature forest.
- include some of the most inaccessible areas that have hardly been harvested.

The proposed protection (buffer) zone can also hardly be harvested as it is swampy for most of the year and protection efforts are therefore kept to a minimum cost.

Part of Malabigambo, Kaiso and Tero West blocks are proposed production zones, and cover the majority of the reserve including areas that have already been heavily exploited and the more accessible areas of the reserve. The redevelopment of the Sango Bay sugar estate near Kaiso block is a potential pressure to the reserve for fuelwood and building poles; and because Malabigambo and Kaiso are contiguous with the Minziro forest in Tanzania where there is timber harvesting, it makes economic sense to have them as production zones to harmonize management and reduce protection costs.

## 8 Proposed management programmes

**Staffing:** The present staff number is inadequate and additionally some redeployment will be necessary as well to create effective patrol teams, with responsibility for redefined beats. The entire reserve needs to be put under the responsibility of a Forest Officer, based at Kateera and an Assistant Forest Officer and a Forest Ranger based at Minziro. The Forest Guard presently at Kasasa should be moved to Minziro (Table 21.1).

**Table 21.1 Existing and proposed staff deployment at Sango Bay**

Station	Existing and proposed No. of staff by category						Remarks
	FO	AFO	FR	FG	PM	Total	
Kateera	0(1)	1(0)	0(1)	0(1)	0(4)	1(7)	The Forest Officer will be in-charge of the over-all management under the supervision of the District Forest Officer.
Kakuuto	0(0)	0(0)	0(0)	1(0)	0(0)	1(0)	
Minziro	0(0)	0(1)	0(1)	1(1)	0(4)	1(7)	
Rakai	1(0)	0(0)	0(0)	0(0)	0(0)	1(0)	
Kasasa	0(0)	0(0)	0(0)	1(0)	0(0)	1(0)	
<b>Total</b>	<b>1(1)</b>	<b>1(1)</b>	<b>0(2)</b>	<b>3(2)</b>	<b>0(8)</b>	<b>5(14)</b>	

Note: FO = Forest Officer; FR = Forest Ranger; AFO = Assistant Forest Officer; PM = Patrolmen; FG = Forest Guard, Nos. in bracket indicate proposed staffing

**Infrastructure:** The uncompleted houses at Kateera should be completed. One additional Officer's house is necessary at Kateera, one detached house, and a semi-detached house are proposed for Minziro (Table 21.2).

**Table 21.2 Existing and (proposed) staff housing at Sango-Bay**

Station	Existing and (proposed) staff housing					Remarks
	FD Detached	FD semi-Detached	FD uniport	Private	Total	
Kateera	2(1)	0(0)	0(1)	0(0)	2(2)	Houses at Kateera require Renovations and Expansion
Kakuuto	0(0)	0(0)	0(0)	1(0)	1(0)	
Minziro	0(1)	0(1)	0(1)	0(0)	0(3)	
Rakai	0(1)	0(0)	0(1)	0(0)	0(2)	
Kasana	0(0)	0(0)	0(0)	1(0)	1(0)	
<b>Total</b>	<b>2(3)</b>	<b>0(1)</b>	<b>0(3)</b>	<b>2(0)</b>	<b>4(7)</b>	

Note: Nos. in brackets indicate proposed staff housing units.

**Demarcation:** The 11 km of reopened external boundary, at the Tanzania border for Kaiso and Malabigambo blocks remains to be planted. The rest of the external boundary is natural and follows the limits of areas of seasonably inundated grassland and swamp which surround the forest. This has to be surveyed and marked with cairns and concrete beacons. Sign boards will be erected at prominent paths and near roads to indicate the forest blocks.

**Patrols and protection activities:** Two patrol teams comprising 1 Forest Guard, and 4 patrolmen each, will be constituted with responsibility for safeguarding the forests. One patrol team to look after Kaiso and Malabigambo forests will be based at Minziro and the other, based at Kateera, will be responsible for Namalala, Tero east and Tero west; these teams will work interchangeably. Men will be rotated between patrol teams and the teams will be moved periodically between the two beats. Patrol routes and check points will be established throughout the reserve and an incentive scheme will be instituted to reward success in curbing illegal activities, especially rampant in Kaiso and Malabigambo blocks.

**Public access and community needs:** The Forest Officer under the supervision of the District Forest Officer will assume responsibility for initiating community outreach programmes, including the development of Collaborative Forest Management Programmes, and community tree-planting programmes especially in Kyebe and Kakuuto subcounties. A programme of village meetings should be instituted to explain and discuss management of the reserve. The Officer will be facilitated with a motor cycle to support the work.



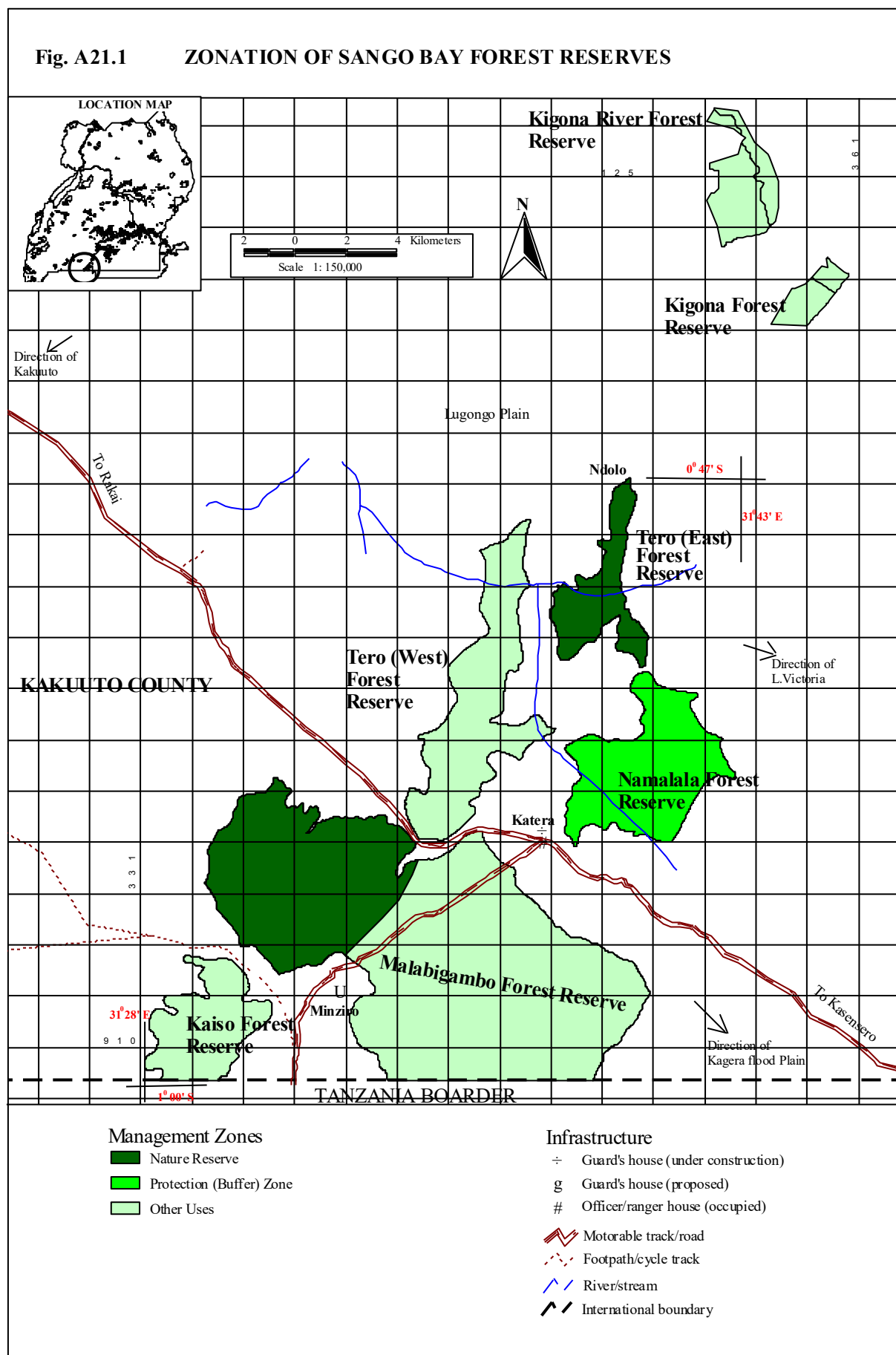
Table 21.3 Summary of Biodiversity values for the Sango Bay forests

Criteria	Trees & Shrubs	Birds	Mammals	Butterflies	Moths	Overall
<b>Total No. of species known</b>	244	317	26	258	94	-
<b>No. of restricted range species (&lt; 5 forest)</b>	12	51	-	29	12	-
<b>Species unique for the forests (list)</b>	<i>Euphorbia grantii</i> <i>Heisteria parvifolia</i> <i>Pseudagrost istachys</i> <i>Ugandensis</i>	African Pygmy Goose Papyrus Canary	-	<i>Belenois theuszi</i> <i>Mylothris kiwuensis</i> <i>Ypthima granulosa</i> <i>Bebearia phantasiella</i> <i>Eagris nottoana</i> <i>Gorgyra bibulus</i> <i>Andronymus helles</i>	<i>Temnora ratrayi</i>	14 species
<b>Uganda endemics</b>	None	None	none	None	none	None
<b>Albertine Rift endemics</b>	None	White-collard Olive back	none	Mylothris kiwuensis	none	2 species
<b>Species diversity (score &amp; rank)</b>	7.2(14=)	5.5(38=)	5.8(36=)	7.2(14)	8.1(4)	6.9(13=)
<b>Species rarity value (score and rank)</b>	7.4(22=)	6.8(12=)	5.1(29=)	5.6(14=)	7.1(10=)	6.8(16=)
<b>Biodiversity Importance Value</b>						13.7(14=)

Overall biodiversity score = 13.9

**9 Principle reference material:**

1. Howard, P.C. (1991). Nature Conservation in Uganda's Tropical Forest Reserves. IUCN, Gland, Switzerland.
2. Langdale-Brown, I., Osmaston, H.A and Wilson, J.G (1964). The Vegetation of Uganda and its bearing on Land-use. Uganda Government Printer, Entebbe.
3. Uganda Forest Department (1954). Working Plan for the Sango Bay Forest Reserve (1955-65). Forest Department, Kampala, Uganda.
4. Uganda Forest Department (1996). Biodiversity Report Series No. 20; Sango Bay Forest Reserves. Forest Department, Kampala, Uganda.



## APPENDIX 22: MORUNGOLE FOREST PROFILE

(Category: SECONDARY conservation forest)

### 1 Basis for selection

The forest was selected for Nature Reserve establishment in recognition of its biodiversity importance, especially because:

- it supports 10 species (8 trees/shrubs and 2 butterflies) found in no other protected area in Uganda, putting it in the top 10% of sites for trees and shrubs in Uganda.
- it supports 2 species of birds, one mammal, 3 species of butterflies and one large moth that are of conservation concern on account of being endemic to the Somali-Maasai region.
- it has considerable water catchment value, supplying a number of permanent and seasonal streams to the arid savanna in Dodoth County.

### 2 Physical description

**Area and demarcation:** The area of the reserve is 151 km<sup>2</sup>; and the total boundary length, 68 km, of which approximately 43 km adjoins rural community lands, and 25 km lies within Kidepo Valley National Park to the north. Demarcation of the boundaries was by intervisible stone cairns 2 m high and about 1 km apart with stone barrows on either side, aligned to indicate the direction of the neighbouring cairns.

**Established:** 1940

**Location:** Morongole lies in the north-eastern corner of Uganda, within Dodoth county in Kotido District between 03°47' -03°53' N and 33°48' -34°05' E. It is covered by Uganda Department of Lands and Surveys map sheets 9/2 and 10/1 (Series Y 732) at 1:50,000.

**Physical features:** Morongole Forest Reserve occupies a continuous ridge running from Mt. Morongole in the east to the Taan hills in the west with an altitudinal range of 1140-2749 m, with 87% exceeding 15° slope.

The ridge is narrow and there are few major rivers passing through the boundary. Large valleys running into the hills are not a prominent feature. Much of the ridge top consists of rocky outcrops with rather smooth and rounded forms, such as Kawalakol.

### 3 Vegetation and forest condition

The majority of the area (101 km<sup>2</sup>, 66%) is occupied by grassland savanna; classified as types N8 and P1 (*Combretum-Acacia-Themeda*, 95 km<sup>2</sup>, and *Acacia-Cymbopogon-Themeda* complex, 6 km<sup>2</sup>). The remainder (50 km<sup>2</sup>, 34%) comprises *Juniperus-Podocarpus* Dry Montane Forest (25 km<sup>2</sup>) and Forest/Savanna mosaic at High altitudes (25 km<sup>2</sup>) (Langdale-Brown et al., 1964).

The forest is largely intact (overall condition score 4), mainly because of the steepness and ruggedness of the terrain which limits access to the peripheral parts of the reserve and valleys between hills.

There has been no commercial use of the forest and the neighbouring communities only use the forest on a subsistence basis (for fuelwood, poles, food and grazing). Hunting (especially in the southern part) and fires are common during the dry season.

**Forest integrity scores:** Settlement = 1, Cultivation = 1; Hunting = 2; Livestock = 1; Timber = 0; Fire = 1; Community use = 1; Mining = 0 (see Appendix 4 for explanation).

## 4 Economic importance

**Community use values:** The forest is situated in a sparsely populated part of the country (37 people per km<sup>2</sup> in 1991), and the northern half of the reserve lies within Kidepo Valley National Park, so apart from the southern peripheral areas and a few valleys to the south, much of the reserve is inaccessible and there is little pressure from local communities, giving a community-use value of 1.2 (see Appendix 3 for explanation).

**Timber production:** Morongole Forest Reserve is unsuitable for timber production since there are no merchantable timber tree species. There are no registered pitsawyers in the reserve.

**Other economic values:** Morongole Forest Reserve is partly within Kidepo Valley National Park and can therefore be of value for tourism due to the panoramic scenery of its hills and ridges. The forest has considerable water catchment value, supplying a number of permanent and seasonal streams to the dry savanna below.

## 5 Biodiversity values

Of the 65 forests investigated for biodiversity, Morongole ranks twenty-seventh in overall importance, with a score of 12.9 (chapter 3, Table 3.1). It is the thirty-third forest in terms of species diversity and ranks tenth in terms of the 'rarity' value of the species represented.

Morongole supports 10 species found in no other Ugandan forest (8 trees/shrubs and two butterflies) (Table 22.3). It is in the top 10% of sites for trees and shrubs and above average for birds.

## 6 Present management

Morongole forest reserve is managed from the Kotido District Forest office and the local offices at Kaabong and Karenga. There is One Forest Ranger (stationed at Kaabong and incharge of the whole of Dodoth county) and One Forest Guard (stationed at Karenga) who is also in-charge of Nyangea Forest Reserve. Both the Forest Ranger and the Forest Guard stay 40 km away from the reserve. And while the Forest Ranger (at Kaabong) stays in a dilapidated government house, the Guard at Karenga lives in his personal house. There is no official means of transport for these staff. There are no motorable tracks within the reserve, and vehicular access to near the reserve boundary is only possible at Kawalakol and Uthake. The latest Working Plan covers the period 1.1.64 to 31.12.73 and prescribes for the protection of the water catchments of the rivers rising within the reserve and sustaining the permanent settlement around its boundary. Effective management and protection of this reserve from illegal activities like agricultural encroachment in the alluvial fans at the mouths of the valleys, overgrazing around the foot of the hills and settlements has not been possible since mid-1970s due to insecurity in the area, lack of funding and staff. The insecurity especially affected the southern fringes of the reserve, which are adjacent to rural settlements. People sought refuge in the hills to avoid armed raiders.

## 7 Proposed zonation

Figure A22.1 shows Morongole Forest Reserve with one Strict Nature Reserve (approximately 30 km<sup>2</sup>), one Wildlife Protection (buffer) Zone (approximately 63 km<sup>2</sup>) and one Production Zone (approximately 58 km<sup>2</sup>).

The proposed Morongole Strict Nature Reserve (30 km<sup>2</sup>) has been selected to:

- protect the high altitude forest.
- Include that part of the reserve which also falls inside Kidepo Valley National Park.

The proposed Wildlife Protection (buffer) Zone (63 km<sup>2</sup>) covers the northern part of the reserve which is under dual management and has steep slopes to provide a natural and valuable buffer for the park. It also covers areas of steep land adjacent to the Strict Nature Reserve and are generally inaccessible but enhance the long term protection and viability of the Strict Nature Reserve.

The proposed Production Zone covers the gently sloping lower slopes and alluvial fans which have been partially encroached upon.

## 8 Proposed management programmes

**Staffing:** The Forest Guard currently stationed at Karenga (approximately 40 km away) cannot effectively manage this reserve. There will be need to recruit one Forest Guard to be incharge of the protection work of this reserve to be stationed at Potipoti (Kawalakol). He will be responsible to the Forest Ranger at Karenga and will be assisted by 8

patrolmen (stationed at Kaikem - 4; and Uthake, 4). There is also need to recruit an Assistant Forest Officer to be in-charge of Morongole and Timu Forest Reserves (Table 22.1).

**Table 22.1 Existing and proposed staff deployment at Morungole**

Station	Existing and proposed No. of staff by category						Remarks
	FO	AFO	FR	FG	PM	Total	
Kotido	1(0)	0(0)	0(0)	0(0)	0(0)	1(0)	
Karenga	0(0)	0(0)	0(1)	1(0)	0(0)	1(1)	
Potipoti (Kawalakol)	0(0)	0(0)	0(0)	0(1)	0(0)	0(1)	
Kaabong	0(0)	0(0)	1(0)	0(0)	0(4)	1(5)	
Kaikem	0(0)	0(0)	0(0)	0(0)	0(4)	0(0)	
Uthake	0(0)	0(0)	0(0)	0(0)	0(4)	0(4)	
<b>Total</b>	<b>1(0)</b>	<b>0(1)</b>	<b>1(1)</b>	<b>1(1)</b>	<b>0(8)</b>	<b>3(11)</b>	

Note: Nos. in brackets indicate proposed staffing, FO = Forest Officer; AFO= Assistant Forest Officer; FR = Forest Ranger; FG = Forest Guard; PM = Patrolmen

**Infrastructure:** Two semi-detached houses will be constructed at Karenga and Kaabong. A Forest Guard's house will be constructed at Potipoti, and two patrol huts capable of accommodating a patrol team of four men each should be constructed at Kaikem and Uthake, respectively (Table 22.2).

**Table 22.2 Existing and proposed staff housing at Morungole**

Station	Existing and proposed staff housing at Morungole					Remarks
	FD Detached	FD semi Detached	FD Uniport/hut	Private	Total	
Kotido	0(0)	0(0)	0(0)	0(0)	0(0)	The house at Kaabong is dilapidated.
Karenga	0(0)	0(1)	0(0)	1(0)	1(1)	
Potipoti (Kawalakol)	0(1)	0(0)	0(0)	0(0)	0(1)	
Kaalang	0(0)	0(1)	0(0)	0(0)	0(1)	
Kaikem	0(0)	0(0)	0(1)	0(0)	0(1)	
Uthake	0(0)	0(0)	0(1)	0(0)	0(1)	
<b>Total</b>	<b>0(1)</b>	<b>0(2)</b>	<b>0(2)</b>	<b>0(1)</b>	<b>1(5)</b>	

Note: Nos. in brackets indicate proposed staff housing units

**Demarcation:** The entire 68 km of external boundary needs resurveying and redemarcation although priority should be given to the 43 km that adjoins rural community lands since the remainder also lies within Kidepo Valley National Park. The demarcation can be done with both intervisible stone cairns and corner beacons with directional trenches along the cutline. Live marker trees should also be planted along the cutline at 30 m intervals.

**Patrol and protection activities:** Two patrol teams each comprising 4 men will be constituted and will be based at Kaikem, and Uthake. Patrols will be carried out in conjunction with the park authorities, especially in areas overlapping the Park. Protection will be done through community education and ranger patrols.

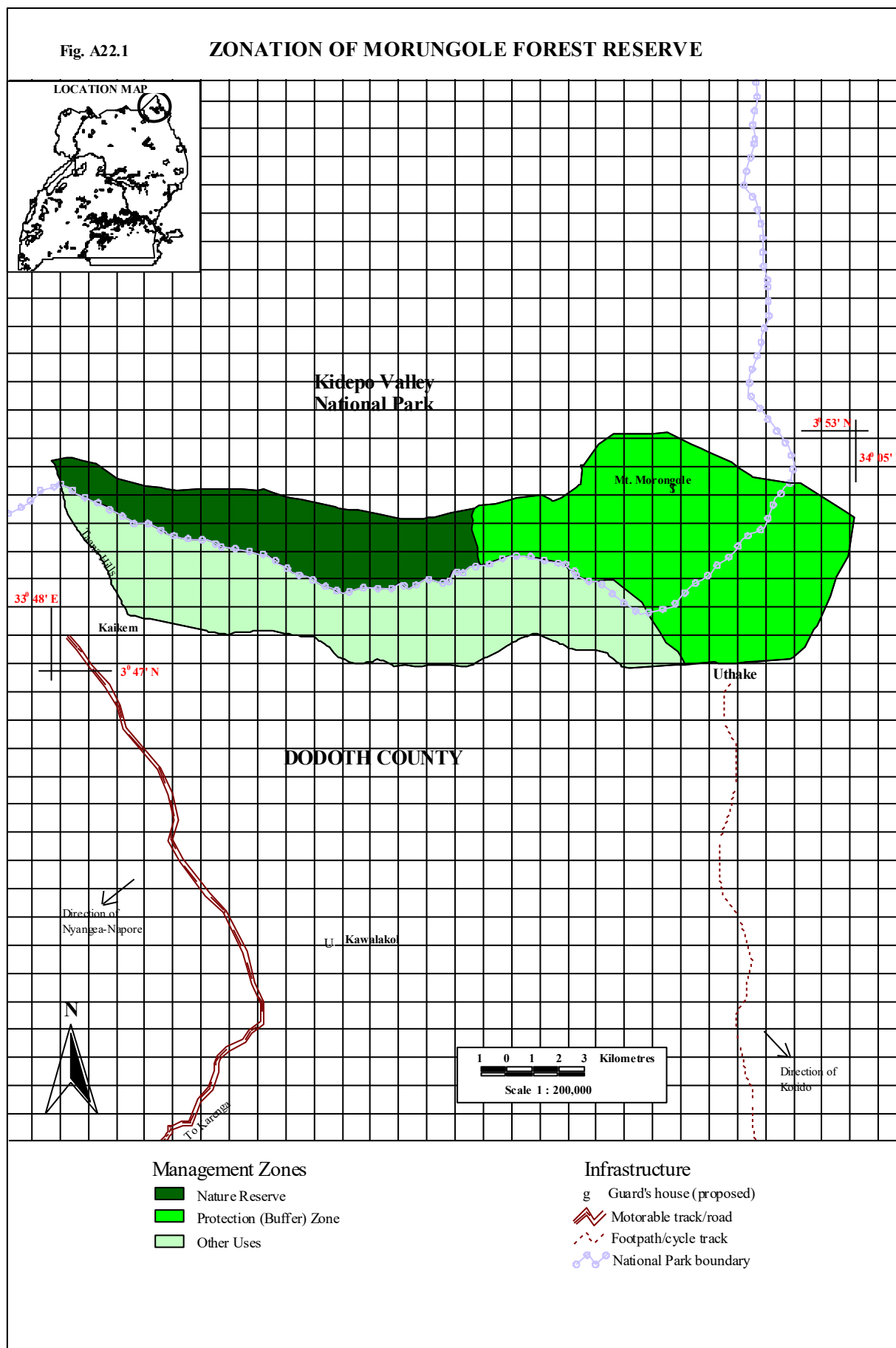
**Public access and community needs:** There will be a need to carry out community education and participation programmes in the surrounding areas to avoid alienating the communities and to look for alternative sources of forest produce e.g. woodlots outside the reserve. The Forest Ranger should be provided with a motorcycle and the Forest Guard with a bicycle to facilitate their work.

**Table 22.1 Summary table of biodiversity values for Morungole**

Criterion	Trees & Shrubs	Birds	Mammals	Butterflies	Moths	Overall
<b>Total No. of species known</b>	191	96	12	77	16	
<b>No. of restricted range species (<math>\leq 5</math> forests)</b>	31	9	1	8	2	
<b>Species unique to forest (list)</b>	<i>Aloe wrefordii</i> <i>Berberis holstii</i> <i>Crotalaria natalitia</i> <i>Ectadiopsis oblongifolia</i> <i>Loranthus dschellensis</i> <i>Loranthus ugogensis</i> <i>Pavetta abyssinca</i> <i>Tephrosia aequilata</i>			<i>Colotis rogersi</i> <i>Anthene contrastata</i>		10 spp
<b>Uganda endemics (list)</b>	-	-	-	-	-	
<b>Albertine Rift endemics (list)</b>	-	-	-	-	-	
<b>Species diversity (score &amp; rank)</b>	7(17=)	4.3(50=)	5.5(38=)	6.3(37=)	3.7(43=)	5.7(33=)
<b>Species rarity value (score &amp; rank)</b>	8.6(5=)	7.5(8=)	5.1(29=)	5(25=)	5.9(29=)	7.2(10=)
<b>Biodiversity Importance Value (score &amp; rank)</b>						12.9(27)
Overall biodiversity score = 13.2						

## 9 Principle reference material

1. Langdale-Brown, I., Osmaston, H.A and Wilson, J.G. (1964). The Vegetation of Uganda and its bearing on Land Use. Government Printer, Entebbe.
2. Uganda Forest Department (1963). Working Plan for the North Karamoja Central Forest Reserves. Forest Department, Kampala, Uganda.
3. Uganda Forest Department (1996). Biodiversity Report Series No. 21; Morungole, Timu and Lwala forest reserves. Forest Department, Kampala, Uganda.





**APPENDIX 23: TIMU FOREST PROFILE**

(Category: SECONDARY conservation forest)

**1 Basis for selection**

This forest was selected for Nature Reserve establishment in recognition of its biodiversity importance, especially because:

- it supports 11 species found in no other Uganda forest (6 trees and 5 Somali-Maasai endemic butterflies (see Table 23.1).
- it is perched on the edge of the rift escarpment some 1000 m higher than the rift valley floor forming an important water catchment for the lowland areas.
- it supports 38 species; (17 of trees, 4 birds and 17 species of butterflies) that occur in five or less other Ugandan forests.

**2 Physical description**

**Area and demarcation:** The area of the reserve is 118 km<sup>2</sup>, and its total boundary length 43 km, all of which adjoins rural community lands. The boundary is artificial with stone cairns and directional trenches on either side.

**Establishment:** 1942

**Location:** Timu lies within Dodoth county in Kotido District on the edge of the rift escarpment overlooking the Turkana region across in Kenya. The forest lies between 03°32'-03°40'N and 34°16'-34°23'E, covered by Uganda Department of Lands and Surveys map sheet 10/4 (Series Y732) at 1:50,000.

**Physical features:** The reserve occupies an area which is shaped like a tilted saucer with the highest part of the rim to the north-east and the lowest to the southwest, where the rim is broken by the Nomoru river. Its altitude ranges from 1700-2020m above sea level, with 4% exceeding a 15° slope. The land rises gently and then more steeply from the south west by narrow, steep-sided 'fingers', and land dividing the many tributaries of the main river Nomoru.

**3 Vegetation and forest condition**

59 km<sup>2</sup> (50%) of Timu is covered with High Altitude forest classified as type B3 (*Juniperus-Podocarpus* Dry Montane Forest) and the remaining area (59 km<sup>2</sup>, 50%) comprises of Dry *Combretum* Savanna, type N11 (*Acacia-Combretum* Langdale-Brown, et al., 1994).

The forest is partially degraded (overall condition score 3) as a result of rapidly increasing agricultural encroachment in the western part of the reserve. There are also settlements by one of the mountain tribes (the Ik, Teuso) on the edge of the escarpment. They carry out shifting cultivation along the slopes. Seasonal grazing of livestock by the Turkana of Kenya during the dry season is common. Hunting of wild game within the reserve by the Ik and armed Karamojong is widespread. Fires are frequent during the dry season.

**Forest integrity scores:** Settlement = 1; Cultivation = 2; Hunting = 1; Livestock = 2; Timber = 0; Fire = 2; Community use = 1; Mining = 0 (see Appendix 4 for explanation).

**4 Economic importance**

**Community use values:** The forest is situated in a sparsely populated part of the country (19 people per km<sup>2</sup> in 1991), so pressure on the forest for firewood, building poles and non-timber forest products is correspondingly low. However, with the improvement in security between the Turkana and the Karamojong, the forest is under considerable threat from encroachment (cultivation). Most parts of the reserve are accessible due to the gentle slopes, and the reserve also serves as dry season grazing land.

Presently the forest has a 'Community use' value of 0.5 (see Appendix 3 for explanation).

**Timber production:** Apart from a few *Juniperus* trees on the higher altitude areas, this reserve does not have suitable timber trees. Since this is a watershed protection reserve, it is unsuitable for timber production. There are no pitsawyers in the reserve.

## 5 Biodiversity values

Of the 65 forests investigated for biodiversity, Timu ranks 37th in overall importance, with a score of 12.1. It ranks fifty-first in terms of species diversity and eighteenth in terms of the 'rarity' value of the species represented. The forest supports eleven species found in no other Ugandan forest (6 trees and 5 Somali-Maasai endemic butterflies) (see Table 23.3). Timu is a very important water catchment because it is perched on the edge of the rift escarpment overlooking Turkana in northern Kenya, some 1000m higher than the rift valley floor.

## 6 Present management

The reserve is managed from the Kotido District Forest Office and the local office at Kaabong (about 40km away). There is a Forest Ranger and a Forest Guard (both stationed at Kaabong) (Table 23.1). The Ranger is in charge of Dodoth county (Nyangea-Napore, Zulia, Morungole and Lwala Forest Reserves). The department has no houses within or near the reserve. There is no departmental transport for the staff. A dry weather from Kaabong passes through the forest to Lopedo and Loyoro along the ridge of the escarpment.

The latest Working Plan covers the period 1.1.64 to 31.12.73 and prescribes the protection of the water catchments of the rivers arising from within the reserve and sustaining the permanent settlement along the boundaries. Protection also serves to increase the percolation of the rainfall into the soil and reduces the intensity of flash floods from the reserve.

## 7 Proposed zonation

Figure A23.1 shows the proposed zonation of the reserve with one Strict Nature Reserve (approximately 25 km<sup>2</sup>) and one protection zone (approximately 8 km<sup>2</sup>).

The proposed Strict Nature Reserve (25 km<sup>2</sup>) has been selected to:

- encompass the widest possible range of altitude, from 1720-2000m, which includes as many forest/vegetation types and habitats as possible.
- cover the area of the forest centrally-located and least affected by human activity.

The proposed protection (buffer) zone covers areas of relatively steep land lying between the proposed Strict Nature Reserve and the rift escarpment to the east and north-east which can be exposed to erosion. This will also serve to enhance the long-term viability of the Strict Nature Reserve.

Since Timu is basically a protection forest for a watershed in an area of dry mountain and hill savanna, the production zone will be for establishment of a plantation to meet the requirements of the surrounding communities.

## 8 Proposed management programmes

**Staffing:** The present staff are stationed very far away from the reserve (in Kaabong) and therefore there is no effective protection of the forest from illegal activities. There will need to be two Forest Guards specifically for this reserve to be stationed at Lokinene (A), and Kanatsep (B), (see map), respectively (Table 23.1). These Guards will be responsible to the Assistant Forest Officer and Forest Ranger at Kaabong.

**Table 23.1 Existing and proposed staff deployment at Morongole**

Station	Existing and proposed No. of staff by category						Remarks
	FO	AFO	FR	FG	PM	Total	
Kaabong	0(0)	0(1)	1(0)	1( )	0(0)	2(1)	
Lokinene	0(0)	0(0)	0(0)	0(1)	0(0)	0(1)	
Kanathep	0(0)	0(0)	0(0)	0(1)	0(0)	0(1)	
Kotido	1(0)	0(0)	0(0)	0(0)	0(0)	1(0)	
Kanadap	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	
<b>Total</b>	<b>1(0)</b>	<b>0(1)</b>	<b>1(0)</b>	<b>1(2)</b>	<b>0(0)</b>	<b>3(3)</b>	

Note: Nos. in brackets indicate proposed staffing, FO = Forest Officer; AFO = Assistant Forest Officer; FR = Forest Ranger; FG = Forest Guard; PM = Patrolmen

**Infrastructure:** One duplex house should be constructed for the Assistant Forest Officer and Forest Ranger at Kaabong. Two Guards' houses are necessary at Lokinene (1) and Kanathep (1). One Patrol hut, capable of accommodating a patrol team of five men should be constructed at Kanadap, for overnight use by the patrol teams (Table 23.2).

**Table 23.2 Existing and proposed staff housing at Timu**

Station	Existing and proposed staff housing					Remarks
	FD Detached	FD semi Detached	FD uniport Hut	Private	Total	
Kaabong	0(0)	0(1)	0(0)	0(0)	0(1)	
Lokinene	0(1)	0(0)	0(0)	0(0)	0(1)	
Kanathep	0(1)	0(0)	0(0)	0(0)	0(1)	
Kotido	0(1)	0(0)	0(0)	0(0)	0(1)	
Kanadap	0(0)	0(0)	0(1)	0(0)	0(1)	
<b>Total</b>	<b>0(3)</b>	<b>0(1)</b>	<b>0(1)</b>	<b>0(0)</b>	<b>0(5)</b>	

Note: Nos. in brackets indicate proposed staff housing units.

**Demarcation:** The entire 43 km of external boundary, which has not been maintained for many years, should be resurveyed and redemarcated with corner beacons or stone corner cairns with directional trenches, and the cutline planted with appropriate live marker trees at 30 m intervals.

**Patrol and protection activities:** Two patrol teams each comprising one Forest Guard and four patrolmen will be constituted. The northern team will be responsible for patrolling the northern part of the reserve while the other team will patrol the southern part.

**Public access and community needs:** The presence of forest extension staff in the communities around Timu has been limited, but with the improvement in security the forest staff (Assistant Forest Officer, Forest Ranger and Forest Guards) will carry out community education to inform the population about the dangers of fire to the ecosystem and biodiversity conservation as a whole. They will also carry out planting in the production zone as well as encourage community planting outside the reserve.

A socio-economic assessment of the needs of the Ik people (Teuso) who are living on the edge of the escarpment (and inside Timu) would be of value if Timu is to be managed appropriately.

The Assistant Forest Officer and Forest Ranger at Kaabong should be provided with motorcycles while the two Forest Guards should be given a bicycle each, to enable them carry out protection and community extension work.

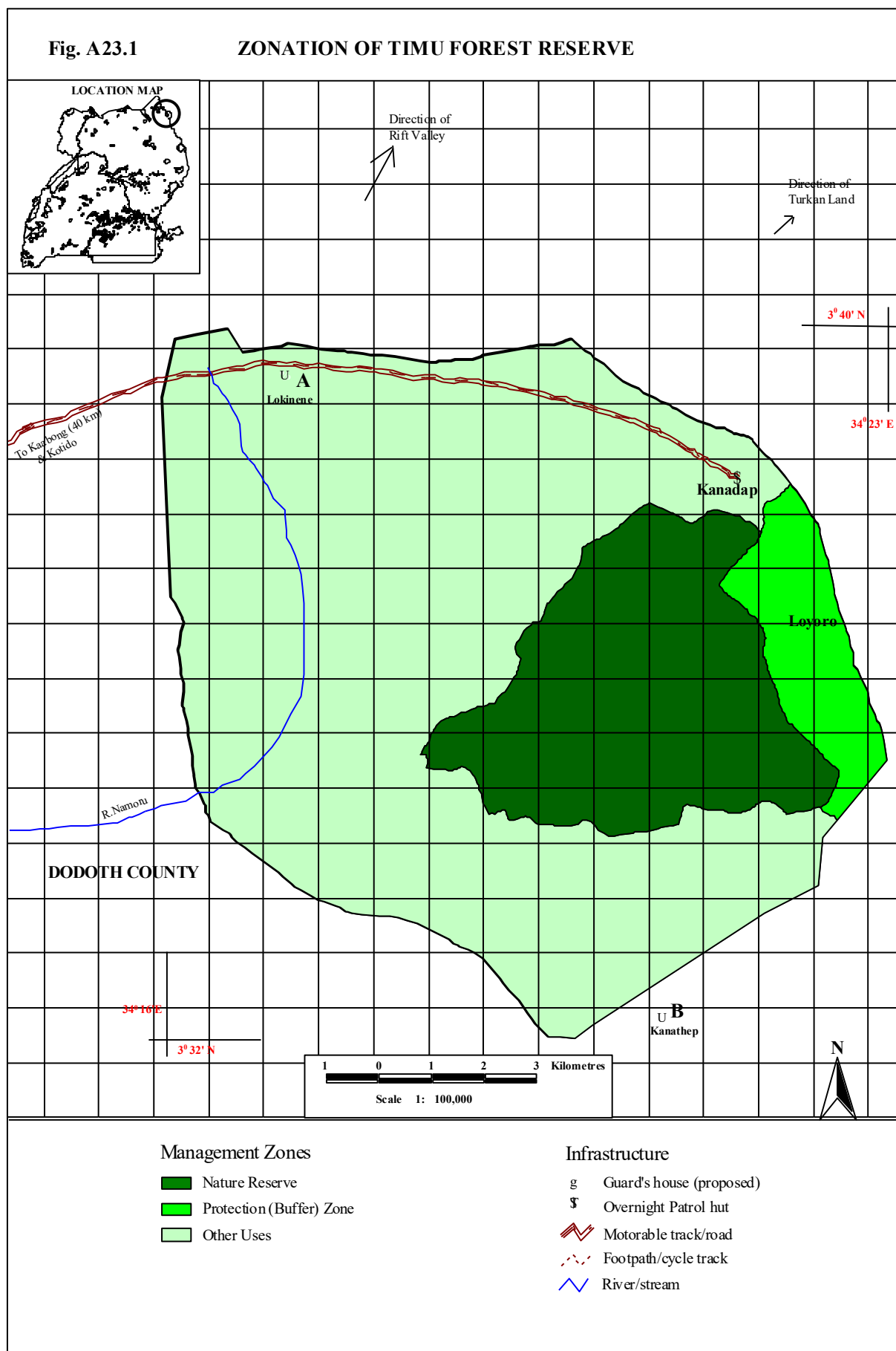
**Table 23.3 Summary table of biodiversity values for Timu**

Criterion	Trees & Shrubs	Birds	Mammals	Butterflies	Moths	Overall
<b>Total No. of species known</b>	166	68	12	77	10	
<b>No. or restricted-range species (<math>\leq 5</math> forests)</b>	17	4	0	17	0	
<b>Species unique to forest (list)</b>	<i>Acokanthera friesiorum</i> <i>Aloe lateritia</i> <i>Aloe wilsonii</i> <i>Pistacia aethiopica</i> <i>Pittosporum lanatum</i> <i>Viscum tuberculatum</i>	None	None	<i>Colotis amata</i> <i>Leptomyrina gorgias</i> <i>Acraea equatorialis</i> <i>Acraea pudorina</i> <i>Gegenes pumilio</i>	None	11 spp
<b>Uganda endemics (list)</b>	None	None	None	None	None	-
<b>Albertine Rift endemics (list)</b>	None	None	None	None	None	-
<b>Species diversity (score and rank)</b>	6.1(32=)	4.2(51=)	4.8(52=)	6.2(38=)	3.8(42=)	5.1(51=)
<b>Species rarity value (score and rank)</b>	8.2(19=)	5.8(25=)	4.2(48=)	6(9=)	4.5(47=)	6.7(18=)

Overall Biodiversity Importance: 12.1

## 9 Principle reference material

1. Langdale-Brown, I., Osmaston, H.A. and Wilson, J.G. (1964). The Vegetation of Uganda and its bearing on Land Use. Uganda Government Printer, Entebbe.
2. Uganda Forest Department (1963). Working Plan for North Karamoja Forest Reserves. Forest Department, Kampala, Uganda.
3. Uganda Forest Department (1996). Biodiversity Report Series No. 21; Morungole, Lwala and Timu forest reserves. Forest Department, Kampala, Uganda.



## APPENDIX 24: ROM FOREST PROFILE

(Category: SECONDARY conservation forest)

### 1 Basis for selection

Rom forest reserve was selected for Nature Reserve establishment in recognition of its biodiversity importance and especially because:

- it supports 3 unique tree species of conservation significance and which are broadly endemic.
- it supports two tree species endemic to the Albertine Rift Region.
- it supports 30 restricted-range species, 17 of trees, 12 of butterflies and 1 bird species.

### 2 Physical description

**Area and demarcation:** The reserve has an area of 109 km<sup>2</sup>, and a total boundary length of 41 km, all of which is entirely surrounded by local community lands. 35 km of boundary is a cutline and 6 km follows a river in the eastern part of the reserve.

**Establishment:** 1937

**Location:** Rom lies in Chua County in Kitgum District in Northern Uganda between 33°32' - 33°43' E and 3°19' - 3°28' N and is covered by Uganda Lands and Surveys Department Map Sheet 17/1 series Y732 at 1:50,000.

**Physical Features:** The reserve is centred around an ancient inselberg with Rom as the highest peak; its altitudinal range is 1180-2382 m above sea level, and 74% of the reserve has slopes exceeding 15°.

