Arabuko-Sokoke Forest
Kenya

Prepared by
the Arabuko-Sokoke Forest Management Team

Strategic Forest Management Plan 2002–2027

KENYA FORESTRY RESEARCH INSTITUTE KEFRI

KENYA WILDLIFE SERVICE

Forest Department

NATIONAL MUSEUMS OF KENYA

BirdLife INTERNATIONAL

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Strategic Forest Management Plan

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Approval

Arabuko-Sokoke
Strategic Forest Management Plan
2002–2027

This strategic management plan is approved for implementation, and will be reviewed from time to time as the need arises.

J.M. MUTIE
Ag. Chief Conservator of Forests
February 2002

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Acronyms

ASF	Arabuko-Sokoke Forest
ASFGA	Arabuko-Sokoke Forest Guides Association
ASFMCP	Arabuko-Sokoke Forest Management and Conservation Project
ASFMT	Arabuko-Sokoke Forest Management Team
ASSETS	Arabuko-Sokoke Sustainable Eco-Tourism Scheme
dbh	Diameter at breast height
DFO	District Forest Officer
DIFAAFA	Dida Forest-Adjacent Area Forest Association
EU	European Union
FADA	Forest-Adjacent Dwellers Association
FD	Forest Department
FoASF	Friends of Arabuko-Sokoke Forest
GIS	Geographical Information System
IPR	Institute of Primate Research
KARI	Kenya Agricultural Research Institute
KEFRI	Kenya Forestry Research Institute
KIFCON	Kenya Indigenous Forest Conservation Project
KSh	Kenya Shillings
KWS	Kenya Wildlife Service
MENR	Ministry of Environment and Natural Resources
MoU	Memorandum of Understanding
NK	Nature Kenya
NMK	National Museums of Kenya
NPV	Net Present Value
NTFP	Non-timber forest product
PFM	Participatory Forest Management
SFMP	Strategic Forest Management Plan
WCK	Wildlife Clubs of Kenya

Message from the Permanent Secretary of the Ministry of Environment and Natural Resources

The two main problems confronting the conservation and management of forests are competition for land and an increasing demand for a wide range of forest goods and services. The pressure on forest land and the growing stock comes from two clearly defined but overlapping user groups: the forest-adjacent communities, who use the forest as a resource to supplement their economic activities, and the small- or large-scale commercial users, whose main market for forest products is the urban areas. The pressure exerted will, if not addressed appropriately, impact negatively on the object of sustainability in forest management. This has put in jeopardy the gains already made in alleviating the poverty situation in the country.

The government recognises the important role played by the forest-adjacent communities in protecting and conserving forests that have formed part of their livelihood. In line with these traditions and the emerging global trends of Participatory Forest Management, the government has accepted the concept of stakeholders' involvement in planning and management of forest resources.

Arabuko-Sokoke Forest is of immense importance to the forest-adjacent community, whose livelihood is substantially dependent on its resources. The forest is rich in biodiversity and recognised as an important bird sanctuary in mainland Africa as well as an important eco-tourism destination.

The Arabuko-Sokoke Forest Conservation and Management Project grew out of the realisation of the need to involve community and other stakeholders in forest management, and to catalyse policy changes in the forestry sector in the country. The aim was to enhance conservation of its biodiversity, ecological functions, and socio-economic and cultural values. One major issue of concern in this forest area is that of problem animals, which have contributed to the poverty levels of the adjacent communities. Management of this problem is a priority, in order to gain the much-desired local community support for forest conservation. Forest-based income-generating activities like the butterfly-farming and bee-keeping piloted by the project have been significant in mitigating the effects of poverty in the community.

This Strategic Forest Management Plan, which has been developed jointly, is a first step towards harmonising the interests of the various stakeholders concerned with the conservation of Arabuko-Sokoke Forest. In implementing the activities and programmes in this document, the government expects that important lessons will emerge from the initiative, which will guide the formulation and adoption of similar plans in other areas in the country.

While the Ministry fully endorses the implementation of this plan, it is seriously constrained by inadequate provision of the required resources. We would therefore wish to appeal to donors and well-wishers to support the effort of the participating partners.

At this point, the Ministry gratefully acknowledges the support from BirdLife International and the European Union for the technical and financial assistance they have provided, without which this document would have been very difficult to produce. This Plan is a means towards an end, and the government affirms its commitment in support of all the planned activities and welcomes continued collaboration and partnership for the more challenging phase of implementation.

Ambassador FRANCIS MUTHAURA
Permanent Secretary
Ministry of Environment and Natural Resources

Joint message from implementing partners

Arabuko-Sokoke forest is a life-supporting system composed of diverse biological and edaphic resources that are of local, national and global importance. It forms the centrepiece of a world-renowned habitat for rare and endangered mammals and birds. Indeed, the concentration of rare species accounts for its status as the second most important site for conservation of threatened bird species on the African mainland. The forest also maintains an underground fresh water system and supports a mangrove ecosystem located between the forest block and the ocean. It is recognised that an increased human population has exerted enormous pressure on the finite resources, resulting in over-exploitation and an increased demand for agricultural development. The recent discovery of large deposits of titanium and high quality silica sand remain potential threats that require careful planning in the management of Arabuko-Sokoke Forest.

In view of the above, this Strategic Forest Management Plan is aimed at mitigating the challenges and threats that the Arabuko-Sokoke ecosystem is currently facing. Considering that this plan has been developed jointly by a myriad of stakeholders through a very elaborate consultative process that took over eighteen months, a committed implementation process is equally envisaged by all those that have a stake in the plan.

The plan has identified four main forest management zones, with specific objectives and proposed types of operational plans. It is envisaged that the plan will contribute to the restoration of degraded areas and the conservation of rare birds and mammals, and ensure sustainable utilisation of the natural resources available in Arabuko-Sokoke. Similarly, the local community living adjacent to the forest will actively participate in its management.

Finally, we wish to extend appreciation to the planning team, the MoU Secretariat and to the other key stakeholders, and to make an earnest appeal for all collaborators to work concertedly towards the implementation of this strategic plan and the operation plans that will be developed thereafter.

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Preface

The Strategic Forest Management Plan for Arabuko-Sokoke Forest is the outcome of a planning process lasting almost 18 months during the period 2000–2002. The planning process was supported through the Arabuko-Sokoke Forest Management and Conservation Project, which was financed by the European Union (DG VIII – Development) under its Tropical Forest budget line. The EU financing was administered by BirdLife International, working in partnership with the institutional members of the Arabuko-Sokoke Forest Management Team: the Forest Department, Kenya Wildlife Service, National Museums of Kenya and Kenya Forestry Research Institute. In addition to these institutional partners, there has been widespread consultation with many other organisations and individuals.

At the outset, the challenge was to produce a Strategic Forest Management Plan for Arabuko-Sokoke Forest which would meet the needs of all stakeholders in the forest, and provide a useful document for managing the forest over the next 25 years. A plan which looked attractive but did not have the consensus of all stakeholders, or a plan which might be rapidly consigned to bookshelves and libraries, would not meet this challenge, and it is hoped therefore that this plan will provide a useful document for many people in future years. The task has been not only to follow a process, but also to define and test the planning process itself, since this has been a new experience not only in Kenya, but also internationally. Although Participatory Forest Management at grassroots level is now well established in many places, there are few examples available from elsewhere where a participatory planning process has been applied to preparation of a Strategic Forest Management Plan. In many ways, therefore, this Plan is unique and innovative in its development.

Whether the plan itself meets this challenge remains to be seen. However, it has taken forest management planning out of the exclusive realms of professional foresters and conservationists, and placed it within the framework of wider civil society. Undoubtedly the product is not perfect, but it does represent a significant step forward, and a starting point for improvement which, it is hoped, will lead to the achievement of the plan's vision and objectives.

Joram K. Kagombe
Forest Management Coordinator
Arabuko-Sokoke Forest Management Team

Executive Summary

Arabuko Sokoke Forest, covering 41,600 ha, is the largest single block of coastal forest remaining in East Africa. It is the only forest reserve where the Forest Department has invited three partners to jointly manage the forest. The three partners are the Kenya Wildlife Service, Kenya Forestry Research Institute and National Museums of Kenya. This is in recognition of the importance of the forest as a biodiversity hotspot and its link with neighbouring communities. Surrounding the forest are 54 villages, whose inhabitants depend on the forest for their subsistence uses.

Arabuko Sokoke Forest needs to be protected and conserved for present and future generations. Strategies for conservation must address short- and long-term goals of forest management. The Arabuko-Sokoke Forest Management Team, other stakeholders and the local community, with financial and technical assistance from European Union and BirdLife International, came together to develop a Strategic Forest Management Plan (SFMP). This plan will guide forest management operations for the next 25 years. It is the first integrated management plan to be developed for a Kenyan forest.

The plan was developed in a participatory way, with wide consultation among the stakeholders. A review of past studies and available data was carried out. A workshop followed, in which the vision and purpose of the plan were agreed. Thematic areas were identified, which formed the basis for nine thematic workshops and one zonation workshop, encompassing all stakeholders and disciplines involved in the entire process. Workshop outcomes were presented to the participants for discussions.

Vision and guiding principle

The vision for the plan is to have an intact and fully functioning forest ecosystem with no reduction in the existing forest area by 2027. The purpose of the plan is to put in place sustainable forest management and conservation practices. This will be achieved by a combination of strategies and actions focusing on the main issues. The strategies will focus on forest zonation, ecotourism, environmental education, problem animal management, subsistence use of the forest, biodiversity conservation, commercial use of the forest, infrastructure development, human resource development, and monitoring and research. The overriding principle for the strategy is sustainability. Arabuko-Sokoke Forest should contribute positively to sustainable development, and meet needs of present and future generations.

Context

The forest has been overexploited over the last years. Most of the commercial trees have been harvested. Commercial exploitation at present is not a viable option, but the communities adjacent to the forest have continued to depend on it for subsistence use, which they consider as their biggest benefit from the forest. The commercial harvesting that has taken place in the past and the continued subsistence use has not been covered by proper management guidelines. This lack of regulation, coupled with rampant, illegal exploitation, has contributed to forest degradation and loss of biodiversity.

Arabuko-Sokoke Forest harbours unique endemic flora and fauna, which makes it an important area for biodiversity. Its rich biodiversity, especially bird species, makes Arabuko-Sokoke Forest very important for eco-tourism.

The forest has contributed to the poverty of the adjacent communities, by harbouring animals such as elephants and baboons that damage crops and may cause injury and death to human beings. Problem animal control has been a major preoccupation for the Kenya Wildlife Service. Some income-generating activities have been introduced to reduce the poverty levels; the most successful have been butterfly-farming and bee-keeping. These activities aim to reduce unsustainable use of the forest and to provide an alternative land use that is not vulnerable to animal damage.

Zonation of the forest

The plan proposes four zones in and around the forest:

- non-extractive zone, divided into a biodiversity conservation sub-zone and eco-tourism sub-zone;
- subsistence zone, divided into a community use sub-zone and non-timber forest products sub-zone;
- commercial zone; and
- intervention zone.

The Strategic Plan

The Strategic Plan proposes nine thematic areas for management of Arabuko-Sokoke Forest. For each thematic area, objectives and outputs are given as follows:

Biodiversity conservation

To conserve and enhance the unique biodiversity of the forest.

- Increase understanding and knowledge of the forest ecosystem.
- Improve local awareness of biodiversity.
- Reduce external threats and interference.
- Restore degraded habitats.

Subsistence use

To enhance the sustainable livelihoods of the forest-adjacent community.

- Address causes of poverty amongst forest-adjacent communities.
- Develop partnerships between government and forest-adjacent communities for shared benefits and responsibilities.
- Develop a more systematic approach to local utilisation of forest resources.

Eco-tourism and environmental education

To add value to the forest through revenue generation and improved awareness.

- Increase sustainable eco-tourism revenues. ·
- Improve local benefits from ecotourism.
- Focus on the longer-term benefits of environmental education.

Problem animal management

To reduce and mitigate damage caused by wildlife in forest-adjacent villages while maintaining the biodiversity conservation importance of the forest.

- Control animal movement.
- Improve effectiveness of patrolling.
- Reduce impact of animal damage.

Forest protection
To significantly reduce levels of poaching and illicit forest product harvesting.
- Involve forest-adjacent communities in forest protection.
- Improve the effectiveness of patrolling.
- Encourage more appropriate legislation and deterrents.

Commercial use
To maximise the commercial potential of available forest resources whilst ensuring their sustainable use.
- Utilise the productive potential of established plantations.
- Support local involvement in commercial forest-based activity.

Infrastructure development
To establish and maintain the infrastructure necessary to achieve the multiple objectives of forest management at least cost.
- Maintain the road network.
- Maintain buildings, services and equipment.
- Develop and work with new institutional partnerships to maximise the impact and utility of infrastructure.

Human resource development
To build an efficient team for the management of the forest.
- Develop partnerships among stakeholders to improve the skills base for effective forest management.
- Build teams and encourage team-work.

Research and Monitoring
To obtain improved understanding of the forest and its usage for better management and monitoring.
- Fill knowledge and information gaps for management.
- Improve technologies in management and introduce new ones.
- Monitor the activities carried out under the strategic plan.

The plan gives actions to be carried out to achieve each objective. These are prioritised and responsibilities are assigned.

The plan proposes retention of the existing administrative framework at Arabuko-Sokoke Forest. The four government departments should continue to work together, with the local community incorporated in the team through the Forest-Adjacent Dwellers' Association. It proposes establishment of an Arabuko-Sokoke Forum, in which other stakeholders, not represented in the management team, will participate. This will be supported through establishment of an Arabuko-Sokoke Forest Trust, which will solicit for support for conservation of the forest.

Part 2 of the plan provides Operational Guidelines, which should be followed when Operational Plans are prepared.

Part 3 gives Planning Information, in the form of thematic profiles of the forest. It also provides the basis for further project development in the forest, which may attract further support to conservation initiatives.

Part 1. The Strategic Plan

1.1 Introduction to Arabuko-Sokoke Forest

Location

Arabuko-Sokoke Forest is the largest single block of indigenous coastal forest remaining in East Africa. It is situated in Kenya's Coast Province and transverses Kilifi and Malindi Districts at a latitude of 3° 20' S and longitude 39° 50' E (Maps 1 and 2).

Topography and altitude

The eastern part of the forest lies on a flat coastal plain at an altitude of about 45 m above sea level. This rises to a plateau of about 60–200 m in the central and western parts of the forest (Map 3).

Forest area

The total forest area is approximately 41,600 ha.

Status

The forest was originally declared as Crown Forest in 1932 and was gazetted as a forest reserve in 1943. An additional 2,675 ha at Kararacha in the south east was added in 1968. Within the forest area about 4,300 ha was designated as a strict Nature Reserve in 1977. This was extended in 1979 by 1,635 ha (Table 1).

Map 1. General location of Arabuko-Sokoke Forest.

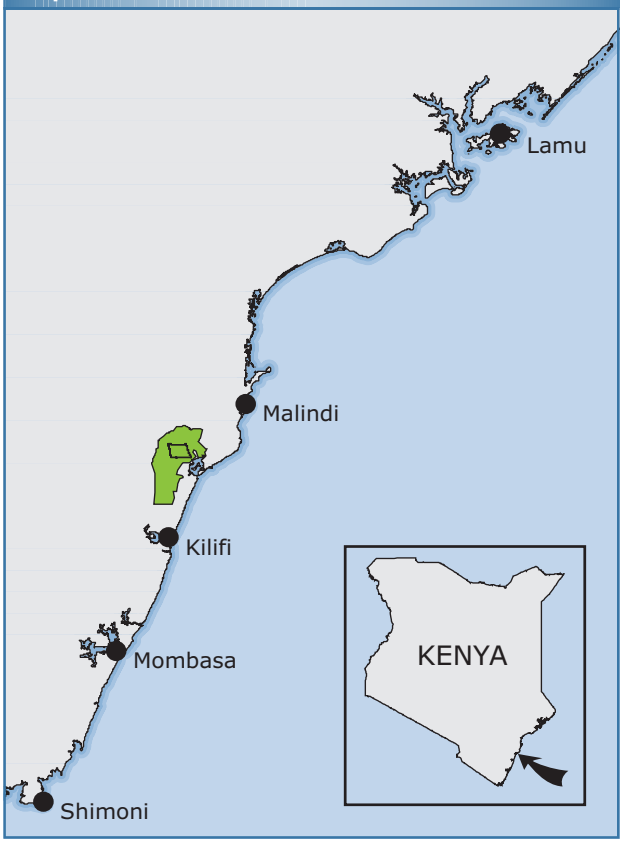


Table 1. Legal status of Arabuko-Sokoke Forest.

Details	Year	Boundary plan	Legal notice	Area/ha
Original gazettement	1932	75/12	44	39,089
Revocation of proclamation 44 and re-gazettement with new boundaries	1943	175/4	48	39,089
Declared central forest	1964		174	39,089
Kararacha extension	1968	175/88	149	2,675
Declaration of Nature Reserve (within forest reserve)	1977	175/194	100	2,699
Declaration of Nature Reserve extension (within forest reserve)	1979	175/215	180	1,635
Declaration of National Park (external to forest reserve)	1990		426	600

Vegetation types

There are three major vegetation types in Arabuko-Sokoke Forest (Map 4).

Mixed Forest — This is a dense forest type which extends to about 7,000 ha on wetter coastal sands in the east of Arabuko-Sokoke. It has a diverse tree flora including *Afzelia quanzensis*, *Hymenaea verrucosa, Combretum schumannii* and *Manilkara sansibarensis* and the cycad *Encephalartos hildebrandtii.*