### 3 Vegetation and forest condition

The majority of the reserve (90 km<sup>2</sup>, 82%) is occupied by Dry *Combretum* savanna, classified as type N8 (*Combretum-Acacia-Themeda*). The remainder (19 km<sup>2</sup>, 18%) comprises of high altitude forest classified as B4 (*Arundinaria* montane bamboo forest) which occurs at the higher altitudes (Langdale-Brown et. al., 1964).

The reserve is generally intact (overall condition score 4) due to the low population density. No timber production is evident but some agricultural encroachment exists. Hunting is evident but not widespread. No mining is done in the reserve.

**Forest integrity score:** Settlement = 2; Cultivation = 1, Hunting = 1, Livestock = 1, Timber = 0, Fire = 3, Community = 1 and Mining = 0 (see appendix 4 for explanation).

### 4 Economic importance

**Community use values:** The forest is situated in a sparsely populated area (9 people/km<sup>2</sup>, 1991). Therefore not much pressure is exerted on it and there is limited use of forest resources by local communities, giving a "Community Use" Value of 0.2 (see appendix 3 for explanation).

**Timber production:** The forest is not important for timber production although an inventory in the 1970s (Lockwood Consultants) provided an estimate of 5m<sup>3</sup>/ha stand volume of merchantable timber exceeding 50 cm dbh. However, the reserve has high potential (score 3) for plantation establishment.

**Other economic values:** The reserve has no or little other significant complimentary values like tourism and recreation but plays a big role in watershed protection. It does not offer much scope for educational and research roles.

## 5 Biodiversity values

Of the 65 forests investigated for biodiversity, Rom ranks the twenty-third in overall importance with a score of 12.3 but ranks seventh in species diversity (score 6.1) and eighteenth in species “rarity” value (score 6.1) (see Chapter 3, Table 3.5 for explanation).

It has thirty restricted range species (17 trees, one bird and 12 butterflies), three tree species which are unique to the forest and two tree species which are Albertine Rift Endemics (see Table 24.3).

## 6 Present management

The reserve is managed from the Kitgum District Forest offices 65 km away. Work in the reserve is coordinated by a Forest Guard located at Rom Trading centre who is supervised by the Forest Ranger for Chua County.

**Table 24.1 Existing and proposed staff deployment at Rom**

Station	Existing and proposed No. of staff deployment at Rom					Total Remarks
	FO	AFO	FR	FG	PM	
Kitgum	1(0)	0(0)	0(0)	0(0)	0(0)	1(0) Also DFO
Chua Hqrs.	0(0)	0(0)	1(1)	0(0)	0(1)	1(2) Ranger for the County
Rom	0(0)	0(0)	0(0)	1(1)	0(1)	1(2)
<b>Total</b>	<b>1(0)</b>	<b>0(0)</b>	<b>1(1)</b>	<b>1(1)</b>	<b>0(2)</b>	<b>3(4)</b>

Note: FO = Forest Officer; AFO = Assistant Forest Officer; FR = Forest Ranger;  
FG = Forest Guard; PM = Patrol man, Nos. in brackets indicate proposed additional staff

**Table 24.2 Existing and proposed staff housing at Rom**

Station	FD detach	FD semi-Detached	FD uniport	Private	Totals	Remarks
Kitgum	1(0)	0(0)	0(0)	0(0)	1(0)	Private house is for a Patrolman.
Chua hqrs	0(1)	0(0)	0(0)	0(0)	0(1)	
Rom	0(0)	0(2)	0(0)	0(1)	0(2)	
<b>Total</b>	<b>1(1)</b>	<b>0(2)</b>	<b>0(0)</b>	<b>0(1)</b>	<b>1(4)</b>	

Note: Nos. in brackets indicate proposed staff housing units.

The reserve is accessible by the all weather road from Kitgum to Kabong and a motorable track to Orom trading centre in the West.

Not much attention has been paid to the reserve of recent due to insecurity. However, the EC-funded Natural Forest Management and Conservation Project has initiated opening of boundaries and sinking of corner beacons.

## 7 Proposed zonation

Figure A24.1 shows the proposed zonation of the reserve with a Nature Reserve (approximately 18 km<sup>2</sup>) and the rest as a production zone and community use zone (approximately 91 km<sup>2</sup>).

The proposed Strict Nature Reserve has been selected to:

- encompass a centrally-located and least accessible part of the reserve where it provides a high degree of inherent protection.
- cover an area of the reserve that is known to support species of conservation interest.
- be a single area of a compact shape to minimize the ratio of the boundary to protected area.

The proposed protection (Buffer Zone) area covers the rest of the reserve (with slope exceeding 15% but below 25%) that is easily accessible.

The proposed production zone will cover the remaining flat areas with slopes of less than 15%, where the community needs for poles and fuelwood can be met easily.

## **8 Proposed management programmes**

**Staffing:** The reserve will continue to be managed by the DFO Kitgum; 2 Forest Rangers at Chua and 2 Forest Guards based at Rom trading centre, but the Forest Rangers should be availed motorcycles for easy movement (see Table 24.1).

**Infrastructure:** A ranger's house should be constructed at Chua County hqs. and a Guard's house (semi detached) at Rom trading centre (see Table 24.2).

**Demarcation:** 44 km of the external boundary should be reopened and demarcated using beacons and live-markers while the internal boundary of the Strict Nature Reserve should be marked by ring-painting major features such as rock outcrops and trees in the standard way.

**Patrols and protection activities:** Two patrol teams should be established, each headed by a Forest Guard to be based at the south-east and north-west beats (see Fig. A24.1).

**Public access and community needs:** The Forest Rangers and Guards, under close supervision of the DFO should initiate a community outreach programme, intended to create awareness and community education about the management of the reserve.

For this purpose the rangers should be availed motorcycles, while the Forest Guards should be given bicycles to support their work.



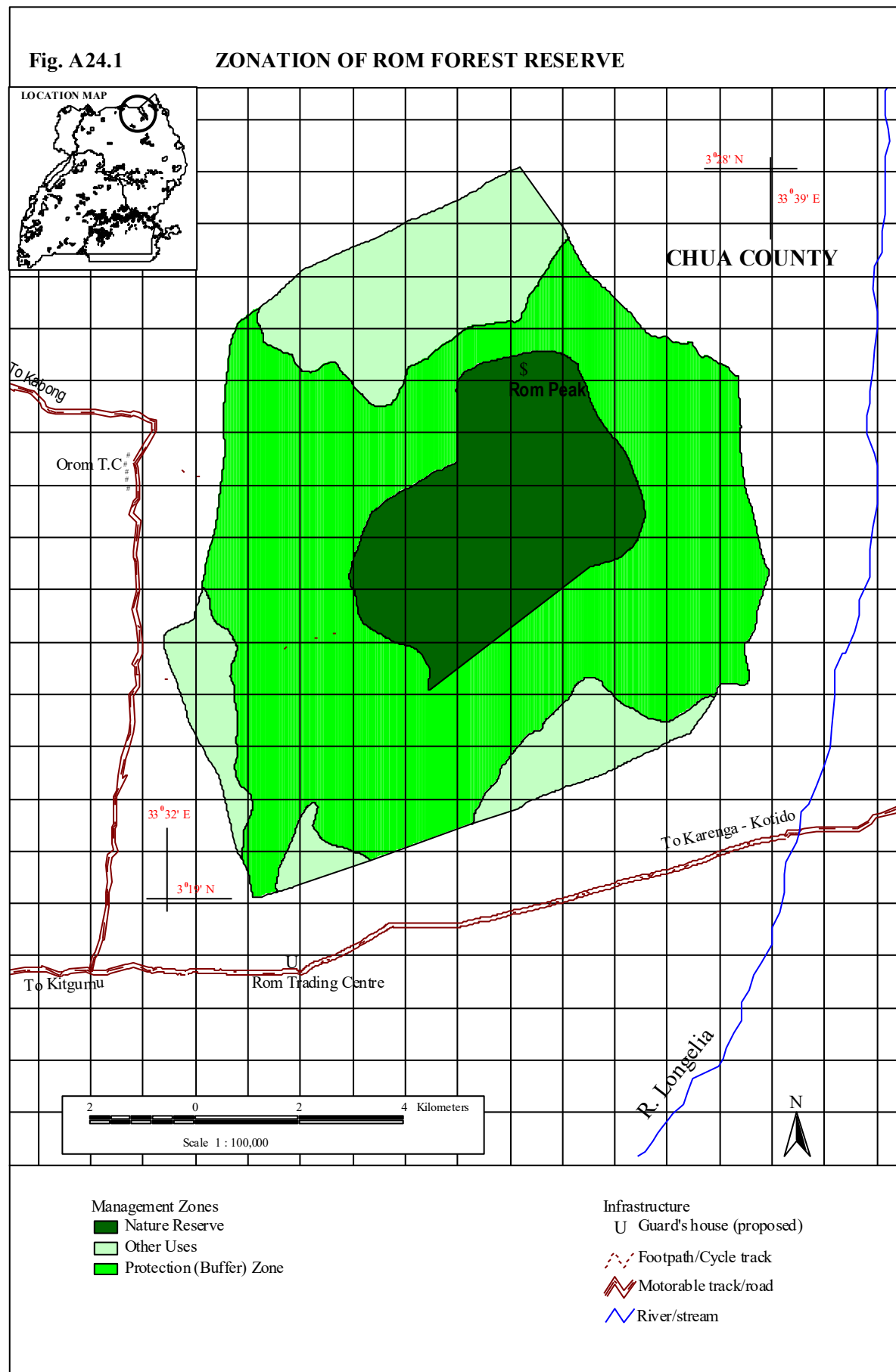
**Table 24.3 Summary of biodiversity values for Rom Forest Reserve**

Criterion	Trees & Shrubs	Birds	Mammals	Butterflies	Moths	Overall
<b>No. of tree species known from forest</b>	212	64	15	109	7	-
<b>No. of restricted range species known from <math>\leq 5</math> forests</b>	17	1	0	12	0	-
<b>Unique to forest list</b>	<i>Boehmeria macrophylla</i> <i>Crotalaria keniensis</i> <i>Turraea fisheri</i>	None	None	none	none	-
<b>Uganda endemics</b>	None	None	None	none	none	-
<b>Albertine Rift Endemics</b>	<i>Grewia pubescens</i> <i>Rytigynia beniensis</i>	None	None	none	none	-
<b>Species Diversity Score and rank</b>	6.6 (18=)	3.9(41)	67(16=)	5.9(31=)	<3.3	6.1(17=)
<b>Species rarity score and rank</b>	7.5(13=)	5.4(18)	4.2(26=)	4.6(18=)	<3.3	6.1(18=)

Overall biodiversity score = 12.2

**9 Principle reference material**

1. Langdale Brown, I., Osmaston, H.A. and Wilson, J.G. (1964). The Vegetation of Uganda and its Bearing on Land Use. Uganda Government Printer, Entebbe.
2. Lockwood Consultants (1973). Resource Development Study for the Republic of Uganda. Lockwood Consultants, Toronto, Canada.
3. Uganda Forestry Department (1996). Biodiversity Report Series No. 8, Nyangea-Napore; Ogili and Rom Forest Reserves. Forest Department, Kampala, Uganda.



**APPENDIX 25: KASAGALA FOREST PROFILE**

( Category: SECONDARY conservation forest)

**1 Basis for selection**

The forest was selected for Nature Reserve establishment in recognition of its biodiversity importance, especially because it supports:

- at least one unique tree species of conservation importance on (Albertine rift endemic).
- vegetation type W2, not otherwise represented in the Protected Area system of Uganda.

**2 Physical description**

**Area and demarcation:** The Forest Reserve covers 103 km<sup>2</sup>, with a total boundary length of 94 km, all of which adjoins rural communities. Of the 94 km of external boundary, 5 km follows the old Kampala-Gulu Road, while 89 km is an artificial boundary maintained as a planted cutline with earth corner cairns and directional trenches.

**Establishment:** As a central forest reserve; 1968.

**Location:** The Forest Reserve lies in Buruli county in the administrative district of Nakasongola, between 0°55' and 1°33' N and 32°00' and 32°35' E, and is covered by Uganda Department of Lands and Surveys map sheets 60/1 and 60/2 (series Y732) at 1:50,000. The forest is bordered on its western side by the Old Kampala-Gulu Road and is interrupted by the Forest Department's Katugo pines plantation.

**Physical features:** 99% of the FR has slopes of less than 5°, making it generally flat, with incisions by shallow inundations which flood in the wet season. Kasagala hills (1,160 m) are an isolated outcrop and form the only elevated part of the forest.

**3 Vegetation and forest condition**

The majority of the area (95 km<sup>2</sup>, 92%) is occupied by woodland savanna, classified as type N1 (*Combretum - Terminalia - Loudetia* savanna), and 8 km<sup>2</sup> (8%) is covered by W2 (*Sorghastrum* Grassland; (Langdale -Brown *et al.*, 1964). W2 is represented by less than 50 km<sup>2</sup> in Uganda's National Parks.

The forest is seriously degraded (overall condition 2) with widespread grazing (there are over 2,500 cattle grazing in the reserve) and cultivation. At least 50% of the area is affected by frequent fires. Settlement around Kyankonwa, Waluli and Kalungu villages is affecting about 30% of the area. The natural vegetation is also being affected by over-exploitation by illegal charcoal burning, especially around the Nakasongola area. Approximately 2000 ha of the plantation is in Katugo Plantations.

**Forest integrity scores:** Settlement = 2; Cultivation = 2; Hunting = 2; Livestock = 3; Timber = 3  
Fire = 4 (see Appendix 4 for explanation).

**4 Economic importance**

The forest is situated in a low density population area (40 people/km<sup>2</sup>). Pressure on the peripheral areas for fuel wood, building poles and non timber forest products is correspondingly low. However, most parts of the reserve are easily accessible by roads, hence opening it up to charcoal burning (which is rampant) by a few individuals working on behalf of businessmen in Kampala.

The communities are also using the forest for bee-keeping, grazing cattle, watering animals and making bricks, a potential that is not completely exploited, giving a community-use value of 2.7 (see Appendix 3 for explanation).

**Timber production:** There is timber production from Katugo plantation.

**Other economic values:** The forest reserve has great potential for plantation forestry, commercial bee farming, legal charcoal burning and legal cattle grazing. The reserve is also of exceptional biological interest (see below).

## 5 Biodiversity value

Of the 65 forests investigated for biodiversity, Kasagala forest ranks 41st in over all importance with a score of 12.0. Although it is a secondary category conservation forest, Kasagala is unique in that it has a limited vegetation type (W2), which is not represented in Uganda's National Parks, and has two species of trees and 1 species of butterfly unique to the forest (see Table 25.3). The forest also houses one species of tree endemic to the Albertine Rift.

## 6 Present management

The reserve is managed from Nakasongola district forest office and a local office at Katugo forest station. The Forest Officer in charge of the Katugo Working Plan Area (which includes Kasagala Forest Reserve) does not visit the Forest Reserve. One Assistant Forest Officer (AFO) for Buruli county and one Forest Guard all based at Katugo are supposed to manage the reserve.

**Table 25.1 Existing and proposed staff deployment at Kasagala**

Station	Existing and proposed number of staff by category					Total
	Forest Officer	Assistant FO	Ranger	F. Guard	Patrolman	
Katugo	1 (0)	1 (0)	0 (0)	2 (0)	0 (6)	4 (6)

Note: Numbers in brackets indicate proposed staffing.

The department has 8 houses (2-3 bedroomed) at Katugo forest station and 1 office (all in good condition) of which 3 houses are occupied by staff working on Kasagala Forest Reserve.

**Table 25.3 Existing and proposed staff housing at Kasagala**

Station	FD detached	FD detached Incomplete	FD semi detached	Uniport	Private	Total
Katugo	3* (0)	0(0)	0(1)	0	0(3)	3(4)
Kyankonoki	0(0)	0(0)	0(1)	0	0(3)	0(4)
<b>Total</b>	<b>3(0)</b>	<b>0(0)</b>	<b>0(2)</b>	<b>0</b>	<b>0(6)</b>	<b>3(8)</b>

Note: Numbers in bracket indicate proposed housing unit(s)

\* denotes houses currently being occupied

The Working Plan Area (including Katugo Plantation) has two vehicles.

Accessing the forest by road is easy as there are networks of feeder roads built in the 1960s, although they become impassable during heavy rains.

A working plan pegged on Katugo Working Plan Area (WPA) expired in 1977, but prescribed development of industrial wood plantations (softwood) in the grassland area.

In recent years (1993-95), with support from the EC-financed Natural Forest Management & Conservation Project, 74 km of the external boundary was resurveyed, re-opened and planted with live markers (sisal, *Maesopsis eminii* and *Dracaena* spp. at 10m intervals) and is well-maintained; 40% of the seedlings survived. 15 km (in the N. East of the reserve) has not been reopened.

## 7 Proposed zonation

Figure A25.1 shows the proposed zonation of the reserve with one Nature Reserve (approximately 21 km<sup>2</sup>), one protection zone (10 km<sup>2</sup>) and one production zone (72 km<sup>2</sup>).

**Proposed Nature Reserve:** The Nature Reserve will occupy the northern section of the forest reserve which is less degraded and supports a vegetation type (W2) poorly represented in the protected area system of Uganda. However, there are 6 households and a dam located within the proposed Nature Reserve. There is a need to relocate the families outside the proposed Nature Reserve.

**Proposed production zone:** This will be the southern portion of the Forest Reserve. The area has great potential for softwood plantation, charcoal burning, bee-keeping and controlled grazing. Currently no revenue is being collected but the potential is there. Legalized charcoal burning would raise 9 million shillings per year; meanwhile licensed cattle grazing (2000 heads) per year at 2,500/- per head would yield 5 million shillings.

## **8 Proposed management programmes**

**Staffing:** Kasagala forest reserve should have its own staff and not be linked to Katugo Plantation development. The following staff are required:

One Assistant Forest Officer stationed at Katugo will be in charge of management and community outreach programmes; with two Forest Guards to be in charge of the Strict Nature Reserve and other Management activities, and, six patrolmen placed all round the Forest Reserve. They will be supervised by the Forest Officer for the Katugo Working Plan Area.

**Infrastructure:** Two Guard houses need to be constructed (see Figure A25.1). Patrolmen will reside in their own houses.

**Boundary demarcation:** 15 km of external boundary remains to be resurveyed and reopened. The internal management zones will be demarcated in a standard way. The southern boundary will follow the swamp. In places where there are no natural features, metallic posts will be erected, preferably at footpath crossings, watering points and other entry points. But more important, the entire forest reserve should be brought under firm Forest Department control, with external boundaries clearly demarcated and planted with live markers.

### **Patrols and protection activities**

The two Forest Guards and the 6 patrolmen will form the core team for patrolling and each will be assigned 15 km of forest boundary to patrol. However, whenever the situation demands, emergency patrols headed by the AFO or the DFO will be instituted. An incentive scheme will be instituted to award for success in curbing illegal activities e.g. payment of safari day allowances.

The AFO needs a motorcycle and Forest Guards and patrolmen need 8 bicycles for effective protection work.

**Public access and community needs:** The AFO based at Katugo will assume responsibility for community outreach programmes; including collaborative management programmes within the forest reserve, and tree-planting and sustainable use of natural resources outside the forest reserve. Through village meetings, the AFO will explain the concept and management objectives of the different zones within the forest reserve to the community.

**Table 25.2 Summary table of biodiversity values for Kasagala**

Criterion	Trees & shrubs	Birds	Mammals	Butterflies	Moths	Overall
<b>Total No. of spp known</b>	164	119	21	76	39	419
<b>No. of restricted range spp (known from <math>\leq 5</math> forests)</b>	9	4	0	2	0	15
<b><i>Spp. unique to the forest</i></b>	<i>Vernonia iodocalyx</i> <i>Viscum bagshawei</i>	none	None	<i>Pilodeudori x caerula</i>	None	3
<b>Uganda endemics (list)</b>	None	none	None	none	None	0
<b>Albertine rift endemic (list)</b>	<i>Grewia pubescens</i>	none	None	none	None	1
<b>Species diversity (score and rank)</b>	5.3(40)	6.8(18=)	6.7(22=)	6.6(30=)	6.5(15=)	5.7(33=)
<b>Species rarity value (score and rank)</b>	7.2(29=)	5.2(34=)	4.8(35)	4(55=)	5.3(38)	6.0(39=)

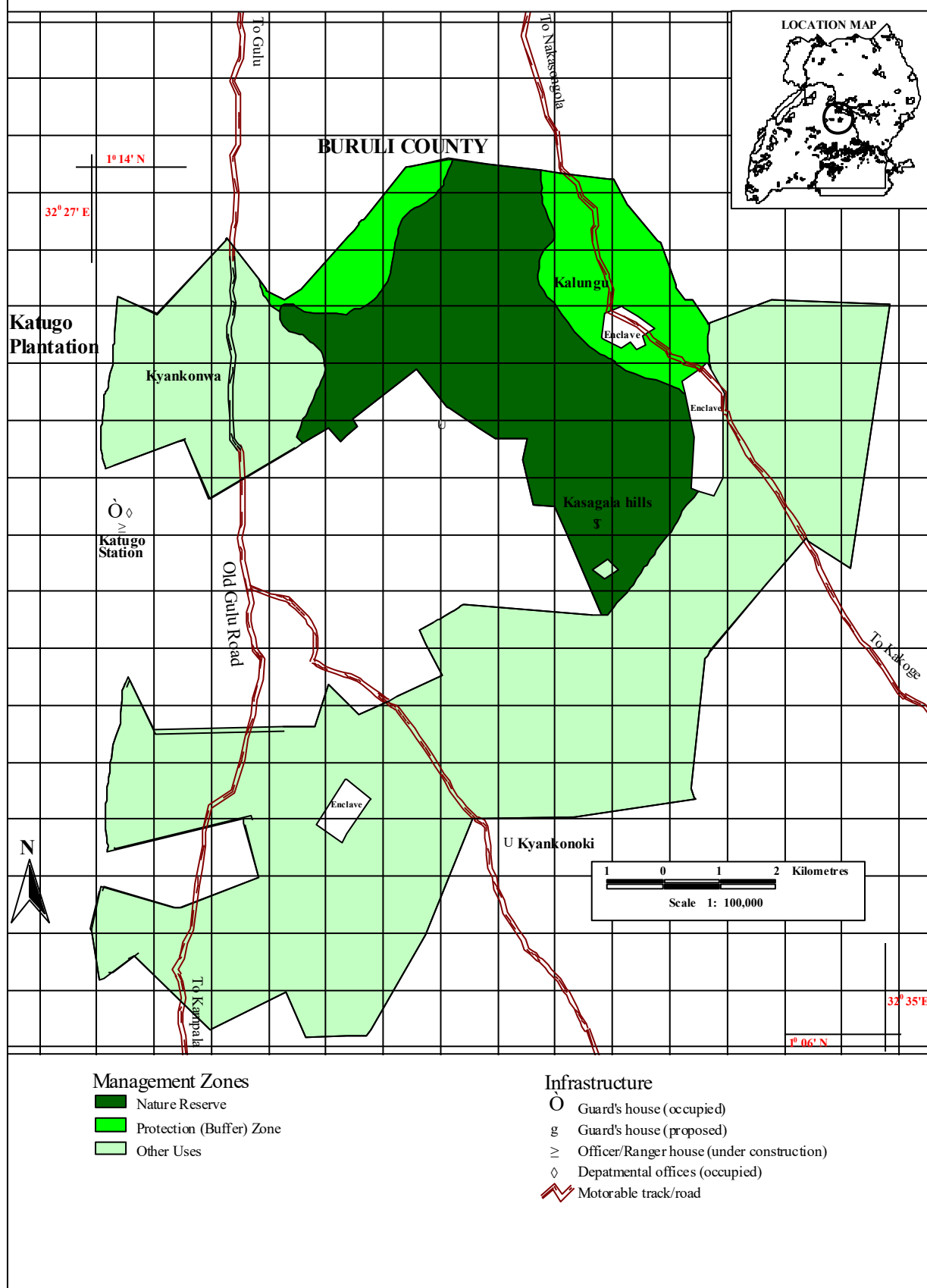
Overall biodiversity score = 12

## 9 Principle reference material

1. Langdale-Brown, I., Osmaston, H.A. and Wilson, J.G. (1964). The vegetation of Uganda and its Bearing on Land-Use. Uganda Government Printer, Entebbe.
2. Uganda Forest Department (1996). Biodiversity Report Series No. 25; Luwero District Forest Reserves. Forest Department, Kamapala, Uganda.

Fig. A25.1

## ZONATION OF KASAGALA FOREST RESERVE



## APPENDIX 26: RWOHO FOREST PROFILE

(Category: SECONDARY conservation forest)

### 1 Basis for selection

The forest was selected for Nature Reserve establishment in recognition of its biodiversity importance, especially because:

- it supports one tree species and three species of butterflies which do not occur anywhere else in Uganda's Protected Area System (see Table 3.5, p.31).
- it supports one species of tree that is of conservation concern on account of being endemic to the Albertine Rift Region (Table 26.3).
- it is representative of a vegetation type (Q4, *Themeda-Chloris* grass savanna) represented only in two other forests in Uganda's Protected Area System.

### 2 Physical Description

**Area and demarcation:** The reserve has an area of 91 km<sup>2</sup>; and a total boundary length 50 km all of which adjoins rural community lands. Of the 50 km of external boundary about 9 km follows streams while 41 km is an artificial boundary maintained as a planted cutline with earth corner cairns and boundary directional trenches.

**Establishment:** 1939

**Location:** On top of a large flat-topped ridge running from North to South, lying between 1°00'–1°12' S and 30°33' and 30°37' E. The forest is shared between Mbarara (Rwampara and Isingiro counties) and Ntungamo (Ruhama county) Districts, and is covered by Uganda Department of Lands and Surveys map sheet 86/3 series Y732 at 1:50,000.

**Physical features:** The ridge drops sharply towards Kabobo valley in the west and descends to the Mishumba valley by a series of parallel ridges running out eastwards. It has an altitudinal range of 1360–1807m with 56% (51 km<sup>2</sup>) exceeding a 15° slope.

### 3 Vegetation and forest condition

The area is occupied by two vegetation communities (Langdale-Brown et al., 1964) classified as types D3 (*Albizia-Markhamia* forest, 45 km<sup>2</sup>: 50%) and the other classified as type Q4 (*Themeda-Chloris* grass savanna, 45 km<sup>2</sup>: 50%) which occurs on hill tops, ridges and hillsides where it is maintained by frequent outbreaks of fire.

The forest is partially degraded (overall condition score 3), mainly because of its proximity to communities and easy access from all sides. There has however been no mechanised timber harvesting.

Little pitsawing, agricultural encroachment and hunting have been noticed. Grazing affects more than 50% of the area.

**Forest integrity scores:** Settlement = 1, Cultivation = 2, Hunting = 1, Livestock = 4, Timber = 1, Fire = 2, Community Use/access = 2, Mining = 0 (see table Appendix 4 for explanation).

### 4 Economic importance

**Community-use values:** The forest is situated in a part of the country with a medium population density (160 people per km<sup>2</sup> in 1991), so pressure on the forest for firewood, building poles, grazing and other non timber forest products is correspondingly moderate, giving an overall community use value of 6.3 (see Appendix 3 for explanation).

**Timber production:** The forest is not an important source of timber although it contains good timber species. Illegal pitsawing has been noticed. Over 15 pitsaws were confiscated between 1991 and 1996, having been found to be illegal.

Approximately 1000 ha of coniferous plantation has been established by the Forest Department since 1964. There is scope for expansion of the plantation to cover most of the grassland area.

**Other economic values:** The reserve serves an important watershed role. It is the source of river Mishumba which flows through the drier South East to river Kagera.



## 5 Biodiversity values

Of the 65 forests investigated for biodiversity, Rwoho ranks 41st in overall importance with a score of 12.0 (see chapter 3, Table 3.1). It is the 3rd in small mammal richness, with a score of 8.8; but the 51st in bird richness, with a score of 7.4.

In terms of rarity value, it ranks 27th for trees with a score of 7.4; 52nd for moths, the 13th for small mammals with a score of 6.5; the 45th for birds and the 18th for butterflies with a score of 5.3 (see Table 26.3).

The forest supports one tree species, and two of butterflies which do not appear anywhere else in Uganda's Protected Area System. It also supports two mammals and one butterfly which are Regional endemics, and 5 trees/shrubs, one small mammal and 8 butterflies of restricted range.

## 6 Present management

The reserve is managed from Mbarara District Forest Office and local offices at Kikunda and Rwoho. There is one Assistant Forest Officer, four Forest Rangers and two Forest Guards. Of these, the Assistant Forest Officer, one Forest Ranger and one Forest Guard take charge of the unplanted part that supports the natural vegetation while the rest work in the coniferous plantations.

The Assistant Forest Officer, two Forest Rangers and one Forest Guard stay at Kikunda station while two Forest Rangers and one Forest Guard stay at Rwoho station (see Table 26.1).

The department has one permanent house at Kikunda and one at Rwoho. The rest of the staff stay in uniports and temporary shelters. Management is facilitated by one motorcycle for plantation management, stationed at Kikunda. There is only one motorable track within the northern coniferous plantation and another at the eastern boundary.

The latest Working Plan covers 1st July 1985 to 30th June 1990 and prescribes for the extensive planting of Pines, the mode of harvesting of the planted area and the area to be planted. The protection of the natural forests in valleys as Nature Reserves is stressed. The Working Plan is aimed at plantation management. There is no Nature Reserve.

Since 1992, with the support of the EC-financed Natural Forest Management and Conservation Project, approximately 30 km of boundary has been re-demarcated by cutlines, almost all of which have been successfully planted with marker trees (*Eucalyptus*, *Ficus* and *Erythrina*) at 50 m intervals. Protection patrols have been intensified.

## 7 Proposed zonation

Figure A26.1 shows the proposed zonation.

It is proposed that the Strict Nature Reserve of approximately 20 km<sup>2</sup> be located in the valleys in the middle and south eastern parts of the reserve which contain most of the natural forest. The rest of the area will act as a Buffer Zone and is expected to be planted with conifers. The reserve has potential for plantation development, with a score of 4.

The proposed Strict Nature Reserve has been selected to encompass a wide range of both plants and animals, both in the savanna grasslands on the hills, and the forest in valleys. Most of the steep slopes are included in the Strict Nature Reserve.

## 8 Proposed management programmes

**Staffing:** The present staffing on this programme, excluding those on plantation management, is inadequate. This includes one Assistant Forest Officer who is also in charge of the plantation and one Forest Guard both residing at Kikunda station; and one Forest Ranger stationed at Rwoho. Another Forest Ranger and Forest Guard will be recruited and stationed at Kagara (between cairn 81 and 82) while another Forest Guard will be recruited and stationed at Kirungu near cairn II (see Table 26.1).

**Table 26.1 Existing and proposed staff deployment at Rwoho**

Station	Existing and proposed No. of staff by category					Remarks
	AFO	FR	FG	PM	Total	

Kikunda	1(0)	2(0)	1(0)	3(0)	9(0)	The Forest Guard is for plantation management
Rwoho	0(0)	2(0)	1(0)	2(0)	5(0)	-
Kagara	0(0)	0(1)	0(1)	0(3)	0(5)	Proposed
Kirungu	0(0)	0(0)	0(1)	0(2)	9(3)	- do -
<b>Total</b>	<b>1(0)</b>	<b>4(1)</b>	<b>2(2)</b>	<b>5(5)</b>	<b>14(8)</b>	

Note: FO = Forest Officer; AFO = Assistant Forest Officer; FR = Forest Ranger;  
FG = Forest Guard; PM = Patrolmen, Nos. in brackets indicate proposed staffing

**Infrastructure:** Two detached houses will be constructed at Kagara to accommodate the Forest Ranger and the Forest Guard, while one detached house will be constructed at Kirungu to accommodate another Forest Guard. The two detached houses at Kikunda and Rwoho, which are very old, will be repaired to accommodate the Assistant Forest Officer and the Forest Ranger (see Table 26.2).

**Table 26.2 Existing and proposed staff housing at Rwoho**

Station	Existing and proposed staff housing					Remarks
	FD Detached	FD semi-Detached	FD Uniport	Private	Total	
Kikunda	1(0)	0(0)	2(0)	0(0)	3(0)	
Rwoho	1(0)	0(0)	0(0)	0(0)	1(0)	
Kagara	0(2)	0(0)	0(0)	0(0)	0(2)	
Kirungu	0(1)	0(0)	0(0)	0(0)	0(1)	
<b>Total</b>	<b>2(3)</b>	<b>0(0)</b>	<b>2(0)</b>	<b>0(0)</b>	<b>4(3)</b>	

Note: Nos. in brackets indicate proposed staff housing units

**Demarcation:** All the external boundary was reopened and planted. All internal management zone boundaries will be demarcated in the standard way. Sign boards will be erected wherever prominent footpaths cross (internal and external) boundaries.

**Patrols and protection activities:** Four patrol teams will be constituted. The one at Rwoho will be composed of one Forest Ranger and two patrolmen; the one at Kikunda, one Forest Guard and three patrolmen; the other at Kirungu, one Forest Guard and two patrolmen, while the one at Kagara will be comprised of one Forest Guard and three patrolmen.

The Assistant Forest Officer in charge will use the motorcycle to check on the stations. Each of the two Forest Rangers will be given a motorcycle while the three Forest Guards will be issued with a bicycle each.

Patrol routes and check points will be established throughout the Nature Reserve area.

**Public access and community needs:** The reserve has a community use potential of score 6.3 (see Appendix 3 for explanation). The surrounding population uses the reserve for grazing, fuelwood, building poles and timber. Apart from grazing, most of these products will be obtained from the plantation. The staff on protection duties should be able to explain to the population where to find the needed products and educate them to guard against illegal grazing in the reserve. One of the Rangers at Rwoho will assume responsibility for community outreach programmes, including the development of Collaborative Forest Management within the reserve and community tree planting programmes.

**Table 26.3 Summary biodiversity values for Rwoho**

Criterion	Tree & Shrubs	Birds	Mammals	Butterflies	Moths	Overall
<b>Total No. of species known</b>	92	63	13	103	-	-

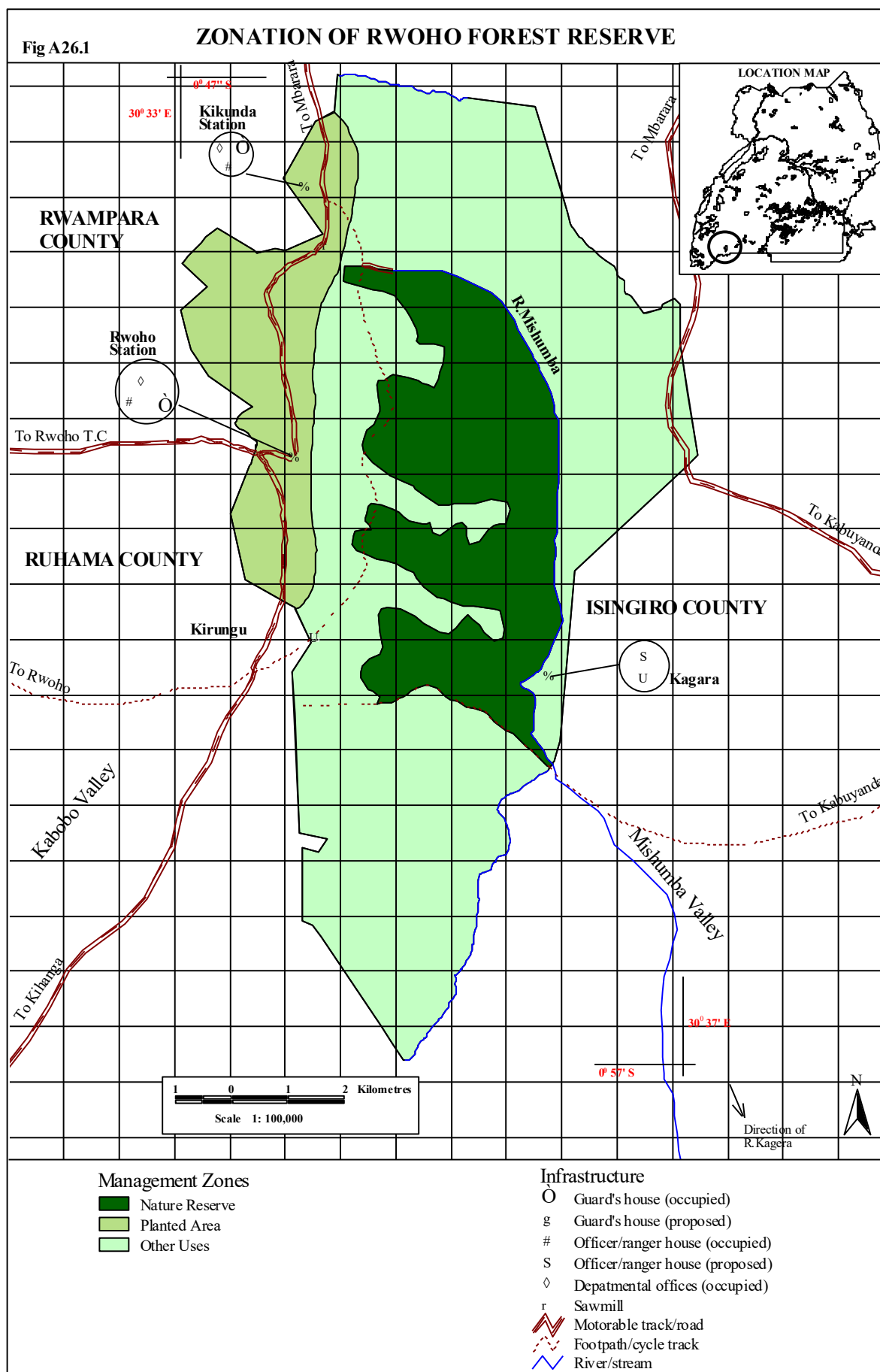
<b>No. of restricted range species (<math>\leq</math> 5 forests)</b>	5	0	1	8	-
<b>Species unique to forest</b>	<i>Terminalia laxiflora</i>	None	None	<i>Colotis pallene</i> <i>Henotesia ubenica</i> <i>Spialia diomus</i>	4
<b>Uganda endemics</b>	None	None	<i>Crocidura selina</i>	<i>Euphaedra peculiaris</i>	2
<b>Albertine Rift endemics</b>	<i>Grewia pubescens</i>	None	None	None	1
<b>Species diversity (score &amp; rank)</b>	5.5(51=)	4.7(45=)	8.8(3)	7.4(19=)	12(36=)
<b>Species rarity value (score &amp; rank)</b>	7.4 (27=)	(45)	6.5(13)	5.3(18=)	6.6(24=)

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Overall biodiversity score = 12

## 9 Principle reference material

1. Langdale Brown, I., Osmaston, H.A. and Wilson, J.G. (1964). The Vegetation of Uganda and its bearing on land-use. Uganda Government Printer, Entebbe.
2. Uganda Forest Department (1985). Bugamba Working Plan Area Management Plan; 1985-90. Forest Department, Kampala, Uganda.
3. Uganda Forest Department (1996). Biodiversity Report Series No. 32; Rwoho and Kijanabalola (Kyalwamuka) Forest Reserves. Forest Department, Kampala, Uganda.



**APPENDIX 27: TAALA FOREST PROFILE**

(Category: SECONDARY conservation forest)

**1 Basis for selection**

The forest was selected for nature conservation in recognition of its biodiversity importance, especially because it supports vegetation type N (Langdale-Brown et al., 1964) not otherwise represented in the protected area system of Uganda.

**2 Physical description**

**Area and demarcation:** The area of the reserve is 92 km<sup>2</sup>, with a total boundary length 58 km, which adjoins rural community land. The external boundary is artificial, and is maintained as a planted outline with earth corner cairns and direction trenches.

**Establishment:** 1958

**Location:** Between 31°36' and 31°51' E and 0°36' and 0°53' N in Kiboga District (Kiboga West County; Ntwetwe sub county and Gayaza sub county).

**Physical features:** The reserve occupies gentle undulating plains with occasional hills out cropping above the terrain at altitudes of 1090-1520 m, with 50% of the area exceeding a 50° slope and 4.4% with a 16-25° slope. The valleys are mainly occupied by papyrus swamps with a few streams.

**3 Vegetation and forest condition**

Half of the area (46 km<sup>2</sup>; 50%) is occupied by tropical high forest communities, classified as type D3 (*Albizia-Markhamia* forest) the remainder (46 km<sup>2</sup>) is a dry *Combretum* savanna grassland, classified as N (unidentified); (Langdale-Brown et al., 1964).

The forest is seriously degraded (overall condition score 2) mainly because of agricultural encroachment and hunting. Cultivation and settlement have affected more than 40% of the area. The problem is compounded by local politicians who allegedly promised land within the reserve to the local community. A few cases of illegal pitting have been reported.

**Forest integrity score:** Settlement = 2; Hunting = 2; Livestock = 2; Timber = 1; Fire = 3 (see Appendix 4 for explanation).

**4 Economic importance**

**Community use value:** The forest is situated in a moderately densely populated area (84 people per km<sup>2</sup>) with fertile agricultural land, so pressure on the forest is high. However, pressure on the peripheral areas of the forest for fuelwood, building poles and non-timber products is low. One major use of the forest by the local community is for brewing waragi (with about 20 “factories”). At least 200 lts of liquor are brewed every day. Fuelwood and water for cooling is from the forest reserve.

The interior of the forest is easily accessible as there are road networks linking private lands within the reserve. The overall “community use” value of the reserve 3.6 (see Appendix 3 for explanation).

**Timber production:** The forest is not important for timber production, although illegal activities have been recorded from 1994, mainly for local use. A few timber species found within the reserve include *M. exelsa*, *Albizia corania* and *Markhamia* spp.

Approximately 2 ha of research plot was established in 1958 and planted with *P. carrebea*, *E. saligna*, *P. patula*, *M. eminii* and *C. lutanica*. The performance of *C. lutanica* has been very poor.

**Other economic values:** The reserve has potential for plantation forestry, especially for pines, *M. eminii* and *Eucalyptus* species.

**5 Biodiversity values**

Of the 65 forests investigated for biodiversity, Taala ranks fifty-sixth overall with a score of 10.7 (Chapter 3 Table 3.1). It is forty-ninth in terms of species diversity with a score of 5.2. The reserve has very few rare species (ranking fifty-eighth with a score of 5.5). Although the reserve is low in conservation value, it is located in a key biogeographical region with a few areas of undisturbed habitat still remaining.

## 6 Present management

The reserve is managed from the Kiboga District Forest office, with a Forest Ranger in charge. He is assisted by a Forest Guard. There is no staff house or office nor transport for the reserve. There is no management plan for the reserve and no Nature Reserve. The trial plot (established in 1958) has been pitsawn.

In recent years (1990-93), with support from the EU Natural Forest Management and Conservation Project, approximately 36 km of boundary has been redemarcated by cutlines, of which 5 km was planted with live markers (*Eucalyptus* and sisal spp) near major entrances to the forest. Protection and patrols have been lax over the period.

## 7 Proposed zonation

**Nature Reserve:** Figure 27.1 shows the proposed zonation of the reserve with one Strict Nature Reserve (approximately 21 km<sup>2</sup>), one community use zone (approximately 15 km<sup>2</sup>) and one production zone approximately 56 km<sup>2</sup>. The proposed south eastern NR (21 km<sup>2</sup>) has been selected to:

- represent the Tropical High Forest (D3) and a mixture of grassland (N) (Langdale Brown et. al., 1964).
- sustain the area which is intact and difficult to access due to its remoteness.
- represent the most hilly part of the reserve.

**Production zone:** 56 km<sup>2</sup> of the central portion of the reserve will be designated as production zone. When funds permit it should be planted with *P. caribea*, *P. patula* and *M. eminii*. The trial plot shows good performance for all these species.

**Community use zone:** 15 km<sup>2</sup> will be demarcated as a community use zone and will occupy the areas close to the northern and southern boundaries, where accessibility is easiest.

## 8 Proposed management programmes

**Staffing:** The present staff is inadequate and some redeployment will be necessary to create an effective management team. The range will need one Forest Ranger in charge of Taala and Luunga FR, 2 Forest Guards (Taala FR) and 6 patrol men (Taala FR). The reserve will be brought under the responsibility of the ranger based at Ntwetwe Trading Centre.

**Table 27.1 Existing and proposed staff deployment at Taala**

Station	Existing proposed number of staff by category					Total
	FO	AFO	FR	FG	PM	
Ntwetwe	0(0)	0(0)	1(1)	1(0)	0(2)	1(3)
Nzo	0(0)	0(0)	0(0)	0(1)	0(2)	0(3)
Kigalama	0(0)	0(0)	0(0)	0(1)	0(2)	0(3)
<b>Total</b>	<b>0(0)</b>	<b>0(0)</b>	<b>1(1)</b>	<b>1(2)</b>	<b>0(6)</b>	<b>1(9)</b>

NB FO = Forest Officers; AFO = Assistant Forest Officer; FR = Forest Ranger; FG = Forest Guard; PM = Patrolman Nos. in brackets indicate proposed number of staff

**Infrastructure:** There is a need for a ranger's house and two Forest Guard houses to be constructed as illustrated in Fig. A27.2 i.e. rangers house near Ntwetwe, Forest Guard houses at Nzo and Kigalama villages.

**Table 27.2 Existing and proposed staff housing at Taala**

Station	Existing and proposed staff housing				Total
	FD detached	FD semi. detached	FD Uniport	Private	

Ntwetwe	0(1)	0(0)	0(0)	0(0)	0(1)
Nzo	0(1)	0(0)	0(0)	0(0)	0(1)
Kigalama	0(1))	0(0)	0(0)	0(0)	0(1)
<b>Total</b>	<b>0(3)</b>	<b>0(0)</b>	<b>0(0)</b>	<b>0(0)</b>	<b>0(3)</b>

Nos. in bracket indicate proposed housing unit(s)

**Demarcation:** There is need to resurvey and reopen the whole boundary. Most of the corner cairns and the marker stones have been destroyed by illegal encroachers and people allegedly looking for mercury.

**Patrol and protection activities:** The entire forest reserve will be brought under the direct supervision of the Forest Ranger based at Ntwetwe. Together with the 2 Forest Guards and 6 patrolmen, they will constitute a team. Each patrolman will oversee 10 km of forest boundary, but when deemed necessary, the Forest Ranger or DFO Kiboga will call an emergency patrol.

**Public access and community needs:** The DFO and the Forest Ranger will assume the responsibility for community outreach programme, including the development of joint forest management within the forest reserve and integrated land use including tree-planting outside the boundary. The management of the reserve should be discussed during community meetings.

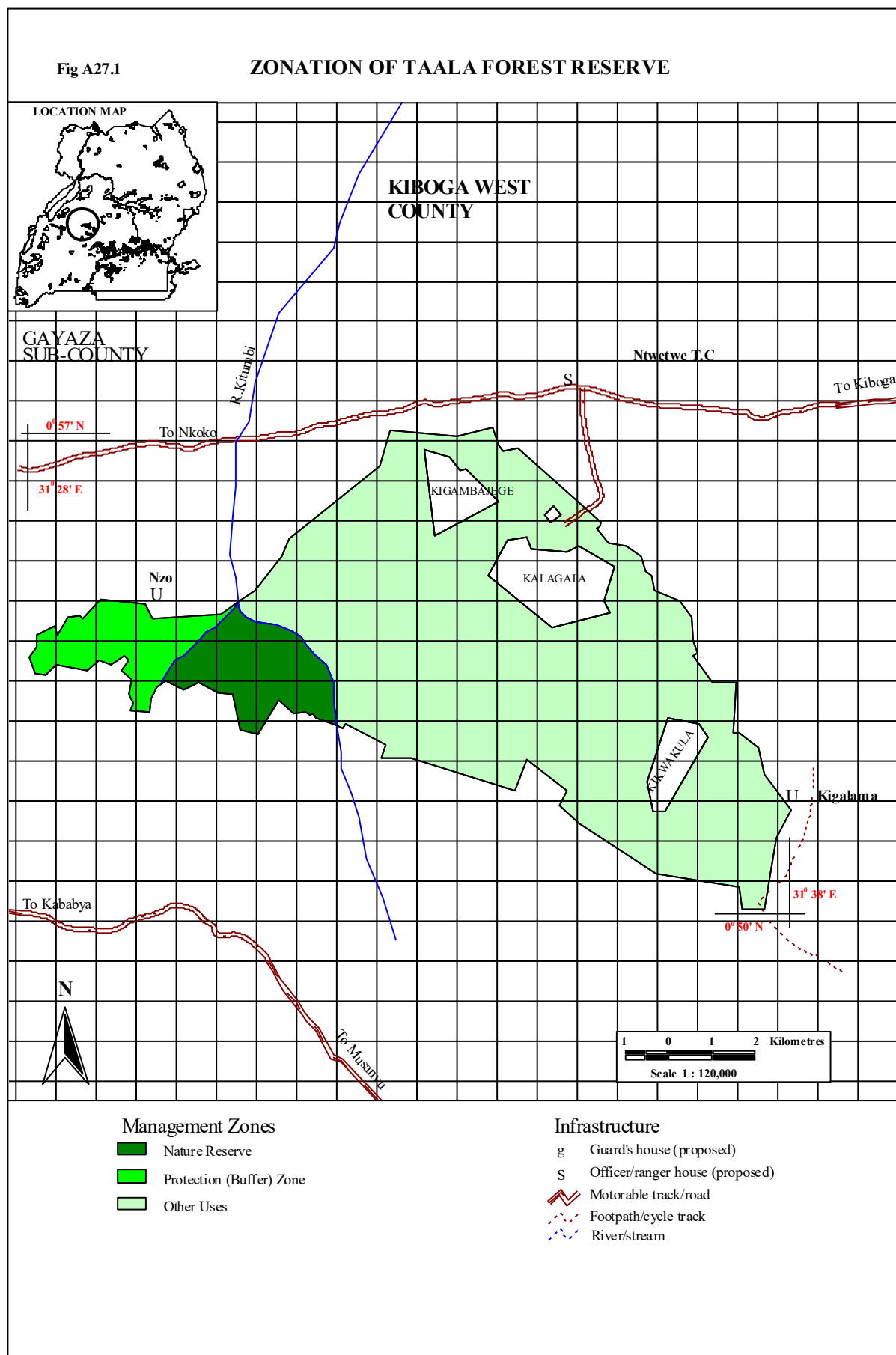
To facilitate their works, the Forest Ranger will need a motorcycle and the Forest Guards and patrol men will need 8 bicycles.

**Table 27.3 Summary table of biodiversity value - Taala forest reserve**

Criterion	Trees & Shrubs	Birds	Mammals	Butterflies	Moths	Overall
<b>Total No. of species known</b>	106	52	13	75	9	-
<b>No. of restricted roged spp (&lt;5 forests)</b>	0	0	0	2	0	-
<b>Species unique to forest list</b>	Nil	Nil	Nil	Nil	Nil	Nil
<b>Uganda Endemic (list)</b>	Nil	Nil	<i>Crocidura selina</i> (shrew)	Nil	-	1
<b>Albertine Rift Endemic (list)</b>	Nil	Nil	Nil	Nil	-	Nil
<b>Species diversity (score and rank)</b>	5(44)	4.5(47=)	6.3(33)	6.6(30=)	3.3(44=)	5.2(49)
<b>Species rarity value (score and rank)</b>	6.1(62=)	5.2(34=)	4.6(40=)	4.5(38=)	5.3(38)	5.5(58=)

## 9 Principle reference material

1. Langdale-Brown, I., Osmaston, H.A. and Wilson, J.G. (1964). The Vegetation of Uganda and its bearing on land-use. Uganda Government Printer, Entebbe.
2. Uganda Forest Department (1996). Biodiversity Report, Series No. 27. Luunga, Namwasa, Taala and Bwezigolo-Gunga Forest Reserves. Forest Department, Kampala, Uganda.





## APPENDIX 28: MARUZI HILLS FOREST PROFILE

(Category: SECONDARY conservation forest)

### 1 Basis for selection

This forest was selected for Nature Reserve establishment in recognition of its biodiversity importance, especially because:

- it is representative of the vegetation type (V, Undifferentiated dry thicket) which although also found in Wabisi-Wajala forest reserve, currently being degazetted, is not otherwise represented in Ugandan's Protected Area system.

### 2 Physical description

**Area and demarcation:** The reserve has an area of 61 km<sup>2</sup>; and a total boundary length of 37.8 km, of which approximately 28.9 km adjoins rural community lands, and 8.9 km adjoins Maruzi Ranching Scheme Stock Farm. Of the 37.8 km of external boundary, approximately 3.2 km follows roads and 2.1 km a track, while 32.4 km is an artificial boundary maintained as a planted cut-line in pairs with earth corner cairns and direction trenches.

**Establishment :** 1939, but with subsequent re-alignments until 1967.

**Location:** 35 km along Apac-Masindi Port road in Maruzi county, Apac District between 32°18' - 32°20'E and 1°44' - 1°47'N. The forest is shared between Akokoro and Ibuje sub-counties. It is covered by 1:50,000 map sheets 40/2 and 40/4 (series Y732).

**Physical features:** The reserve occupies steeply undulating and rocky terrain, running from north to south on the western part, and gently undulating and almost flat terrain on the eastern part, at altitudes of 1050-1370 metres; with 13% exceeding a 15° slope and 36% between 6-15° slopes. The remainder has less than a 5° slope. The area is drained by small seasonal streams flowing to the Nile River.

### 3 Vegetation and forest condition

The majority of the area (61 km<sup>2</sup>; 86%) is occupied by dry *Combretum* savanna, classified as types N1, (*Combretum-Terminalia-Loudetia*, 31 km<sup>2</sup>) and N2 (*Combretum-Hyparrhenia*, 30 km<sup>2</sup>). The remainder (5 km<sup>2</sup>; 7%) comprises an *Acacia-Albizia-Panicum-Chloris* community type, classified as J2 and another 5 km<sup>2</sup>; (7%) comprises dry thicket (type V; Langdale-Brown *et al.*, 1964).

The forest is largely intact, mainly because of the low population and the presence of testes flies. There has been no timber harvesting, but slight agricultural encroachment. Hunting is widespread; fuelwood and stone collection are prevalent in Akokoro for fish smoking and construction respectively.

**Forest integrity scores:** Settlement = 0; Cultivation 2; Hunting = 3; Livestock = 2; Timber = 0; Fire = 3; Community use access = 1; Mining = 0.

### 4 Economic importance

**Community use values:** The forest is situated in a less populated part of the country (20 people per km<sup>2</sup> in 1991), so pressure on the forest for firewood, building poles and non timber forest products is correspondingly low. However, areas close to the fishing villages are increasingly being encroached on for firewood and building poles, giving a 'community use' value of 0.7.

**Timber production:** Maruzi is a watershed protection forest reserve in a savanna woodland with almost no merchantable timber species except a few gallery forest patches dominated by stunted stands of *Antiaris toxicaria*. There are no registered pitsawyers in this forest.

**Other economic values:** The reserve serves an important watershed role, protecting the waters of Lake Kyoga, Lake Kwana and the River Nile. It has a potential for ecotourism with vantage points on the hills for viewing the pleasant scenery of the hills in Masindi, the Nile, Lakes Kwana and Kyoga. Honey-gathering and bee-keeping are of high potential. The local community benefit from illegal bush-meat hunting. It has a plantation potential score of 3.

### 5 Biodiversity values

Of the 65 forests investigated for biodiversity, Maruzi ranks fifty-sixth in overall importance, with a score of 10.7. It is the fifty-seventh scoring forest in terms of species diversity, but ranks fortieth in terms of 'rarity' value of the species represented. The forest supports 15 restricted-range species (known from 5 or less forests in the country). It represents the largest block of the combination of *Combretum-Terminalia-Loudetia* and *Hyparrhenia* forest types N1, N2 (Langdale-Brown et al., 1964) in the protected area system.

## 6 Present management

The reserve is managed from the Apac District Forest Office. There is one Assistant Forest Officer (stationed at Maruzi County headquarters in a privately rented house), and one Forest Guard (stationed at Akokoro in his private house). The department has no houses at Maruzi. Construction of one semi-detached guard house and one detached house had started at Akokoro sub-county, financed by the EU Natural Forest Management & Conservation Project, but work stopped at foundation level. Management is facilitated by the District Forest Officer's pick-up, stationed in Apac. The latest Working Plan covers the period 1.7.68 to 30.6.78 and prescribes the protection of the area's water catchment role.

In recent years (since 1990, with support of the EU-financed Natural Forest Management and Conservation Project), approximately 27 km of the boundary has been re-demarcated by cut-line, of which none has been successfully planted with live markers.

## 7 Proposed zonation

Figure A28.1 shows the proposed zonation of the reserve, with one Nature Reserve (approximately 20 km<sup>2</sup>), one protection zone (approximately 10 km<sup>2</sup>), and one production zone (approximately 30 km<sup>2</sup>).

The proposed Nature Reserve (20 km<sup>2</sup>), has been selected to:

- encompass the widest possible range of altitude, from 1375m to below 1000m on generally dry, steep and inaccessible land which is prone to erosion.
- protect a viable area of the dry *Combretum-Terminalia-Loudetia* and *Combretum-Hyparrhenia* forest types N1, N2 (Langdale-Brown et al., 1964).

The proposed protection zone covers areas of steep land adjacent to the north of the Nature Reserve, unsuitable for cultivation on account of erosion hazards, and extends southwards onto the gently undulating landscape characterised by regular fires, firewood and building pole collection. However, it will serve to enhance the long-term viability of the Nature Reserve.

The proposed production zone covers about half of the reserve, including the areas that were heavily cultivated and settled; the more accessible area of the reserve on the eastern and northern parts with a higher population pressure; the grasslands parts of the reserve where the land is generally flatter and more suitable for plantation development and community agroforestry activities.

## 8 Proposed Management Programmes

**Staffing:** The present staff number is inadequate, and some deployment will be necessary to create two effective patrol teams, with responsibility for Akokoro and Awila beats as shown in Table 28.1. The entire reserve will be brought under the responsibility of one Forest Officer, based at Akokoro assisted by one Forest Ranger, based at Awila, two Forest Guards and six patrolmen.

**Table 28.1 Existing and proposed staff deployment at Maruzi Hills**

Station	Existing and proposed No. of staff by category						Remarks
	FO	AFO	FR	FG	PM	Total	
Akokoro	0(1)	0(0)	0(0)	1(1)	0(3)	1(5)	FG at Akokoro paid by EU Project
Ibuje	0(0)	1(0)	0(1)	0(1)	0(3)	1(5)	
<b>Total</b>	<b>0(1)</b>	<b>1(0)</b>	<b>0(1)</b>	<b>1(2)</b>	<b>0(6)</b>	<b>2(10)</b>	

Note: FO = Forest Officer; AFO = Assistant Forest Officer; FR = Forest Ranger;  
FG = Forest Guard; PM = Patrolmen, Nos. in bracket indicate proposed staffing.

**Infrastructure:** The uncompleted houses at Akokoro should be completed. One additional guard house and another for the Forest Ranger are necessary at Awila beat. An office block will be necessary at Awila.

**Table 28.2 Existing and proposed staff housing at Maruzi**

Station	Existing and proposed staff housing at Maruzi					Remarks
	FD Detached	FD semi detached	FD Uniport	Private	Total	
Akokoro*	1(1)	1(1)	0(0)	0(0)	2(2)	*houses not completed
Ibuje	0(1)	0(1)	0(1)	0(0)	0(3)	
<b>Total</b>	<b>1(2)</b>	<b>1(2)</b>	<b>0(1)</b>	<b>0(0)</b>	<b>2(5)</b>	

Note: Nos. in brackets indicate proposed staff housing units

**Demarcation:** 32.4 km of the reopened external boundary remains to be planted. Internal management zones may not be demarcated as this is likely to prove counter-productive by being mis-interpreted by local people to represent a re-alignment of the forest boundary and be taken as an invitation to encroach up to the 'new' line. Sign boards will be erected wherever prominent footpaths cross (external and internal) boundaries.

**Patrol and Protection activities:** Two patrol teams, each comprising one Forest Guard and three patrolmen will be constituted, with responsibility for safeguarding ranges based at Akokoro and Awila. Men will be rotated between patrol teams and teams will be moved periodically between ranges. Patrol routes and checkpoints will be established throughout the reserve. An incentive scheme will be instituted to reward success in curbing illegal activities.

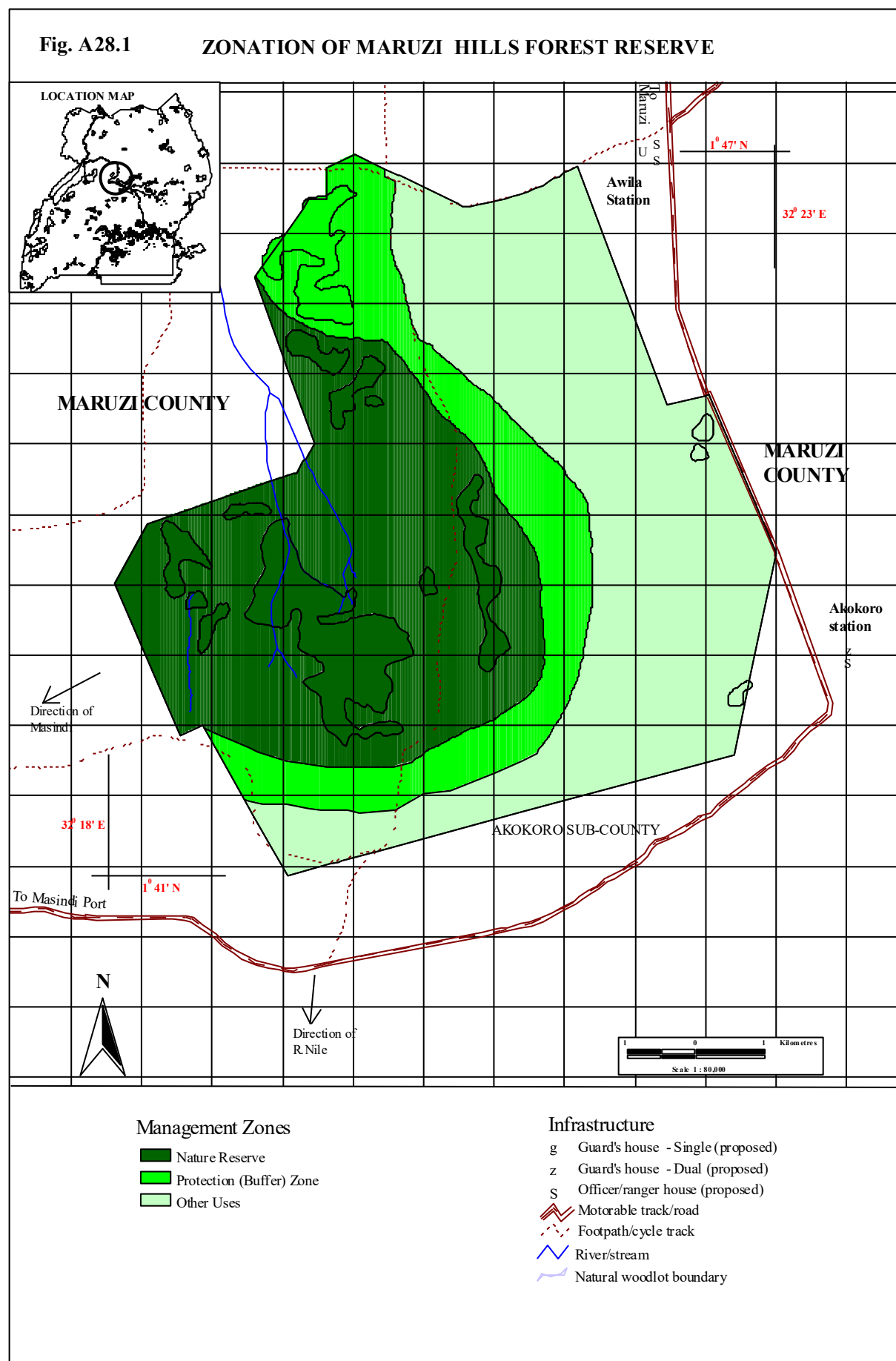
**Public access and community needs:** The Forest Officer and Forest Ranger based at Akokoro and Awila respectively will assume responsibility for community outreach programmes, including the development of joint forest management programmes within the reserve, and community tree-planting programmes outside the boundary. A programme of village meetings should be instituted to explain and discuss management of the reserve, and in particular the management zones as they are established. The Forest Officer will be provided with a motorcycle and the Forest Ranger and two Forest Guards with bicycles to support the work.

**Table 28.3 Summary of biodiversity values for Maruzi Hills**

Criterion	Trees & Shrubs	Birds	Mammals	Butterflies	Moths	Overall
Total No. of species known	130	52	5	69	12	-
No. of restricted range species ( $\geq 5$ forests)	9	1	0	4	0	-
Species unique to the forest	<i>Cadaba farinosa</i> <i>Triumfetta annua</i>	0	0	0	-	2
Uganda endemics	0	0	0	0	-	-
Albertine Rift endemics	0	0	0	0	-	-
Species diversity (score & rank)	4.9(45)	4.4(49)	3.7(58)	4.4(45)	-	4.7(59)
Species rarity value (score & rank)	7.4(26)	4.7(55)	3.8(57)	4.4(45)	-	6(44)
Overall biodiversity importance 10.7(56)						

## 9 Principal reference material

1. Langdale-Brown, I., Osmaston, H.A. and Wilson, J.G. (1964). The Vegetation of Uganda and its bearing on landuse. Uganda Government Printer, Entebbe.
2. Uganda Forest Department (1995). Reports for Natural Forest Management and Conservation Project 1993-95. Forest Department, Kampala, Uganda.
3. Uganda Forest Department (1996). Biodiversity report, Series No. 30, Kibeka and Maruzi Hills Forest Reserves. Forest Department, Kampala, Uganda.



## APPENDIX 29: ITWARA FOREST PROFILE

(Category: SECONDARY conservation forest)

### 1 Basis for selection

The forest was selected for Nature Reserve establishment in recognition of its biodiversity importance, especially because:

- it supports 1 tree species and 1 butterfly species found in no other Ugandan forest.
- it supports one species of tree that is of conservation concern on account of being endemic to Albertine Rift Region.
- it supports populations of chimpanzees (*Patroglodytes*).

### 2 Physical description:

**Area and demarcation:** Itwara has an area of 87 km<sup>2</sup>, and total boundary length of 41 km, all of which adjoins rural community lands. Of the 41 km of external boundary, approximately 17 km follows rivers and streams while 21 km is an artificial boundary maintained as a planted outline with earth corner and intermediate cairns and directional trenches. 3 km adjoins the road that separates the forest from the Toro/Kachuma Tea Estate.

**Establishment:** 1932

**Location:** On the escarpment overlooking the Western Rift Valley between 0°45' and 0°52' N; 30°25' and 30°32' E. The forest lies in Burahya and Mwenge counties of Kabarole district. It is covered by Uganda Department of Lands and Surveys map sheets 56/2 and 57/1 (series Y732) at 1:50,000.

**Physical features:** It covers steeply undulating terrain with an altitudinal range of 1220-1510 m above sea level, and with 23% exceeding a 15° slope. The area is dissected by the Wamisu and Sogahi rivers which drain northwards into Lake Albert.

### 3 Vegetation and forest condition

67 km<sup>2</sup> (77%) is occupied by vegetation type C3 (*Parinari* Forest); 10 km<sup>2</sup> (12%) comprises F2 (Forest/savanna mosaic at medium altitudes).

The forest is largely intact (overall condition score 4), because much of it is largely surrounded by tea estates. Mechanical timber harvesting stopped in 1986. There is no agricultural encroachment and legal pitsawing stopped 1990/91. Hunting is common but mining is non-existent.

**Forest Integrity scores:** settlement = 0; cultivation = 0, hunting = 1; livestock = 1; timber = 1; fire = 1; community use = 1; mining = 0 (see Appendix 4 for explanation).

### 4 Economic importance

**Community-use values:** The forest is situated in a medium-density populated area (106 people per km<sup>2</sup> in 1991) so pressure on the peripheral areas of the forest for firewood, building poles and non-timber products is correspondingly low. The forest is largely surrounded by tea estates, and the north-western part is hilly, therefore potentially valuable resources in many areas remain under-utilised, giving a community use value of 3.7 (see Appendix 3 for explanation).

**Timber production:** The forest has been an important source of timber, but timber production has stopped. A timber inventory in the early 1970s (Lockwood consultants, 1973) provided an estimate of 47 m<sup>3</sup> per ha standing volume of merchantable timber exceeding 50 cm dbh.

**Other economic values:** The reserve serves an important watershed role, protecting waters of Lake Albert. The reserve's high biodiversity interest (see below) offers scope for the development of a research and education role.

### 5 Biodiversity values

Itwara Forest Reserve has a biodiversity importance value of 11.4; ranking 49th out of the 65 investigated forests. Its species diversity value is 5.1 and it has a rarity value of 6.3. The forest supports two species found in no other Ugandan forest (1 tree and 1 butterfly). One species is endemic to the Albertine Rift (Table 29.3).

## 6 Present management

The reserve is managed from Kabarole District Offices and local offices at Kijura. There is one Assistant Forest Officer stationed at Kijura, and no other staff. The department has one house at Kijura and a proposed Ranger post under the EC Forestry Project stopped at slab level at Kisangi. Management is facilitated by one motorcycle stationed at Kijura. However, there are no roads or motorable tracks within the reserve. The only road to the sawmill is now impassable because the bridges collapsed. Vehicular access to within 500 m of the forest boundary is possible almost all around using Tea Estate roads, except in the North West where it is hilly. The latest Working Plan covers the period 1959-65 and prescribes for the conversion of the forest to a uniform system by clear felling on a 60 year rotation.

There is no Nature Reserve. There are 2 Eucalyptus plantations for the tea estate companies that were established in 1957. In recent years (since 1990), with the support of the EC-financed Natural Forest Management and Conservation Project, approximately 14 km of boundary has been re-demarcated by cutline of which 9 km has been successfully planted with *Eucalyptus* marker trees in 3 rows at 5m x 10m intervals.

## 7 Proposed zonation

Figure A29.1 shows the proposed zonation of the reserve with one Strict Nature Reserve (approximately 20 km<sup>2</sup>), one protection (buffer) zone (10 km<sup>2</sup>) and one production zone (57 km<sup>2</sup>).

The proposed Strict Nature Reserve has been selected to:

- support unique species of conservation significance; and
- protect a substantial undisturbed core area.

The proposed protection (buffer) zone is mainly composed of *Olea* spp. It is near the hilly part of the reserve and offer protection to the Strict Nature Reserve.

The proposed production zone covers the southern and north western parts that have already been exploited by pitsawing and sawmilling.

## 8 Proposed management programmes

**Staffing:** The present staff is inadequate. The reserve should be divided into 2 parts. Each part should be headed by a Forest Ranger, one stationed at Kijura and another at Kisanji. However, the entire reserve should remain under the Assistant Forest Officer stationed at Kijura. There is also need for 2 Forest Guards and 8 patrolmen (Table 29.1).

**Table 29.1 Existing and proposed staff housing at Itwara**

Station	FD Detached	FD semi Detached	FD Uniport	Private	Total	Remarks
Kijura	1(1)	0(2)	0(0)	0(0)	1(3)	
Kisangi	1*(0)	2*(0)	0(0)	0(0)	3*(0)	
<b>Total</b>	<b>2(1)</b>	<b>2(2)</b>	<b>0(0)</b>	<b>0(0)</b>	<b>4(3)</b>	

Note: Nos. in brackets indicate proposed staff housing units.  
\* indicates uncompleted houses

**Infrastructure:** New buildings for a ranger post are required at Kijura. The uncompleted houses at Kisangi need to be completed (Table 29.2).

**Table 29.2 Existing and proposed staff housing at Itwara**

Station	Existing and proposed staff housing at Itwara				Total
	FD Detached	FD semi Detached	FD Uniport	Private	
Kijura	1(1)	0(2)	0(0)	0(0)	1(3)
Kisangi	1*(0)	2*(0)	0(0)	0(0)	3*(0)
<b>Total</b>	<b>2(1)</b>	<b>2(2)</b>	<b>0(0)</b>	<b>0(0)</b>	<b>4(3)</b>

Note: Nos. in brackets indicate proposed staff housing units.  
\* indicates uncompleted houses

**Demarcation:** Approximately 7 km of re-opened external boundary needs to be planted. Cairn/trench marking and repairs should be done. Areas planted need beating up. Internal boundaries need to be established.

**Patrol and protection activities:** 2 patrol teams, each comprising of one Forest Guard and 4 patrolmen, will be constituted, with responsibility for safeguarding ranges, based at Kijura and Kisangi.

**Public access and community needs:** The Assistant Forest Officer (AFO) based at Kijura will assume responsibility for community outreach programmes, including the development of Collaborative Forest Management programmes within the reserve and community tree-planting programmes outside the boundary. The AFO and Forest Rangers will each be provided with a motorcycle to support their work. The Forest Guards will each be provided with a bicycle.

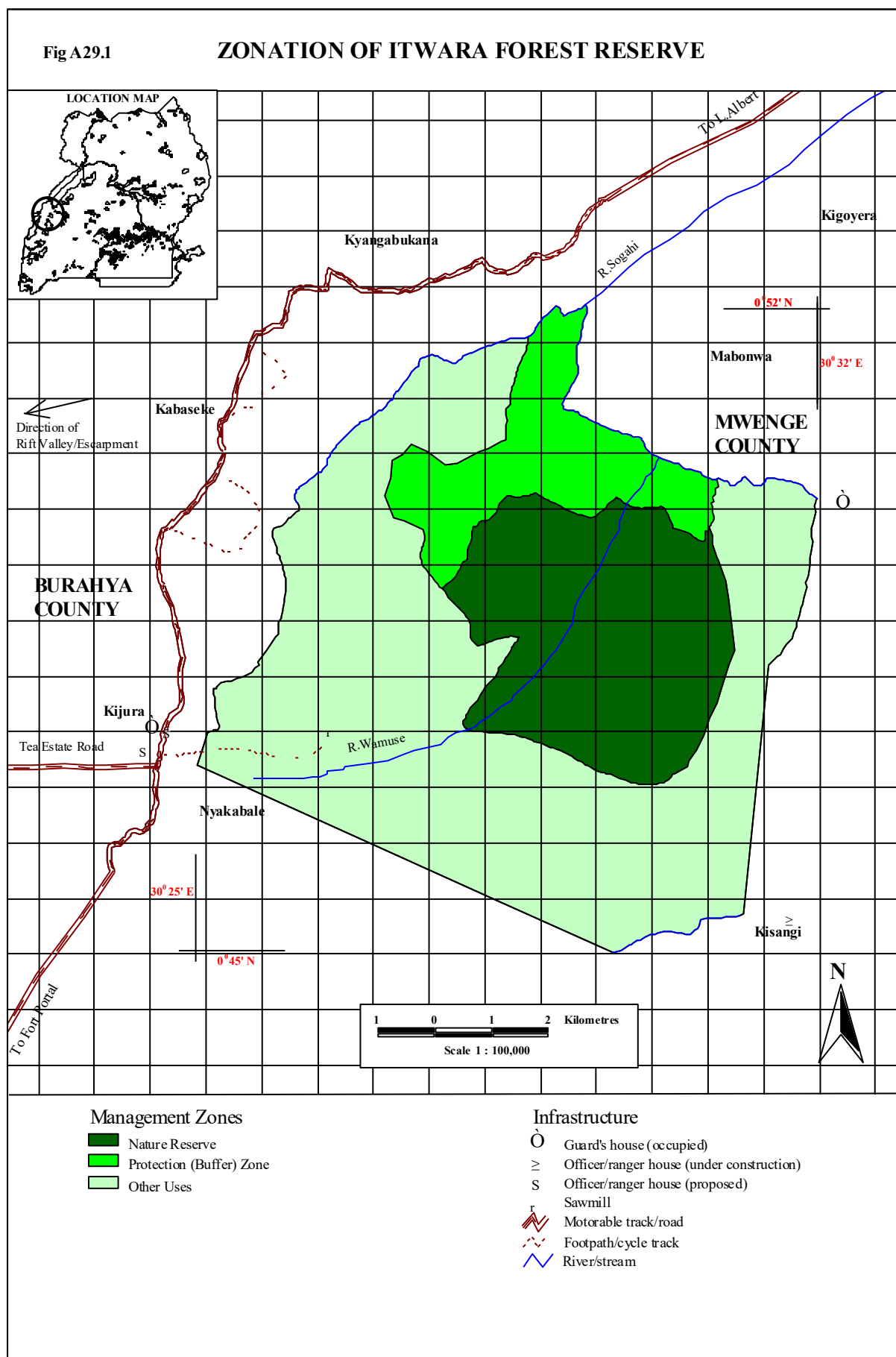


**Table 29.3 Summary table of biodiversity values for Itwara**

Criterion	Trees & Shrubs	Birds	Mammals	Butterflies	Moths	Overall
<b>No of species known</b>	256	183	9	127	56	-
<b>No. of restricted range species (&lt; 5 forests)</b>	9	5	0	8	5	-
<b>Species unique to forest</b>	<i>Chrysophyllum pentagonocarpum</i>	-	-	<i>Dixeia doxo</i>	-	2 spp
<b>Uganda endemics</b>	0	-	-	-	-	-
<b>Albertine Rift endemics</b>	<i>Rhytigynia beniensis</i>	-	-	-	-	1 spp
<b>Species diversity (score &amp; rank)</b>	-	4.6(46)	3.2(60)	8.7(11)	6.6 (14)	5.1(54=)
<b>Species rarity value (score &amp; rank)</b>	-	5.9 (23=)	4.2(48=)	5.1(22=)	7(13=)	6.3(27=)
Overall biodiversity importance 11.4(49=)						

## 9 Principle reference material

1. Lockwood Consultants (1973). Forest Resource Development Study for the Republic of Uganda. Lockwood Consultants, Toronto, Canada.
2. Uganda Forest Department (1958). Kibale-Itwara Management Plan, 1959 to 1965. Forest Department, Kampala, Uganda.
3. Uganda Forest Department (1966). Kabarole District Forest Office files, Fort Portal. Forest Department, Kampala, Uganda.
4. Uganda Forest Department (1996). Biodiversity Report Series No. 16, Itwara forest reserve. Forest Department, Kampala, Uganda.



## APPENDIX 30: ERA FOREST PROFILE

Category: CORE conservation forest

### 1 Basis for selection

The forest was selected for Nature Reserve establishment in recognition of its considerable biodiversity importance, especially because:

- it supports one species of mammals, one butterfly and one large moth that are of conservation concern on account of being endemic to the Somali-Masaai region.
- it supports 45 species, 18 of trees, 11 of birds, 2 of mammals, 6 of butterflies and 1 species of large moths that occur in not more than five other Ugandan forests.
- it makes an important contribution to the protection of Uganda's biodiversity, adding more than 1% of mammal species to the protected area total (see Table 3.5, pp. 35).

### 2 Physical features

**Area and demarcation:** 74 km<sup>2</sup>; total boundary length, 45.6 km; of which approximately 44 km is adjacent to rural communities.

The entire boundary is a surveyed outline except for 2 km of road and 2.5 km of stream in the western and south western parts of the reserve, respectively.

**Establishment:** 1947

**Location:** The forest is located west of the river Nile, in Vurra and Itula sub-counties of Moyo District in North Western Uganda between 03°29'N-03°39'N and 31°36'E-31°46'E. It is covered by Uganda Department of Lands and Surveys Map Sheet 5/3 (series Y732) at 1:50,000.

**Physical Features:** The reserve is on the escarpment rising from the River Nile with an altitudinal range of 850-1040 m above sea level. A number of streams originating outside the reserve pass through it, draining into the River Nile.

### 3 Vegetation and forest condition

44 km<sup>2</sup> (60%) of the vegetation of the reserve is classified as N5, (*Combretum-Acacia-Hyparrhenia* savanna); 15 km<sup>2</sup> (20%) G1 (undifferentiated semi-deciduous thicket) and 15 km<sup>2</sup> (20%) L3 (*Butyrospermum-Hyparrhenia dissoluta* savanna); (Langdale-Brown et al., 1964).

The vegetation is largely unaffected by human activities, no more than 10% of it is degraded. Grazing affects no more than 30% and cultivation affects less than 2% of the area. There are annual fires in the reserve, especially during the dry season.

**Forest integrity score:** Settlement = 0; Cultivation = 4; Hunting pressure = 1; Livestock grazing = 1; Timber harvest = 0; Fire = 3; Community use/access = 1; Mining = 2 (see Appendix 4 for explanation).

### 4 Economic importance

**Community use values:** The population surrounding the reserve is sparse (37 people per km<sup>2</sup> in 1991) but there is pressure for cultivation because the surrounding areas outside the reserve are rocky.

The flat areas of the reserve are particularly threatened and the settlement of Sudanese refugees in the North- Eastern and Southern parts pose more threats.

The surrounding communities depend on the reserve for fuelwood, building poles, local handcraft materials and traditional medicines. Hunting by traps and for honey is prominent in the reserve.

Most of the building materials and fuelwood for the refugees settled around the reserve is obtained from the reserve.

The communities also collect stones from within the reserve for construction of permanent structures especially for refugee agencies. Community Use value score is 1.6 (see Appendix 3 for explanation).

**Other economic values:** The reserve is of great importance for protection of water catchment.

## 5 Biodiversity values

Out of the 65 forest reserves investigated for biodiversity, Era ranks 13th in overall biodiversity importance; and 11th in species diversity; but 15th in the “rarity” value of species represented. The reserve has three species of trees, one species of mammal and one of large moths that are unique to the forest including the primitive cycad, *Encephalartos barteri*, an extremely rare and globally restricted species only known to occur in Era, Agoro-Agu and the Imatong mountains in Sudan, where its current status is not known. The presence of the species therefore bestows a great value to Era Forest Reserve.

The reserve is categorised as one of the large savanna reserves which have important biodiversity values and its hill ranges and valleys require a high degree of protection.

Era also ranks third in the representation of the vegetation category N5 (*Combretum-Acacia Hyperrhenia* savanna) with 44 km<sup>2</sup>.

## 6 Present management

The reserve is managed from the Moyo District Forest Offices. Day-to-day management is by two Forest Rangers and one Forest Guard. There are also two patrolmen who act as headmen to supervise activities in the reserve (Table 30.1).

**Table 30.1 Existing and proposed staffing at Era**

Station	Existing and proposed No. of staff by category						Remarks
	FO	AFO	FR	FG	PM	Total	
Moyo	1(1)	0(0)	1(1)	1(1)	1(1)	3(3)	1 ranger also works in Mt. Otzi FR.
Palorinya	0(1)	0(0)	1(1)	0(0)	1(1)	2(2)	
<b>Total</b>	<b>1(1)</b>	<b>0(1)</b>	<b>2(2)</b>	<b>1(1)</b>	<b>2(2)</b>	<b>5(5)</b>	

Note: FO = Forest Officer; AFO = Asst. Forest Officer; FG = Forest Guard; FR = Forest Ranger; PM = Patrol man, Nos. in brackets indicate proposed staffing

There is no existing infrastructure specifically for the reserve. The Forest Rangers and Guards stay in rented or private houses, as do the patrolmen.