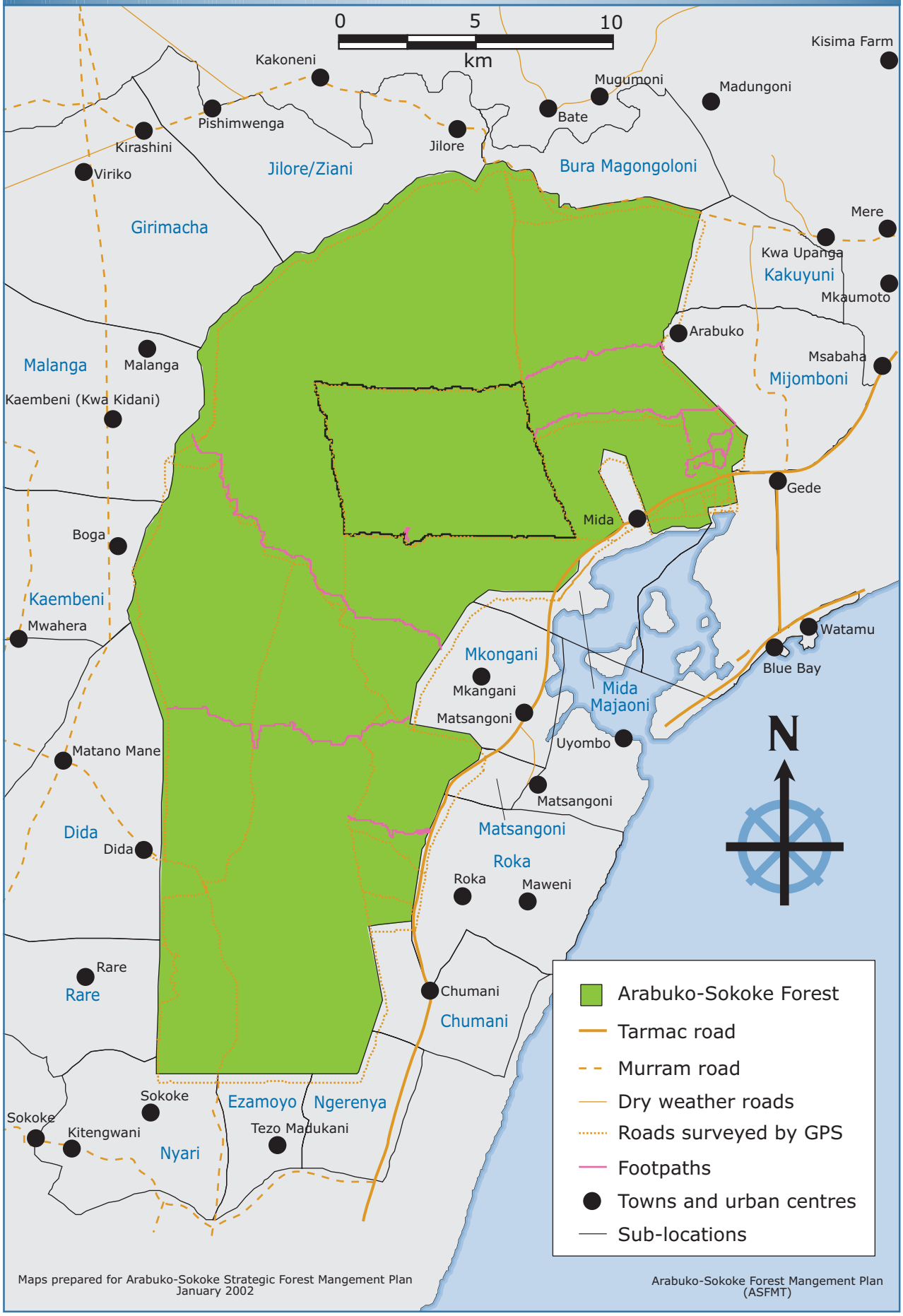
Brachystegia Forest — This is a more open forest covering about 7,700 ha, dominated by *Brachystegia spiciformis* on drier and infertile white sands through the centre of the forest.

Cynometra Forest — This is a dense forest or thicket on the north-west side of Arabuko-Sokoke, covering about 23,500 ha on the red Magarini sands towards the western side of the forest. It is dominated by trees of *Cynometra webberi* and *Manilkara sulcata*, and the euphorbia species *Euphorbia candelabrum*, but with reducing numbers. *Brachylaena huillensis* also used to be abundant in this zone, but its numbers have been severely reduced by extraction.

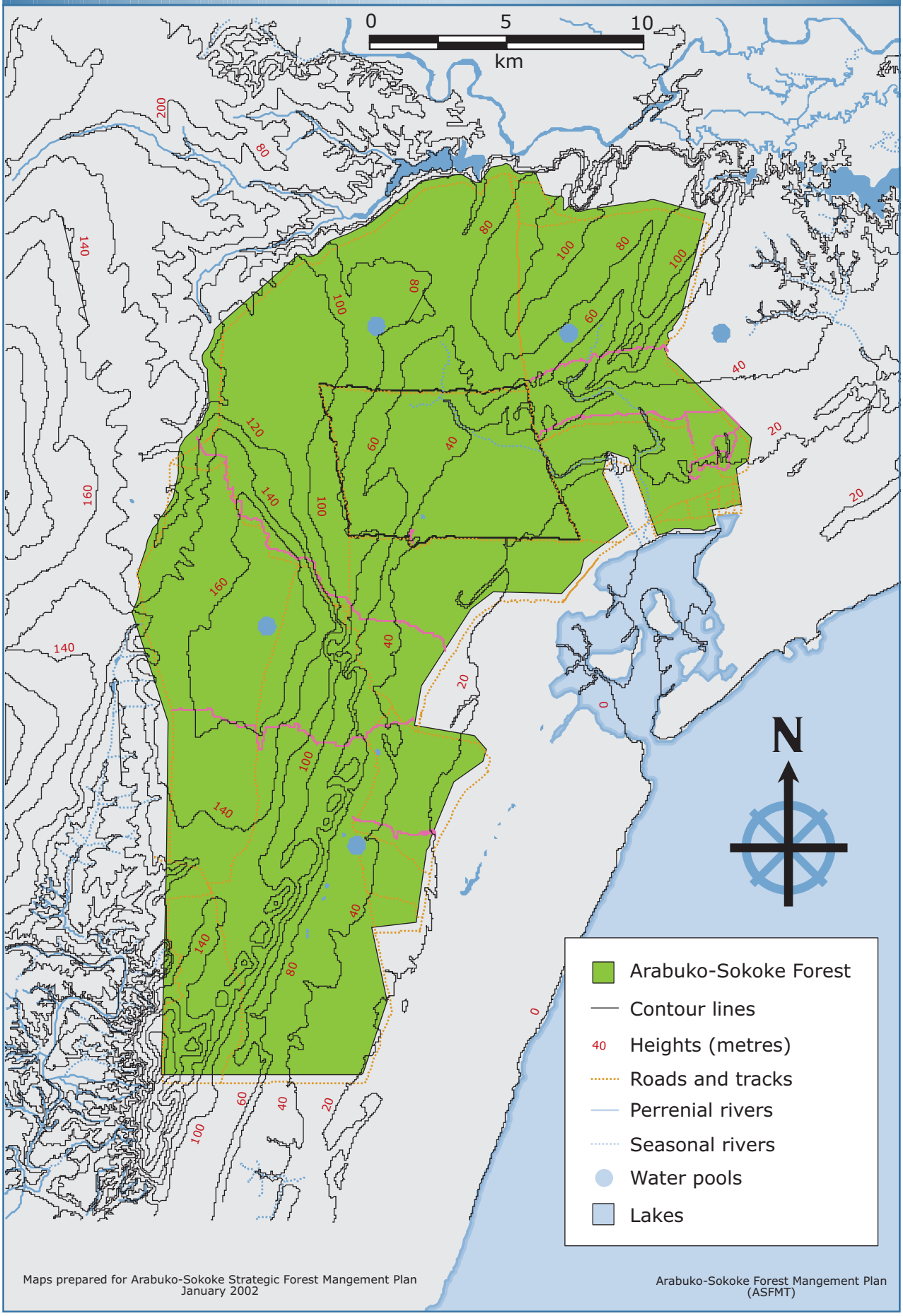
Biodiversity

The forest has rich biodiversity, including a concentration of endemic and endangered flora and fauna. It has been ranked as the second most important forest for conservation of threatened bird species in mainland Africa. More than 230 bird species have been recorded, including six globally threatened species: Clarke's Weaver (endemic to the forest and its immediate surroundings), Sokoke Scops Owl, Amani Sunbird and Sokoke Pipit (all of which are near-endemics), Spotted Ground Thrush (a rare migrant) and East Coast Akalat (a rare species confined to East African coastal forests). Fifty-two mammal species have been recorded in the forest, including 3 taxa which are globally threatened: the Golden-rumped Elephant-shrew (of which 90% of the

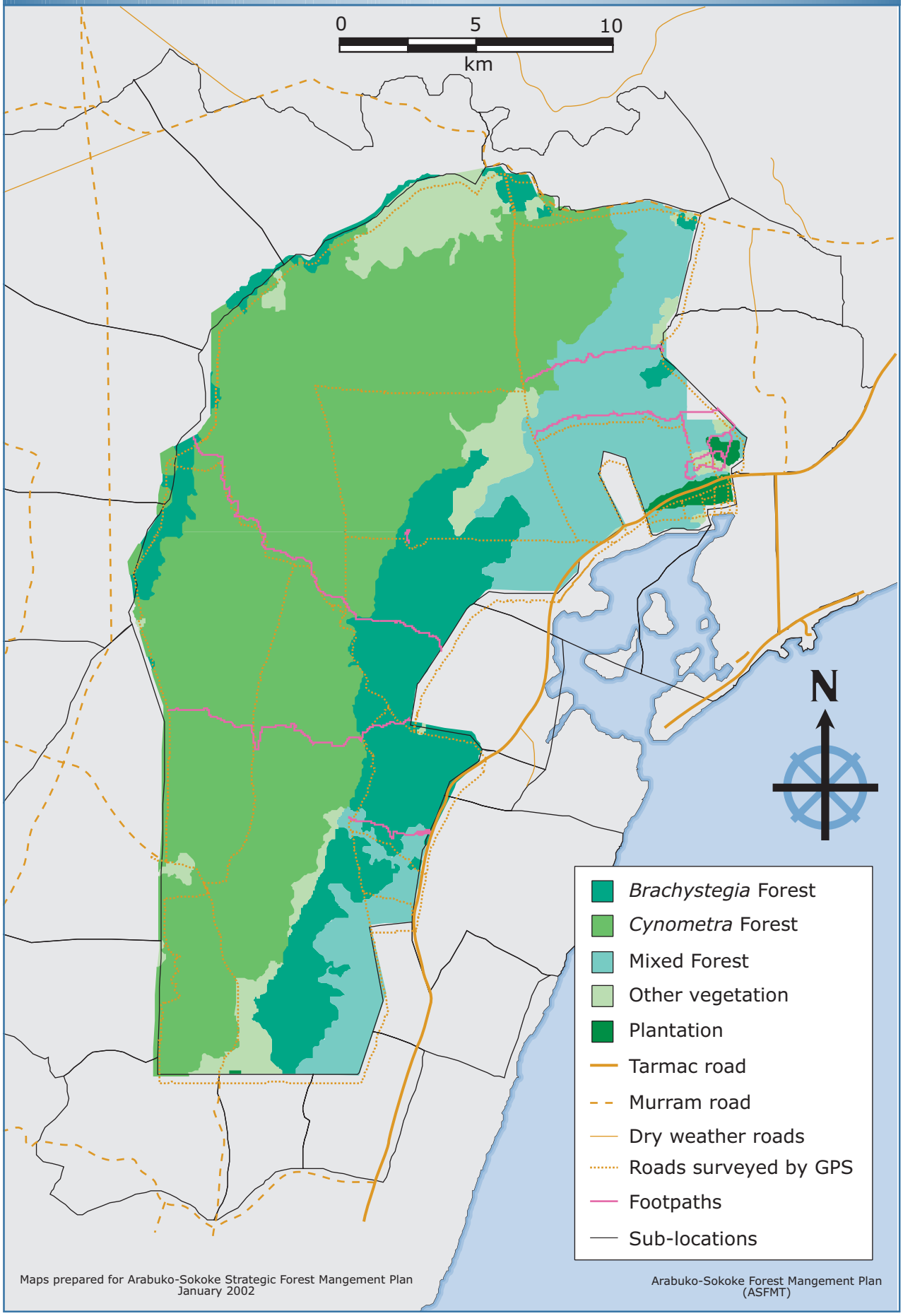
Map 2. Administrative features of Arabuko-Sokoke Forest.