**Table 30.2 Existing and (proposed) housing\***

Station	FD Detach	FD Semi	FD Uniport	Private	Total	Remarks
Moyo	-	0(0)	-	-	0(1)	Also for Otzi Forest Reserve
Palorinya	0(0)	0(1)	-	1(1)	1(1)	
Lama	0(1)	-	0(1)	1(1)	1(2)	
<b>Total</b>	<b>0(1)</b>	<b>0(2)</b>	<b>0(1)</b>	<b>2(2)</b>	<b>2(5)</b>	

Note: Nos. in brackets indicate proposal staff housing units

There is one pick-up for the DFO and a motorcycle shared by the rangers.

The reserve is accessible by motorable track from Moyo to Palorinya which was re-opened by the refugee agencies. The road to Obongi in the western part of the reserve forms part of the boundary (3 km).

Other footpaths exist within the reserve and are mainly used by people cultivating inside.

The reserve was established for protection purposes. However, there are no records and no Working Plan has been written.

From 1994, a total of 44 km of the boundary was resurveyed and reopened by slashing a width of 4 m with support from the EC-funded Natural Forest Management and Conservation Project. Of the 44 km, 8 km was planted with live markers of *Tectona grandis* and sisal but the survival was low due to bush fires and animal browsing.

Arising from the pressure anticipated from the proximity of the refugees to the reserve a belt of 12.5 km x 500 m along the southern boundary was planned to be planted with *Senna* spp to act as a barrier to deter further extension into the reserve. A total of 25 ha in all has been established since 1994.

Agricultural encroachment is the major threat to the integrity of the reserve especially in the north-eastern parts.

## 6 Proposed zonation

Figure A30.1 shows the preliminary proposed zonation of the reserve into Strict Nature Reserve (approximately 50 km<sup>2</sup>) and Buffer Zone (24 km<sup>2</sup>).

The proposed Strict Nature Reserve has been selected to:

- pay particular attention to the protection of species and/or vegetation types that the forest was selected to represent.

The proposed Buffer Zone will cover the areas immediately adjacent to the Strict Nature Reserve which need to be maintained in a relatively natural state to shelter the Strict Nature Reserve.

## 7 Proposed management programme

**Staffing:** The present staff is adequate but should be redeployed. One Assistant Forest Officer should take full responsibility for the reserve and surrounding public lands, assisted by two Forest Rangers, two Forest Guards and four patrolmen to monitor the northern and southern parts of the reserve (see Table 30.1).

**Infrastructure:** A duplex (semi-detached) house should be built at Palorinya while a guard's house is proposed at Lama to ensure that the staff have close supervision of the activities in the reserve. Patrolmen will operate from their homes (see Table 30.2).

**Demarcation:** The entire boundary (45.6 km) should be demarcated and maintained.

Live markers should be planted, starting with the areas encroached, with a band of suitable tree species. Corner cairns, directional trenches and beacons should be reinforced. Sign posts should be put at road junctions and paths that cross boundaries.

Internal boundaries of the various management zones will as much as possible follow natural features which can be reinforced by painting trees with different colours, indicating the zones in the standard way.

**Patrol and protection activities:** Two patrol teams should be instituted to cover northern and southern parts of the reserve. Two patrolmen should be based at Lama, near the refugee settlement, and two at Palorinya. Patrol routes should be established, and an incentive scheme be put in place to guarantee commitment.

**Public access and community needs:** Collection of fuelwood in the reserve should be restricted to domestic use and no commercial or large cutting of firewood for institutions within the reserve should be prohibited.

Conservation education and tree planting programmes should be encouraged among the communities surrounding the reserve; the Forest Rangers will be facilitated with motorcycles to carry out the programmes.

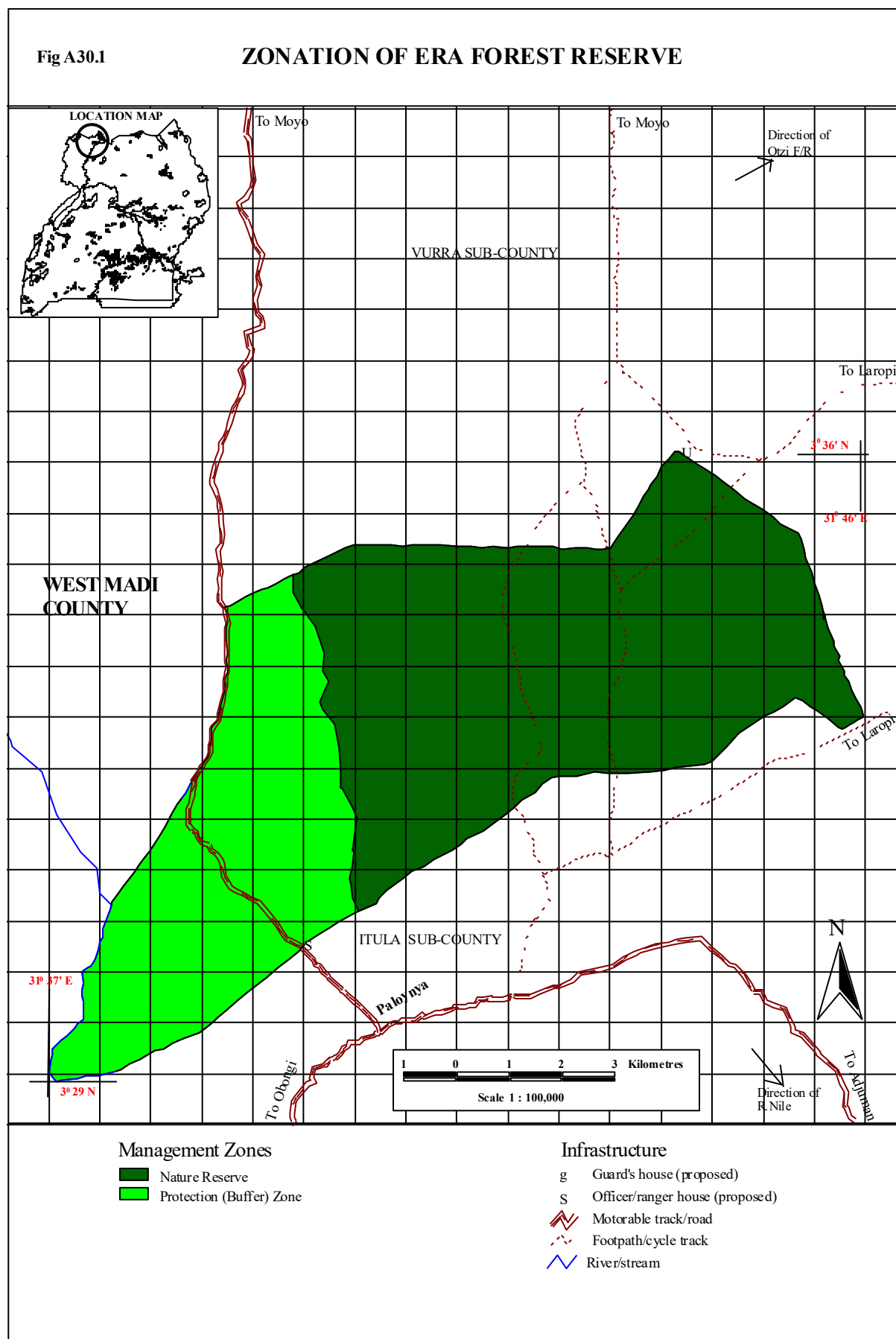
**Table 30.3 Summary of biodiversity values for Era**

Criterion	Trees & Shrubs	Birds	Mammals	Butterflies	Large Moths.	Overall
Total No. of species known from forest.	145	113	15	56	39	
No. of restricted range species (known from $\leq 5$ forests)	18	11	2	6	8	
Species unique to forest	<i>Aloe tweedie</i> <i>Encephalartos barteri</i> . <i>Ozoroa pulcherrima</i>	None -	<i>Crocidura cyanea</i>	-	<i>Orthogonioptilum</i> spp.	
Uganda endemics	-	-	-	-	-	
Albertine Rift Endemics	-	-	-	-	-	
Species diversity (score & rank)	7.9 (18)	6.4 (18)	6.9 (15=)	4.4 (41=)	5.9 (17)	6.9 (11)
Species rarity (score & rank)	7.5 (13=)	5.5 (17=)	5.4 (16=)	4.5 (19=)	6.8 (16=)	6.5 (15)

Overall biodiversity score = 13.4

## **9 Principle reference material**

1. Langdale-Brown, I., Osmaston, H.A. and Wilson, J.G. (1964). The Vegetation of Uganda and its Bearing on Land Use. Uganda Government Printer, Entebbe.
2. Lockwood Consultants (1973). Forest Resource Development Study for the Republic of Uganda. Lockwood Consultants, Toronto, Canada.
3. Uganda Forest Department (1963). Working Plan for Madi Pole and Fuelwood Plantation Reserves 1963-1974. Forest Department, Kampala, Uganda.
4. Uganda Forest Department (1996). Biodiversity Report Series No. 17. Otzi and Era Forest Reserves. Forest Department, Kampala, Uganda.





## APPENDIX 31: KYALWAMUKA FOREST PROFILE

(Category: SECONDARY conservation forest)

### 1 Basis for selection

The forest was selected for Nature Reserve establishment in recognition of its considerable biodiversity importance, especially because:

- it supports 1 species of tree and 1 species of butterfly known from no other Protected Area in Uganda.
- it is representative of a vegetation type N14 (Langdale-Brown et. al., 1964) represented in only two other forests in Uganda's Protected Area system.

### 2 Physical description

**Area and demarcation:** 65 km<sup>2</sup>; total boundary length 36 km, part of which adjoins rural community lands. Of the 36 km of external boundary, approximately 20 km follows rivers and streams, while 16 km is an artificial boundary maintained as a planted cut-line with earth corner cairns.

**Establishment:** As central forest reserve, 1967.

**Location:** It lies in the county of Kooki in the administrative district of Rakai between 31°07'-31° 12'E and 0° 30'-0° 40'S. Covered by Uganda Department of Lands and Surveys map sheet 87/1 (series Y732) at 1:50,000.

**Physical features:** With an altitudinal range of 1280-1552 m, the reserve has 17% exceeding 15% slope. It is located east of Lake Mburo National Park, separated by Lake Kachera which forms the western boundary of the reserve.

### 3 Vegetation and forest condition

The majority of the area (49 km<sup>2</sup>, 75%) is occupied by Dry *Combretum* savanna classified as type N14. 4 km<sup>2</sup> (6%) by types J1 (*Acacia-Albizia-Beckeropsis-Cymbopogon* savanna), and another 4 km<sup>2</sup> (6%) by Q4 type (*Themeda-Chloris* grass savanna). The remaining 4 km<sup>2</sup>; (6%) by type X1, (*Cyperus-papyrus* swamp).

The Forest is heavily degraded (overall condition 1) mainly by grazing and fishermen. There is no pitsawing, but grazing and illegal cutting of firewood by fishermen are widespread.

**Forest integrity score:** Settlement = 2; cultivation = 3; hunting = 1; livestock grazing = 4; timber harvesting = 0; fire = 2; community use = 2; mining = 0 (see Appendix 4 for explanation).

### 4 Economic importance

**Community use values:** The forest is situated in an area with a low population density (88 people per km<sup>2</sup> in 1991) so the pressure on the forest products is low, giving it a community use value of 3.5 (see Appendix 3 for explanation).

### 5 Biodiversity values

Of the 65 forests investigated for biodiversity, Kyalwamuka ranks fifty first in overall importance with a score of 11. It is the forty-eighth scoring forest in terms of species diversity and ranks fifty third in terms of the 'rarity' value of the species represented. The forest supports 2 species found in no other Ugandan forest (including one species of tree and one species of butterfly) (Table 31.3).

### 6 Present management

The reserve is managed from Rakai district forest offices. There is only one Forest Guard stationed at N. Sozibili in Kooki county.

There is neither transport nor departmental houses within the reserve. There is one road that runs through from Lwanga Trading Centre within the reserve to Lyatonde town. No workplan exists.

In recent years (since 1990), with the support of the EC-Financed Natural Forest Management and Conservation Project, approximately 16 km of boundary has been re-demarcated by cutline, of which 6 km has been successfully planted with marker trees of *Erythrina* at 20m intervals.

## 7 Proposed zonation

The whole reserve is encroached by fishermen and cattle ranchers. The reserve should be put under firm Forest Department control. Figure A28.1 shows the proposed zonation of the reserve with one Nature Reserve (20 km<sup>2</sup>), two protection zones (approximately 10 km<sup>2</sup>) and one production zone (approximately 35 km<sup>2</sup>).

The proposed Nature Reserve has been selected because:

- It is located east of Lake Mburo National Park, from which it is separated by Lake Kachera.
- It is the area that is least encroached in the reserve, and least accessible by road.

The two proposed protection zones have been selected to maintain a relatively natural state to shelter the Nature Reserve against encroachers and fire caused by cattle keepers.

## 7 Proposed management programme

The present staff number is inadequate. The entire reserve will be brought under the responsibility of an Assistant Forest Officer based at Lwanga. One Forest Ranger, 2 Forest Guards and 4 Patrolmen are necessary (Table 31.1).

**Table 31.1 Existing and proposed staff deployment at Kyalwamuka**

Station	Existing and proposed No. of staff by category						Remarks
	FO	AFO	FR	FG	PM	Total	
N. Sozibili	0(0)	0(0)	0(0)	1(0)	0(0)	1(0)	Station is very far from the Forest Reserve
Lwanga	0(0)	0(1)	0(1)	0(1)	0(4)	0(6)	
<b>Total</b>	<b>0(0)</b>	<b>0(1)</b>	<b>0(1)</b>	<b>1(1)</b>	<b>0(4)</b>	<b>1(6)</b>	

Note: FO = Forest Officer; AFO = Assistant Forest Officer; FR = Forest Ranger;  
FG = Forest Guard; PM = Patrolmen, Nos. in brackets indicate proposed staffing.

**Infrastructure:** One house should be constructed each for the Forest Ranger and Forest Guard at Lwanga.

**Table 31.2 Existing and proposed staff housing at Kyalwamuka**

Station	Existing and proposed staff housing					Remarks
	FD Detached	FD semi Detached	FD uniport	Private	Total	
N. Sozibili	0(0)	0(0)	0(0)	1(0)	1(0)	
Lwanga	0(0)	0(2)	0(0)	1(0)	1(2)	
<b>Total</b>	<b>0(0)</b>	<b>0(2)</b>	<b>0(0)</b>	<b>2(0)</b>	<b>2(2)</b>	

Nos. in brackets indicate proposed staff housing units.

**Demarcation:** 10 km of re-opened external boundary remains to be planted. Sign boards should be erected wherever prominent footpaths cross boundaries.

**Patrols and protection activities:** One patrol team comprising of one Forest Guard and 4 patrolmen will be constituted based at Lwanga Trading Centre. Patrol routes will be established throughout the Reserve.

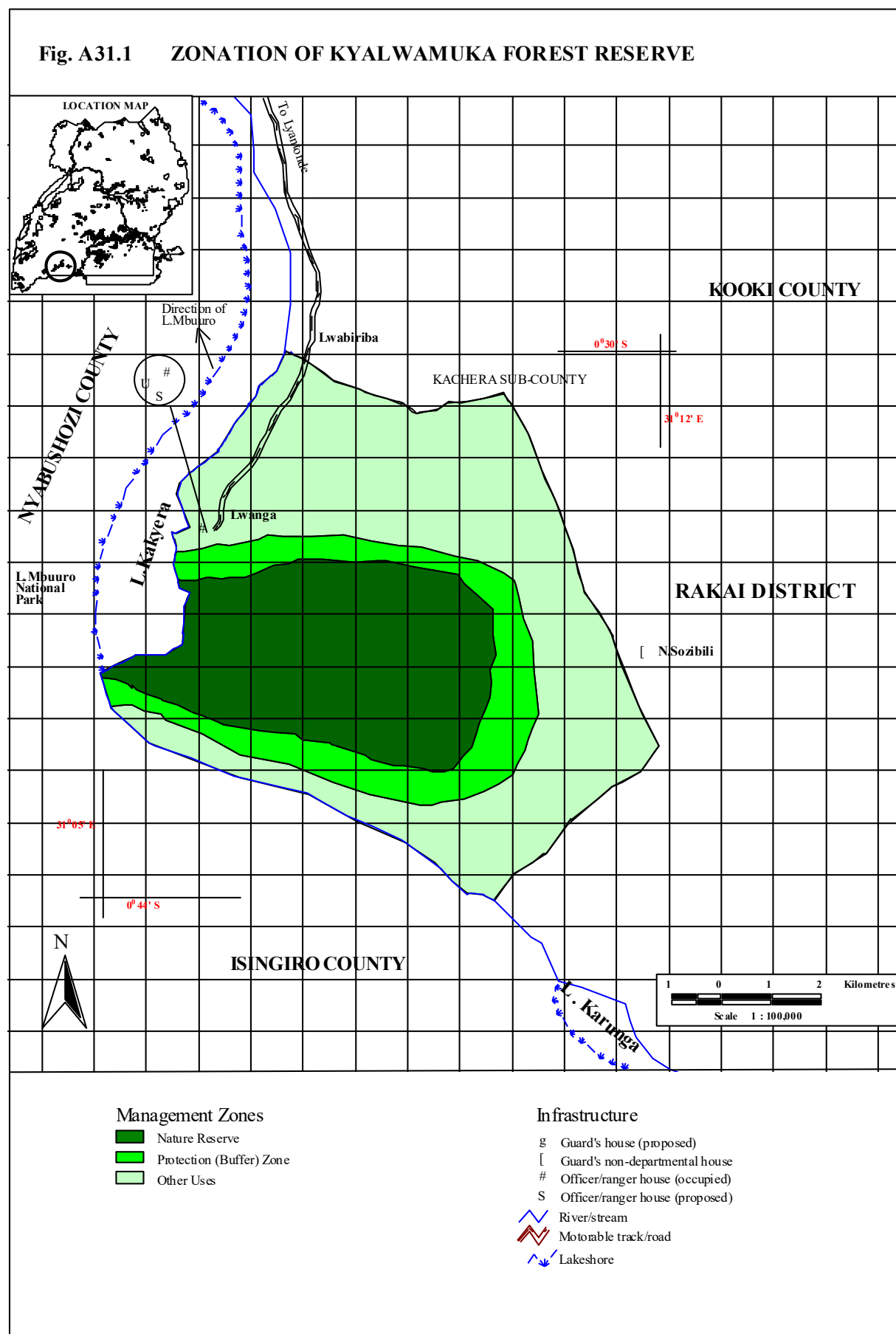
**Public access and community needs:** A Forest Ranger based at Lwanga under the supervision of the Assistant Forest Officer will assume responsibility for community outreach programmes, including the development of Collaborative Forest Management programmes within the reserve, and community tree-planting programmes outside the boundary. A programme of village meetings should be instituted to explain and discuss management of the reserve. The Ranger will be provided with a motorcycle to support the work.

**Table 31.3 Summary of biodiversity values for Kyalwamuka**

Criterion	Trees & Shrubs	Birds	Mammals	Butterflies	Months	Overall
<b>Total No. of species known</b>	66	82	10	40	-	-
<b>No. of restricted range species (<math>\leq 5</math> forests)</b>	4	4	0	7	-	-
<b>Species unique to the forest</b>	<i>Boscia</i> <i>Angustifolia</i>	0	0	<i>Colotis incretus</i>	-	2
<b>Uganda endemics</b>	0	0	0	0	-	-
<b>Albertine Rift endemics</b>	0	0	0	0	-	-
<b>Species diversity (score &amp; rank)</b>	4 (51)	9.1 (5)	6.5 (31)	4.4 (59)	-	5.3(46=)
<b>Species rarity value (score &amp; rank)</b>	6.8 (42)	4.7 (54)	3.9 (54)	5 (25)	-	5.7(52=)
Overall biodiversity importance 11.0 (51)						

## 9 Principle reference material

1. Langdale-Brown, I., Osmaston, H.A., and Wilson, J.G. (1964). The Vegetation of Uganda and its bearing on Landuse. Uganda Government Printer, Entebbe.
2. Uganda Forest Department (1996). Biodiversity Report Series No. 32; Rwoho and Kyalwamuka Forest Reserves. Forest Department, Kampala, Uganda.



**APPENDIX 32: LWALA FOREST PROFILE**

(Category: SECONDARY conservation forest)

**1 Basis for selection**

The forest was selected for Nature Reserve establishment in recognition of its biodiversity importance, especially because:

- it supports a unique species of butterfly (*Spialia mangana*) of the arid zone which is of both national and international interest.
- it is an important water catchment for the lowland areas of Karamoja.

**2 Physical description**

**Area and demarcation:** The forest's area is 59 km<sup>2</sup>, and the total boundary length is 33 km, all of which adjoins rural community lands. The entire boundary is artificial and consists of intervisible stone cairns with directional trenches.

**Establishment:** 1940

**Location:** Lwala Forest Reserve is located in Dodoth county of Kotido district 4 km south of Morongole Forest Reserve between 03°40'-03°45'N and 33°58'-34°05' E and is covered by Uganda Department of Lands and Surveys maps sheets 9/4 and 10/3 (series Y732) at 1:50,000.

**Physical features:** The reserve occupies a broad ridge lying parallel to and south of Morongole Forest Reserve, with the north and south sides very steep, and the east and west slopes less steep due to a series of foothills. The slopes are drained by narrow, rocky and steep storm courses which empty into rivers Nalakas and Kapelepelot to the west and south respectively. The reserve has an altitudinal range of 1480-2455 m and 76% exceeds a 15° slope.

**3 Vegetation and forest condition**

The majority of the area (40 km<sup>2</sup>, 68%) is occupied by dry *Combretum* savanna communities, classified as types N8 (*Combretum-Acacia-Themeda*, 35 km<sup>2</sup>) and N5 (*Combretum-Acacia-Hyparrhenia*, 5km<sup>2</sup>). The remainder comprises of *Juniperus-Podocarpus* dry montane forest (7 km<sup>2</sup>, 12%). Forest/Savanna mosaic at high altitudes (7 km<sup>2</sup>, 12%) and *Acacia-Cymbopogon/Themeda* complex, (5 km<sup>2</sup>, 8%) (Langdale-Brown, *et al.*, 1964).

The forest is largely intact (overall condition score 4) mainly because of difficult access due to the steep slopes. There has been no timber harvesting and agricultural encroachment is very limited and only on the western slopes.

**Forest integrity scores:** Settlement = 1; Cultivation = 1; Hunting = 2; Livestock = 1; Timber Harvesting = 0; Fire = 2; Community Use = 1; Mining = 0 (see Appendix 4 for explanation).

**4 Economic importance**

**Community use value:** The forest is situated in a sparsely populated part of the country (37 people per km<sup>2</sup> in 1991), so there is not much pressure on the forest products and it is only the peripheral lower altitude areas which are subject to limited encroachment by maize and sorghum cultivation. Encroachment is only found in the western section of the forest which borders the surrounding farming villages of the Dodoth. Some grazing of livestock is done on the lower slopes of the reserve. Fires are common during the dry season. Community use value = 1.5 (see Appendix 3 for explanation).

**Timber production:** The forest is not suitable for timber production mainly because it lacks good merchantable timber trees and also because of its steep and rugged terrain. The riverine and plateau forests with dense trees are very limited in extent as deep soils are rare.

**Other economic values:** Lwala is important as a water catchment area to sustain local agriculture and for nature conservation because of its intact high altitude forest.

**5 Biodiversity values**

Of the 65 forests investigated for biodiversity, Lwala ranks forty-third in overall importance, with a score of 11.5 (Table 32.3). It is forty-ninth in terms of species diversity and ranks thirty-first in terms of the 'rarity' value of the species represented. This could be mainly because most species recorded in Lwala so far are also found elsewhere in

similar forests. However, the forest supports one unique species of butterfly, *Spialia mangana* (the Arabian Grizzled Skipper) of the true arid zone which is of both national and international interest (Table 32.3).

## 6 Present management

The reserve is managed from the Kotido District Forest Office and the local office at Kaabong. There is one Forest Ranger stationed at Kaabong 30 km away, who is also in charge of other forest reserves in Dodoth county (Nyangea-Napere, Timu, Morongole, Zulia, Lotim-Puti and Lomej). He is assisted by one Forest Guard (stationed at Kaabong). There is no departmental house at or near Lwala and the two staff at Kaabong have no means of transport. There are no roads or motorable tracks within the reserve and vehicular access within 2 km of the forest boundary is only possible at Narengapak (along the Kaabong-Karenga road, see Figure A32.1).

The latest Working Plan covers the period 1.1.64 to 31.12.73 and prescribes the protection of the water catchment of the rivers originating from within the reserve and sustaining the permanent settlements around its boundary. Like other reserves in Kotido district, protection work in Lwala (boundary maintenance, patrolling, maintenance of cairns and directional trenches) stopped in the mid 1970s due to insecurity, low funding, lack of staff and general breakdown of law and order. However, with improvement in security and support from the EU Natural Forest Management and Conservation Project, resurveying and redemarcation is to be started.

## 7 Proposed zonation

Figure A32.1 shows Lwala Forest Reserve with one Strict Nature Reserve (approximately 20 km<sup>2</sup>), one protection (buffer) zone (approximately 26 km<sup>2</sup>) and one production zone (approximately 14 km<sup>2</sup>).

The proposed Strict Nature Reserve has been selected to cover the high altitude forest which is almost inaccessible due to the steep terrain.

- it also serves to protect the water catchment for the surrounding area.

The proposed protection zone covers steep land adjacent to the Nature Reserve to accord it long term protection.

The proposed production zone has been selected to include relatively gentler slopes to the west and north of the reserve which have been partly encroached by cultivators.

## 8 Proposed management programmes

**Staffing:** There is a need to recruit a trained Forest Guard to be specifically in charge of the protection of this forest. The Forest Guard will be based at Narengapak, (see Fig. A32.1), and will be responsible to the Forest Ranger at Kaabong (Table 32.1). This Guard will be provided with a bicycle.

**Table 32.1 Existing and proposed staff deployment at Lwala**

Station	Existing and proposed No. of staff by category						Remarks
	FO	AFO	FR	FG	PM	Total	
Kaabong	0(0)	1(0)	1(0)	1(0)	0(0)	2(0)	Proposed new station
Narengapak	0(0)	0(0)	0(0)	0(1)	0(4)	0(5)	
<b>Total</b>	<b>0(0)</b>	<b>0(0)</b>	<b>1(0)</b>	<b>1(1)</b>	<b>0(4)</b>	<b>2(5)</b>	

Note: FO = Forest Officer; AFO = Assistant Forest Officer; FR = Forest Ranger;  
FG = Forest Guard; PM = Patrolmen, Nos. in brackets indicate proposed staffing.

**Infrastructure:** One Guard's house will be constructed at Narengapak, together with one uniport to serve as a store for tools/equipment (Table 32.2).

**Table 32.2 Existing and proposed staff housing at Lwala**

Station	Existing and proposed staff housing					Remarks
	FD Detached	FD semi Detached	FD Uniport	Private	Total	
Kaabong	1(0)	0(0)	0(0)	0(0)	1(0)	Requires renovation
Narengapak	0(0)	0(1)	0(1)	0(4)	0(6)	Proposed station
<b>Total</b>	<b>1(0)</b>	<b>0(1)</b>	<b>0(1)</b>	<b>0(4)</b>	<b>1(6)</b>	

Note: Nos. in brackets indicate proposed staff housing units

**Demarcation:** The entire 33 km of external boundary will be resurveyed and redemarcated with corner beacons/stone cairns. Live marker trees will be planted along the boundary outline at an interval of 20 m. Internal zoning or demarcation will be done, where appropriate, in the standard way.

**Patrols and protection activities:** There will only be one patrol team comprising of the Guard and four patrolmen who will routinely patrol the entire reserve. This team will be based at Narengapak. Patrols will be intensified during peak periods of opening of cultivation in the nearby fields, grazing and the fire seasons.

**Public access and community needs:** Since the surrounding communities have been relying on this reserve for resources such as building poles and firewood, FD staff will work with the community in the collaborative management of the forest. The Ranger will also carry out programmes to encourage tree planting outside the reserve in order to reduce pressure on the forest.

**Table 32.3 Summary biodiversity values for Lwala**

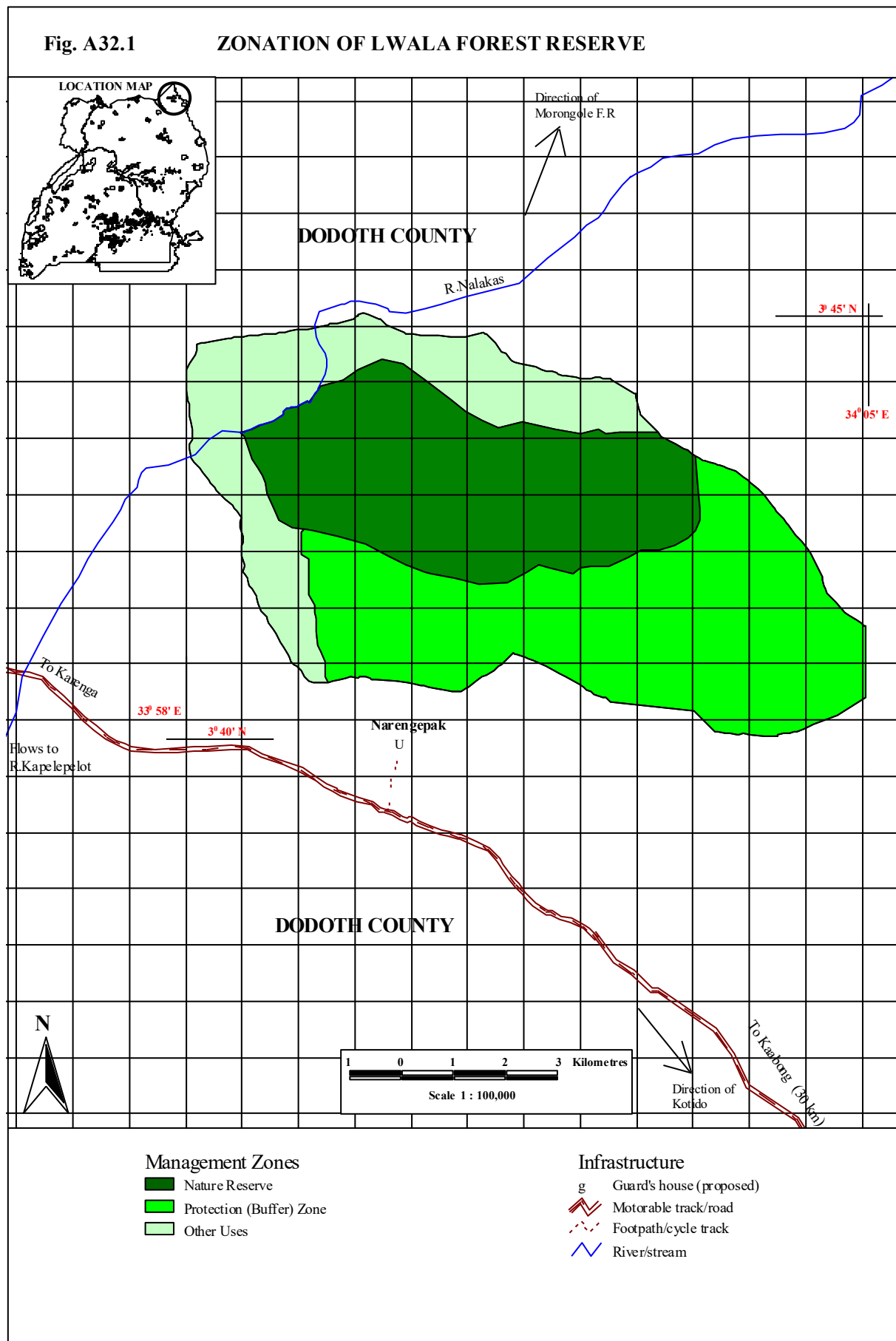
Criterion	Trees & Shrubs	Birds	Mammals	Butterflies	Moths	Overall
<b>Total No. of species known</b>	111	33	5	17	3	
<b>No. of restricted range species (<math>\leq 5</math> forest)</b>	7	1	0	2	0	
<b>Species unique to forest (list)</b>	None	None	None	<i>Spialia mangana</i>	none	1 sp
<b>Uganda endemics (list)</b>	None	None	None	none	none	-
<b>Albertine Rift endemics (list)</b>	None	None	None	none	none	-
<b>Species diversity (score &amp; rank)</b>	6.8 (20)	3.4(56)	6(35)	5.6(45=)	-	5.3(49=)
<b>Species rarity value (score &amp; rank)</b>	7.5(18=)	5.5(27=)	4.3(43=)	4.8(32=)	-	6.2(31=)

Overall biodiversity score 12.1

## 9 Principle reference material

1. Langdale-Brown, I., Osmaston, H.A. and Wilson, J.G. (1964). The Vegetation of Uganda and its Bearing on Land Use. Uganda Government Printer, Entebbe.
2. Uganda Forest Department (1963). Working plan for North Karamoja Central Forest Reserves. Forest Department, Kampala, Uganda.
3. Uganda Forest Department (1996). Biodiversity Report Series No. 21 Morongole, Lwala and Timu forest reserves. Forest Department, Kampala, Uganda.





## APPENDIX 33: OGILI FOREST PROFILE

(Category: SECONDARY conservation forest)

### 1 Basis for selection

The forest was selected in recognition of its considerable biodiversity importance, especially because:

- it supports vegetation type J2 (*Acacia-Albizia Panicum-Chloris* savanna) not otherwise represented in Uganda's Protected Area system.
- it also supports one unique tree species
- it supports four species with restricted ranges; two trees, one of bird and one of butterfly (Table 33.3).

### 2 Physical description

**Area and demarcation:** The reserve has an area of 53 km<sup>2</sup>, and a total boundary length 49 km; all of which is an artificial boundary cutline and surrounded by local community lands.

**Establishment:** 1937

**Location:** Ogili Forest Reserve lies in Chua and Agago counties in Kitgum District in Northern Uganda between 33°16'-33°21' E and 3°8' N - 3°21' N; it is covered by Uganda Department of Lands and Surveys Map Sheets 16/3 and 16/4 (series Y732) at 1:50,000.

**Physical features:** It is an isolated hill seated amongst an extensive flat area with an altitudinal range between 1060-1992 m above sea level.

### 3 Vegetation and forest condition

About 20 km<sup>2</sup> (37%) of the reserve is occupied by *Butyrospermum* savanna classified as L3 (*Butyrospermum-Hyparrhenia dissoluta*), another 20 km<sup>2</sup> (37%) with Dry Combretum savanna classified as N4 (*Combretum-Oxytenanthera-Hyparrhenia*) and 13 km<sup>2</sup> (24%) with moist Acacia savanna classified as J2 (*Acacia-Albizia-Panicum-Chloris*); (Langdale-Brown et. al., 1964).

The forest is intact (overall condition score 5). There is no timber harvesting and agricultural encroachment, but hunting is evident.

**Forest integrity scores:** Settlement = 0, Cultivation = 1, Hunting = 1, Livestock = 0, Timber = 0, Fire = 3 and Mining = 0 (see Appendix 4 for explanation).

### 4 Economic importance

**Community use values:** The forest is located in an area with low population density (32 people/km<sup>2</sup> in 1991). Therefore, there is little use of resources within the reserve and in the peripheral areas, giving a community use value of 2.2 (see Appendix 3 for explanation).

**Timber production:** The forest is not significant for timber production and no timber inventory has been carried out.

**Other economic uses:** There are no other significant economic uses of the forest anticipated, but it is important for watershed protection.

## 5 Biodiversity values

Of the 65 forests investigated, Ogili ranks the sixteenth in overall importance, with score 13.1, but ranks third in species diversity (score 8.0) and twenty-second in species “rarity” (score 5.7) (see Chapter 3, Table 3.5 for explanation). Strangely, it ranks first in species diversity of trees with (score 10). The reserve has four species with restricted ranges (two trees, one each of birds and butterfly) (see Table 33.1).

The reserve has the largest representation (13 km<sup>2</sup>, 72%) of moist acacia savanna classified as J2 (*Acacia-Albizia-Panicum-Chloris*), a vegetation type which is not represented elsewhere in the country’s Protected Area system.

## 6 Present management

The reserve is managed from the District Forest Offices at Kitgum. There is a Forest Ranger based at Chua county Headquarters, with one Forest Guard who resides at his home near the reserve (see Table 33.1).

There is no departmental building for this reserve and the Forest Ranger resides in a rented house at the county headquarters.

The only available means of transport is the pick-up for the DFO and a motorcycle for his assistant both of which are not directly used for management of this reserve. There has been no Working plan for this reserve.

Under the EC funded Natural Forest Management and Conservation Project, boundary reopening was initiated in 1994. No patrols have been carried out.

## 7 Proposed zonation

Figure A33.1 shows the preliminary proposed zonation of the reserve with one Strict Nature Reserve (24 km<sup>2</sup>), which covers all the areas in the north-western part of the reserve of more than 15% slope. The rest of the reserve is zoned as a protection area.

The proposed Ogili Strict Nature Reserve (24 km<sup>2</sup>) has been selected to:

- Cover the least accessible part of the reserve to provide a high degree of inherent protection.
- Cover the area of undisturbed natural vegetation representing ecological climax communities.
- Have clearly defined boundaries following natural features (the cliff and ridges).

The protection zone includes all the remaining areas (29 km<sup>2</sup>) of the reserve from which the community can obtain local forest products on a sustainable basis as controlled by the management but this zone also requires a high degree of protection. Management action in this zone should be geared towards securing the integrity of the reserve and to protect the water catchment.

## 8 Proposed management programmes

**Staffing:** The reserve will continue to be managed by the DFO Kitgum, assisted by the Forest Ranger for Chuuo County who will be based at Chuuo County Headquarters and one Forest Guard situated near Owl Primary School (see Table 33.1).

**Table 33.1 Existing and proposed staffing at Ogili**

Station	Existing and proposed No. of staff by category					Remarks
	FO	FR	FG	PM	Total	
Kitgum	1(0)	0(0)	0(0)	0(0)	1(0)	DFO Kitgum
Chuuu	0(0)	1(0)	0(0)	0(0)	1(0)	Also ranger for Rom
Owl	0(0)	0(0)	1(0)	0(2)	1(2)	
<b>Total</b>	<b>1(0)</b>	<b>1(0)</b>	<b>1(0)</b>	<b>0(2)</b>	<b>3(2)</b>	

Note: Nos. in brackets indicates proposed staffing, FO = Forest Officer; AFO = Assistant Forest Officer; FR = Forest Ranger; FG = Forest Guard; PM = Patrolmen

**Infrastructure:** A house should be constructed for a Forest Ranger at the Chuuo County Headquarters while another house should be constructed near Owl Mission and Primary School for the Forest Guard (see Table 33.2).

**Table 33.2 Existing and proposed staff housing at Ogili**

Station	Existing and proposed No. of staff housing					Remarks
	FD detached	FD semi Detached	FD uniport	Private	Total	
Kitgum	1(0)	0(0)	0(0)	0(0)	1(0)	for DFO
Chua County	0(1)	0(0)	0(0)	0(0)	0(1)	for FR
Wol	0(0)	0(1)	0(0)	0(0)	0(1)	FG and PM for PM
<b>Total</b>	<b>1(1)</b>	<b>0(1)</b>	<b>0(0)</b>	<b>0(0)</b>	<b>1(2)</b>	

Note: \* Figure represent No. of staff families accommodated (i.e. 2 in semi detach denote two families occupying a duplex). Nos. in brackets indicates numbers of proposed staff housing units.

The Forest Ranger should be availed a motorcycle and the Forest Gurad a bicycle, to support management of the reserve.

**Demarcation:** The 49 km of the external boundary will be re-opened and demarcated with cairns, beacons and directional trenches. These will be reinforced by planting of live markers with suitable tree species.

The internal boundary of the Nature Reserve will be marked by painting trees and rock outcrops along it in the standard way. This should be reinforced with sign plates marked "Nature Reserve" fixed at regular intervals along the boundary and at paths crossing the boundaries.

**Patrol and protection activities:** Two patrolmen will be employed to patrol along Omiya-Anyimia (the northern side) and another along Wol (southern side). Patrol routes and check sites will be established in the reserve, to ensure effective management.

**Public access and community needs:** The public shall have restricted access to the forest, in the area outside the proposed Nature Reserve.

The Forest Ranger and Guard under supervision of the DFO, will run a community awareness and education programme including the development of Collaborative Forest Management programmes within the reserve. Meetings will be instituted to discuss management of the reserve, especially the importance of the Nature Reserve.

**Table 33.3 Summary of biodiversity values for Ogili**

Criterion	Trees & Shrubs	Birds	Mammals	Butterflies	Moths	Overall
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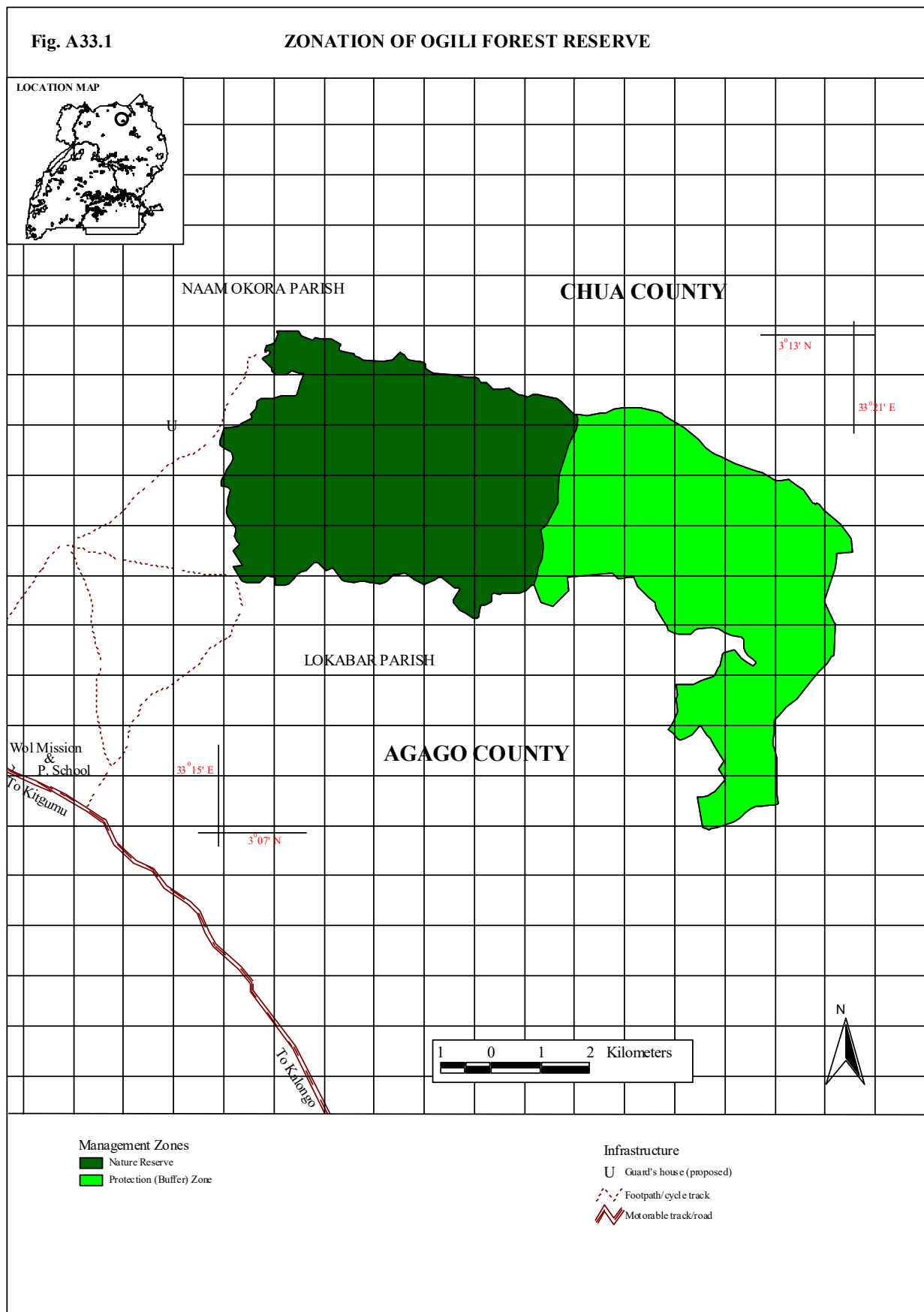
<b>No. of species known</b>	115	50	2	42	-	-
<b>No. of Restricted Range species <math>\leq 5</math> forests</b>	2	1	0	1	-	4
<b>Species Unique to Forest (Lists)</b>	<i>Lannea edulis</i>	none	None	none	none	-
<b>Uganda Endemics</b>	-	-	-	-	-	-
<b>Albertine Rift Endemics</b>	-	-	-	-	-	-
<b>Species Diversity (score and Rank)</b>	10(1)	6.4(18=)	6.7(11=)	5(33=)	<3.3	8.0(3)
<b>Species Rarity Value</b>	6.7(17=)	4.6(26)	2.5(42)	3.7(27)	<4.5	5.7(22)

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Overall biodiversity score 13.1

## 9 Principle reference material

1. Forestry Department (1996). Biodiversity Report Series No. 8, Nyangea-Napore, Ogili and Rom Forest Reserves. Forest Department, Kampala, Uganda.
2. Langdale-Brown, I., Osmaston, H.A. and Wilson, J.G. (1964). The Vegetation of Uganda and its Bearing on Land Use. Uganda Government Printer, Entebbe.
3. Lockwood Consultants (1973). Forest Resource Development Study for the Republic of Uganda. Lockwood Consultants, Toronto, Canada.



## APPENDIX 34: KITECHURA FOREST PROFILE

(Category: SECONDARY conservation forest)

### 1 Basis for selection

The forest was selected for Nature Reserve establishment in recognition of its biodiversity importance, especially because:

- it supports 2 species of butterflies found in no other Protected Area in Uganda.
- it is representative of a vegetation type X2, (*Miscanthidium* swamp) not otherwise represented in Uganda's Protected Area system.
- it supports 15 species (3 of trees and 12 of butterflies) that occur in not more than five other Ugandan forests.

### 2 Physical description

**Area and demarcation:** The area of the reserve is 53 km<sup>2</sup>, and its total boundary length 37 km, all of which adjoins local community lands. Of the 37 km, approximately 18 km follows rivers and streams while 11 km is an artificial boundary maintained as a planted cutline with earth corner cairns and direction trenches. 8 km adjoins the road to Kakabara trading centre.

**Establishment:** 1953

**Location:** It neighbours Kagombe and Matiri Forest Reserves and is situated on the escarpment above the Western Rift Valley between 0°34' and 0°54' N; 30°32' and 30°58' E. The reserve is located in Mwenge county, in Kabarole district and is covered by Uganda Department of Lands and Surveys map sheet 57/4 (series Y732) at 1:50,000.

**Physical features:** With an altitudinal range of 1189-1372 m above sea level, the reserve is bordered to the East by Kaija and Kagensa rivers; 19% of it exceeding 15° slope.

### 3 Vegetation and forest condition

20 km<sup>2</sup> (37%) is classified as type D3 (*Albizia-Markhamia* forest); 7 km<sup>2</sup> (13%) as type F2 (Forest/Savanna mosaic at medium altitude); 20 km<sup>2</sup> (37%) as type N3 (*Combretum-cymbopogon*); and 3 km<sup>2</sup>, (5%) as type X2 (*Miscanthidium* swamp).

The forest is intact (overall condition score 4) mainly because it is surrounded by other reserves. There has been no mechanized timber harvesting and no pitsawing activities. Hunting is common and encroachment on the western side covers approximately 3 km<sup>2</sup>.

**Forest integrity scores:** Settlement = 0, Cultivation = 1, Hunting = 1, Livestock = 0, Timber = 0, Fire = 0, Community Use = 0, Mining = 0 (see appendix 4 for explanation) (see Appendix 4 for explanation).

### 4 Economic importance

**Community use values:** The forest is situated in part of the country with a very low population density (47 people per km<sup>2</sup> in 1991), so pressure on the forest for firewood, building poles and non-timber forest products is very low. The forest is largely surrounded by other forest reserves, so that potentially valuable resources in many areas remain under-utilized giving a 'community use' value of 2.3 (see Appendix 3 for explanation).

**Timber production:** There is no timber production registered, and no illegal timber cutting was detected. A timber inventory in the early 1970s (Lockwood Consultants, 1973) provided an estimate of 40 m<sup>3</sup> per ha standing volume of merchantable timber exceeding 50 cm dbh.

### 5 Biodiversity values

Among the 65 forests investigated for biodiversity, Kitechura has an overall species diversity of 5.7 and overall species rarity of 5.8. It ranks 45th with an overall biodiversity importance value of 11.5. The forest supports 2 species of butterflies found in no other Ugandan forest (Table 34.3).

## 6 Present management

Kitechura is managed from Kabarole District Forest Offices and a local office at Kagora approximately 45 km from the reserve. There is one Forest Ranger and one Forest Guard (Table 34.1). The department has no houses and no transport attached to this reserve (Table 34.1). There are no roads or motorable tracks within the reserve. Vehicular access within 500 m of the forest boundary is possible on most of the south-western part of the reserve. The latest Working Plan covers the period 1963 to 1972. There is no Nature Reserve.

In recent years (since 1990), with the support of the EC-financed Natural Forest Management and Conservation Project, approximately 11 km of boundary has been redemarcated by outline of which 5 km has been successfully planted with marker trees (*Senna* sp. *Dracaena fragrans* and *Euphorbia* spp).

## 7 Proposed zonation

Figure A34.1 shows the proposed zonation of the reserve, with one Strict Nature Reserve (approximately 20 km<sup>2</sup>), one protection (buffer) zone of approximately 10 km<sup>2</sup> and one production zone (approximately 23 km<sup>2</sup>). The proposed Nature Reserve has been selected:

- to protect a viable area of *Miscanthidium* swamp type X2, not otherwise represented in the country's Protected Area system.
- as it is located in the least accessible part of the reserve, where it is provided with a high degree of inherent protection.

The proposed protection (buffer) zone covers areas adjacent to the Strict Nature Reserve which need to be maintained in a relatively natural state to shelter the Strict Nature Reserve against "edge effects".

The proposed production zone covers the more accessible peripheral areas of the reserve which are also well stocked with timber.

## 8 Proposed management programmes

**Staffing:** The reserve is to be managed by one Assistant Forest Officer (AFO), one Forest Ranger (FR) and one Forest Guard (FG), all based at Kitenga Forest Station. These will be assisted by four patrolmen and the available three nurserymen at Kitenga (Table 34.1).

**Table 34.1 Existing and proposed staff deployment at Kitechura**

Station	Existing and proposed No. of staff by category						Remarks
	FO	AFO	FR	FG	PM	Total	
Kagora	0(0)	0(0)	1(0)	1(0)	0(0)	2(0)	FR & FG should move to Kitenga station
Kitenga	0(0)	0(1)	0(1)	0(1)	3(7)	3(10)	PM at Kitenga include nursery workers.
<b>Total</b>	<b>0(0)</b>	<b>0(1)</b>	<b>1(1)</b>	<b>1(1)</b>	<b>3(7)</b>	<b>5(10)</b>	

Note: FO = Forest Officer; AFO = Assistant Forest Officer; FR = Forest Ranger, FG = Forest Guard; PM = Patrolmen, Nos. in brackets indicate proposed staffing.

**Infrastructure:** 3 houses are required at Kitenga for the Assistant Forest Officer, Forest Ranger and Forest Guard (Table 34.2).

**Table 34.2 Existing and proposed staff housing at Kitechura**

Existing and proposed staff housing			
Station	FD detached	FD semi Detached	Total
Kitenga	0(1)	0(2)	0(3)
<b>Total</b>	<b>0(1)</b>	<b>0(2)</b>	<b>0(3)</b>

Note: Nos. in brackets indicate proposed staff housing units.



**Demarcation:** Both internal and external boundaries will be demarcated in the standard way. About 6 km of the planted area needs replanting as most live markers have died. There is need for beating-up on the remaining boundary.

**Patrols and protection:** One patrol team comprising of one Forest Guard and four patrolmen will be constituted. These will be based at Kitenga trading centre. Patrol routes will be established throughout the reserve. The forest reserve can be jointly managed with Kagombe, Matiri and Ibambara Forest Reserves since these are all adjacent to each other.

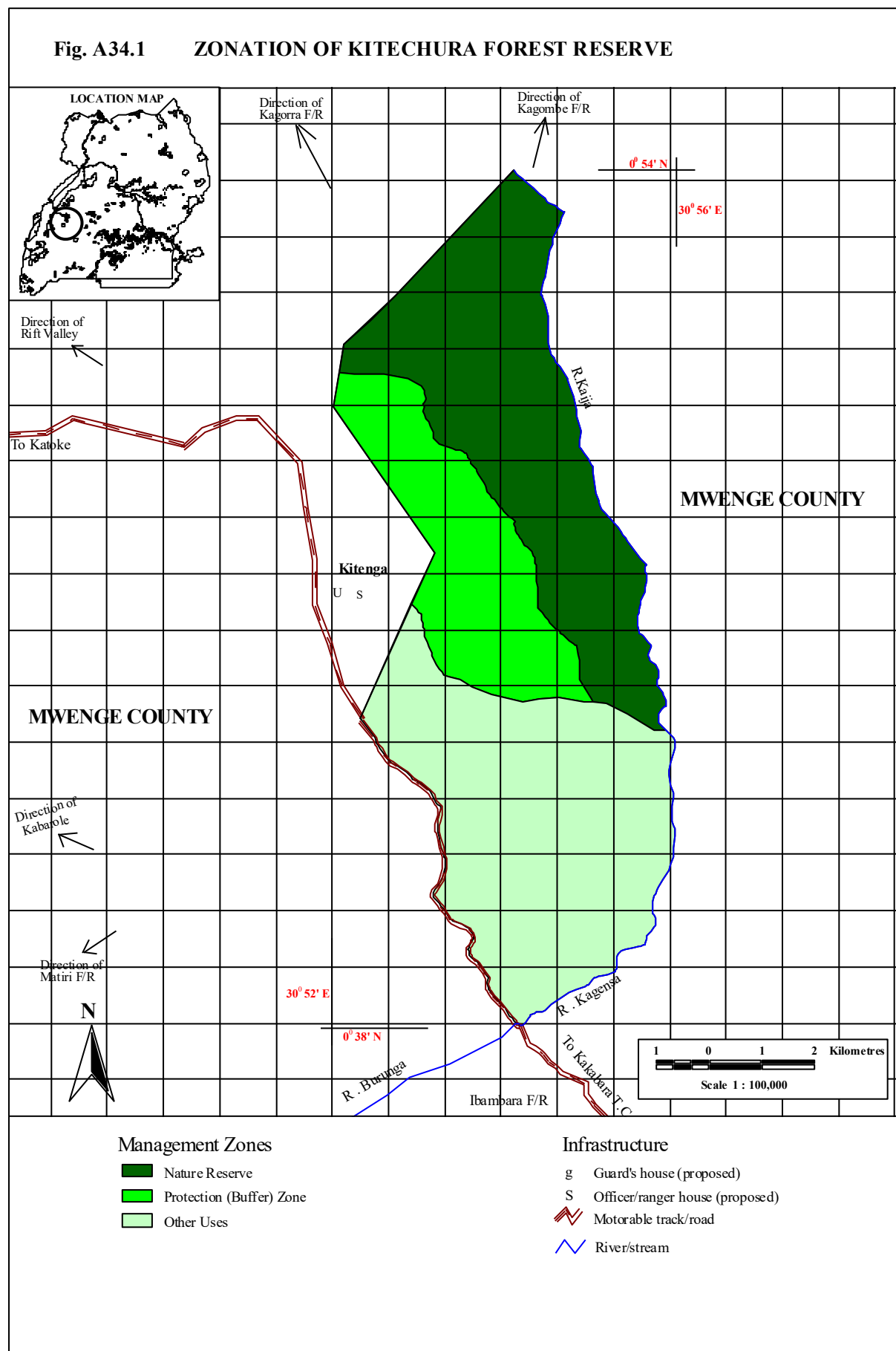
**Public access and community needs:** The AFO in charge will assume responsibility for community outreach programmes, including the development of collaborative management programmes within the reserve. The AFO and FR will each be provided with a motorcycle. Bicycles will be provided to the Forest Ranger and Guard.

**Table 34.3 Summary of biodiversity values for Kitechura**

Criterion	Trees & Shrubs	Mammals	Mammals	Butterflies	Overall
No. of species known	114	90	14	114	
No. of restricted range species (≤5 forest)	3	0	0	12	
Species unique to forest	0	0	0	<i>Iolaus bolissus</i> <i>Kedestes brunneostriga</i>	2 spp
Uganda endemics	0	0	0	0	
Albertine Rift endemics	0	0	0	0	
Species diversity (score & rank)	3.6(56=)	7.6(12)	9.3(2)	8.8 (10)	5.7(42)
Species rarity	6.3(59=)	5.2(34=)	5.6(20=)	5.2 (20)	5.8(47=)
Overall biodiversity importance score = 11.5(45=)					

## **9 Principal reference material**

1. Lockwood Consultants (1973). Forest Resource Development Study of the Republic of Uganda. Lockwood Consultants, Toronto, Canada.
2. Uganda Forest Department (1963). The Working Plan for Kitechura forest reserve, 1963-1972. Forest Department, Kampala, Uganda.
3. Uganda Forest Department (1996). Biodiversity Report Series No. 10; Kagombe, Matiri and Kitechura Forest Reserves. Forest Department, Kampala, Uganda.



**APPENDIX 35: ECHUYA FOREST PROFILE**

(Category: CORE conservation forest)

**1 Basis for selection**

The forest was selected for Nature Reserve establishment in recognition of its high biodiversity importance, especially because:

- it supports five species of trees, four of butterflies and one of birds which do not occur anywhere else in Uganda.
- it also supports eight species of birds, seven of butterflies and one of trees that are of conservation concern on account of being endemic to the Albertine Rift region (see Table 35.3).
- the forest supports *Bradypterus graueria* a globally threatened species.

**2 Physical description**

**Area and demarcation:** The reserve has a total area of 35 km<sup>2</sup> ; and a total boundary length of 45 km, all of which adjoins rural community lands. Of the 45 km of external boundary about 2 km follow a stream while 9 km of the south-western end of the reserve boundary runs along the north-eastern border of Rwanda. 43 km is an artificial boundary maintained as a planted cut line with earth corner and intermediate cairns, beacons and directional trenches. The cutline includes the boundary that falls along the Uganda-Rwanda international boundary.

**Establishment:** 1939

**Location:** The south western boundary runs along the north-eastern border of Rwanda. The forest is shared between Kabale (Rubanda county) and Kisoro (Bufumbira county) districts. It lies between 1°14'-1°21' and 29°47'-29°52' E and is covered by the Uganda Department of Lands and Surveys map sheets 93/2 and 93/4 (series Y732) at 1:50,000.

The climate is tropical with two peaks of rainfall, and an annual total of 1400-1900 mm. The annual mean temperature range is: Minimum 7°-15°C and Maximum 20°-27°C.

**Physical features:** The reserve occupies a high altitude ridge with an altitudinal range of 2270-2570 m above sea level, with 74% exceeding a 15° slope. It contains the large Muchuya swamp which runs north-south along the centre of the reserve and drains to the north.

**3 Vegetation and forest condition**

The majority of the area is dominated by two vegetation communities classified as type B2 (*Hagenia-Rapanea* moist montane forest (17 km<sup>2</sup>, 49%) and B4 (*Arundinaria* Montane Bamboo forest, (18 km<sup>2</sup>, 51%), (Langdale-Brown et. al., 1964).

The forest is partially degraded (overall condition score 3) mainly because it is surrounded by a high human population. The reserve is relatively small in size. There is some agricultural encroachment on the banks of Muchuya swamp and some hunting also takes place. The issue of the encroachment is being handled by the Forest Department and will soon be resolved.

**Forest integrity scores:** Settlement = 0; Cultivation = 2; Hunting = 1; Live stock grazing = 4; Bamboo harvesting = 5; Fire = 1; Community use/access = 3; Mining = 1. (see appendix 4 for explanation).

#### 4 Economic importance

**Community use values:** The forest is situated in one of the most densely populated parts of the country (302 people per km<sup>2</sup> in 1991). Consequently, pressure on the forest for firewood, building poles and non-timber products is high. The reserve is relatively small and easily accessible from all sides and is therefore fully utilised by the surrounding community giving a “community-use value of 20” (see Appendix 3 for explanation).

**Timber production:** The forest is not an important source of timber.

**Other economic values:** The reserve is an important watershed. The Muchuya swamp acts as a water reservoir which drains to the north. It is easily accessible and can be a tourist attraction with its rare species of birds, butterflies and trees.

#### 5 Biodiversity values

Of the 65 forests investigated for biodiversity, Echuya ranks eighth in overall importance with a score of 14.3 (see chapter 3 Table 3.1). It is the top-scoring forest in terms of tree rarity value with a score of 10, the 4th in terms of moth rarity value with a score of 7.9, first in terms of rarity value of mammals and butterflies with a score of 10 each and the second in terms of bird rarity value, with a score of 9.6. It supports ten species which do not occur anywhere else in Uganda. Of these, five are trees, four are butterflies, and one is a bird species (see Table 35.3).

#### 6 Present management

The reserve is managed from Kabale and Kisoro District offices. Two Forest Guards stay at Rwaburimbe station. 12 patrolmen are employed. Four work on the Kisoro side and eight on the Kabale side of the reserve (see Table 35.1).

**Table 35.1 Existing and proposed staff deployment at Echuya**

Station	Existing and proposed No. of staff by category					Remarks
	AFO	FR	FG	PM	Total	
Karengyere	0(1)	0(0)	0(0)	0(0)	0(1)	Existing ranger to move to Rwaburimbe
Rwaburimbe	0(0)	0(2)	2(1)	8(3)	10(1)	
Kanabe	0(0)	0(2)	0(1)	4(3)	4(6)	
Rusheyu	0(0)	0(0)	0(1)	0(5)	0(6)	
<b>Total</b>	<b>0(1)</b>	<b>0(4)</b>	<b>2(3)</b>	<b>12(11)</b>	<b>14(16)</b>	

Note: Numbers in brackets indicate proposed staffing.

The department has one staff house at Karengyere, one ranger's house and a duplex house for two Forest Guards at Rwaburimbe station. The Department also has one Forest Ranger's and one duplex house at Kanaba on the Kisoro side. These are not occupied (see Table 35.2).

**Table 35.2 Existing and proposed staff housing at Echuya Forest Reserve**

Station	Existing proposed staff housing			Remarks
	Single	Duplex	Uniport	
Karengyere	1(0)	0(0)	0(0)	Old & needs repair
Rwaburimbe	1(0)	1(0)	0(0)	2nd ranger to stay in one wing of duplex
Kanaba	1(0)	1(0)	0(0)	- do -
Rushayu	0(1)	0(0)	0(0)	new station
<b>Total</b>	<b>3(1)</b>	<b>2(0)</b>	<b>0(0)</b>	

Note: Numbers in brackets indicate proposed staffing.

Management is not facilitated by any means of transport.

The latest working plan covers the period 1st July 1967 to 30th June 1977 and prescribes for preservation of forest cover to protect soils and maintain water supplies, provision of sustained supply of bamboos to the public and for amenity purposes.

An area of about 3 ha had been given out for a wheat growing project which stopped in the late 1980s. This area has been planted with pines. These trees will be maintained until they are harvested. Then the area will be planted with bamboos.

A timber trial plot was established near the entrance of the reserve on the Kabale-Kisoro road (near Rwaburimbe station) in the 1960s. The trees are due for harvesting. These trees should be measured and harvested and then the area can be planted with bamboos.

There is no Nature Reserve.

In recent years (since 1990) with the support of the EC-financed Natural Forest Management and Conservation Project, about 43 km of boundary has been reopened by cutline of which 39 km have been successfully planted with marker trees (*Eucalyptus*, *Ficus*, *Erythrina* and *Pinus*) at 50 m intervals or less. The unplanted part lies on the Uganda-Rwanda border.

## 7 Proposed zonation

An area totalling about 22 km<sup>2</sup> is proposed as a Strict Nature Reserve while the remaining 13 km<sup>2</sup> will be a Buffer Zone (Fig. A35.1). The proposed Strict Nature Reserve has been selected to encompass part of the bamboo zone and to accommodate most of the rare species, as indicated in Table 32.3. Further, the Strict Nature Reserve will serve the following functions:

- Protect the steep slopes into Muchuya swamp which are likely to have most of the rare species mentioned.
- Accommodate most of the tree species on the northern side of Kabale-Kisoro road.
- Allow use of bamboos. The areas especially those with a lot of bamboos will be difficult to protect due to pressure for bamboos and these form part of the Buffer Zone. Controlled bamboo harvesting will be allowed in the Buffer Zone.

## 8 Proposed management programmes

**Staffing:** The present staffing is not adequate and there is therefore need to employ one Assistant Forest Officer, 4 more Forest Rangers, 3 Forest Guards and 11 patrolmen with responsibility for newly defined activities (see Table 35.1).

The entire reserve will be brought under the responsibility of one Assistant Forest Officer based at Karengyere. He will be assisted by one Forest Ranger stationed at Kanaba and another at Rwabusimbe. Two more Forest Rangers will be recruited, one for Kanaba and one for Rwaburimbe, to assume responsibility for community outreach programmes.

**Infrastructure:** There are two stations, one at Rwaburimbe and the other at Kanaba. There is a ranger's house at Karengyere. The two stations are on the northern side of the reserve.

One additional guard house will be necessary at Rushayu (near cairn 200) on the mid-south-eastern part of the reserve to control the heavy harvesting of bamboos by Rwandese (see Fig. A35.1 and Table 35.1).

**Demarcation:** The entire external boundary of 43 km was reopened and most of it is planted with live markers. The boundary will be demarcated with concrete corner beacons and maintained regularly.

All internal management zone boundaries will be demarcated in the standard way. Sign boards will be erected whenever prominent paths cross external and internal boundaries.

**Patrols and protection activities:** Three patrol teams will be constituted. The teams based at Kanaba and Rwaburimbe will consist of one Forest Guard and three patrolmen each while that at Rushayu will consist of one Forest Guard and five patrolmen. The bigger team at Rushayu will be necessary in order to cope with a larger area and to control thefts especially on the Uganda-Rwanda border.

Men will be rotated between patrol teams and teams will be rotated between stations. Patrol routes and check points will be established throughout the reserve. For effective patrols, a charge officer will be facilitated with a motorcycle. His four Forest Rangers will be facilitated each with a bicycle. Please note that of the four rangers, two will concentrate on Collaborative Forest Management while two will do protection work.

**Public access and community needs:** This reserve has a maximum community use potential of “score 20”. The surrounding population use the reserve for grazing, fuelwood and building poles. There is therefore need to help the population develop alternative sources of the much needed forest products.

Two Forest Rangers will therefore be needed to develop a programme of community tree planting outside the reserve and a programme of village meetings to explain and discuss the management of the reserve and in particular the management of the Strict Nature Reserve and Buffer Zone.

One ranger will be stationed at Kanaba to help the Kisoro community and the other at Rwaburimbe to help the Kabale community. Each of the rangers will be provided with a motor cycle to do his work.

**Table 35.3 Summary Table of Biodiversity Values**

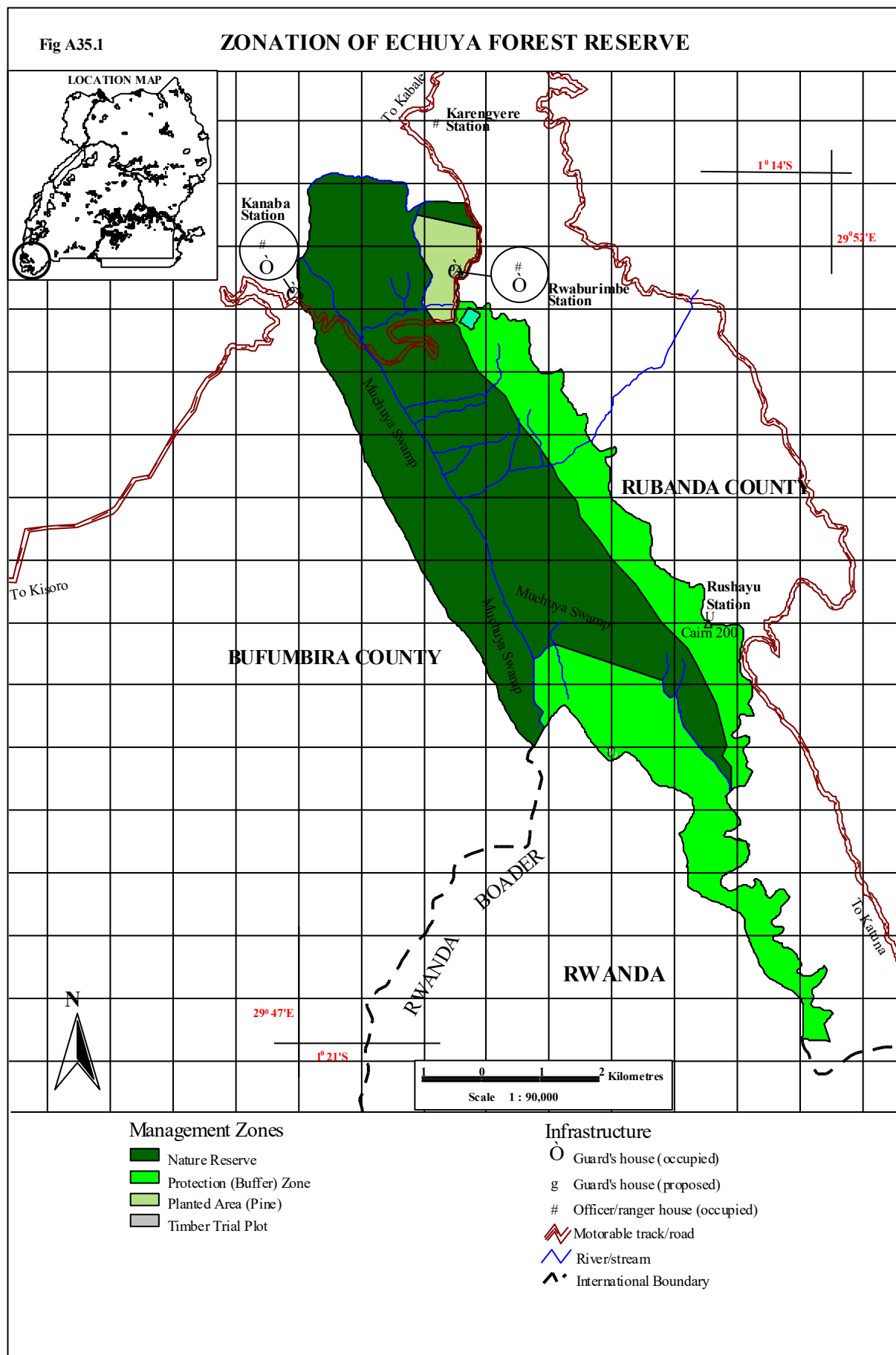
Criterion	Trees & Shrubs	Birds	Mammals	Butterflies	Moths	Overall
<b>Total No. of species known</b>	127	85	20	54	43	-
<b>No. of restricted range species</b>	24	17	8	24	4	-
<b>Species unique to the forest</b>	<i>Chorostylis ramnoides</i> <i>Crotalaria mildbraedii</i> <i>Hypericum lanceolatum</i> <i>Lobelia stuhlmanii</i>	<i>Cape grass owl.</i>		<i>Harpenderyeus argentostratus</i> <i>Charaxes alticola</i> <i>Issoria hanningtoni</i> <i>Zenonia anax</i>	-	9
<b>Uganda endemics</b>	None	None	None	none	-	-
<b>Albertine Rift endemics (list)</b>	<i>Rhytigynia beniensis</i>	Stripe-breasted Tit Collared Apalis Grauer's Rush Wabler Red-faced woodland Warbler Rwenzori Batis Regal Sunbird Dusky Crimson-wing White-collared Olive back	-	<i>Acraea amicitiae</i> <i>Hypolycaena jacksoni</i> <i>Zenonia crasta</i> <i>Acraea burgessi</i> <i>Bicyclus aurivilli</i>	-	13
<b>Species rarity value score &amp; rank</b>	10(1)	9.6(2)	10(1)	10(1)	7.9(4=)	9.7(1)
<b>Species biodiversity (score &amp; rank)</b>	3.8(53)	6.2(30)	5.1(45)	5.2(53)	5(35=)	4.4

Overall biodiversity score = 14.3

## 9 Principle Reference Material

- Howard, P.C. (1991). Nature conservation in Uganda's Forest Reserves. IUCN, Gland, Switzerland.
- Langdale-Brown, I., Osmaston, H. A. and Wilson, J.G. (1964). The vegetation of Uganda and its bearing on Land use. Uganda Government Printer, Entebbe.
- Uganda Forest Department (1996). Biodiversity report series No. 22; Echuya and Mafuga Forest Reserves. Forest Department, Kampala, Uganda.





**APPENDIX 36: MAFUGA FOREST PROFILE**

(Category: SECONDARY conservation forest)

**1 Basis for selection**

The forest was selected for Nature Reserve establishment in recognition of its biodiversity importance, especially because:

- it supports three species of trees and one of butterfly which do not occur anywhere else in Uganda.
- it supports ten species of birds, two of mammals, four of butterflies and one large moth of conservation concern because they are endemic to the Albertine Rift Region (see Table 36.3).
- it supports the vegetation type G4 (montane thicket) that does not occur anywhere else in Uganda.

**2 Physical description**

**Area and demarcation:** The area of the reserve is 38 km<sup>2</sup>, and the total boundary length is 43 km, all of which adjoins rural community lands. Of the 43 km of external boundary, approximately 6 km follows a stream while 10 km is an artificial boundary maintained as a planted outline with earth corner cairns and directional trenches on the area not yet planted with *Pinus* spp. The planted area has about 27 km of boundary which is a cleared fireline.

**Establishment:** 1941

**Location:** On high altitude land in the Kigezi highlands between 1°00'–1°05' S and 29°51'–29°55' E. The forest is shared between Kabale (Rubanda county) and Rukungiri districts (Kinkizi and Rubabo counties). It is covered by Uganda Department of Lands and Surveys map sheet 93/2 (series Y732) at 1:50,000.

**Physical features:** The reserve occupies high altitude land and comprises broad ridges dissected by steep valleys. It has an altitudinal range of 1820–2467 m above sea level with 92% (35 km<sup>2</sup>) exceeding a 15° slope.

**3 Vegetation and forest condition**

The forest forms Uganda's largest plantation of exotic trees, mainly *Pinus patula*, *Cupressus lusitanica*, fire breaks of *Eucalyptus* and natural vegetation. There are two small swamps, one near Kerere and the other near Rutooma. The entire planted area is about 30 km<sup>2</sup> leaving about 7 km<sup>2</sup> unplanted in the north-west of the reserve. Of these, about 4 km<sup>2</sup> in the south of the unplanted area forms the proposed Nature Reserve, in which about 1 km<sup>2</sup> is a dense forest located in valley bottoms. The majority of this remaining natural forest is classified as *Pygeum* moist montane forest (type B1) and montane thicket (type G4) (Langdale Brown et. al., 1964) with some areas covered with scrub and bracken.

The forest is partially degraded (overall condition score 3) mainly because of the population pressure and its easy accessibility.

**Forest integrity scores:** Settlement = 0, Cultivation = 3, Hunting = 0, Live stock grazing = 4, Timber Harvesting 1, Fire = 1–2 and Mining = 1 (see Appendix 3 for explanation).

**4 Economic importance**

**Community use values:** The forest is situated in one of the most densely populated parts of the country (200 people per km<sup>2</sup> in 1991), so pressure on the reserve for grazing, fuelwood and non-timber forest products is high, giving a community-use value of 16.4 (see Appendix 3 for explanation).

**Timber production:** The forest is an important source of plantation timber which covers about 30 km<sup>2</sup>. The plantation is likely to be extended to cover the remaining 1 km<sup>2</sup> which is not covered by the Strict Nature Reserve and protection (buffer) zone.

**Other economic values:** The reserve is important as part of the watershed for the river Ishasha that flows into Lake Edward.

**5 Biodiversity values**

Of the 65 forests investigated for biodiversity Mafuga ranks 20th, in overall importance with a score of 13.4 (see chapter 3, Table 3.1). It is the 56th with a score of 5.1 in terms of species diversity but ranks 5th overall in terms of rarity value of the species represented, perhaps due to its high altitude. In terms of rarity value, it is the second for butterfly species and the 4th for birds, 7th for mammals and trees and 17th for moths (see Table 36.3). It also supports 17 species endemic to the Albertine Rift Region (11 birds, 4 butterflies and two mammals).

Three trees species and one butterfly are unique to this reserve (Table 36.3).

## 6 Present management

The reserve is managed from Kabale District Forest Office with local stations at Mafuga and Kirima. There is one Forest Officer stationed at Mafuga, two Assistant Forest Officers (stationed at Mafuga and Kirima) four Forest Rangers (two at Mafuga and two at Kirima); five Forest Guards (three at Mafuga and two at Kirima) and two patrolmen at Mafuga (see Table 36.1).

It should be noted that the staff and housing are for plantation management. There is need to construct two single houses at Mubushenyi near the Nature Reserve to protect it.

The Department has five houses for staff in Kirima, six houses and two uniports in Mafuga. Some of these houses are however in a state of disrepair and lots of repairs are needed (see Table 36.2).

**Table 36.1 Existing and proposed staff deployment at Mafuga**

Station	Existing and proposed No. of staff by category						Remarks
	FO	AFO	FR	FG	PM	Total	
Mafuga	1(0)	1(0)	2(0)	3(0)	2(0)	9(0)	Most staff belong to plantation management
Kirima	0(0)	1(0)	2(0)	2(0)	0(0)	5(0)	All staff belong to plantation management
Mubushenyi	0(0)	0(0)	0(1)	0(1)	0(0)	0(2)	
<b>Total</b>	<b>1(0)</b>	<b>2(0)</b>	<b>4(1)</b>	<b>5(1)</b>	<b>2(0)</b>	<b>14(2)</b>	

Note: FO = Forest Officer, AFO = Assistant Forest Officer; FR = Forest Ranger;  
FG = Forest Guard; PM = Patrolmen, Nos. in brackets indicate proposed staffing

**Table 36.2 Existing and proposed staff housing at Mafuga**

Station	Existing and proposed staff housing at Mafuga				Remarks
	FD Detached	FD semi Detached	Uniport	Total	
Mafuga	6(0)	0(0)	2(0)	8(0)	Two to be constructed at Mubushenyi for FR and FG. All houses need repair.
Kirima	5(0)	0(0)	0(0)	5(0)	
Mubushenyi	0(2)	0(0)	0(0)	0(2)	
<b>Total</b>	<b>11(2)</b>	<b>0(0)</b>	<b>2(0)</b>	<b>13(2)</b>	

Note: Nos. in brackets indicate proposed staff housing units.

Management is facilitated by one pick up and one tractor at Mafuga, and one motorcycle at Kirima. The road from Kabale to Kanungu passes through the reserve.

The latest Working Plan covers the period 1/7/85-30/6/90 and prescribes for (1) profitable production of softwood timber, (2) protection of water catchment areas, and (3) conservation of flora and fauna which should not however compromise the first two objectives. There is no Nature Reserve. Establishment of softwood plantations started in the 1940s.

In recent years (since 1990) with support of the EC-financed Natural Forest Management and Conservation Project, about 10 km of boundary in the unplanted area have been redemarcated by cutline and planted with marker trees

(*Pinus*, *Erythrina* and *Eucalyptus* at between 5 m and 20 m intervals. Protection patrols have been carried out to stop grazing and illegal felling.

## 7 Proposed zonation

Most of the reserve has been planted with *Pinus patula* and *Cupressus lusitanica*. *Eucalyptus grandis* was planted as fire lines. Only 7km<sup>2</sup> to the north west remains unplanted, out of which approximately 4 km<sup>2</sup> will be a Strict Nature Reserve and about 2 km<sup>2</sup> will be protection Buffer Zone. These areas lie on the southern side of the Kabale-Kanungu Road. An area of about 1 km<sup>2</sup> on the northern side of the road will be planted with pines (Fig. A33.1). The rest of the reserve (32 km<sup>2</sup>) will be for production.

## 8 Proposed management

**Staffing:** Whereas the present staff might be adequate for the plantations, those that are on management of the Nature Reserve are inadequate. These include one Forest Ranger, one Forest Guard and two patrolmen.

**Infrastructure:** Although there are houses within the plantation, they are far from the Strict Nature Reserve. One Forest Ranger's and one Forest Guard's houses should be constructed near Mubushenyi on the ridge overlooking the Strict Nature Reserve for effective control of illegal activities (see map).

**Demarcation:** All the 10 km of the external boundary of the unplanted area have been re-opened and planted, and they should be maintained.

The boundary of the Strict Nature Reserve will be the edge of the plantation on all sides except the West, South and the South East where it is made up of rivers and streams.

**Patrol and protection activities:** One team headed by a Forest Ranger and composed of two patrolmen and one Forest Guard will be constituted with the responsibility of protecting the Nature Reserve. The Ranger and the Guard will need a motorcycle and bicycle respectively. The Forest Officer in charge of Mafuga plantations will also take charge of the Nature Reserve.

**Public access and community needs:** The Ranger in charge will take up the responsibility of explaining to the people about the existence and the importance of the Nature Reserve and will guide them on how to get their needs from the plantation rather than the natural forest. The Forest Officer will initiate Collaborative Forest Management arrangements and tree planting by the community adjacent to the reserve.