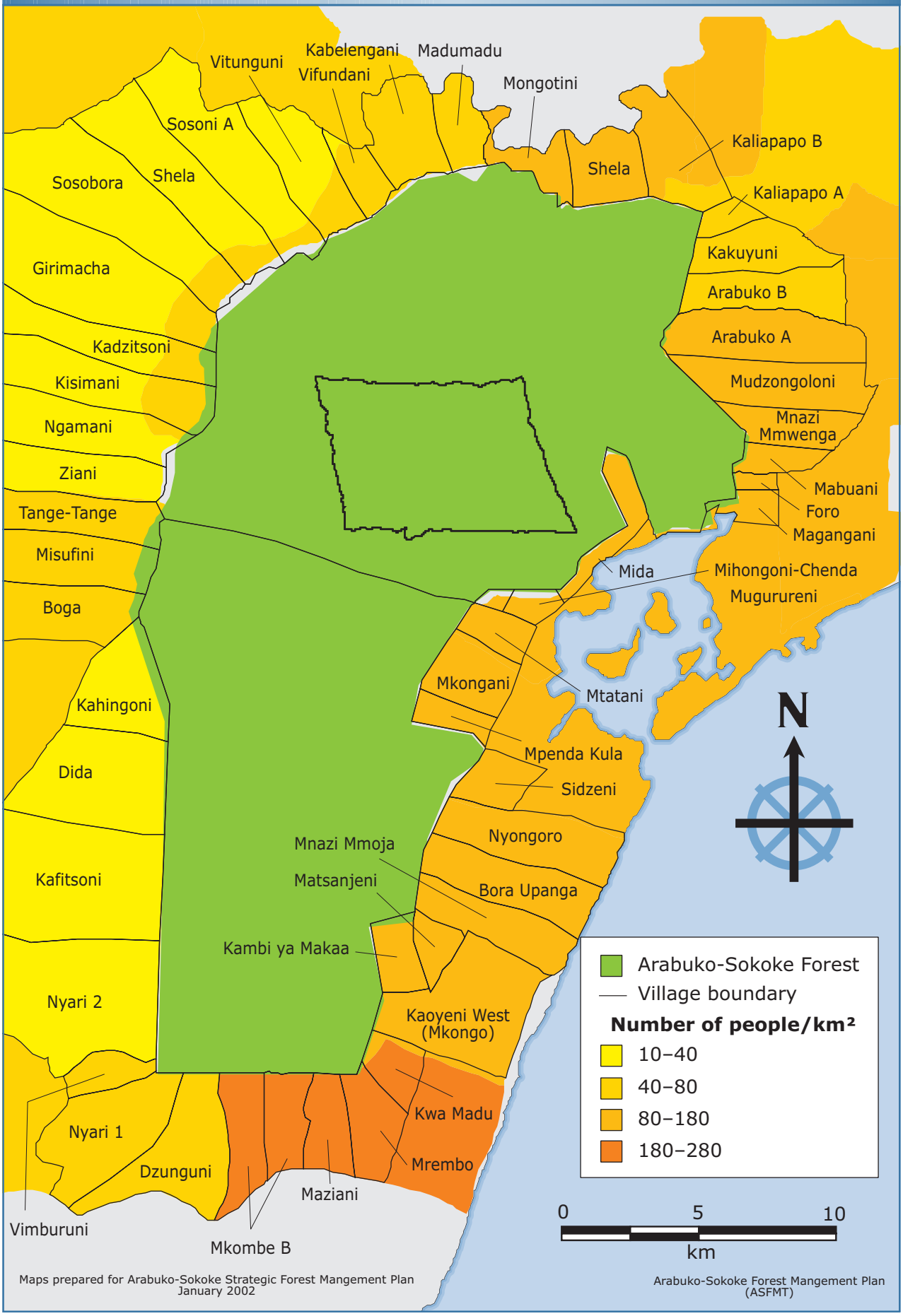
Map 3. Topography of Arabuko-Sokoke Forest.



Map 4. Vegetation types of Arabuko-Sokoke Forest.



Map 5. Population density surrounding Arabuko-Sokoke Forest.



known global population lives in the forest); the Sokoke Bushy-tailed Mongoose (one of the 5 mongoose species recorded) and Ader's Duiker (which has only one other population, in Zanzibar). The forest is also a refuge for some of Kenya's less common mammal species and supports a herd of about 70 elephants. Diverse populations of reptiles and invertebrates are present; the latter include more than 250 recorded species of butterfly (among which are 4 endemics). Over 600 recorded plant species are known, including 50 that are globally or nationally rare.

Human population adjacent to the forest

There are approximately 50 villages surrounding the forest, with a total population of about 104,000 (Map 5). The main ethnic group in the area is the Giriama; they displaced the former Sanya communities, who were originally forest dwellers and hunters. Today the forest-adjacent population is mostly small scale subsistence farmers who utilise the forest for some of their livelihood requirements. The main crops grown are maize, cassava and beans. Locally grown cash crops include coconut, mango, cashew-nut and sesame. Farmers are increasingly taking up dairy farming, although levels are still low. There are no squatters within the forest. The shamba system has been used for establishing exotic plantations in the past, but it was not very successful due to crop raids by wild animals (mainly elephants and baboons).

History

Arabuko-Sokoke Forest is all that remains of what was previously a much more extensive forest. Population growth, coupled with increasing demands for timber and land for agriculture, have contributed to a reduction in the extent and condition of the forest. Much of the forest is now degraded, particularly through the removal of commercial timber species for carving and general construction.

1.2 Policy, legal and institutional background

Policy

The Kenya forest policy is laid down in Session Paper no. 1 of 1968. This policy is being reviewed in the light of the Kenya Forest Master Plan process.

The forest policy was one of the outputs of the Kenya Forestry Master Plan project, which was a joint venture of MENR and Finnish Development Assistance (FINNIDA). The project developed various scenarios in their 1994 publication *Kenya Forestry beyond 2000*. The areas covered were: capacity of the forest to meet the local needs for wood and other forest products; meeting the demands for industrial wood products; protecting biodiversity, promoting eco-tourism and conserving the forest; ensuring that sustainable benefits from the forest which support agriculture and mitigation of global warming continue. The document established a good foundation for future forestry sector planning. The time-span for the Master Plan was 25 years.

The proposed Forestry Policy (1994) under the Kenya Forestry Master Plan contains seven policy objectives:

1. Increase the forest and tree cover of the country in order to ensure an increasing supply of forest products and services for meeting the basic needs of the present and future generations and for enhancing the role of forestry in socio-economic development.
2. Conserve the remaining natural habitats and their wildlife, rehabilitate them and conserve their biodiversity.
3. Contribute to sustainable agriculture by conserving the soil and water resources by tree planting and appropriate forest management.
4. Support the Government policy of alleviating poverty and promoting rural development, by income based on forest and tree resources, by providing employment, and by promoting equity and participation by local communities.
5. Fulfil the agreed national obligations under international environmental and other forestry-related conventions and principles.
6. Manage the forest resources assigned for productive use efficiently for the maximum sustainable benefit, taking into account all direct and indirect economic and environmental impacts; also review the ways in which the forest and trees are valued, in order to facilitate management decisions.
7. Recognise and maximise the benefits of a viable and efficient forest industry for the national economy and development.

The proposed policy statement on indigenous forest, in which category ASF falls, states that "all gazetted indigenous forests, woodland and bush land and mangroves should remain reserved". They will be managed by state-approved agencies which will allocate them primarily for: (1) regulated multi-purpose forestry, using the zoning concept which does not endanger the conservation efforts of the forest; (2) preservation of biodiversity; (3) conservation of soil and water; and (4) providing products and services, mainly locally, on a subsistence basis, by community participation where appropriate.

In the general management principles, the policy states that "the rationale of forest management depends on local conditions set by climate, soil and tree species, and the actual forest-related needs of the people, which incorporate both social and cultural aspects. In all circumstances, the forest resources will be managed in a sustainable manner with due regard to environmental conservation. Reliable information on forest resources and their utilisation should be ensured. This information should include forest health monitoring".

Legislation

The FD operates through the Forest Act Cap 385 of the Laws of Kenya. However, the Act is outdated and does not address current issues, realities and expectations. A new Bill, the Forestry Bill 2000, was therefore prepared. The Bill has gone through all stages of development and is awaiting tabling in Parliament to become law. The Bill is more comprehensive, covering aspects of community participation and multiple stakeholders in forestry. It proposes the establishment of a Kenya Forestry Service, which would be a corporate body responsible for: (a) formulation of policies, for approval by the Board, regarding the management, conservation and utilisation

of all types of forest areas in the country; (b) management of all indigenous forests for conservation purposes; (c) management of all private forests in consultation with the owners; (d) protection of all forests in Kenya in accordance with the provisions of the Act.