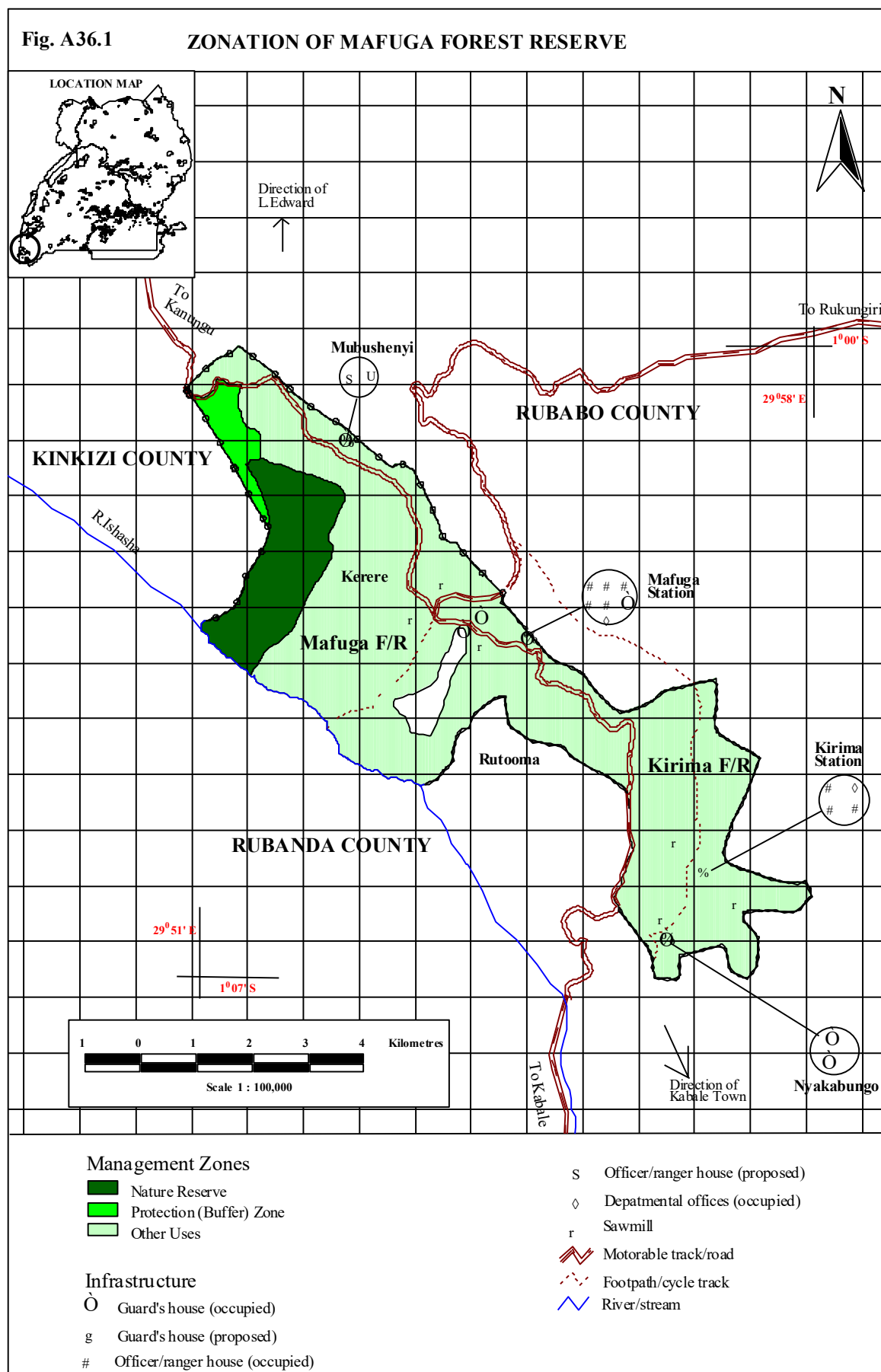
**Table 36.3 Summary of biodiversity values for Mafuga**

Criterion	Trees & Shrubs	Birds	Mammals	Butterflies	Moths	Overall
<b>Total number of species known</b>	115	130	18	45	33	
<b>No. of restricted range species <math>\leq 5</math> forests</b>	17	20	2	11	2	
<b>Species unique to the e forest</b>	<i>Ceasalpina decapetala</i> <i>Oxyanthus troupinii</i> <i>Peddiea rapaneoides</i>	-	-	<i>Charaxes xiphares</i>	-	4
<b>Uganda endemics</b>	-	-	-	-	-	-
<b>Albertine Rift endemics (list)</b>	<i>Oxyanthus troupinii</i> <i>Peddiea rapaneoides</i>	Stripe-breasted Tit Collared Apalis Red-faced Woodland Warbler Yellow-eyed Black Flycatcher Rwenzori Batis Blue-headed Sunbird Purple-breasted Sunbird Regal sunbird Strange Weaver Dusky Crimson-wing White-collared Olive-back	<i>Myosorex blarina</i> <i>Lophuromys woosnam</i>	<i>Acraea amicitiae</i> <i>Bicyclus aurivillii</i> <i>Bicyclus matuta</i> <i>Mylothris crocea</i>	-	19
<b>Species rarity value score and rank</b>	8.4 (7=)	(4=)	7.7(7=)	8.5(2)	(17=)	8.1(5)
<b>Species biodiversity score and rank</b>	4.4(47)	7.9(10)	6.9(18=)	4.7(58)	5.6(31)	5.1(56=)

Overall biodiversity score = 13.4

## **9 Principle reference material**

1. Lockwood Consultants (1973). Forest Resource Development Study for the Republic of Uganda. Lockwood Consultants, Toronto, Canada.
2. Uganda Forest Department (1985). Mafuga Working plan Area for 1985-90. Forest Department, Kampala, Uganda.
3. Uganda Forest Department (1996). Biodiversity Report Series No. 56; Echuya and Mafuga forest reserves. Forest Department, Kampala, Uganda.



## APPENDIX 37: IGWE LUVUNYA FOREST PROFILE

(Category: SECONDARY conservation forest)

### 1 Criteria for selection as Nature Reserve

The forest was selected for Nature Reserve establishment in recognition of its considerable biodiversity importance, especially because:

- it is relatively diverse in species, despite its small size and degraded nature.
- it supports one tree species and one species of butterfly found in no other Ugandan forests.
- it supports one species of butterfly not found elsewhere in Uganda's Protected Area System and which is of conservation concern on account of being endemic to the Albertine Rift region.

### 2 Physical description

**Area and description:** The reserve is composed of two blocks: The Igwe block and Luvunya block (see map, Fig A37.1), totalling 20 km<sup>2</sup>. Total boundary length is 34 km all of which adjoins rural community lands. The whole external boundary is artificial, maintained as a planted outline with corner beacons, earth cairns and directional trenches.

**Establishment:** As local forest reserve in 1965.

**Location:** In the administrative district of Bugiri, 00°25'–00°31'N and 33°49'–33°52'E. The forest is covered by the Uganda Department of Lands and Surveys Map sheets 63/4 and 73/2 (series Y732) at 1:50,000.

**Physical features:** The reserve occupies flat terrain at altitudes of 113–1295 m above sea level, with only 1 km<sup>2</sup> (5%) exceeding 15° slope. The Luvunya block is dissected by river Luvunya, which is seasonal and drains into Kibimba swamp.

### 3 Vegetation and forest condition

The entire area of the reserve (20 km<sup>2</sup>, 100%) is occupied by medium altitude moist semi-deciduous forest, classified as type D4 (*Albizia-Chlorophora* forest) (Langdale-Brown et al., (1964).

The forest is partially degraded, especially the Igwe block, (overall condition score 3), mainly because of past tree harvesting for firewood by Kibimba Rice Company and the surrounding area being heavily populated (224 people per km<sup>2</sup>) putting the reserve under high pressure for minor forest produce. There has been no mechanical timber harvesting, and no agricultural encroachment, although there are signs of previous illegal pitsawing. Hunting for small mammals is now widespread.

**Forest integrity score:** Settlement = 0; Timber = 0; Fire = 1; Cultivation = 0; Hunting = 0/1; Livestock = 0; Community Use = 1; Mining = 0 (see Appendix 4 for explanation).

### 4 Economic importance

**Community use value:** The forest is situated in one of the most densely populated parts of the country (224 people per km<sup>2</sup> in 1991), consequently the periphery of the forest is under heavy pressure for firewood, charcoal, building poles and non-timber forest products. The small size and flat terrain of the reserve make it very accessible giving a community use value of 20 (see Appendix 3 for explanation). Recent frequent patrols have reduced the rate of forest exploitation.

**Timber production:** Given its small size, and even with 75% being a forested area, the forest is unsustainable in terms of timber production. An inventory in early 1970s (Lockwood Consultants, 1973) provided an estimate of 10m<sup>3</sup> per ha standing volume of merchantable timber exceeding 50 cm dbh. The forest has a fuelwood plantation potential score = 1 (see Appendix 3 for explanation).

**Other economic values:** Apart from provision of minor forest products, the forest has low potential for other economic values. It lacks tourism attractions and facilities. It has poor value in terms of local recreation, education and research, as well as watershed protection, but has easy access from the Jinja-Tororo highway.



## 5 Biodiversity

Of the 65 forests investigated for biodiversity, Igwe-Luvunya ranks thirty-fifth in overall importance, with a score of 12.2 (chapter 3, Table 3). It is sixteenth scoring in terms of species diversity, but ranks fifty-second in terms of the 'rarity' value of species presented, presumably because many of its species are shared with other medium-altitude semi-deciduous forests. The forest supports 2 species found in no other Ugandan forest (one tree and one butterfly; see Table 37.3). It has no endemics to Uganda but there is one species endemic to the Albertine Rift region.

## 6 Present Management

The reserve is managed from the Iganga District Forest Offices and with a local office at Bugiri. There are three Forest Officers and one Assistant Forest Officer, four patrolmen (two each for Luvumya and Igwe blocks), and three nursery men (see Table 37.1). The local station at Bugiri has one duplex and one single housing unit. In addition, the main station also has 3 uniports. There are no buildings at the reserve itself. Two Forest Officers are accommodated in departmental units at Iganga while the third is in a non-departmental house (see also Appendix 17). The Assistant Forest Officer is accommodated in the single (detached) house at Bugiri while the patrol and nursery men are in private houses at Kitodha and Bugiri respectively. Management is facilitated by the District Forest Officer's pick-up and a motor cycle for the Assistant Forest Officer stationed at Iganga and Bugiri respectively. A cycle track exists in the northern part of Igwe block (see Fig. A37.1). There has not been any formal working plan for the area.

With support of the EU-financed Natural Forest Management and Conservation Project, 34 km of boundary have been re-demarcated by cutline, maintained by planting with live marker trees (*Euphorbia*, *Maesopsis* and Mahogany) at 10m intervals, and with earth corner cairns, beacons and directional trenches. Approximately 9 km of boundary had its marker trees destroyed by either drought or fire. Protection patrols have been conducted on a daily basis by patrolmen.

**Table 37.1 Existing and proposed staff deployment at Igwe-Luvunya**

Station	Existing and proposed No. of staff by category						Remarks
	FO	AFO	FR	FG	PM	Total	
Iganga	3(0)	0(0)	0(0)	0(0)	0(0)	3(0)	
Bugiri	0(1)	1(0)	0(1)	0(0)	0(0)	1(1)	
Kitodha	0(0)	0(0)	0(1)	0(1)	*4(0)	4(1)	
<b>Total</b>	<b>3(1)</b>	<b>1(0)</b>	<b>0(2)</b>	<b>0(1)</b>	<b>4(0)</b>	<b>8(2)</b>	

**Table 37.2 Existing and proposed staff housing at Igwe-Luvunya**

Station	Existing and proposed staff housing*						Remarks
	FD Detached	FD semi (incomplete)	FD semi (complete)	FD uniports	Private	Total	
Iganga	1(0)	0(0)	1(0)	0(0)	1(0)	3(0)	Housing in Iganga is also for South Busoga (Appendix 17)
Bugiri	1(0)	0(0)	1(0)	0(0)	0(0)	2(0)	
Kitodha	0(1)	0(0)	0(0)	0(0)	0(0)	4(1)	
<b>Total</b>	<b>2(1)</b>	<b>0(0)</b>	<b>2(0)</b>	<b>0(0)</b>	<b>1(0)</b>	<b>9(1)</b>	

NB: \*figures represent No. of staff families accommodated.

## 7 Proposed zonation

Figure A37.1 shows the preliminary zonation of the reserve, with two Nature Reserves (approximately 14 km<sup>2</sup>).

The proposed Igwe (8 km<sup>2</sup>) and Luvunya (6 km<sup>2</sup>) Strict Nature Reserves have been selected to protect a substantial undisturbed part of the relatively diverse forest which is small and highly susceptible to degradation.

The proposed protection zone of the eastern part of Luvunya block covers an area of steep land adjacent to the Nature Reserve, that is unsuitable for intensive use (on account of erosion hazards) but which can serve to enhance the long-term viability of the Strict Nature Reserve.

The Western protection zone of Luvunya and the Igwe protection zones cover land adjacent to areas of high human activities (agricultural land), that have also been affected by extraction of trees for firewood, poles and charcoal burning. They can serve to enhance the long-term viability of the Strict Nature Reserves.

The whole of Igwe-Luvunya will be treated as one Nature Reserve. This is because of the small nature of both blocks, which are surrounded by a dense human population and are therefore under serious threat from human activities. Its small size therefore renders them highly susceptible to degradation.

## 8 Proposed management

**Staffing:** The reserve will be managed under one Forest Officer, the Assistant Forest Officer in charge and a ranger (to be deployed at Kitodha). The two patrolmen for each of Igwe and Luvunya blocks are sufficient. However, there is need to have one Forest Guard for the two blocks, stationed at Kitodha.

**Infrastructure:** The Forest Officer and Assistant Forest Officer will be accommodated in the departmental houses at Bugiri. However, one house will be constructed at Kitodha for the ranger who will be in charge of Igwe and Luvunya. A store should also be constructed at Kitodha.

**Demarcation:** Following previous effects of fire and drought, several sections (approximately 9 km) of re-opened boundary require beating up and therefore continued maintenance to ensure their sufficient establishment. Provisionally, all Internal Management Zone boundaries will be demarcated by ring-painting in a standard way. Sign boards will be erected wherever prominent tracks and footpaths cross an external boundary.

**Patrol and protection activities:** Two patrol teams, each with two patrolmen, (the guard alternating between them) will be constituted, with responsibility for safeguarding the two blocks (Fig. A37.1) as separate ranges. They will be based at Kitodha and Bumoli. Men will be rotated between patrol teams and teams will be moved periodically between ranges. Patrol routes and check points will be established throughout the reserve. An incentive scheme will be instituted to reward success in curbing illegal activities. The patrolmen and guard will be provided with a bicycle each.

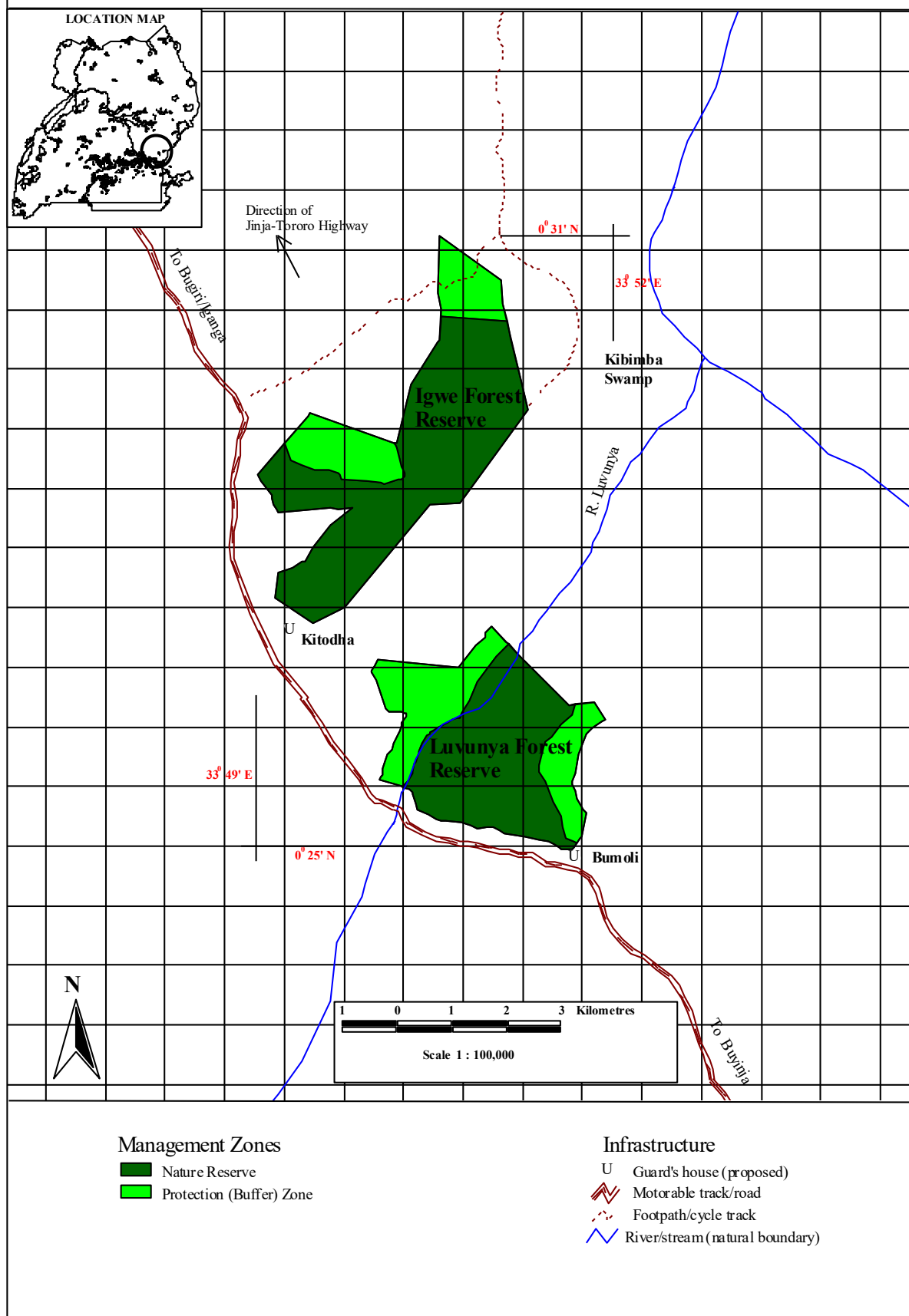
**Public access and community activities:** The Assistant Forest Officer and the Ranger (based at Bugiri and Kitodha) and a Guard will assume responsibility for community outreach programmes, including community conservation education and tree planting programmes outside and along the boundary. As surrounding communities have much depended on the reserve for poles and other minor forest products, community development initiatives will also be encouraged to provide alternatives. A programme of village meetings will be instituted to explain and discuss management of the reserve, in particular the management zones as they are established. The ranger will be provided with a motorcycle to support his work.

**Table 37.3 Summary of biodiversity values for Igwe-Luvunya Forest Reserve**

Criterion	Trees & shrubs	Birds	Small mammals	Butterflies	Large moths	Overall
<b>Total No. of spp known</b>	202	30	7	132	34	405 spp
<b>No. of restricted range spp. (<math>\leq</math> 5 forests)</b>	10	0	0	7	0	17 spp
<b>Species unique to forest</b>	<i>Wisadula amplissima</i>	None	None	<i>Mimacraea eltringhami</i>	none	2 spp
<b>Uganda endemics</b>	None	None	None	none	-	None
<b>Albertine Rift endemics</b>	None	None	None	<i>Mimacraea eltringhami</i>	-	1 spp
<b>Species diversity (score &amp; rank)</b>	7.7(11)	3.2(59)	5.2(41=)	7.9(15)	<3.3	6.7(16=)
<b>Species rarity (score &amp; rank)</b>	6.8(42=)	4.6(57=)	4.3(43=)	4.5(38=)	4.6(46)	5.7(52=)
						12.2(35=)
Overall biodiversity importance score = 12.2						

## 9 Principle reference material

1. Langdale-Brown, I., Osmaston, H.A. and Wilson, J.G. (1964). The Vegetation of Uganda and its Bearing on Land Use. Uganda Government Printer, Entebbe.
2. Lockwood Consultants (1973). Forest Resources Development Study for the Republic of Uganda. Lockwood Consultants, Toronto, Canada.
3. Uganda Forest Department (1996). Biodiversity Report Series No. 29; Igwe Luvunya Forest Reserve. Forest Department, Kampala, Uganda.

**Fig. A37.1 ZONATION OF IGWE AND LUVUNYA FOREST RESERVES**

## APPENDIX 38: WEST BUGWE FOREST PROFILE

(Category SECONDARY conservation forest)

### 1 Basis for selection

The forest was selected for Nature Reserve establishment in recognition of its biodiversity importance, especially because:

- it supports important biological values, being relatively diverse despite its small size.
- it supports two species of trees and one of butterfly not found elsewhere in Uganda's PA system; these are of conservation concern, being unique to the forest and broadly endemic.
- it supports one tree species not found elsewhere in Uganda's PA system, that is of conservation concern because of being endemic to the Afromontane region.

### 2 Physical Description

**Area and demarcation:** The reserve has an area of 30.5 km<sup>2</sup>; with a total boundary length of 38 km, all of which adjoins rural community lands. Approximately 1 km follows the river Malaba and 37 km is an artificial boundary, 19 km of which is maintained as a planted cutline with earth/stone corner cairns and directional trenches while 14 km, mostly in Sitambogo block, remains unsurveyed, and approximately 5 km is surveyed but unmaintained.

**Establishment:** 1940

**Location:** The reserve lies within Samia Bugwe county in the Administrative District of Tororo, 00°30'-00°33' N and 33°56'-34°05' E. It lies approximately 10 km West of Tororo town. The forest is covered by the Uganda Department of Lands and Surveys Map sheets 63/4 and 64/3 (series Y732) at 1:50,000.

**Physical features:** The reserve has a relatively flat terrain at altitudes of 1113-1235 m above sea level, with most of the area (30.6 km<sup>2</sup>) with slopes below 5° and 1 km<sup>2</sup> between 6-15°. The forest is bisected by the main Jinja-Tororo road. River Solo runs across the extreme eastern end (towards Tororo town) of the central block and drains Northwestwards.

### 3 Vegetation and forest condition

The majority of the area (25 km<sup>2</sup>, 64%) is occupied by medium altitude semi-deciduous forest communities, classified as type D4 (*Albizia-Markhamia* forest). The remainder is covered by forest/savanna mosaic at high altitudes classified as type F1 (Forest/savanna mosaic, 9 km<sup>2</sup>); and a *Combretum-Cymbopogon* community, classified as type N3 (Dry *Combretum* savanna, 5 km<sup>2</sup>) (Langdale-Brown et al., (1964). A large part of the forest has been affected by burning and grazing. A detailed forest type map is available at the Forest Department headquarters, based on 1950s aerial photography.

The forest is heavily degraded (overall condition score 1), because of previous agricultural encroachment, illegal pitsawing and charcoal burning which followed Kenya's 1977/80 strict laws limiting charcoal burning in the country, which stimulated production on the Ugandan side. There is no mechanized timber harvesting, though this was previously done by Busitema Sawmills up to the early 1990s. There is agricultural encroachment in Sitambogo block.

**Forest Integrity Scores:** Settlement = 1; Cultivation = 2; Hunting = 0; Livestock = 1; Timber = 0; Fire = 1; Community Use = 2 and Mining = 0 (see Appendix 4 for explanation).

### 4 Economic importance

**Community use values:** The forest is situated in one of the more densely-populated parts of the country (176 people per km<sup>2</sup> in 1991) and consequently the periphery of the forest is under heavy pressure for firewood, charcoal, building poles and non-timber forest products. Its location within agricultural land coupled with its small size exacerbates the problem. The generally flat terrain of the forest makes it easily accessible, and it has a community use value of 10.6 (see Appendix 3 for explanation). However, recent intensification of conservation measures (under the EU Natural Forest Management and Conservation Project) has reduced the rate of degradation.

**Timber production:** Given its small size, though with a 55% forested area and with significant timber resources, the reserve cannot sustain timber production. An inventory in the 1970s (Lockwood Consultants, 1973) provided an estimate of 5m<sup>3</sup> per ha standing volume of merchantable timber exceeding 50 cm dbh. The forest has a good potential

for plantation forestry due to its generally flat terrain and good grassland areas especially on Amonikakinei and Sitambogo hills. There are no registered pitsawyers. The only sawmill was stopped in the early 1990s.

**Other economic values:** The reserve has good recreation potential being the only available natural rest centre between Iganga and Busia and there is already a picnic site by the roadside. The Jinja-Tororo and Busia highways make the reserve accessible, connecting it to the eastern tourist circuit. It is low in tourism attractions although there are crocodiles and some hippos along the nearby River Malibu; and the de Brass's Monkey still occurs here and in only a few other nearby forests of Uganda and Western Kenya. The reserve has good potential for local recreation especially in terms of access to Bustier-Busia junction as a potential market for local peoples' handicrafts. Its good biodiversity interest (see below) offers scope for development of a research and recreation role.

## 5 Biodiversity values

Of the 65 forests investigated for biodiversity, West Bugwe ranks sixteenth in overall importance, with a score of 13.6 (chapter 3, Table 3.1). It is thirteenth in terms of species diversity and ranks thirty-fourth in terms of 'rarity' value of species represented, presumably because most of its species are shared with other medium altitude moist semi-deciduous forests in the country. The forest supports 3 species found in no other Ugandan forests (2 trees and a butterfly). However, it has no species endemic to either Uganda or the Albertine Rift, but there is one tree of the Afromontane biome. All its vegetation types are represented in other protected areas in the country.

## 6 Present management

The reserve is managed from the administrative district of Tororo. There is one Forest Officer, stationed at Tororo, two Forest Rangers (one stationed at Amonikakinei and the other at Busitema trading centre). There are two Forest Guards stationed at Busitema (see map Fig. A38.1) and 10 patrol men. The department has 1 semi permanent staff house at Amonikakinei block which is getting dilapidated. It also has two uncompleted houses (1 detached and 1 semi-detached) located opposite Busitema Agricultural College main gate (see Table 38.2). Management is facilitated by one pick-up stationed at Tororo. There are a number of roads and motorable tracks within the reserve making vehicular access easy. The latest working plan covers the period of July 1962 to June 1972 and prescribes for supplying firewood and charcoal for industrial requirements in the vicinity of Tororo, improving the savanna and thicket vegetation by early burning so as to check soil erosion on the steep hill slopes and lastly to investigate possible species for and methods of timber growing in case the fuel production schemes failed or do not take up the whole of the reserve.

There is no Nature Reserve. Some timber trial plots were established in Amonikakinei block (see map fig A38.1) in 1950 but they were harvested in 1994.

In recent years (since 1991), with support from EU-financed Natural Forest Management and Conservation Project, approximately 37.2 km of boundary has been re-demarcated by cutline, of which 18.5 km has been successfully planted with marker trees (*Eucalyptus*, *Euphorbia*, *Atocarpus*) at 5m intervals (Fig. A38.1). Protection patrols have been intensified in the reserve and community tree-planting and education activities have been initiated since 1996 in Habuleke, Busitema, Bulumbi and Bukhubalo.

## 7 Proposed zonation

Figure A38.1 shows the proposed zonation of the reserve, with two Nature Reserves (approximately 25 km<sup>2</sup>) and four protection zones (approximately 10 km<sup>2</sup>)

The proposed central (24.1 km<sup>2</sup>) and Amonikokinei (1.0 km<sup>2</sup>) Nature Reserves have been selected to:

- protect the remaining natural forest areas of the reserve.
- protect the unique biological values of the forest as it is relatively diverse despite its small size.

The proposed protection zones cover steep areas of Sitambogo and the western end of the central block which are generally unsustainable for production purposes (on account of erosion hazards), but which can serve to enhance the long-term viability of the Nature Reserves. In addition, the proposed eastern and Amonikakinei protection zones will be low-impact use zones adjacent to high human populations and will also enhance the long-term viability of the adjacent Nature Reserves by providing some 'conservation support' activities. The Amonikakinei zone encompasses the 2 recently harvested trial plots.

## 8 Proposed management programmes

**Staffing:** The number of Forest Guards will be increased to 3 from 2 while the rest of the staff is adequate and will form 3 patrol teams, with responsibility for newly-defined beats based at Amonikakinei, Busitema and Namutere. The entire reserve will be brought under the responsibility of a single Forest Officer (Table 38.1).

**Table 38.1 Existing and proposed staff deployment at West Bugwe**

Station	Existing and proposed No. of staff by category						Remarks
	FO	AFO	FR	FG	PM	Total	
Tororo	1(1)					1(1)	
Amonikakinei			1(0)			1(1)	
Busitema			1(1)	*2(3)	*5(5)	8(9)	
Namutere			0(1)		*5(5)	5(5)	
<b>Total</b>	<b>1(1)</b>		<b>2(2)</b>	<b>2(3)</b>	<b>10(10)</b>	<b>15(16)</b>	

NB	Nos. in brackets indicate proposed numbers of staff, Forest Ranger; FG = Forest Guard; PM = Patrolman	FO = Forest Officers; AFO = Assistant Forest Officer; FR = * denotes staff, not government employee
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**Infrastructure:** The uncompleted houses at Busitema (opposite Busitema College) will be completed. The semi-permanent structure at Amonikakinei will be replaced with a permanent guard house. Another semi-detached house for one ranger and a guard (see Fig. A38.1) will be constructed at Namutere (see Fig. A38.1).

**Table 38.2 Existing and proposed staff housing at West Bugwe**

Station	Existing and Proposed staff housing							Remarks
	FD Detached	FD detached (incomplete)	FD semi (incomplete)	FD semi (complete)	FD uniport	Private	Total	
Tororo	2(0)	0(0)	0(0)	0(0)	0(0)	0(0)	2(0)	The houses belong to Peri urban Project
Amonikakinei	1(1)	0(0)	0(0)	0(0)	0(0)	0(0)	1(1)	
Busitema	0(0)	1(0)	1(0)	0(0)	0(0)	3(0)	5(0)	
Namutere	0(0)	0(0)	0(0)	0(1)	0(0)	0(1)	0(2)	
Total	3(1)	1(0)	1(0)	0(1)	0(0)	3(1)	8(3)	

NB \* figures represent Nos. of staff families accommodated  
1 denotes house to be replaced

**Demarcation:** Approximately 15.5 km of reopened boundary remains to be planted. All internal management zone boundaries should be demarcated by ring-painting trees in the standard way. Sign boards should be erected wherever prominent footpaths cross (external and internal) boundaries.

**Patrol and protection activities:** 3 patrol teams, each comprising of a guard and 3 patrolmen will be constituted, with responsibility for safeguarding ranges as shown in Figure A38.1. These ranges will be based at Busitema, Namutele and Amonikakinei. Men will be rotated between patrol teams and teams will be moved periodically between ranges. Patrol routes and checkpoints will be established throughout the reserve. An incentive scheme will be instituted to reward success in curbing illegal activities. Each of the 3 guards will be provided with a bicycle.

**Public access and community needs:** Two rangers (based at Busitema and Namutere) will assume responsibility for community outreach programmes, including the development of Joint Forest Management programmes within the reserve, and community tree-planting programmes outside the boundary. A programme of village meetings will be instituted to explain and discuss management of the reserve, and in particular the management zones as they are established. Each of these rangers will be provided with a motorcycle to support the work.



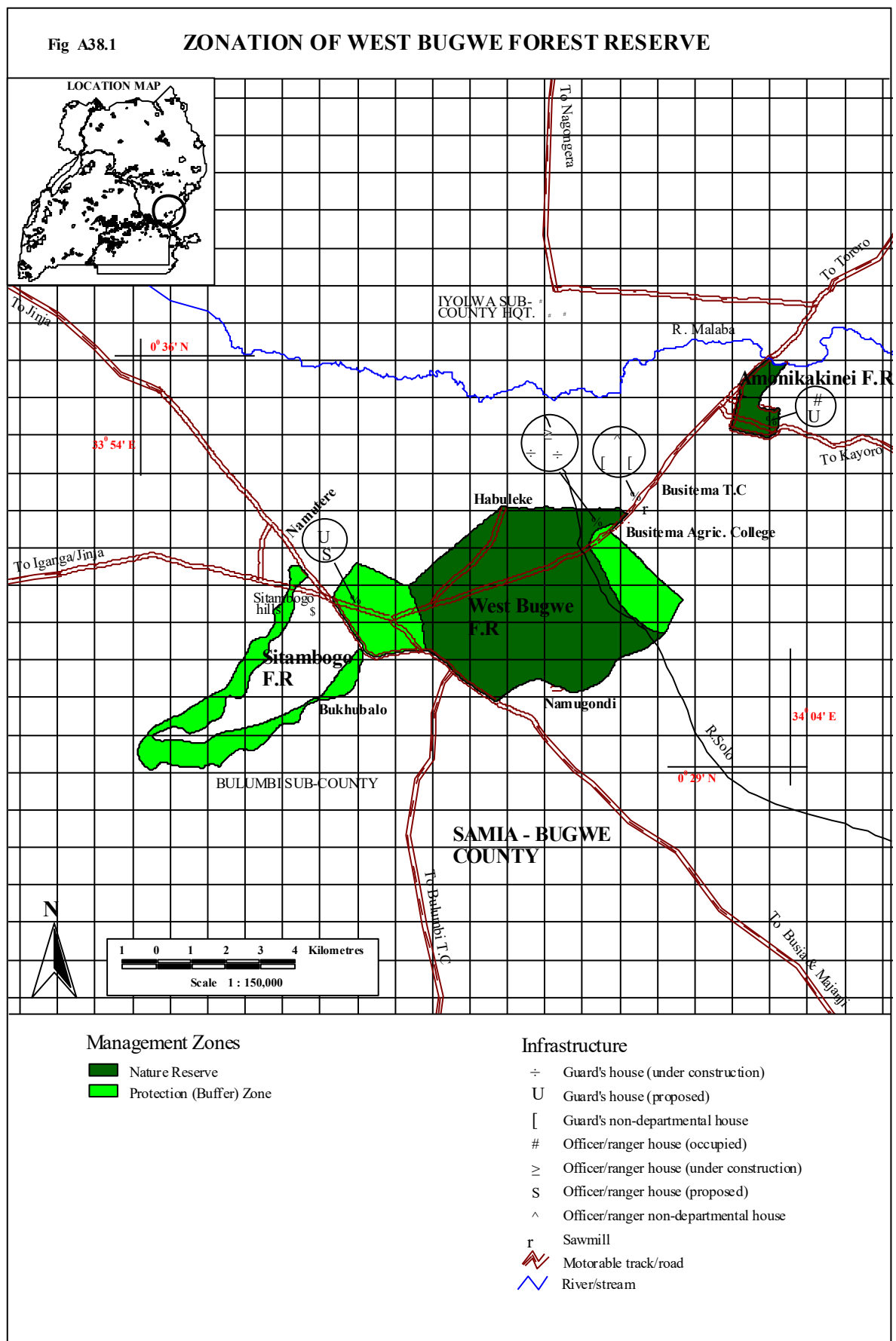
**Table 38.3 Summary table of biodiversity values of West Bugwe Forest Reserve**

Criterion	Trees/shrubs	Birds	Small mammals	Butterflies	Large moths	Overall
<b>Total No. of spp. Known</b>	255	89	11	102	33	-
<b>No. of restricted range spp (≤ 5 forests)</b>	15	5	0	6	0	26 spp
<b>Species unique to forest</b>	<i>Maesa welwitschii</i> <i>Phyllanthus reticulatus</i>	None	none	<i>Belenois rubrosignate</i>	None	3 spp
<b>Uganda endemics</b>	None	None	none	None	None	None
<b>Albertine Rift endemics</b>	None	None	none	None	None	None
<b>Species diversity (score &amp; rank)</b>	8.8(4)	3.3(57=)	7.5(12=)	7.5(18)	6.2(26=)	7.2 (13)
<b>Species rarity value (score &amp; rank)</b>	7.2(29=)	5.2(34=)	5.2(28)	4.4(42=)	5.4(36=)	6.1(34=)

Overall Biodiversity importance = 13.4 (18)

**9 Principle reference material**

1. Langdale-Brown, I., Osmaston, H.A. and Wilson, J. G. (1964). The Vegetation of Uganda and its Bearing on Land-Use. Uganda Government Printer, Entebbe.
2. Lockwood Consultants (1973). Forest Resource Development Study for the Republic of Uganda. Lockwood Consultants, Toronto, Canada.
3. Uganda Forest Department (1992). Interim Management Plan for West Bugwe forest reserve. Forest Department, Kampala, Uganda.
4. Uganda Forest Department (1996). Biodiversity Report, Series No. 6. West Bugwe Forest Reserves. Forest Department, Kampala, Uganda.



## APPENDIX 39: MPIGI GROUP OF FORESTS PROFILE

(Category: SECONDARY conservation forest)

### 1 Basis for selection

The Mpigi group of Forest Reserves were selected for Nature Reserve establishment in recognition of their biodiversity importance, especially because:

- they support 4 species of trees known from no other Protected Area in Uganda.
- they support one species of tree not found elsewhere in Uganda's Protected Area system that is of conservation concern on account of being endemic to the Albertine Rift Region.
- they serve as a watershed protection for the water draining into Lake Victoria.

### 2 Physical description

**Area and demarcation:** The Mpigi forest reserves (50 in number without Mpanga FR) cover 261 km<sup>2</sup> with a total boundary length of 979 km. Of the external boundaries approximately 15 km follow swamps and roads while 164 km is an artificial boundary maintained as planted cutline with earth corner cairns and directional trenches.

The Mpanga FR covers 4.53 km<sup>2</sup> with a total boundary length of 12.6 km of which about 1 km follows a swamp. The 11.6 km is an artificial boundary maintained as planted cutline with earth corner cairns and directional trenches. The Mpigi Forest Reserves and the Mpanga Forest Reserve are completely surrounded by rural community lands.

**Establishment:** Mpigi group: 1932  
Mpanga FR: 1932

**Location:** The reserves are on the western shore of Lake Victoria in Mpigi District of Central Uganda (Mawokota, Butambala, Busiro, Busujju and Gomba counties), between latitude 0°0' and 0°30' N and 31°45' and 32°30' and are E covered by Uganda Department of Lands and Surveys map sheets 70/2, 70/3, 70/1,2, 70/4, 703,4 at 1:50,000.

**Physical features:** The reserves occupy valley bottoms of typical Buganda landscape with an altitudinal range of 1150-1190 metres above sea level. About 89% of the forest area has slopes of less than 5°.

### 3 Vegetation and forest condition

The largest area of the Mpigi forests (250 km<sup>2</sup>; 95.8%) and 5 km<sup>2</sup> (100%) of Mpanga forest are occupied by Tropical High Forest community classified as type C2 (*Piptadeniastrum-Albizia-Celtis* forest) and 11 km<sup>2</sup> are classified as XI (*Cyperus papyrus* swamp); (Langdale-Brown et al., 1964). The forest reserves are in various degrees of degradation, mainly due to easy accessibility, available markets for forest produce and the pressure put on them by the communities.

- Kitubulu and Semunya Forest Reserves are heavily degraded (overall condition score 1), due to pitsawing, firewood cutting and agricultural encroachment.
- Katabalalu, Gangu, Lwamunda, Navugulu, Nawandigi and Buto-Buvuma Forest Reserves are heavily degraded due to commercial firewood cutting, illegal pitsawing, charcoal burning and encroachment. This has affected 50-75% of the forests (overall condition score 2).
- Mpanga FR is largely intact with over 70-90% of the area unaffected. Present encroachment affects less than 2% of the area (giving an overall condition score of 4). The reserve has been used for research purposes over decades, and this has provided it with inherent protection.

### 4 Economic importance

**Community use value:** The Mpigi forests and Mpanga are situated in one of the most densely populated parts of the country (194 people per km<sup>2</sup>, in 1991) so pressure on the peripheral areas of the reserves for fuelwood, building poles and other non timber forest products is very high. The forests are quite accessible by motorable tracks and potential resources in many parts of the reserves are being used by the communities, giving a community use value of 20 (maximum score) (see Appendix 3 for explanation).

**Timber production:** The Mpigi forest reserves are not very important sources of timber. Most of the stock was exploited between 1980-93, with timber standing volume at 20 m<sup>3</sup>/ha exceeding 50 cm dbh. The Mpanga FR is better stocked with timber (50m<sup>3</sup>/ha > 50 cm dbh), probably because of its being a research forest reserve which has therefore not been exploited.

**Other economic importance:** The reserves serve a watershed protection role, protecting water draining into Lake Victoria. Its location on the western tourist route and being close to Kampala makes Mpanga forest an ideal stop-over for nature tourism. The reserves are of some biodiversity interest (see below) and offer scope for the development of a research and educational role.

## 5 Biodiversity values

Of the 65 forests investigated for biodiversity, the Mpigi Forest Reserves rank 18th in overall importance with a score of 13.4. They are ranked 7th in terms of species diversity but 40th in terms of species rarity, presumably because many of the species are shared with other Lake shore tropical forests along the L. Victoria basin. The forests support two species unique to the area (*Brucea antidysenterica* and *Psychotria succulenta*) and one spp (*Rhytigynia beniensis*) endemic to the Albertine Rift.

The Mpanga forest ranks 11th in overall importance with a score of 13.8. It ranks 4th in terms of species diversity but 40th in terms of species rarity. There are 2 species of trees (*Crotalaria recta* and *Ficus wildemaniana*) unique to the forest.

## 6 Present management

The Mpigi and Mpanga forest reserves are managed from the Mpigi District Forest Office and local offices at Entebbe forest station, Kasanje forest station, Bongole forest station and Gangu forest station. There are two Forest Officers, one Assistant Forest Officer, five Forest Rangers, 17 Forest Guards and 16 Patrolmen in the reserves under this review (refer to Table 39.1).

The Department has 19 residential houses and one office funded by Forest Department. Under the EC, Natural Forest Management & Conservation Project there are five houses at different levels of completion (two require painting, two at foundation level and one at wall plate level).

Management is facilitated by 5 motorcycles and one pick up. Of the 5 motor cycles, one is in good running condition, three need major servicing and one needs replacement.

Most parts of the reserves are quite accessible by road (although it becomes difficult during rainy seasons).

In recent years since 1989), with help from the EC-financed Natural Forest Management and Conservation Project, approximately 175 km of boundaries have been reopened by cutline, of which about 80 km has been successfully planted with live markers (*Terminalia ivorensii*, *Khaya anthotheca*, *Eucalyptus* spp and *Maesopsis eminii*). Most work was done in Buto Buvuma, Katabalalu, Gangu and Mpanga forest reserves with over 70% of their boundaries reopened. Little work was done in Navugulu, Kyansonzi, Nawandigi, Semunya and Lwamunda Forest Reserves (9-35% of their boundaries reopened).

Protection has been intensified between 1989-94, with eviction of several encroachers. Replanting the encroached areas was done in some forests, with 6 ha of Nawandigi (1996), 3 ha of Navugulu (1988/89), ½ ha of Lwamunda (1993/94), 5 km<sup>2</sup> of Gangu (1992/93/94), and 7 ha of Kyansonzi (1993/94).

## 7 Proposed zonation

Figure A39.1 shows the proposed zonation of the reserves with 3 Strict Nature Reserves totalling approximately 25 km<sup>2</sup>, 7 Production Zones (app. 85 km<sup>2</sup>). One recreation area (4.5 km<sup>2</sup>) and the rest as Protection (buffer) Zone.

### Proposed Strict Nature Reserves

- 1 The proposed central part of Navugulu FR (7 km<sup>2</sup>) has been selected to:
  - represent the least affected part of the forests. There are big trees with a closed canopy which are heavily loaded with epiphytes.
  - represent a community around Mpondwe hill which stands above the general landscape in the valley and is not very suitable for timber production.

- represent the wetland ecosystem of the forest.
- 2 The proposed central portion of Nawandigi FR (7 km<sup>2</sup>) is selected to:
- represent the wetland (swamp forest) ecosystem.
  - ensure the continued existence of this natural forest as it is relatively remote from potential markets for forest produce.
- 3 The whole of Gangu FR (11 km<sup>2</sup>) is proposed as a Strict Nature Reserve because:
- its relatively intact.
  - the encroached areas have been successfully replanted and are doing quite well.
  - the neighbouring communities are law abiding.

## 8 Proposed production zones

Although the Mpigi forests have low stocks of timber (20 m<sup>3</sup>/ha > 50 cm dbh), low impact timber extraction can be carried out. There are stocks of *Antiaris toxicaria*, *Celtis* spp, *Parinari*, *Lovoa*, *Mitragyna*, *Maesopsis eminii* and *Funtumia* spp that could be exploited. The following areas are proposed as the main production zones:

- Lwamunda forest, which is fairly well-stocked.
- the eastern and northern portions of Buto Buvuma FR, although not well-stocked, could be replanted with fast growing trees like *Maesopsis eminii*.
- the eastern and the northern parts of Nawandigi FR are fairly well-stocked but replanting would be ideal for long term timber exploitation.
- The whole of Semunya, Katabalalu and Kitubulu Forest Reserves need replanting. Natural regeneration (of Musizi) in Kitubulu Forest Reserve is proving very successful.

### Proposed protection (buffer) zones (28 km<sup>2</sup>)

These will cover areas neighbouring the core Strict Nature Reserves. Each of the 3 Strict Nature Reserves will have community use zones within reach from various parts of the villages.

### Recreation zone (4.5 km<sup>2</sup>)

The proposed recreation zone is Mpanga forest which is probably the most intact reserve in Mpigi district. It is quite accessible by vehicles and is only ½ km from the Kampala-Mbarara highway.

## 8 Proposed management programme

**Staffing:** The present staff is inadequate and more need to be recruited (Table 39.1). Re-deployment will also be necessary to create 6 effective patrol teams. The reserves will be brought under the responsibility of one Forest Officer based at Mpigi town and will be linked with each range station by radio communication. There will be two Forest Officers of which one will be in charge of ecotourism, 1 AFO, 6 rangers, 24 Forest Guards and 44 Patrolmen to manage the forest estate.

**Table 39.1: Existing and proposed staff deployment at the Mpigi group of forests**

Ranger	Existing and proposed number of staff by category					Total
	Forest Officer	Assist. FO	Ranger	F. Guard	Patrolman	
Mayanja	0(0)	0(0)	1(0)	4(1)	4(6)	10(7)
Semunya	0(0)	0(0)	1(0)	3(0)	2(4)	6(4)
Mpigi	2(2)	0(0)	1(0)	2(2)	3(5)	8(9)
Nawandigi	1(0)	0(0)	1(0)	3(1)	3(5)	8(6)

Gangu/Bongole	0(0)	0(0)	1(0)	3(1)	4(4)	8(5)
Mpanga	1(0)	0(0)	0(1)	0(2)	0(2)	1(5)
Entebbe	0(0)	1(0)	0(0)	2(0)	0(2)	3(2)
<b>Total</b>	<b>4(2)</b>	<b>1(0)</b>	<b>5(1)</b>	<b>17(7)</b>	<b>16(28)</b>	<b>44(38)</b>

Note: Numbers in bracket indicate proposed staffing.

**Infrastructure:** The incomplete houses at Lugo, Mabanda, Bongole and Gangu stations will be completed, and the old FD houses that can be renovated will be worked on. Eight new houses will be constructed (Table 39.2).

**Table 39.2 Existing and proposed staff housing in Mpigi**

Station	FD detached	FD detached (incomplete)	FD semi-Detached	Private	Total	Remarks
Lwamunda	2*(0)	0	0(2)	1	3(2)	
Katonga	0(0)	0	0(1)	0	0(1)	
Walukunyu	0(0)	0	0(1)	0	0(1)	
Siji	0(0)	0	0(1)	0	0(1)	
Kasanje	2*(0)	0	0(1)	2	4(1)	
Nakauka	0(0)	0	0(1)	0	0(1)	
Mpanga	4*(0)	0	0(0)	0	4(0)	
Lugo	1*(0)	1	0(0)	0	2(0)	
Mabanda	2*(0)	0	1(0)	1	4(0)	
Gombe	1*(0)	0	0(0)	0	1(0)	
Bumbo	0(0)	0	0(1)	0	0(1)	
Bongole	2(0)	0	1(0)	1	4(0)	
Gangu	1*(0)	1	1(0)	0	3(0)	
Entebbe	4*(0)	0	0(0)	0	4(0)	
<b>Total</b>	<b>19(0)</b>	<b>2</b>	<b>3(8)</b>	<b>5</b>	<b>29(8)</b>	

Note: Numbers in brackets indicate proposed housing unit(s)  
 \* denotes houses currently being occupied

**Demarcation:** About 450 km of external boundaries of the major forests will be reopened and planted with live markers. All internal management boundaries will be demarcated by ring painting trees in a standard way. Red paint will be used to demarcate Strict Nature Reserves and yellow for Buffer Zones. Sign posts will be erected where paths cross internal/external boundaries.

**Patrol and protection activities:** Each of the ranges will constitute a patrol team under the supervision of the Ranger in charge. The ranges will be based at Lwamunda station, Kasanje station, Mpigi town, Mabanda station, Bongole station and Entebbe station. Patrol routes and check points will be established throughout the reserve. Whenever deemed necessary, patrol teams will be moved periodically. An incentive scheme will be instituted to reward success in curbing illegal activities.

**Public access and community needs:** One Forest Officer (Ecotourism) and two Rangers (based at Mpanga & Lwamunda) will assume responsibility for community outreach programmes including the development of Collaborative Forest Management and community conservation programmes, including tree-planting outside the boundaries. A programme of village meetings will be instituted to explain and discuss management of the reserves, particularly the management of the zones being established. The area requires a second vehicle for nature conservation and each of the Rangers will be provided with a motorcycle and the Forest Guards and Patrolmen will be given bicycles.

**Table 39.3: Summary of biodiversity values for Mpigi group forests**

Criterion	Trees & Shrubs	Birds	Mammals	Butterflies	Moths	Overall
<b>Total No. of known spp.</b>	305	158	12	61	26	562
<b>No. of restricted Range spp ( known from <math>\leq 5</math> forests)</b>	14	1	0	1	0	16
<b>Spp unique to the forest</b>	<i>Brucea antidysenterica</i> <i>Psychotria succulenta</i>	none	None	None	none	2
<b>Uganda endemic (list)</b>	None	none	None	None	none	none
<b>Albertine rift endemic (list)</b>	<i>Rhytigynia beniensis</i>	none	None	none	none	1
<b>Species diversity (score and rank)</b>	9(3)	6.1(31)	4.8(52=)	6(41=)	7.2(11)	7.4(7)
<b>Species rarity (score and rank)</b>	7.2(29=)	5.5(27=)	4.3(43=)	3.8(58=)	5.4(36=)	6.0(40=)

**Table 39.4 Summary of biodiversity values for Mpanga**

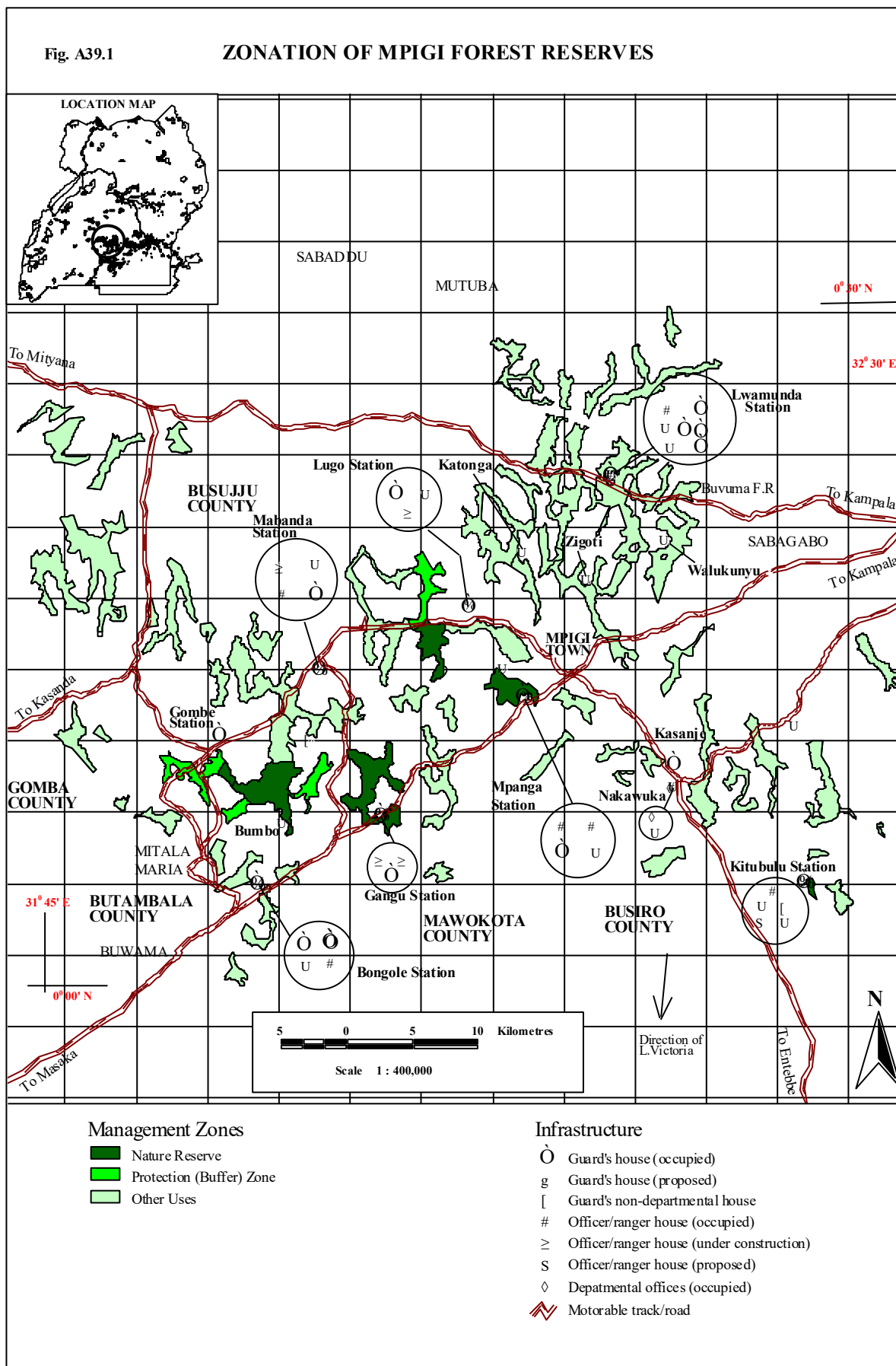
Criterion	Trees	Birds	Mammals	Butterflies	Moths	Overall
<b>Total No. of species known</b>	205	141	8	78	94	526
<b>No. of restricted ranged spp (known from <math>\leq 5</math> forests)</b>	6	none	None	3	4	13
<b>Species unique to the forest (list)</b>	<i>Crotalaria recta</i> <i>Ficus wildemania</i>	none	None	none	none	2
<b>Uganda endemic (list)</b>	None	none	None	none	none	None
<b>Albertine Rift endemic (list)</b>	None	none	None	none	none	None
<b>Sp diversity (score and rank)</b>	9.6(2)	5.4(40)	2.8(61)	6(41=)	8.5(3)	7.7(4)
<b>Spp rarity</b>	7(35=)	5.3(27=)	4.3(43=)	4.2(47=)	6.1(26=)	6.0(40=)

Overall biodiversity score = 13.5

**9 Principle reference material**

1. Langdale-Brown, I., Osmaston, H.A. and Wilson, J.G. (1964). The Vegetation of Uganda and its bearing on Land-Use. Uganda Government Printer, Entebbe.
2. Uganda Forest Department (1996). Biodiversity Report Series No. 10; The Mpigi group Forest Reserves. Forest Department, Kampala, Uganda.





**APPENDIX 40: SESSE ISLANDS FORESTS PROFILE**

(Category: CORE conservation forest)

**1 Basis for selection**

The forests were selected for Nature Reserve establishment in recognition of their considerable biodiversity importance, especially because:

- they support 13 species unique to them, including 8 trees, one mammal, 3 butterflies and one moth.
- they support one species of mammal, one butterfly and one species of moth that are of conservation concern on account of being endemic to Uganda.
- they are occupied by the *Piptadeniastrum-Uapaca* vegetation type, which is not represented in any other protected area in Uganda.

**2 Physical Description**

**Area and demarcation:** A total area of 43 km<sup>2</sup> is spread over 34 Forest Reserves, with a total boundary length of 100 km, all of which adjoins rural, largely fishing communities. A big part (approximately 70 km) of boundary follows shorelines because these forests exist as small patches on Lake Victoria Islands.

**Establishment:** As Central Forest Reserves in 1968.

**Location:** These are 34 forest reserves spread throughout the islands which lie between 32°0-32°40 E and 0°10-0°40 S. They lie in Kalangala district (Bujumba and Kyamuswa counties); and are covered by Uganda Department of Lands and Surveys map sheets 80/1-4; 81/1,3; and 89/1,2 (series Y732) at 1:50,000.

**Physical features:** These reserves range from small rocky outcrops of 3 ha such as Sekazinga to sizeable ones of over 1,000 ha. (Busowe, 1,716 ha); covering an altitudinal range of 1152-1262 m above sea level, with only about 2% exceeding a 15% slope. Some of the reserves have low-lying inlets of Lake Victoria covered by papyrus swamps, but the bulk are well drained hilly outcrops covered by both dense forest and grassland areas.

**3 Vegetation and forest condition**

All the 34 forest reserve area (88.6 km<sup>2</sup>; 100%) is occupied by tropical high forest communities, classified as type C1 (medium altitude moist evergreen forest: *Piptadeniastrum-Uapaca* forest; Langdale-Brown et al., 1964) which are sometimes interspersed with small patches of moist grassland savanna on hill tops. A detailed forest type map is available at Forest Department Headquarters, based on the 1950s aerial photography.

The forests are largely intact (overall condition 4), but are now being affected by pitsawing in some areas mainly for the valuable timber species of *Piptadeniastrum africanum*, which is rare elsewhere. There is limited agricultural encroachment, mainly because people are not aware of the boundaries, rather than a sign of any lack of areas to settle; this is evidenced by uninhabited areas bordering most of the reserves.

**Forest Integrity scores:** Settlement = 1; Hunting = 1; Livestock = 0; Timber = 3; Fire = 0; Community use = 1; Mining = 0 (see Appendix 4 for explanation).

**4 Economic importance**

**Community values:** These forest patches are situated in one of the least populated parts of the country (35 people per km<sup>2</sup> in 1991). So pressure on the peripheral areas of the forests for firewood, building poles and non-timber forest products is correspondingly low. Large areas of the forest patches are additionally so remote and inaccessible that potentially valuable resources in many of the 34 forest reserves remain under-utilized, giving a “community use” value of 5.9 (see Appendix 3 for explanation).

**Timber production:** These forests have recently become an important source of pitsawn timber, most of which is cut illegally and not properly documented. A sawmill was being put up in Busowe forest but failed.

**Other economic values:** The series of reserves serve as major windbreaks on the open waters of Lake Victoria, the largest fresh water lake in Africa. They also provide firewood for fish smoking, fishing being a major economic activity on the lake. These reserves are also located in an area with a high potential for ecotourism development,

based on attractions such as the scenic waters of Lake Victoria and the largely intact flora and fauna. The reserves' biodiversity values (see below) offer scope for the development of a research and education role, especially on island biogeography.

## 5 Biodiversity values

Of the 65 forests investigated for biodiversity, the Sesse conglomerate ranks 44th in overall importance with a score of 11.6 and does not therefore score among the highest; however, they have some unique species of conservation significance. The forests support 13 species found in no other Ugandan forest (8 trees, 1 mammal, 3 butterflies and 1 moth), and 2 species endemic to Uganda (Table 40.3).

## 6 Present management

The reserves are managed from the Kalangala District Forest offices with headquarters in Lutoboka Forest Reserve. There is one District Forest Officer, and two Forest Rangers (one stationed at the headquarters and the other in Busowe Forest Reserve, Bugoma landing site); three Forest Guards (one stationed at the headquarters responsible for overseeing activities in Malabana forests (Gala, Banga, Towa and Mugoye forest reserves; one stationed at Bugoma, in-charge of Busowe, and the other stationed on Bukasa, the second largest island); and two nursery women at Kalangala (see map figure A40.1). The department has two staff houses and a uniport at Kalangala and an additional one is under construction (1 duplex and one house at Kalangala, Lutoboka forest reserve). Management is facilitated by one Mitsubishi pick-up, stationed at Kalangala. However, there are no roads or motorable tracks within the small patches of forest, but there is vehicular access to Busowe, Towa, Lutoboka, Mugoye, Banga and Gala Forest Reserves where some portion of the boundaries are bordered by roadsides.

There has been no Nature Reserve. Some trial plots for *Pinus patula* and *Pinus caribaea* were established in Towa forest reserve in the 1970s and are doing quite well.

In recent years (since 1992), with support of the EU-financed Natural Forest Management and Conservation Project, approximately 5 km in Towa, 4 in Gala (all completed) and 3 in Busowe have been re-opened by cutline but none of it has been planted with live markers. There have been no patrols since the theft of the departmental motorcycle early in 1996.

## 7 Proposed zonation

Figure A40.1 shows the proposed zonation among the 34 forest reserves. Five forest reserves, Funve, Nsirwe, Busowe, Mugoye and Bufumira have been set aside as Nature Reserves, one forest reserve, Lutoboka, as a recreation zone and the rest left as production zones. The five forest reserves (32 km<sup>2</sup>) have been selected as Nature Reserves to:

- Preserve the range of species on the islands;
- Encompass the widest possible area as they are the largest of the 34 forest patches.
- Protect a viable area of the medium altitude moist evergreen forest type C1 (Langdale-Brown et al., 1964) which is otherwise found only in one other protected area in Uganda (Jubiya forest, a lake shore forest in Masaka District).
- For Nsirwe, a small rocky island of about 1 ha, to protect a nesting site for birds free from disturbance. Birds of assorted species have found Nsirwe a good nesting site and research is necessary to establish why this small island harbours a wide range of species of birds.

These Nature Reserves will be buffered by patrols as they are mostly surrounded by water and mailo land owners.

The proposed recreation zone is on the main Bugala Island. It is already being utilised for campsites, such as the Hornbill camp. Its accessibility by visitors and nearness to the Town Council offers no possibility for any strict conservation, but its management will be enhanced by utilization for beaches and camping sites.

## 8 Proposed management programmes

**Staffing:** The present staff number is adequate, but some redeployment will be necessary to afford effective control of the reserves. One guard should be posted to Bukasa Island and one to Malabana. The entire 34 forest reserves should be under one DFO at Kalangala but with radio-communication in Bukasa Island where one Forest Guard should be based.

**Table 40.1 Existing and proposed staffing in Sesse Islands**

Station	Existing and proposed No. of staff by category						Remarks
	FO	AFO	FR	FG	PM	Total	
Lutoboka (hqrs)	1(0)	0(0)	1(0)	1(0)	0(0)	3(0)	
Bugima	0(0)	0(0)	1(0)	1(0)	0(0)	2(1)	
Bukasa	0(0)	0(0)	0(0)	1(1)	0(0)	1(2)	
Malabana	0(0)	0(0)	0(0)	0(1)	0(0)	0(1)	
<b>Total</b>	<b>1(0)</b>	<b>0(0)</b>	<b>2(0)</b>	<b>3(2)</b>	<b>0(0)</b>	<b>6(2)</b>	

Note: FO = Forest Officer; AFO = Assistant Forest Officer; FR = Forest Reserve; PM = Patrolmen  
Nos. in brackets indicate proposed staffing

**Infrastructure:** The uncompleted houses in Kalangala should be completed. Two ranger houses are to be put up at Busowe (Bugoma) (1) and Kalangala (1), four additional guard houses are necessary at Bugoma (1) in Busowe forest reserve, at Malabana (1) in Banga Forest Reserve, at Kalangala and at Buga Forest Reserve in Bukasa Island. Two patrol boats are necessary to facilitate effective monitoring and control of the scattered reserves on the different islands. A recommendation is made for petrol engines of 25 horse power and 40 horse power as petrol engines are easier to service. An additional two motorcycles will be necessary for the rangers' movements, especially on the main Bugala islands.

**Table 40.2 Existing and proposed staff housing in Sesse Islands**

Station	Existing and proposed staff housing					Remarks
	FD Detached	FD semi Detached	FD uniport	Private	Total	
Lutoboka (hqrs)	2(1)	1(1)	1(0)	0(0)	4(2)	The two detached houses are very old.
Bugima	0(1)	0(1)	0(0)	1(0)	1(2)	
Bukasa	0(0)	0(1)	0(0)	0(0)	0(1)	
Malabana	0(0)	0(1)	0(0)	0(0)	0(1)	
<b>Total</b>	<b>2(2)</b>	<b>1(4)</b>	<b>1(0)</b>	<b>1(0)</b>	<b>5(6)</b>	

Note: Nos. in brackets indicate proposed staffing

**Demarcation:** All the boundaries for the proposed Nature Reserves should be opened and planted. Signboards should be erected at each of the landing sites to the zoned Nature Reserves.

**Patrols and protection:** Patrol teams are not necessary at present.

**Public access and community needs:** One ranger based at Kalangala will assume responsibility for community outreach programmes, including the development of ecotourism. The ranger will be provided with a motorcycle to facilitate his work.

**Table 40.3 Entebbe summary of biodiversity values for Sesse Islands**

Criterion	Trees & Shrubs	Birds	Mammals	Butterflies	Moths	Overall
Total No. of species known	148	89	12	153	38	-
No. of restricted range species ( $\leq 5$ forests)	16	11	1	19	2	-

<b>Species unique to forest (list)</b>	<i>Melastomastrum segregatum</i> <i>Antidesma vogelianum</i> <i>Bertiera naucleoides</i> <i>Embelia schimperi</i> <i>Ficus cordata</i> <i>Lasianthus seseensis</i> <i>Mareya brevipes</i> <i>Smilax anceps</i>	-	Polomys isseli	Triclema lamias Neptis puella Acraea simulata	Polyptychus pauperculus	13 spp
<b>Uganda endemics (list)</b>	None	none	Polomys isseli	Acraea simulata	Polyptychus pauperculus	3 spp
<b>Albertine Rift endemics (list)</b>	None	none	None	None	none	0 spp
<b>Species diversity (score &amp; rank)</b>	3.7(54=)	6.5(24=)	3.7(57=)	6.9(25=)	5.8(30=)	4.7
<b>Species rarity value (score &amp; rank)</b>	7.9(14=)	5.2(34=)	6.1(16=)	5.3(19=)	6.4(24)	6.8
Overall biodiversity score = 11.5						

## 9 Principle reference material

1. Langdale-Brown, I., Osmaston, H.A. and Wilson, J.G. (1964). The Vegetation of Uganda and its Bearing on Land-Use. Uganda Government Printer, Entebbe.
2. Uganda Forest Department (1996). Biodiversity Report Series No. 23. Mujuzi, Ssesse Islands and Jubiya Forest Reserves. Forest Department, Kampala, Uganda.



**APPENDIX 41: JUBIYA FOREST PROFILE**

(Category: SECONDARY Conservation forest)

**1 Basis for selection**

The forest was selected for Nature Reserve establishment in recognition of its biodiversity importance, especially because:

- it supports three species of butterfly unique to it and one that is endemic to the Albertine Rift Region.
- it is representative of vegetation type (C1, *Piptadeniastrum-Uapaca* forest) that occurs only in one other forest in the Protected Area System.

**2 Physical description**

**Area and demarcation:** The area of the reserve is 46 km<sup>2</sup>; and the total boundary length, 81 km, of which 51 km adjoins rural community lands, waters and swamps of Lake Victoria and about 30 km adjoins enclaves within the reserve. Of the 81 km of boundary about 36 km are artificially boundary maintained as a planted cut line with earth corner cairns and directional trenches.

**Establishment:** 1948 as a Local Forest Reserve.

**Location:** The reserve lies in a low-lying area of the Lake Victoria basin between 0°10'-0°20' S and 31°50'-32°00' E. It is situated in Bukoto county in the administrative district of Masaka, and is covered by Uganda Department of Lands and Surveys map sheets 80/14, 81/13 and 89/1, 2 series Y732 at 1:50,000.

**Physical features:** The reserve occupies a low-lying area in the Lake Victoria basin with an altitudinal range of 1134-1159 m without any area exceeding a 6° slope. The low-lying areas of the reserve are often flooded when the level of Lake Victoria rises.

**3 Vegetation and forest condition**

The reserve is composed of two equal types of tropical high forest communities. One type is classified as C1 - (*Piptadeniastrum-Uapaca* forest (23 km<sup>2</sup>, 50%) and the other as C2 - *Piptadeniastrum-Albizia-Celtis* forest (23 km<sup>2</sup>, 50%). There are also pockets of swamps and small pockets of open moist savanna which have been maintained by frequent outbreaks of fire.

The forest is partially degraded (overall condition score 3) particularly by people living in the enclaves and those from fish landings along the shores of Lake Victoria. There was some mechanized timber harvesting in the early 1960s in some parts of the forest. Agricultural encroachment covered about 2 ha and some illegal pitsawing and charcoal burning were also noted. There is no evidence of hunting and mining in this forest reserve.

**Forest integrity scores:** Settlement = 1, Cultivation = 1, Hunting = 0, Live stock grazing =1-2, Timber harvesting = 2, Fire =2, Community use Access = 2, Mining = 0 (see Appendix 4 for explanation).

**4 Economic importance**

**Community use values:** Although the forest is not situated in a densely-populated area, as it is surrounded by water and swamps (42 people/km<sup>2</sup> 1991); the people living in the enclaves and fish-landing sites have caused some considerable damage. They obtain fuelwood, building poles, timber for making canoes and charcoal for sale in Masaka town. There are many motorable tracks and footpaths which join village enclaves within the reserve. The population within the enclaves and fish landings, and the fact that most of the reserve is surrounded by swamps and water, give it a community use value of 3.4 (see Appendix 3 for explanation).

**Timber production:** The forest had some timber resources estimated at about 20 m<sup>3</sup> per ha of standing volume of merchantable timber exceeding 50 cm dbh in 70% of the reserve area which is forested (Lockwood Consultants, 1973). There was some mechanised harvesting in the 1960s.

At present, a substantial amount of timber is still being harvested, by illegal pitsawyers.

**5 Biodiversity values**

Of the 65 forests investigated for biodiversity, Jubiya ranks 34th in overall importance with a score of 12.4. It is 27th in terms of species diversity with a score of 6.4 and ranks 34th in terms of species rarity. The reserve supports one species of butterfly that is endemic to Albertine Rift Region and three unique to the forest (see Table 38.3).

## 6 Present management

The reserve is managed from Masaka District forest office and local offices at Jubiya and Kisasa. There is one Assistant Forest Officer stationed at Kisasa. There is one Forest Ranger stationed at Jubiya station and two Forest Guards stationed at Kisasa and Jubiya (see Table 41.1). The department has one staff house and one unipoint at Kisasa. There are two small houses at Jubiya which are in a very poor state (see Table 41.2).

Management is not facilitated by any means of transport. There are many motorable tracks within the reserve which join the village enclaves and also to the fish-landing sites. The main road from Masaka to Kalangala touches the southern corner of the reserve (see Fig. A41.1).

A Nature Reserve covering 90 ha (0.9 km<sup>2</sup>) was proposed in the last working plan. It was located between Bwami and Kasaka enclaves. Some timber trial plots, mainly of *Pinus caribea* were established in the last working plan. These are located between Bwami and Kasaka enclaves (see Fig. A41.1), established mainly in some of the grassland areas of the reserve in the 1950s, and most of them have been harvested.

**Table 41.1 Existing and proposed staff deployment at Jubiya**

Station	Existing and proposed No. of staff by category					Remarks
	AFO	FR	FG	PM	Total	
Kisasa	1(0)	0(0)	1(0)	0(0)	2(0)	The Guard is not for Jubiya but for Kisasa reserve
Jubiya	0(0)	1(0)	1(0)	2(0)	4(0)	
Bukeso	0(0)	0(1)	0(1)	0(2)	0(4)	all to be recruited
Kasaka	0(0)	0(1)	0(1)	0(2)	0(4)	all to be recruited
<b>Total</b>	<b>1(0)</b>	<b>1(2)</b>	<b>2(2)</b>	<b>2(4)</b>	<b>6(8)</b>	

Note: FO = Forest Officer; AFO = Assistant Forest Officer; FR = Forest Ranger; FG = Forest Guard; PM = Patrolmen. Nos. in brackets indicate proposed staffing

In recent years (since 1990) with the support of the EC-financed Natural Forest Management and Conservation Project, about 23 km of boundary has been reopened by cutline. These are the boundaries of enclaves within the reserve. Two patrolmen have been recruited for protection activities.

## 7 Proposed zonation

It is proposed that a Strict Nature Reserve of about 30 km<sup>2</sup> be demarcated. The remaining 16 km<sup>2</sup> will act as a Buffer Zone. The proposed Nature Reserve has been selected to encompass all types of vegetation types represented in this reserve i.e. swamp, grassland and closed forest. The two main community use zones (buffers) encompass areas which are being disturbed by people living in enclaves and fish landings sites (see Fig. A41.1).

## 8 Proposed management programmes

**Staffing:** The present staff number, of one AFO, one Forest Ranger and one Forest Guard, is inadequate. Two more Rangers and two more Forest Guards will be required to effectively manage the reserve.

4 patrolmen will be needed to work with the 3 Forest Guards (see Table 41.1).

**Infrastructure:** Two Rangers and 2 Guards houses will be constructed, one set at Kasaka enclave and the other at the boundary of Bukeso enclave (see Fig. 41.1 and Table 41.2).

**Table 41.2 Existing and proposed staff housing at Jubiya**



Station	Existing and proposed staff housing				Remarks
	FD Detached	FD semi-Detached	Uniport	Total	
Kisasa	1(0)	0(0)	1(0)	2(0)	AFO's house to be renovated
Jubiya	2(0)	0(0)	0(0)	2(0)	Houses are too old. Should be renovated or new ones built.
Bukeso	0(2)	0(0)	0(0)	0(2)	New station: one for ranger and one for guard.
Kasaka	0(2)	0(0)	0(0)	0(2)	New station: One for ranger and one for Guard.
<b>Total</b>	<b>3(4)</b>	<b>0(0)</b>	<b>1(0)</b>	<b>4(4)</b>	

Note: Nos. in brackets indicate proposed staff housing units

The two houses at Jubiya station which are in a very poor state will be renovated to accommodate one Forest Guard and one Forest Ranger. New ones may be constructed. The house for an AFO at Kisasa will be renovated.

**Demarcation:** About 13 km of enclave boundaries remain to be redemarcated and boundary marker stones fixed. The internal boundaries of community use zones follow obvious tracks, paths and boundaries of enclaves except the one in the north west. Boundaries of enclaves will have to be patrolled to avoid encroachments. Sign boards should be erected where prominent tracks or footpaths cross external or internal boundaries.

**Patrols and protection activities:** Three patrol teams, each comprising of one Forest Guard and two patrolmen will be formed. These teams will be based at Jubiya, Kasaka and Bukeso (see Fig. A41.1). Men will be rotated between teams and teams will be rotated between stations.

The AFO and one Forest Ranger will be given motorcycles while the two Rangers and the three Forest Guards will be given a bicycle each.

**Public Access and Community Needs:** The staff will take the responsibility of educating the public about what can be obtained and from where. They will encourage tree planting within the enclaves and promote Collaborative Forest Management.

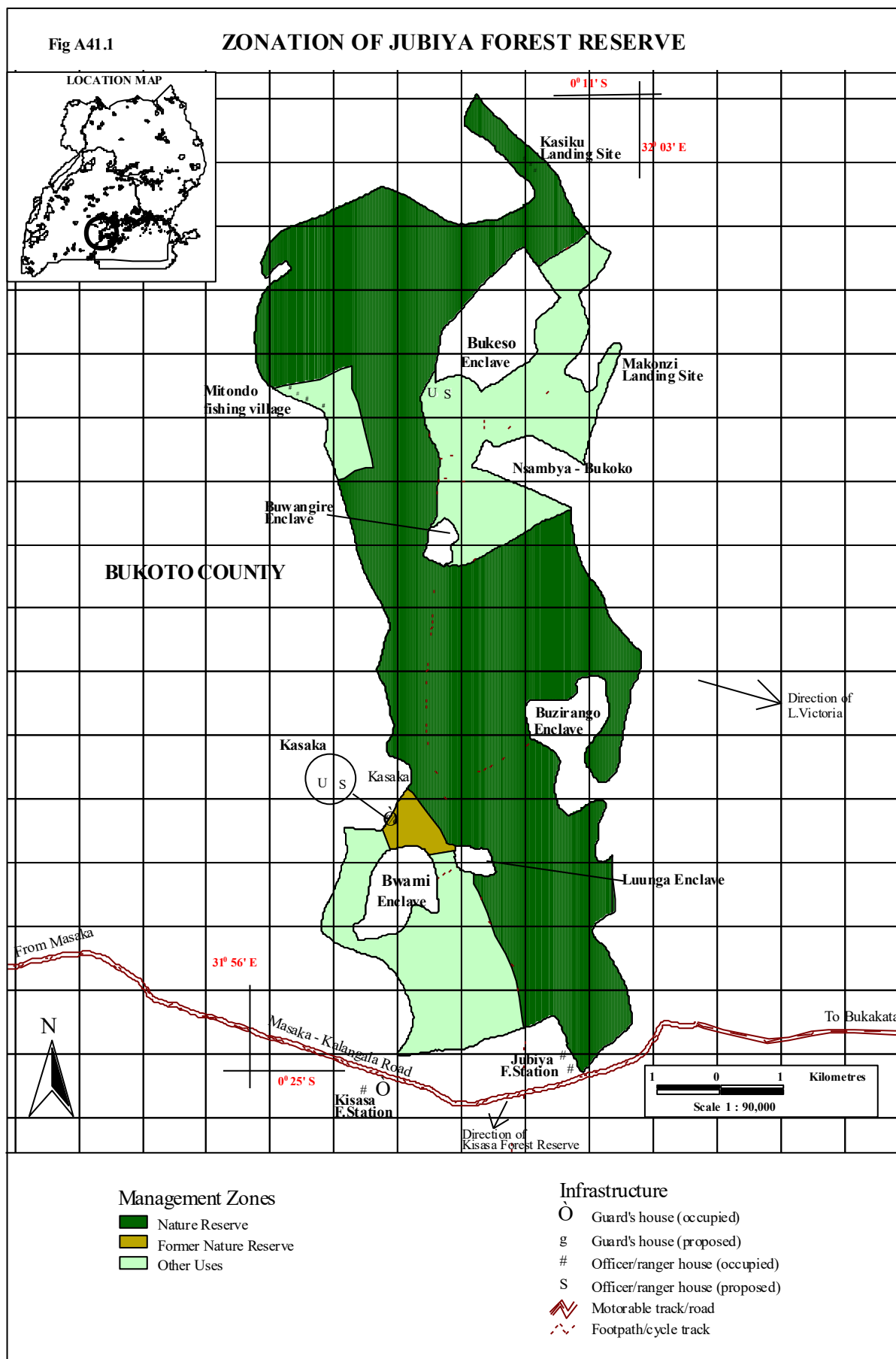
**Table 41.3 Summary of biodiversity values for Jubiya**

Criterion	Trees & Shrubs	Birds	Mammals	Butterflies	Moths	Overall
<b>Total number of species known</b>	182	92	11	150	63	
<b>No. of restricted range species (<math>\leq 5</math> forests)</b>	8	3	0	12	2	
<b>Species unique to forest</b>	-	-	-	<i>Acraea eltringhami</i> <i>Xanthodisca vibius</i> <i>Andronymus marina</i>	-	3
<b>Uganda endemics</b>	-	-	-	-	-	0
<b>Albertine Rift Endemics</b>	-	-	-	<i>Acraea eltringhami</i>	-	1
<b>Species rarity value (score and rank)</b>	7.2(29=)	5.1(42=)	3.9(54=)	5(25=)	5.7 (30=)	6.1(34=)
<b>Species biodiversity (score and rank)</b>	6.7 (21=)	6.6(22=)	3.9(56)	7(22=)	6.7(13=)	6.4(27=)

Overall biodiversity score 12.4

**9 Principle reference material**

- 1 Lockwood Consultants (1973). Forest Resource Development Study for the Republic of Uganda. Lockwood Consultants, Toronto, Canada.
- 2 Uganda Forest Department (1996). Biodiversity Report Series No. 23; Mujuzi, Ssesse Islands and Jubiya forest reserves. Forest Department, Kampala, Uganda.



## APPENDIX 42: LOKUNG FOREST PROFILE

(Category: SECONDARY conservation forest)

### 1 Basis for selection

The forest was selected for Nature Reserve establishment in recognition of its biodiversity importance, especially because:

- it supports at least one unique species of conservation significance (broadly endemic).
- it is representative of a vegetation type G3 (Lowland bamboo thicket) not otherwise represented in Uganda's Protected Area system.
- it supports six restricted range species: one species of tree, 2 of birds, one mammal and 2 species of butterflies (Table 39.3).

### 2 Physical description

**Area:** The reserve has an area of 14 km<sup>2</sup> with a total boundary length of 19 km, which completely adjoins local community lands.

**Establishment:** 1937

**Location:** The reserve lies between 3°32' N-3°37' N and 32°41'-32°44' E; in Lamwo County, Kitgum District in Northern Uganda. It is covered by Uganda Department of Lands and Surveys map sheet 7/3 (series Y732) at 1:50,000.

**Physical features:** The reserve occupies a flat area with altitudinal range between 1020-1060 m, with the whole reserve covering an area with a slope of less than 5°.

### 3 Vegetation

The entire 14 km<sup>2</sup> of the reserve is covered by a vegetation type classified as G3 (lowland bamboo thicket); (Langdale-Brown *et al.*, 1964). This is however, almost completely under cultivation with only a few stands of bamboos remaining.

**Forest integrity score:** Settlement = 3; Cultivation = 5; Hunting = 3; Livestock = 4; Timber = 0; Community Use = 3; Mining = 0 (see Appendix 4 for explanation).

### 4 Economic importance

**Community use value:** Although the reserve is located in one of the least populated areas (16 people per km<sup>2</sup> 1991), it is under serious threat from cultivation. Community Use Value = 1.7 (see Appendix 4 for explanation).

**Timber production:** The reserve is not of any significance for timber production but has a high potential for plantation forestry. Timber Potential score = 4.

**Other economic values:** Harvesting of bamboo for domestic use is an important activity for the local community, especially for building poles.

### 5 Biodiversity values

Of the 65 forests investigated for biodiversity, Lokung ranks 32nd in overall importance with a score of 10.6. It ranks the 24th in species diversity with score 4.9 and 24th in the "rarity" value of species represented, score 6.7.

## 6 Present management

The reserve is one of those managed by the District Forest Officer based in Kitgum. The Forest Ranger for Lamwo county and a Forest Guard at Lokung Trading centre are responsible for day-to-day activities in the reserve (see Table 42.1).

There are no departmental buildings or staff transport facilities for the management of the reserve apart from the DFO's pick up and a motorcycle for the Assistant DFO all based in Kitgum town (see Table 42.2).

The reserve has good accessibility through the all-weather road from Padibe to Palabek and another road that passes along the western boundary.

The last Working Plan for the reserve covered a period from 1/1/63-31/12/72 and this was written for the former Acholi Plantation Reserves.