There are about 77 statutes that deal with environmental legislation. Until 1999 there was no framework for environmental legislation. Parliament passed the Environmental Management and Coordination Bill, 1999, on 15 December 1999 and it came into force on 14 January 2000. This legislation establishes the national environmental principles, provides guidance and gives coherence to good environmental management. It also deals with cross-sectional issues such as overall environmental policy formulation, environmental planning, protection and conservation of the environment, environmental impact assessment, environmental audit and monitoring, environmental quality standards, environmental protection orders, institution coordination and conflict resolution. It will have impacts on other legislation dealing with the environment, such as: land tenure and land use legislation, forestry legislation, wildlife legislation, water laws, and agriculture legislation. The Act provides a good avenue for environmental protection and the establishment of an operation framework under the National Environment Management Agency (NEMA). However, NEMA is not yet operational but is expected to start work soon.

Under the new Forest Bill, local communities will be allowed to participate in forest management. A pilot Participatory Forest Management (PFM) project is underway in the south-west of ASF, in the Dida Sub-location. The concept of community participation in forest management has been accepted by the government and, on the strength of this, the Permanent Secretary (MENR) gave permission in October 2000 for the Dida pilot project. This type of permission has been used in other forest reserves, like the Ngong Road Forest Sanctuary. FD is working on national guidelines for PFM.

Administrative framework

Four Government Departments work in partnership at Arabuko-Sokoke Forest: Forest Department (FD), Kenya Wildlife Service (KWS), Kenya Forestry Research Institute (KEFRI), and National Museums of Kenya (NMK). Day-to-day activities are co-ordinated through four working groups overseen by a Senior Management Committee (SMC). The combined membership of the four working groups, plus the SMC, forms the Arabuko-Sokoke Forest Management Team (ASFMT). The working groups are the:

- Forest management working group,
- Rural development working group,
- Tourism and education working group, and
- Research and monitoring working group.

The four concerned departments are co-ordinated at the national level by various memoranda of understanding (MoUs) and there is a Secretariat in Nairobi for this purpose. The MoUs have been instrumental in guiding the project and partners on the ground. At present, the ASFMT does not have legal status. However, much has been achieved through the goodwill and co-operation of team members.

International partnerships

BirdLife International (a term used here to include its predecessor, the International Council for Bird Preservation), a global partnership of conservation NGOs whose co-ordinating Secretariat is based in the UK, has worked alongside the forest management team since 1983, when a series of natural resource surveys were undertaken. FD and KWS worked closely with BirdLife International when Arabuko-Sokoke Forest came under joint FD-KWS management (under their MoU) in 1991. Between 1990 and 1992, the UK Overseas Development Administration (ODA) funded the Kenya Indigenous Forest Conservation Project (KIFCON), which undertook investigative work, and proposed pilot projects for conserving indigenous forests in Kakamega, Mau and Arabuko-Sokoke. In the plan for Phase II, it was proposed that a pilot programme in Arabuko-Sokoke would have been implemented by FD and KWS, supported by BirdLife International with funding from ODA. However, the withdrawal of ODA funds prevented this.

With the withdrawal of ODA, the British Development Division in East Africa provided bridging funds to continue essential work. These funds maintained the operations of the ASFMT and were vital in allowing for the review and reshaping of the project design before the start of the Arabuko-Sokoke Forest Management and Conservation Project (ASFMCP) in 1996, which was financed by a European Union (EU – DG VIII Tropical Forest budget line) grant to the BirdLife International Secretariat. During this project, the designated BirdLife International Partner in Kenya, Nature Kenya (formerly the East Africa Natural History Society), became increasingly involved. It is likely that the future role of BirdLife International at Arabuko-Sokoke should be played increasingly, if not entirely, by Nature Kenya, rather than by the BirdLife International Secretariat.

The ASFMCP will be finalised with the production of this management plan. The partnership in forest management in ASF has been a test case of how multi-stakeholder involvement can strengthen forest management. The local community has been involved in management through the Forest Adjacent Dwellers Association (FADA), formed in 1999. Future governance and institutional partnerships are discussed under Section 8.

1.3 Vision, purpose and strategic objectives

The vision

Arabuko-Sokoke Forest is a unique and important asset. This long-term vision guides the purpose, objectives and approach to the conservation and use of the forest at present, and into the future. The vision reflects the need to adapt the approach to forest resource management to one which meets the continually changing needs of society, and which incorporates the diversity of interests and values which society attributes to the forest, both for today and for future generations. Whatever decisions and actions are taken today must lead towards the long-term vision—this is the challenge for sustainable forest management.

The vision is important because it spells out the direction in which to go and the means to get there.

The Vision of Arabuko-Sokoke Forest in 2025

"An intact and fully functioning forest ecosystem with no reduction in the existing forest area"

Where…

- Local forest-adjacent communities have opportunities to participate in meaningful ways in the management of the forest, and as primary beneficiaries of its products and services.
- The unique biodiversity of the forest is expressly conserved and enhanced through forest management interventions and actions.
- Forest resource condition is developed and improved through management actions emphasising the use of best practice and the best available information.
- Environmental education and eco-tourism opportunities are enhanced for linking wider society with management of the forest.
- Sufficient resources are made available to support an effective and motivated forest management team, enabling them to meet the challenge of this vision.

Purpose

The purpose sets the long-term goal which is expected to have been achieved by the end of the 25 years.

- ***Sustainable forest management and conservation practices established and in operation***

Strategic management objectives

The strategic forest management objectives determine the direction to take in order to achieve the long-term vision. The strategic objectives for Arabuko-Sokoke Forest are broadly defined by the national objectives for forest management and conservation of indigenous forest in Kenya, as expressed in National Forest Policy. Since National Policy Objectives are by definition broad, they have been further refined in this plan to fit the unique local context of Arabuko-Sokoke Forest.

In order of priority, the strategic forest management objectives are:

1. ***To conserve and enhance the unique biodiversity of the forest.***
2. ***To contribute towards meeting subsistence needs and improving the livelihoods of forest-adjacent communities.***
3. ***To improve and develop the condition and potential for utilisation of the forest.***

1.4 The Approach

The strategic forest management objectives will be achieved by implementing different actions over a period of time. The *way* in which these actions are carried out is just as important to achieving the objectives as *what* is actually done. The following principles have been developed to guide the way actions are carried out to achieve the long-term vision.

- *Relevant stakeholder participation in the planning and implementation of all activities will be ensured.*

In a multi-stakeholder society, all those who have a "stake" in the resource must be represented in any decision-making process concerning its use. Although this may be time-consuming in the short term, it ensures that communications and the common vision are used to resolve differences and reduces conflict in the longer term. This principle has guided the preparation of this strategic plan.

- *Competing interests will be resolved and reconciled "on site" as far as possible and prior to any implementation of any action.*

This strategic plan establishes the broad umbrella or framework under which all types of activity are carried out. It will be impossible to resolve all the varied differences between diverse stakeholder interests at once. However, experience suggests that potential conflicts are best tackled on a site-by-site basis with the involvement of relevant stakeholders as close to the source of conflict as possible. In some cases a higher authority may need to be consulted.

- *Working partnership arrangements will be established between government agencies and other stakeholder groups in civil society in order to implement actions.*

Experiences with Arabuko-Sokoke Forest to date suggest that partnership arrangements between different government agencies and other groups in civil society can be an effective way to create joint responsibility and "ownership" of actions. No single body or organisation has the sole right to plan, implement and benefit from actions, and best results will come through collaborative efforts.

- *Transparency and openness will be built into working practices.*

Good communication, common vision, and accountability for actions can come only through the use of open and transparent working practices. Civil society today demands more accountability, and the advance of communications technology has made it much easier to adopt this style of working practice: both within the government agencies concerned, and between the government agencies and other stakeholder groups in society. Transparency works both from the top downwards, as well as from the bottom upwards.

- *Priority will be given to forest resource conservation rather than to extractive development.*

Indigenous forests in Kenya are unlikely ever to make a significant contribution to meeting the commercial forest product needs of society and forest-based industry. The high value of Arabuko-Sokoke Forest is a feature of its uniqueness and importance for conservation of biodiversity rather than its ability to supply forest products. Recognising this, any development or extractive use of the forest should take place only insofar as it conserves or enhances the forest's biodiversity value, rather than its economic value.

- *Actions will be focused on the sustainable use of the forest rather than the sustainable yield of products.*

A certain level of extractive use of Arabuko-Sokoke Forest, particularly its use for meeting subsistence forest product requirements, can undoubtedly be achieved without compromising its biodiversity value. While use of the forest at this level is both acceptable and desirable, it is unlikely that all the subsistence needs of forest-adjacent communities can be met in this way. In general, the non-

consumptive use of the forest, rather than its yield of products, should be considered as a means of achieving sustainable forest management.

- *Actions will be taken cautiously and their impact will be carefully monitored.*

Knowledge of the Arabuko-Sokoke Forest ecosystem is limited. It will not always be possible to predict the impact of any action on its unique features. Research and studies will contribute to building up understanding slowly, but, in the meantime, care must be taken to avoid any drastic action which may have unpredictable consequences, and to monitor all that is done in order to understand the impacts better. This is the precautionary principle.

- *The planning guidelines developed in this strategy will be used to underpin the preparation and implementation of all operational plans.*

The way in which things are done is as important as what is done: particularly in a multi-stakeholder environment which must be inclusive and transparent. This Strategic Forest Management Plan contains guidelines for planning and implementing all types of activity within operational forest management plans of various types. These have been prepared by looking at the knowledge and experience gained to date, and should therefore be considered as "best practice" to guide the way in which management operations are implemented. As experience and better understanding are gained over time, these guidelines may alter to reflect this.

- *All management actions will be carried out on the basis of approved operational plans conforming with the strategies and principles outlined in this Strategic Forest Management Plan.*

This Strategic Forest Management Plan forms the broad framework for all forest management activities within and around Arabuko-Sokoke Forest. However, it does not describe on a site-by-site basis what should take place or when. Different types of operational plan perform this function (see Box). The Strategic Forest Management Plan provides the criteria by which operational plans are approved (both in terms of the activities contained within them, and the way in which they are to be carried out). Only those operational plans which comply with the objectives, principles and guidelines contained in the strategic plan should be approved for implementation.