Under the EC financed Natural Forest Management and Conservation Project, the entire 19 km of the boundary was re-opened.

## 7 Proposed zonation

Figure A42.1 shows the preliminary proposed zonation of the reserve into a Strict Nature Reserve covering an area of 9 km<sup>2</sup> and a Protection (buffer) Zone covering 4 km<sup>2</sup>.

The proposed Strict Nature Reserve will cover all the areas of the reserve south of River Awac. The Nature Reserve has been selected to cover the remaining undisturbed natural vegetation particularly the lowland bamboo thicket.

The protection (buffer) zone will cover the remaining 4 km<sup>2</sup> in the northern part of River Awac which will be maintained in a relatively natural state to buffer the Nature Reserve against edge effects such as exposure to fires and invasion by exotic vegetation.

## 8 Proposed management programmes

**Staffing:** The present staffing is adequate for the management of the reserve with more responsibilities being given to the Forest Ranger, Lamwo County and the Forest Guard who should be based at Lokung 2 km from the reserve (see Table 42.1).

The Forest Ranger should be availed a motorcycle while the Forest Guard should have a bicycle to ensure proper supervision.

**Table 42.1 Existing and proposed staff deployment at Rom**

Station	Existing and proposed No. of staff by category					Remarks
	FO	FR	FG	PM	Total	
Kitgum	1(0)	0(0)	0(0)	0(0)	1(0)	Also DFO Kitgum
Padibe	0(0)	1(0)	0(0)	0(0)	1(0)	
Lokung T.C.	0(0)	0(0)	1(0)	0(2)	1(2)	
<b>Total</b>	<b>1(0)</b>	<b>1(0)</b>	<b>1(0)</b>	<b>0(2)</b>	<b>2(2)</b>	

Note: FO = Forest Officer; FR = Forest Ranger; FG = Forest Guard; PM = Patrol man  
Nos in brackets indicate proposed staffing.

**Infrastructure:** A house for the Forest Ranger should be constructed at Padibe County from where he can manage both Lokung and Agoro-Agu Forest Reserves. Additionally, a unit for a Forest Guard should be built at Lokung Trading Centre.

**Table 42.2 Existing and proposed staff housing at Lokung**

Station	Existing and proposed staff housing at Lokung				Total
	FD Detach	FD semi	FD uniport/hut	Private	
Kitgum	1(0)	0(0)	0(0)	0(0)	1(0)
Padibe	0(1)	0(0)	0(0)	0(0)	0(1)
Lokung	0(0)	0(2)	0(0)	0(1)	0(2)
<b>Total</b>	<b>1(1)</b>	<b>0(2)</b>	<b>0(0)</b>	<b>0(1)</b>	<b>1(3)</b>

Note: Nos in brackets indicate proposed staff housing units.

**Demarcation:** The 19 km of boundary should be re-opened and reinforced by establishment of beacons and live markers of appropriate tree species. The internal boundary of the proposed Nature Reserve will as much as possible follow natural features and will be reinforced with sign plates and painting of trees in the standard way.

**Patrol protection activities:** Two patrolmen will be employed to cover the two proposed zones of the reserve. The patrols will be closely monitored by the Forest Guard and Forest Ranger.

**Public access and community use:** There will be community mobilization through awareness and education outreach programmes (by the DFO and the staff). One possibility to be considered is the establishment of plantations for provision of poles and firewood with community support.

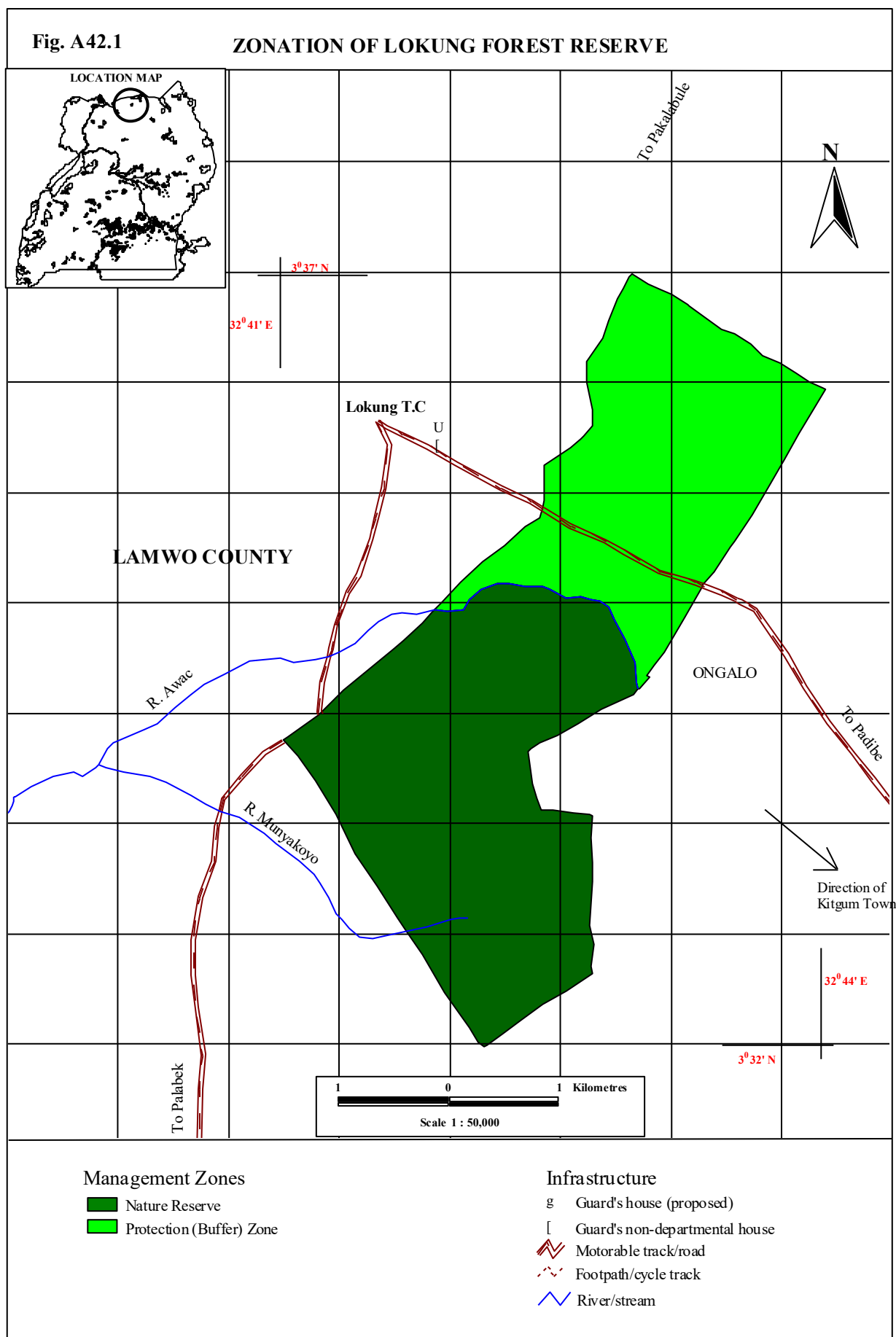
**Table 42.3 Summary of biodiversity values for Lokung**

Criterion	Trees & Shrubs	Birds	Mammals	Butterflies	Moths	Overall
<b>Total No. of species</b>	85	54	13	51	4	-
<b>No. of restricted range Species (<math>\leq 5</math> forests)</b>	1	2	1	2	0	-
<b>Species unique to forest (list)</b>	<i>Jasminum bussei</i>	-	-	-	-	-
<b>Uganda endemics (list)</b>	-	none	none	None	None	none
<b>Albertine Rift endemics (list)</b>	-	none	none	none	None	none
<b>Species diversity (score &amp; rank)</b>	5.2(28)	3.7(42=)	5.2(24=)	5(28=)	< 3.3	4.9(24=)
<b>Species rarity value (score and rank)</b>	6.7(17=)	5(22)	4.2(6=)	4.2(24=)	5.2(25=)	5.7(24=)

Overall biodiversity score = 10.6

## **9 Principle reference material**

1. Langdale Brown, I., Osmaston, H.A. and Wilson, J.G. (1964). The Vegetation of Uganda and its Bearing on Land Use. Uganda Government Printer, Entebbe.
2. Lockwood Consultants (1973). Forest Resource Development Study for the Republic of Uganda. Lockwood Consultants, Toronto, Canada.
3. Uganda Forest Department (1962). Workplan for Acholi Plantations, 1/1/63-31/12/1972. Forest Department, Kampala, Uganda.
4. Uganda Forest Department (1985). Reports of Natural Forest Management and Conservation Project, 1988-95. Forest Department, Kampala, Uganda.
5. Uganda Forest Department (1996). Biodiversity Report Series No. 14; Agoro-Agu and Lokung Forest Reserves. Forest Department, Kampala, Uganda.





## APPENDIX 43: KAZOوبا FOREST PROFILE

(Category: SECONDARY Conservation Forest)

### 1 Basis for selection

The forest was selected for Nature Reserve establishment in recognition of its biodiversity importance, especially because:

- it is representative of a vegetation type, N14 (Langdale-Brown et al, 1964) not otherwise represented in Uganda's Protected Area system.
- it supports 6 restricted range species, including 3 species of trees, one bird and 2 butterflies (Table 43.3).

### 2 Physical description

**Area and demarcation:** The area of the reserve is 74 km<sup>2</sup>; the total boundary length being 38 km, all of which adjoins rural community lands. All the boundary is artificial with corner cairns and directional trenches.

**Establishment:** As central forest reserve; 1967.

**Location:** Lies within the administrative district of Masaka between 0°04' and 0°07'N and 31°06' and 31°10'E. It is covered by Uganda Department of Lands and Surveys map sheet 59/4 (series Y732) at 1:50,000.

**Physical features:** an altitudinal range of 1180 to 1330 m, with only 5.2% exceeding 15° slopes.

### 3 Vegetation and forest condition

The majority of the area (70 km<sup>2</sup>; 95%) is occupied by dry *Combretum* savanna; type N14 (Langdale-Brown et. al., 1964). The remainder (4km<sup>2</sup>, 5%) comprises of type N2, *Combretum-Hyparrhenia* savanna. This vegetation type is largely affected by over-grazing.

The forest is largely converted (overall condition score 1) mainly because it has been apportioned and leased to ranchers. Cultivation and hunting is widespread. Grazing is almost everywhere.

**Forest integrity scores:** Settlement = 3, Cultivation = 3, Hunting Pressure = 1, Livestock grazing 4, Fire = 2, community use 1, mining = 0 (see Appendix 4 for explanation).

### 4 Economic importance

**Community use values:** The forest is situated in a low-density part of the country (30 people per km<sup>2</sup> in 1991), but is widely used for grazing and is very accessible. However, the demand for forest products is low, giving a community use value of 1.1 (see Appendix 3 for explanation).

**Timber production:** The reserve is not of any significant for timber production but has a high plantation potential score of 4.

### 5 Biodiversity values

Of the 65 forests investigated for biodiversity, Kazooba has a biodiversity overall importance score of 10.9. It Ranks 8<sup>th</sup> with a score of 7.9 in mammal species diversity and 12<sup>th</sup> with a score of 7.6 in birds species diversity (Table 43.3).

### 6 Present management

The reserve is managed from Masaka District Forest Offices. There is one Forest Guard stationed at Lwemiyaga. The department has no staff houses and no transport attached to this reserve. There are motorable tracks within the reserve and vehicular access of the forest boundary is possible in many places. There is no Working Plan and no Nature Reserve.

In recent years (since 1990), with the support of the EC-Financed Natural Forest Management and Conservation Project, approximately 22 km of boundary has been re-demarcated by cutline of which 6 km has been successfully planted with *Draceana* and *Cassia* spp. at 20m intervals.

### 7 Proposed zonation

The North-Eastern part is recommended for Strict Nature Reserve as it is the only part that is not extensively encroached and not leased. It is also far from the main transport artery. The site also supports vegetation type N14, not otherwise represented in Uganda's Protected Area System. The Buffer Zone has been selected to surround the Nature Reserve and to shelter it against "edge effects" such as fires and exotic vegetation.

## 8 Proposed management programmes

**Staffing:** The present staffing is inadequate, therefore additional staffing is necessary (Table 43.1).

**Table 43.1 Existing and proposed staff deployment at Kazooba**

Station	Existing and proposed No. of staff by category						Remarks
	FO	AFO	FR	FG	PM	Total	
Lwemiyaga	0(0)	0(0)	0(0)	1(0)	0(0)	0(0)	Lwemiyaga (Not shown on map because it is some distance away).
Lumegere	0(0)	0(1)	0(1)	0(1)	1(4)	1(7)	
<b>Total</b>	<b>0(0)</b>	<b>0(1)</b>	<b>0(1)</b>	<b>1(1)</b>	<b>1(4)</b>	<b>2(7)</b>	

Note: FO = Forest Officer; AFO = Assistant Forest Officer; FR = Forest Ranger; FG = Forest Guard; PM = Patrolmen, Nos. in brackets indicate proposed staffing.

**Infrastructure:** Accommodation is required for the proposed Assistant Forest Officer (1 house at Lumegere); Forest Ranger (1 house at Lumegere); and Forest Guard (1 house at Lumegere) (Table 43.2).

**Table 43.2 Existing and proposed staff housing at Kazooba**

Station	Existing and proposed staff housing at Kazooba					Remarks
	FD Detached	FD semi Detached	FD Uniport	Private	Total	
Lwemiyaga	0(0)	0(0)	0(0)	1(0)	1(0)	FG should shift to Lumegere
Lumegere	0(1)	0(1)	0(0)	0(0)	0(2)	
<b>Total</b>	<b>0(1)</b>	<b>0(1)</b>	<b>0(0)</b>	<b>0(0)</b>	<b>1(2)</b>	

Note: Nos. in brackets indicate proposed staff housing units.

**Demarcation:** The degraded part of the forest reserve will be turned into a softwood plantation, or at least allowed to regenerate. 22 km of re-opened boundary remains to be planted. Signboards will be erected whenever prominent footpaths cross boundaries.

**Patrols and protection activities:** 1 patrol team comprising of one Forest Guard and 4 patrolmen will be constituted with responsibility for safeguarding the forest. They are to be based at Lumegere.

## Public access and community needs

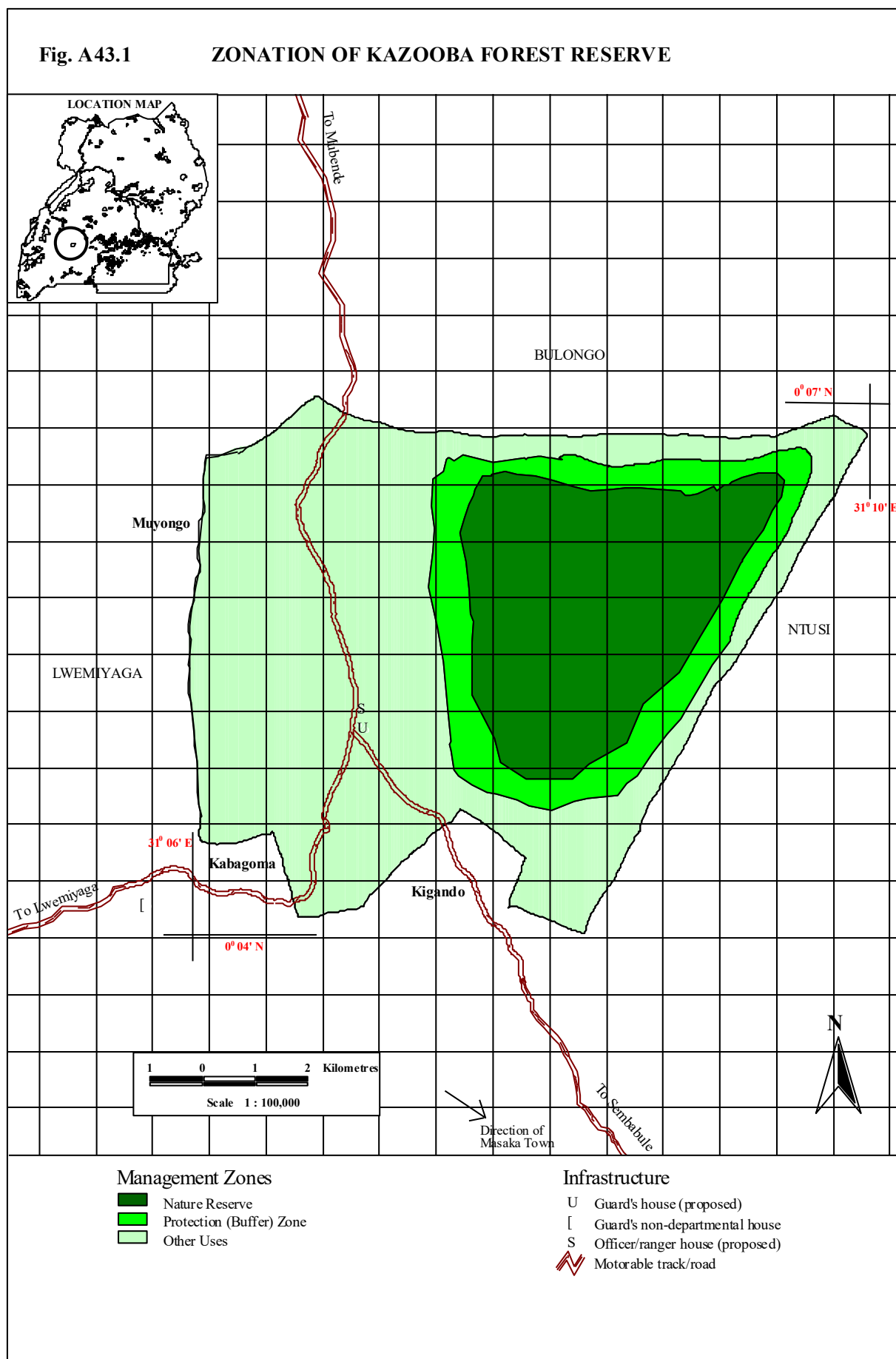
The Assistant Forest Officer and Ranger based at Lumegere will assume responsibility for community outreach programmes, including the development of Collaborative Forest Management programmes within the reserve and community tree-planting programmes outside the boundary. They will be provided with a motorcycle and a bicycle respectively.

**Table 43.3 Summary of biodiversity values for Kazooba**

Criterion	Trees & Shrubs	Birds	Small mammals	Butterflies	Large moths	Overall
<b>Total No. of species known</b>	78	89	11	67	11	
<b>No. of restricted range species (<math>\leq 5</math> forests)</b>	3	1	0	2	0	
<b>Species unique to forest</b>	0	0	0	0	0	
<b>Uganda endemics</b>	0	0	0	0	0	
<b>Albertine Rift endemics</b>	0	0	0	0	0	
<b>Species diversity (score &amp; rank)</b>	3.4 (58)	7.6 (12)	7.9 (8)	6.6 (30)	6.4 (21)	5.1
<b>Species rarity value (score &amp; rank)</b>	6.8 (42)	4.7 (54)	4.3 (43)	3.8 (58)	6.5 (21)	5.8
Overall Biodiversity Importance 10.9 (51)						

## 9 Principle reference material

1. Langdale Brown, I., Osmaston, H.A. and Wilson, J.G. (1964). The Vegetation of Uganda and its Bearing on Land Use. Uganda Government Printer, Entebbe.
2. Lockwood Consultants (1973). Forest Resource Development Study for the Republic of Uganda. Lockwood Consultants, Toronto, Canada.
3. Uganda Forest Department (1996). Biodiversity Report Series No. 31. Kazooba, Kasana-Kasambya and Nsowe Forest Reserves. Forest Department, Kampala, Uganda.
4. Uganda Forest Department (1996). Masaka District Forest office files. Forest Department, Kampala, Uganda.



**APPENDIX 44: ZULIA FOREST PROFILE**

(Category: SECONDARY conservation forest)

**1 Basis for selection**

The forest was selected for Nature Reserve establishment in recognition of its biodiversity importance, especially because:

- it supports vegetation types N10 (*Boswellia-Fagara-Heeria*); N12 (*Acacia-Heeria-Terminalia*); Q7 (*Eragrostis-Loudetia* grass savanna); R1 (Acacia tree and shrub steppe); S1 (*Chrysopogon* grass steppe) and V5 (*Acacia mellifera* thicket) otherwise not represented in Uganda's Protected Area System.

**2 Physical description**

**Area and demarcation:** The area of this reserve is 1026 km<sup>2</sup>, of which 420 km<sup>2</sup> lies within Kidepo Valley National Park. Zulia has never been demarcated but much of the reserve follows international boundaries (Sudan and Kenya), and the River Kidepo to the south.

**Establishment:** 1942

**Location:** Zulia Forest Reserve is located in the extreme north-eastern corner of Uganda, bordering Sudan to the north and Kenya to the east; the Kidepo River forms the southern border. It is covered by Uganda Department of Lands and Surveys map sheets 1/4, 2/3, 9/1, 9/2 and 10/1 (series Y732) at 1:50,000.

**Physical features:** It consists of an extinct volcanic crater with the Turkana escarpment to the east and surmounted by the Zulia and Lomil hills, which slope down to the Kidepo basin to the west. The slopes of these hills are steep and rocky - particularly on the escarpment, while the Kidepo basin is a gently undulating plain out of which protrude old volcanic hills. Zulia Forest Reserve covers much of the headwaters of the Kidepo river. It has an altitudinal range of 1040-2148 m above sea level.

**3 Vegetation and forest condition**

The majority of the area (586 km<sup>2</sup>, 57%) is occupied by Dry *Combretum* savanna, classified as types N8, N10, N11 and N12; while 138 km<sup>2</sup> (13%) is covered by bushland classified as T2, T3 and T6. The remainder is composed of *Chrysopogon* grass steppe, type S1 (93 km<sup>2</sup>, 9%), dry thicket types V3 and V5 (78 km<sup>2</sup>, 7.6%), *Juniperus-Podocarpus* dry montane forest (62 km<sup>2</sup>, 6%), and Forest-savanna mosaic at high altitudes (62 km<sup>2</sup>, 6%), (Langdale-Brown et al., 1964).

The forest is intact (overall condition score 5) mainly because of its remoteness, and the small population. Zulia is inaccessible and because of insecurity as a result of conflict between the Didinga, Mening, Turkana, Toposa and the Karamojong cattle raiders and poachers, the surrounding area is largely uninhabited. The forest reserve also overlaps with Kidepo Valley National Park (420 km<sup>2</sup>) to the west and south, which accords it further protection. Hunting (poaching) particularly by the Sudanese is common.

**Forest integrity scores:** Settlement = 0, Cultivation = 0; Hunting = 1; Livestock = 1; Timber = 0; Fire = 1; Community Use = 1; Mining = 0 (see Appendix 4 for explanation).

**4 Economic importance**

**Community use values:** The forest is situated in a very sparsely populated part of the country (9 people per km<sup>2</sup> in 1991). The few scattered villages of the Teuso (Ik) people, who live a semi-nomadic life, are centred around the waterholes.

**Timber production:** There is no timber production in the reserve as it is mainly covered by savanna, bushland and steppe communities.

**Other economic values:** Zulia is vital as a watershed as it covers the Turkana escarpment, Mt. Zulia, the Lomil hills and the Kidepo-Kapekenyang drainage.

**5 Biodiversity values**

Zulia was not sampled for biodiversity by the recent biodiversity inventory team. However, according to previous work, Zulia supports several unique communities and it represents a large block of Dry *Combretum* savanna, type N10 (*Boswellia-Fagara-Heeria*) found in no other Ugandan forest. It is the only forest with vegetation types Q7 (*Eragrostis-loudetia* grass savanna), S1 (*Chrysopogon* grass steppe) and V5 (*Acacia mellifera* thicket).

## 6 Present management

The reserve is managed from the Kotido District Forest Office and the part of the reserve which overlaps with Kidepo Valley National Park (420 km<sup>2</sup>) is under dual management together with the Wildlife Authorities based at Apoka.

Zulia is not actively managed by the Forest Department due to its remoteness and lack of resources and insecurity in the area. There are no Forest Department staff there and no infrastructure (houses, roads/tracks).

Zulia Forest Reserve was not demarcated in the 1950s by the Forest Department like other reserves in Kotido district because it was considered very remote, containing few inhabitants, infested with tsetse flies and much of it was included in the game reserve by then.

## 7 Proposed zonation

Zulia Forest Reserve cannot be proposed for zonation before more study is carried out to establish important sites, biodiversity values and after security in that part of Uganda is improved. However, its remoteness bordering both Kenya and Sudan and the National Park to the South gives it enough protection. Its big size (1026 km<sup>2</sup>) also has inherent protection advantages.

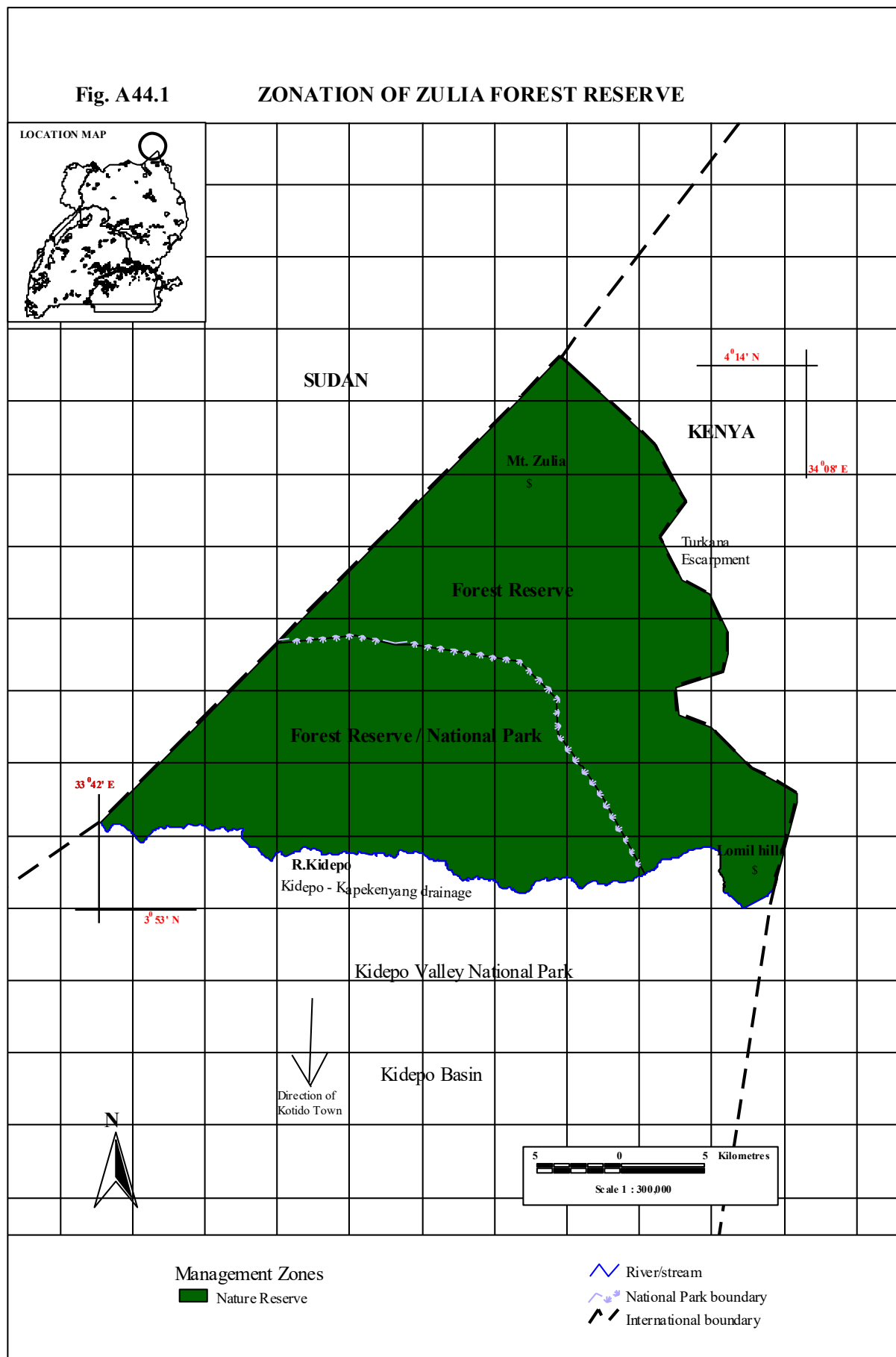
## 8 Proposed management programmes

Management programmes will be proposed after more on-the-ground study has been carried out, to cover the entire reserve and identify important sites.

**Staffing:** Forest Department staff presence is proposed.

## 9 Principle reference material

1. Forest Department (1963). Working Plan of the north Karamoja Central Forest Reserves. Forest Department, Kampala, Uganda.
2. Langdale-Brown, I., Osmaston, H.A., and Wilson, J.G. (1964). The Vegetation of Uganda and its bearing on land-use. Uganda Government Printer, Entebbe.



## APPENDIX 45: KAMUSENENE FOREST PROFILE

(Category: SECONDARY conservation forest)

### 1 Basis for selection

The forest reserve selected for Nature Reserve establishment in recognition of its biodiversity importance, especially because:

- it supports vegetation type (W5) not otherwise represented in Uganda's Protected Area System.
- it supports 3 species of trees, 1 bird and 5 species of butterflies that occur in not more than five other Ugandan forests.

### 2 Physical description

**Area and demarcation:** The area of the reserve is 62 km<sup>2</sup>; with a total boundary length of 40 km. The reserve is completely surrounded by rural communities who are cattle keepers. 39 km of the "external" boundary is an artificial boundary not maintained. There are corner cairns and directional trenches. 1 km follows the Ngoma-Luwero Road.

#### Establishment:

**Location:** The reserve is in the Luwero triangle, Ngoma sub county, Nakaseke county, in central Uganda between 0°55' and 1°33' N, 32°00' and 32°35' E, and is covered by Uganda Department Lands and Surveys covered by map sheet 50/3 (series Y732) at 1:50:000.

**Physical features:** The reserve occupies a plain with 98% of the landscape in the less than 5° slope category. It is intersected by shallow swamps which drain into River Towa. The altitudinal range is between 1057-1179 m with Kamusenene hill (11179 m) forming the highest point.

### 3 Vegetation and forest condition

The forest reserve has three major vegetation types; 15 km<sup>2</sup> (24%) of Acacia savanna classified as W5 (*Acacia-Imperata* grassland), 42 km<sup>2</sup> (68%) classified as N2 (*Combretum-Hyparrhenia* grassland) and 5 km<sup>2</sup> (8%) classified as N1 (*Combretum-Terminalia-Laudetia* grassland); (Langdale-Brown et al., 1964).

The forest is heavily encroached by landless cattle keepers with over 70 households (average of 3 people per house hold) and an estimated 4,000 cattle (overall condition score 2). Widespread grazing has affected 75% of the area, 50% of the area is affected by fire. Settlement affects less than 30% of the forest reserve.

**Forest integrity score:** Settlement = 3; Hunting = 3; Livestock = 5; Timber = 0; Fire = 3 (see Appendix 4 for explanation).

### 4 Economic importance

**Community use values:** The forest reserve is situated in one of the lowest populated areas of Uganda (4 people per km<sup>2</sup> in 1991), so pressure on the peripheral areas of the forest for firewood, building poles and non-timber products is correspondingly low, giving a "community use" value of 0.2 (see Appendix 3 for explanation).

**Timber production:** The forest is not an important source of hardwood timber. However, its ideal for the establishment of industrial timber plantation.

**Other economic values:** The forest reserve has potential for legalized cattle grazing and commercial bee farming.



## 5 Biodiversity values

Of the 65 Forest Reserves investigated for biodiversity, Kamusenene ranks 56th with a score of 10.3. In terms of species rarity it ranks 50th with a score of 5.8 but ranks 58th in terms of species diversity with a value of 4.5. Despite ranking low, the forest reserve has vegetation type W5 (*Acacia-Imperata* grassland) not otherwise represented in Uganda's Protected Area System.

## 6 Present management

The reserve is managed from Luwero District Forest Office with no local office. There is one patrol man who is incharge of both Kapimpini and Kamusenene Forest Reserves (Table 45.1). The reserve has no management plan.

There is no record of when the last boundary work was done, information from the local people put the dates around the early 1960s.

## 7 Proposed zonation

Figure A45.1 shows the proposed zonation of the Forest Reserve.

**Proposed Nature Reserve:** About 13 km<sup>2</sup> of the reserve is proposed as Strict Nature Reserve and will occupy the area around and south of Kamusenene hill. The area has a gradual change of vegetation type from the hill top to Kazinga swamp.

**Proposed Protection Zone:** A strip of land (about 9 km<sup>2</sup>) around the Strict Nature Reserve will be used as a protection zone to buffer the SNR.

**Proposed Production Zone:** About 40 km<sup>2</sup> of the reserve will be left under production.

## 8 Proposed management programmes

**Staffing:** The present staff number is inadequate; redeployment will be necessary to create an effective patrol team. The entire forest reserve will be brought under the responsibility of a Forest Ranger based at Ngoma who should be assisted by 2 Forest Guards and 4 patrolmen (Table 45.1).

**Table 45.1 Existing and proposed staff deployment at Kamusenene**

Station	Existing and proposed number of staff by category					Total
	Forest Officer	Asst. FO	Forest Ranger	Forest Guards	Patrolman	
Ngoma	0	0	0(1)	0	1(1)	1(2)
Katebe	0	0	0	0(1)	0(1)	0(2)
Kamusenene	0	0	0	0(1)	0(2)	0(3)
<b>Total</b>	<b>0</b>	<b>0</b>	<b>0(1)</b>	<b>0(2)</b>	<b>1(4)</b>	<b>1(7)</b>

Note: Numbers in brackets indicate proposed staffing.

**Infrastructure:** Three houses should be built at the following locations; Ngoma, a trading centre, for a Forest Ranger, Katebe village for a Forest Guard and at Kamusenene village for another Forest Guard (Table 45.2).

**Table 45.2 Existing and proposed staff housing at Kamusenene**

Station	Existing and proposed No. of staff by category			Total
	FD detached	FD semi detached	Uniport	
Ngoma	0(1)	0(0)	0(0)	0(1)
Katebe	0(0)	0(1)	0(0)	0(1)
Kamusenene	0(0)	0(1)	0(0)	0(1)
<b>Total</b>	<b>0(1)</b>	<b>0(2)</b>	<b>0(0)</b>	<b>0(3)</b>

Numbers in brackets indicate proposed staff housing units

**Demarcation:** The 39 km of external boundary needs resurveying and re-opening and should be planted with live markers (e.g. sisal). All management zones should be demarcated in a standard way.

**Patrol and protection activities:** The patrol team will comprise of the two Forest Guards and 4 patrol men under the supervision of the Forest Ranger. Patrol routes and check points will be established in appropriate places within the forest reserve, with each patrol man being in charge of 10 km of boundary.

**Public access:** The Forest Ranger based at Ngoma will be in charge of community outreach programmes including Collaborative Forest Management within the forest reserve and community conservation programmes (including tree planting) outside the reserve. A programme of village meetings will be instituted to explain and discuss management of the Forest Reserve and in particular, the management zones as they are established.

The forest will be provided with 1 motorcycle and 6 bicycles to ease transport.

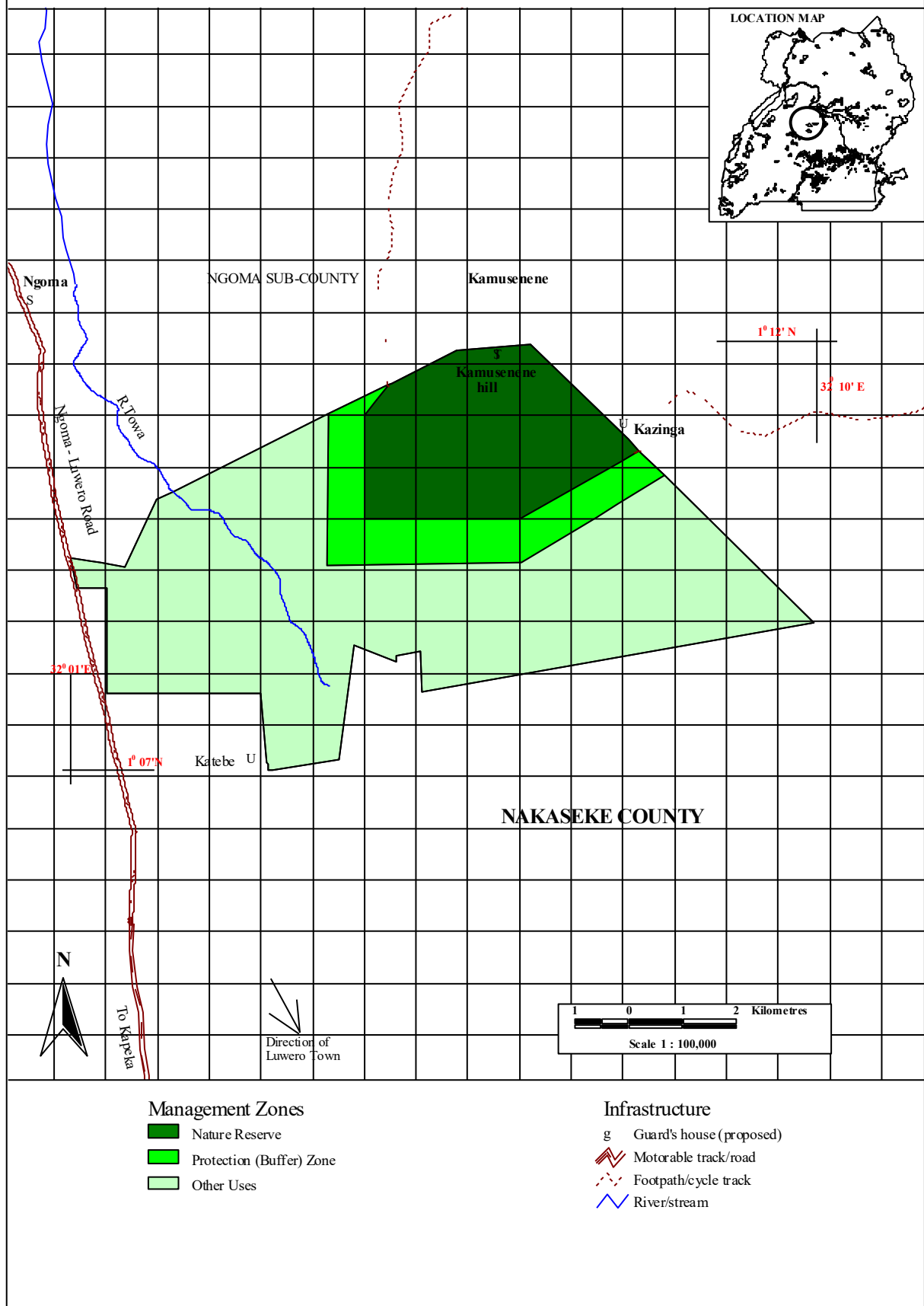
**Table 45.3 Summary of biodiversity values**

Criterion	Trees & Shrubs	Birds	Mammals	Butterflies	Moths	Overall
Total No. of spp known	70	61	4	52	-	187
No. of restricted range spp ( $\leq 5$ forest)	3	1	0	5	-	9
Species unique to the forest (list)	Nil	Nil	Nil	Nil	Nil	Nil
Uganda endemic (list)	Nil	Nil	Nil	Nil	Nil	
Albertine Rift endemics (list)	Nil	Nil	Nil	Nil	Nil	Nil
Species diversity (score & rank)	3.6(56=)	5.5(39=)	5.1(48=)	4.7(33=)	6.5(20=)	4.5(58=)
Species rarity (score and rank)	6.3(60=)	4.8(51=)	6.6(12=)	4.2(51=)	Nil	5.8(50=)

Overall biodiversity importance = 10.4

## 9 Principle reference materials

1. Langdale-Brown, I., Osmaston, H.A. and Wilson, J.G. (1964). The Vegetation of Uganda and its bearing on landuse. Uganda Government Printer, Entebbe.
2. Uganda Forest Department (1996). Biodiversity report series No. 25; Luwero District Biodiversity Report. Forest Department, Kampala, Uganda.

**Fig. A45.1 ZONATION OF KAMUSENENE FOREST RESERVE**





The Forestry Nature Conservation Master plan is a product of several years of biodiversity planning for all the forest reserves over 50 km<sup>2</sup> in Uganda. This is a practical document for forestry conservation planning and management. This edition reflects some of the recent changes in policy and legislation environment within the forestry sector.

The Master Plan gives the results of a biological inventory program that was undertaken in 65 major forests in Uganda. It describes the data analysis that was done to select forests for Nature Reserve establishment and procedures for zoning regimes in each of the forests. The zones for each forest are preliminary and will be revised as more information becomes available.

The Plan lays down the strategy for integrating biodiversity conservation with other aspects of natural forest management through establishment of a national system of Strict Nature reserves, Buffer and Production Zones with their management objectives. By so doing, it addresses both the preservation and production functions of forest management in Uganda.

The plan also provides a general description of Uganda's protected forest estate that includes National Parks, Wildlife and Forest reserves and the justification for zoning Uganda's forests. Uganda is internationally recognized as a country with exceptional biodiversity and this is mostly concentrated in the protected forests.

The plan provides some practical guidelines for Forest Managers on zoning procedures, boundary demarcation, forest protection and local community participation in forest management. This is a generic plan that can be used by any agency responsible for the conservation and management of the forest estate in Uganda.