Types of Operational Plan

- Participatory Forest Management Plan (PFMP) (5 years)
- Commercial licence (for harvesting) (annual)
- Problem animal management plan (bi-annual)
- Patrolling plan (annual)
- Habitat management plan (5 years)
- Eco-tourism development plan (5 years)
- Infrastructure development plan (e.g. road maintenance) (annual)
- Research plan (5 years)

- *The respective responsibilities and roles, as well as rights and benefits of all relevant stakeholders, will be identified for planning, implementing and monitoring actions in the forest.*

The involvement of local people and other groups in society as stakeholders in the planning and implementation process is not simply intended as a means of creating beneficiaries for the products and services in return for not carrying out destructive activities. Participatory forestry is more concerned with the sharing of responsibilities in an agreed way, including sharing in protection, implementation of actions, and monitoring. This may then result in forest products also becoming available for sharing. Participatory planning will emphasise the respective roles and responsibilities of stakeholders, particularly at the level of forest-adjacent communities. Participatory forest management plans will aim to formalise these roles and responsibilities for both local communities and government departments who are partners in such arrangements.

- *The knowledge base and understanding will be built up through ongoing studies and research since it is critical to better management of the forest resource.*

Good, empirical information is fundamental to planning, implementation and monitoring. Arabuko-Sokoke Forest has the ability to attract a wide range of research and studies because of its biological uniqueness and importance. Increased knowledge of ecological, social and environmental systems at Arabuko-Sokoke will help to improve interventions and should be welcomed as being fundamental to better management of the resource.

- *The link between reward and effort, which is critical to successful implementation of all actions, will be reinforced.*

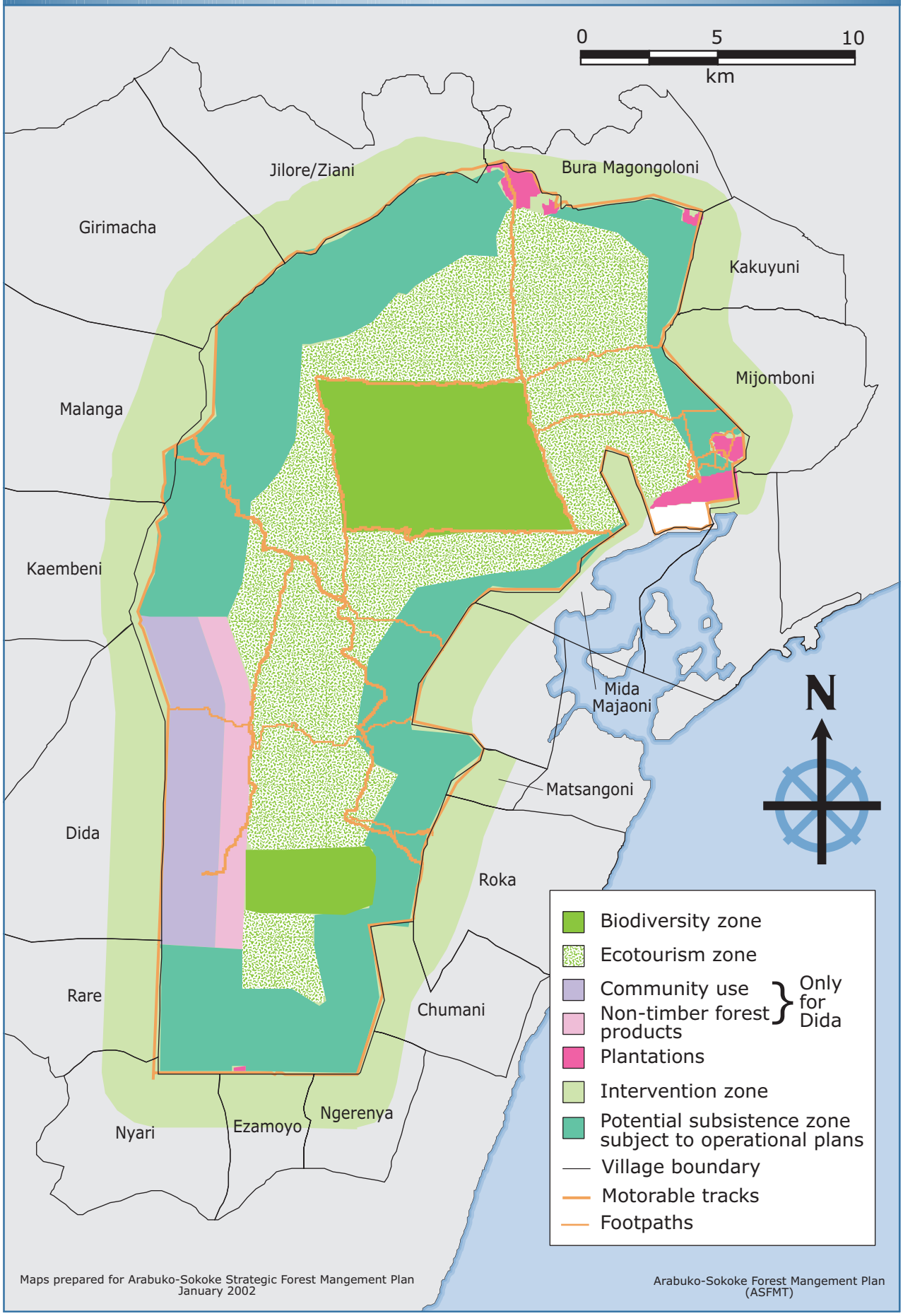
Implementation of this Strategic Forest Management Plan, and the achievement of its objectives and vision is wholly dependent on individuals within the partner institutions and other stakeholder groups. Unless there is a link between their inputs as individuals (efforts) and the benefits they receive from the process (rewards), lack of motivation will result. Organisational structures frequently do not provide this link. As far as possible, emphasis will be put on institutional structures and human resource development so as to facilitate such linkages.

1.5 The planning process

In accordance with the principles of the approach outlined in section 1.4 this Strategic Forest Management Plan has been prepared through an **open** and **transparent** process involving representatives of all the **main stakeholder groups**. A series of thematic workshops was held, attended by representatives of different stakeholder groups. During the preparation process there have been wide-ranging discussions covering all the major areas of interest, and the final strategies and actions incorporated into the plan have been reached through a process of **consensus.**

A total of 12 workshops, visioning, zonation, nine thematic and final workshops were held; 25 to 60 participants attended each workshop. A position paper was prepared before the zonation workshop and the thematic workshops for presentation and discussion. Details of the planning process are provided in Annex 1, while Annex 2 gives the names of participants.

Map 6. Forest Management Zones.



1.6 Zonation

It is proposed that Arabuko-Sokoke Forest be divided into 4 main forest management zones, 2 of which each have 2 sub-zones. Indicative zones have been identified, discussed and agreed between a wide range of stakeholder groups through their representatives during thematic workshops. The primary management objective for each zone corresponds broadly with one of the strategic management objectives for the forest, but there may also be other subsidiary management objectives for any particular zone; i.e. zones can have multiple objectives.

Tables 2 and 3 list the zones and give their main characteristics. All zones have multiple management objectives and multiple stakeholders. The Strategic Forest Management Plan attempts to reconcile these different objectives and "stakes", recognising that the forest needs to provide a wide range of goods and services to meet the requirements of today's society. The Subsistence and Non-extractive Zones, and their sub-zones, require careful definition, and precise boundaries have been proposed only adjacent to Dida (Map 6). Elsewhere, these distinctions will be subject to Operational Plans to be developed.

Arabuko-Sokoke Forest Zones.

1. Non-extractive Zone
Areas of forest lying furthest from villages and which are most important for biodiversity conservation. There will be no extraction of forest products from this zone. Subdivided into:
- ***1.1 Biodiversity conservation sub-zone*** consisting of the most sensitive and important biodiversity areas where restricted access will be allowed only for research and study purposes.
- ***1.2 Eco-tourism sub-zone*** where greater access for eco-tourism and awareness-raising will be permitted.

2. Subsistence Zone
Forest areas lying closest to villages and most heavily used by villagers for their subsistence forest product needs. Subdivided into:
- ***2.1 Community use sub-zone*** from which the collection of a range of locally required forest products will be permitted.
- ***2.2 NTFP sub-zone*** from which a more limited range of products only can be utilised by local communities (particularly non-timber forest products, such as medicinal plants).

3. Commercial Zone
A very small zone consisting of the established plantations within the forest. These will continue to be managed only for timber, pole and fuelwood production, and will not be extended further.

4. Intervention Zone
An area lying entirely outside the forest boundary and consisting mostly of private land. Communities in this area will be supported in carrying out activities which give livelihood benefits as well as contributing to forest conservation.

Table 2. Forest management zones: criteria, management objectives and management options.

Zone/Sub-zone		Criteria	Management objectives (in order of priority)	Management options	Responsibility for implementation
1. Non-extractive Zone	1.1 Biodiversity conservation sub-zone	• Important biodiversity areas • Inaccessible areas • Representing all 3 major forest types • At least 25% of the total forest area	• Conserve and enhance the unique biodiversity of the forest	• Studies and research	• NMK • KWS • KEFRI
	1.2 Eco-tourism sub-zone	• Known bird watching sites • Other wildlife sites • Areas accessible by roads and trails • At least 25% of the total forest area	• Conserve and enhance the unique biodiversity of the forest • Enhance forest habitats • Generate revenue for sustainable forest management	• Studies and research • Habitat improvement • Eco-tourism development (trails; signs; bird watching facilities) • Awareness raising	• KWS • Local communities
2. Subsistence Zone	2.1 Community use sub-zone	• Up to a maximum of 2 km from forest boundary (western side villages) • Up to a maximum of 1 km from forest boundary (eastern side villages) • Up to 1 ha per household	• Contribute to meeting subsistence needs and improving livelihoods of forest-adjacent communities • Improve and develop forest condition and utilisation potential • Conserve and enhance the unique biodiversity of the forest	• Fuelwood and pole harvesting • NTFP and medicinal plant collection • Tree planting (enrichment planting) • Rehabilitation of degraded areas • Carving wood extraction	• Local communities • FD
	2.2 NTFP use sub-zone	• Up to 3 km from the forest boundary (western side) • Overlapping with sub-zone 2.1, but also extending beyond it	• Contribute to meeting subsistence needs and improving livelihoods of forest-adjacent communities • Conserve and enhance the unique biodiversity of the forest	• NTFP and medicinal plant collection • Other non-extractive forest use, such as bee-keeping and butterfly-farming	• Local communities • FD
3. Commercial Zone		• Existing plantation areas	• Improve and develop forest condition and utilisation potential • Reduce pressure on natural forests • Generate revenue for sustainable forest management	• Silvicultural practices • Harvesting • Replanting	• FD • Local communities
4. Intervention Zone		• Outside the forest reserve • Sub-locations bordering the forest • Community willingness • Demand for forest products	• Contribute to meeting subsistence needs and improving livelihoods of forest-adjacent communities • Reduce pressure on natural forests	• On-farm tree planting • Tree nurseries • Problem animal control • Agroforestry • Beekeeping • Butterfly farming • Schools and education programme • Eco-tourism • Water source development	• Local communities • KEFRI • FD • NMK • KWS • Schools

Table 3. Forest management zones: stakeholders, products and services.

Zone/Sub-zone		Primary stakeholders	Products	Services	Type of operational plan
1. Non-extractive Zone	1.1 Biodiversity conservation sub-zone	• FD • NMK • KEFRI • NGOs	• Information and knowledge	• Source of regeneration for other zones • Gene bank • Water conservation	• Research plan • Forest protection plan
	1.2 Eco-tourism sub-zone	• Tourism industry • Local community	• Fruit • Herbs • Honey • Butterflies • Silkworms • Medicinal plants • Revenue	• Source of regeneration for other zones • Gene bank • Education • Awareness • Water conservation • Tourism attraction	• Eco-tourism development plan • Research plan • Infrastructure development and maintenance plan • Forest protection plan
2. Subsistence Zone	2.1 Community use sub-zone	• Local community	• Firewood • Grass • Fruit • Herbs • Poles • Wood for carving • Timber • Honey • Butterflies • Silkworms • Bush meat • Medicinal plants • Local incomes	• Awareness • Water conservation	• Participatory forest management plan (PFMP) • Forest protection plan • Infrastructure development and maintenance plan • Problem animal management plan • Fencing alignment plan
	2.2 NTFP use sub-zone	• Local community	• Fruit • Herbs • Honey • Butterflies • Silkworms • Medicinal plants • Local incomes	• Awareness • Water conservation	• Participatory forest management plan (PFMP) • Forest protection plan • Infrastructure development and maintenance plan
3. Commercial Zone		• External users	• Firewood • Poles • Wood for carving • Timber • Revenue	• Environmental	• Felling plan (licence) • Forest protection plan
4. Intervention Zone		• Local community	• Fuelwood • Poles • Tree seedlings • Butterflies • Silkworms	• Awareness • Water conservation • Crop protection • Livelihood security • Water conservation	• Participatory forest management plan • Problem animal management plan • Infrastructure development and maintenance plan • Forest protection plan

1.7 Thematic areas

Nine themes representing the major issues or concerns with the management of Arabuko-Sokoke Forest were identified during initial stages of the Strategic Forest Management Planning process. All these issues need to be addressed if the strategic objectives of the plan are to be achieved.

Thematic workshops were held, covering each theme, to which all stakeholders or their representatives were invited. During the workshops, the main issues concerning each theme were discussed, and the strategies for addressing them were agreed and prioritised.

Summary of themes

- Biodiversity conservation
- Subsistence use
- Eco-tourism and environmental education
- Problem animal management
- Forest protection
- Commercial use
- Infrastructure development
- Human resource development
- Research and Monitoring

In the plan, the section on each theme contains some key strategies for addressing the identified issues. These indicate the general means by which the particular issues or problems will be addressed. Within each strategy there are several specific actions, which will be taken to implement the strategy over the period of this strategic plan. Each strategy has been given a priority rating (1–4) to indicate how soon it should be tackled (1 indicates highest priority). In addition, the lead institution and other institutions (shown in brackets) responsible for implementing and/or co-ordinating the action have been identified.

1.7.1 Biodiversity conservation

Issues

Arabuko-Sokoke Forest has great importance as a unique ecosystem which contains a number of rare and endangered species. The forest is surrounded by a rapidly increasing population which is highly dependent on it for subsistence and commercial needs. Levels of unsustainable forest use have intensified, with increasing human populations resulting in higher levels of resource degradation. Recent studies have indicated problems with the regeneration of certain tree species, such as *Brachylaena huillensis,* which has been a target for selective harvesting for many decades, leading to concern for its long-term future. Changes in forest structure and composition such as this affect the already

Plate 1. The six globally threatened bird species of Arabuko-Sokoke Forest. From top to bottom: Clarke's Weaver, Sokoke Scops Owl, Amani Sunbird (female and male), East Coast Akalat, Spotted Ground Thrush and Sokoke Pipit (painting by Norman Arlott).

threatened bird and animal species that are adapted to the unique habitats found in the forest.

The already precarious status of some of the most threatened species found in Arabuko-Sokoke Forest is exacerbated by the fact that many of these species are dependent on areas of relatively undisturbed forest, which are becoming less common as pressures increase. For example, forest-adapted birds at Arabuko-Sokoke depend mainly on habitat of a certain structure, and so are adversely affected by changes brought about by forest degradation through pole cutting and fuelwood harvesting. Removal of dry fuelwood reduces invertebrate abundance (especially of termites and beetles), and causes loss of nest sites for hole- or ground-nesting birds. Hunting for food is a more direct threat to several of the endangered mammal species. Estimated populations of the most threatened bird species range from about 1,000 Sokoke Scops Owls to around 7,400 East Coast Akalats. It has been variously estimated that a viable population size probably requires a minimum of 500 pairs. Protection of the remaining undisturbed forest habitat is therefore essential to ensure the survival of these species.

Awareness of the important biodiversity of the forest is low amongst forest-adjacent communities. Most of the rare or endangered species have little, if any, local significance and provide no tangible benefits. People may not even be aware that these species are threatened, while they are only too acutely aware of their own forest product needs.

The very existence of the forest is subject to increasing external economic pressures. The gravest of these is the possibility of the mining of recently discovered titanium deposits in the underlying sands. There is also pressure for forest excisions (the lifting of legal protection) to provide more agricultural land for subsistence farmers. These threats stem from an underestimation of the many values of biodiversity, and of the important contribution the forest makes to local livelihoods through the goods, services and other attributes, such as its ethical and aesthetic importance.

Objective

To conserve and enhance the unique biodiversity of the forest.

Strategies and actions

Enhancing understanding and knowledge of the forest ecosystem

Better information and understanding of the forest ecosystem is the key to sustainable biodiversity conservation. The contribution of researchers has been critical to generating understanding and awareness of the importance of Arabuko-Sokoke Forest. Opportunities should continue to be sought for such research, making sure that identified priority issues are addressed. However, it is not sufficient that knowledge and understanding of the forest should rest solely with researchers. Local people too are a repository of knowledge about the forest. Their participation and support will strengthen the knowledge base. Measures will therefore be taken to increase the benefits flowing to local people from research, through their direct involvement. Research must address their needs as well as those of biodiversity conservation, particularly where these concern sustainable utilisation of the forest.

Actions	Initial lead responsibility	Priority
Conduct research that documents and utilises the indigenous knowledge of forest-adjacent communities.	NMK (FADA, KEFRI)	2
Prioritise and co-ordinate research to ensure that resources are targeted at key issues, rather than responding solely to a researcher-driven agenda.	NMK (KEFRI)	1
Initiate long-term monitoring to ensure that changes and impacts can be identified and tackled before they become critical.	NMK (KEFRI, FD)	4
Promote research into appropriate technologies for efficient utilisation of forest resources.	KEFRI	3

Improving local awareness of biodiversity values

The strategy is to seek greater participation of local communities in research and other biodiversity activities such as eco-tourism, with the result that biodiversity values will become of more direct relevance to them. This will strengthen their awareness of the importance of Arabuko-Sokoke Forest, and will promote their support for its sustainable management.

Actions	Initial lead responsibility	Priority
Promote local participation and benefits from eco-tourism as a means of creating better awareness of biodiversity (see 1.7.3).	KWS (FD,FADA)	2
Actively involve local people in biodiversity research, both as direct beneficiaries (employment) and in order to raise local levels of awareness and expertise.	NMK (FD, KEFRI)	2
Disseminate research findings to the local community using extension and communication centres.	FD (NMK)	2

Countering external threats and interference

Many of the actions required to counter external threats to the existence of Arabuko-Sokoke Forest lie outside the scope of this Strategic Forest Management Plan. However, the plan will be used to promote Arabuko-Sokoke Forest

Actions	Initial lead responsibility	Priority
Build on the success of the existing management to include wider representation of stakeholders, particularly at local level, to ensure more co-ordinated action and response to external threats.	FD, KWS	2
Broaden the existing MoU to include other stakeholders.	FD, KWS (ASFMT)	1
Contribute to the process of realising user rights to the forest resources, particularly those of forest-adjacent communities.	FD, KWS	1
Strengthen lobbying and publicity both nationally and internationally.	FADA, NK	3
Utilise the framework of this plan to fund-raise for and support implementation actions contained within it.	FD, KWS (NGOs)	1
Use the boundary survey of the forest to obtain a title deed.	FD	1

to a wider audience, both for the purposes of generating resources and for lobbying. The strategy is therefore to raise the profile of Arabuko-Sokoke Forest more widely and continuously, rather than simply responding to specific external threats as they occur. The MoU arrangement, involving four government partners for implementing forest management and conservation activities, has shown some success (although it has not been without its initial problems). It is proposed to extend this partnership approach, both by broadening it to include representatives of other stakeholders and strengthening it at the local level.

Restoring degraded habitats

Considerable areas of the forest have already been degraded through unsustainable utilisation. Some of these degraded areas probably still contain populations of the important bird and animal species, but numbers are not high enough to persist without recruitment from the remaining areas of higher-quality habitat. As a strategy, specific interventions will be undertaken in order to restore some of these habitats. In some cases, a reduction in human pressure will enable them to recover without further intervention.

Actions	Initial lead responsibility	Priority
Seek substitutes for forest products through agro-forestry, tree planting and other appropriate technologies in the intervention zone, to alleviate some of the human pressure on the forest.	KEFRI (FADA, FD)	1
Undertake site-specific interventions aimed at restoring degraded forest habitats such as enrichment planting and promotion of natural regeneration.	FD, KEFRI	2

1.7.2 Subsistence use

Issues

Subsistence use of Arabuko-Sokoke Forest is probably the greatest single threat to its unique biodiversity, but it is the aspect of the forest which is most valued amongst forest-adjacent villages. Local communities are dependent on the forest for a range of their livelihood needs, including: fuelwood, poles, fruits, medicinal plants, bush-meat and fodder. As adjacent populations increase, forest resources dwindle, leading to degradation and adverse impacts on biodiversity. However, forest dependency leading to unsustainable utilisation is a symptom of poverty, not ignorance, and local people are only too aware of their impacts. It is important, therefore, to try to address the causes of poverty, rather than its effects. People do not depend on forests through choice, but out of necessity. It is recognised that the poorer people are, the more they are dependent on the forest resources. This scenario correspondingly changes as livelihoods improve.

Attempts by the FD and KWS to control subsistence use of the forest have not been particularly successful. With limited resources and personnel there is little they can do to control its day-to-day use by the forest-adjacent communities who depend on it. On the other hand, forests are productive, and renewable resources and sustainable management for a range of forest products is possible if utilisation is systematic and controlled. In addition, many uses of the forest (such as bee-keeping and butterfly-farming) are non-destructive and can continue to provide livelihood benefits without endangering the forest resource. The success of the Kipepeo Project for butterfly-farming and bee-keeping clearly demonstrates this.

Participatory forest management is an approach that is now being widely used to address issues of unsustainable subsistence forest use. This means involving local communities in the forest management planning process, and eliciting their support for sustainable levels of utilisation. At Arabuko-Sokoke this approach is being piloted at Dida village and early indications are that it may be a viable strategy. Despite experience with Participatory Forest Management, it is too early to be sure of success. Both local communities and government officials need to be convinced of the potential value of this approach.

In addition to subsistence use, many secondary users also depend on forest products for their livelihoods. In particular, wood carvers in local towns and villages depend on obtaining supplies of good quality carving timber for the manufacture of handicrafts. In the past, extraction of some of the highly valued timbers, particularly muhuhu (*Brachylaena huillensis*), has contributed significantly to forest degradation. This subsistence cutting still continues, although it is illegal. Similarly, poorer households may earn a living from fuel collection (and sometimes pole harvesting), which they sell locally for cash income. A recent study showed that the pole poachers have depleted the forest of mature seed-producing trees and now resort to cutting young trees that have not reached seeding age. This has serious effects on regeneration.

Objective

To enhance the sustainable livelihoods of the forest-adjacent community

Strategies and actions

Mitigating the causes of poverty amongst forest-adjacent communities

A strategy aimed at addressing the causes of poverty amongst forest-adjacent communities will be adopted. This will include interventions seeking to support sustainable livelihoods, with a particular focus on the poorer members of the community who tend to be most forest-dependent. Particular attention will be given to supporting and

Actions	Lead responsibility	Priority
Promote non-consumptive and non-destructive use of the forest as a means of sustaining local livelihoods through income generation e.g. bee-keeping, butterfly-farming.	NMK, KEFRI	1
Reduce forest dependency by promoting diversification of activities, particularly on-farm activities such as agroforestry and establishment of wood-lots, to create alternative sources for forest products.	KEFRI, FD	1
Involve local communities in other forest-centred activities e.g. eco-tourism and research, with a view to increasing local benefits from the forest.	KWS, FD	1

Plate 2. A butterfly farmer checks a *Charaxes* trap beside his flight cage; butterfly farming has proven to be the most successful forest-based income-generating activity at Arabuko-Sokoke Forest.

promoting income generation activities which either utilise the forest in non-destructive ways, or provide an alternative source of income or forest products from outside the forest. Either way, it is hoped that pressure on the forest from unsustainable use will be eased.

Developing partnerships between government agencies and forest-adjacent communities

Over the past 3 years, Participatory Forest Management and planning has been piloted in the Dida Sub-location on the western side of the forest. This has involved forest-adjacent communities working closely in partnership with the government: particularly the Forest Department. The PFM pilot at Dida has attracted considerable enthusiasm and some success, and the local level institution has now been registered. As a result, other villages have started to express interest in becoming involved in a similar undertaking. A phased approach will be taken to increase the scale of this participatory approach, to cover all forest-adjacent communities around Arabuko-Sokoke in future. Although some of the required approaches for participatory forestry at village level are now known, the legal and institutional framework needed to support it effectively is still weak. Strengthening this will be a key action, through inclusion of the Arabuko-Sokoke experiences into national level decision-making.

Actions	Lead responsibility	Priority
Expand to other priority areas, the institutional arrangements and participatory forestry planning already being piloted at Dida Village.	FD, KEFRI	1
Provide information and experiences to Government of Kenya, which will stimulate support for a stronger legal and policy framework for Participatory Forest Management.	FD	2
Promote the development of new skills, techniques and attitudes amongst frontline staff, enabling them to work more effectively with local communities.	FD	1
Establish and support community policing systems by actively involving local communities in forest protection.	FD, KWS	1
Organise site visits for communities and frontline staff to enable them to share experiences of successful community-based forest resource management initiatives elsewhere in order to stimulate the development of these approaches at Arabuko-Sokoke.	FD	3
Strengthen existing village level institutions to raise awareness of Participatory Forest Management approaches and potential.	FD	1

Developing a systematic approach to local utilisation of forest resources

The development of participatory approaches for forest management implies that communities will themselves be responsible for regulating their use of the forest. Past attempts to regulate forest use by Forest Departments usually focused on timber production, whereas management systems for the diverse range of locally important products such as poles, fuelwood and wild animals have received very little attention. The strategy for encouraging sustainable levels of forest usage will focus on sensitising and educating forest-adjacent communities about forest productive capacity, and at the same time seeking alternative sources of forest products.

Actions	Lead responsibility	Priority
Identify and pilot on-farm activities to reduce forest dependency.	KEFRI, FD	1
Conduct participatory action research and forest resource assessment as a basis for preparing forest management plans.	KEFRI, FD	2
Provide training and support at village level by promoting sustainable harvesting practices.	FD	1
Encourage the use of alternative tree species by the wood carving industry and promote their establishment on private farmland.	FD	1
Carry out research for domestication of some of the important forest species.	KEFRI, FD	3

1.7.3 Eco-tourism and environmental education

Issues

The unique biodiversity of Arabuko-Sokoke is an important asset, which can be used for the development of forest-based eco-tourism. Eco-tourism has the potential to generate revenue in a non-destructive way and adds value to the forest resource. It also creates wider awareness of the forest, its importance, and the need for its conservation. Although eco-tourism is broadly compatible with biodiversity conservation, it is necessary to identify clearly areas or zones within the forest where it can take place without any adverse impacts.

There has been some activity in the development of eco-tourism at Arabuko-Sokoke, but there is still further potential. Few hotels outside Watamu have been involved in promoting the forest as a tourist attraction and more visitors from hotels in Malindi and Kilifi could be brought to the forest. Special attention will be made to attract visitors to the southern part of the forest. More promotional activities are required to attract more visitors. The development of infrastructure and facilities is required to make the forest an attractive eco-tourist destination and to create opportunities for eco-tourism.

At present, there is no mechanism in place for eco-tourism revenue to contribute directly to sustainable forest management and conservation. The amount raised from voluntary contributions has been small, and there is as yet no entry fee to the forest. Currently, most of the income from tourism activities goes to local hotel and travel business with very little direct benefit to local people. The only group that benefits at present is the Arabuko Sokoke Forest Guides, who charge a fee to take tourists into the forest.

In the longer-term, environmental education is the key to ensuring the future of Arabuko-Sokoke Forest. With improved understanding and appreciation of its importance especially amongst local people, there will be less pressure in the future for excisions and resistance to destructive developments. A good start has been made in the development of environmental education, but further emphasis is required to ensure that there is widespread and continuing understanding of the importance of the forest.

Objective

To add value to the forest through income and revenue generation and improved awareness.

Strategies and actions

Increasing sustainable eco-tourism revenues

A strategy of increasing the number of visitors, and consequently the level of revenue from eco-tourism will be adopted. Visitors will be drawn into areas of the forest, which can sustain additional tourism without adverse effects. Recommendations on the marketing and promotion of Arabuko-Sokoke Forest have been included in the tourism development plan (Bliss, 2000). Further studies may be required to identify and implement specific marketing strategies, particularly for tourists from the adjacent resorts of Malindi and Kilifi and possibly as far as Mombasa. A system of gate fees is proposed,

Plate 3. Tourism: local guide with bird-watchers in the forest.

with a proportion of the earnings being channelled back into the forest to contribute towards its sustainable management, and to help cover the additional costs of extending the scope and range of eco-tourism activities currently available.

Actions	Lead responsibility	Priority
Introduce a system of gate charges for visitors, and levies on tour operators.	KWS, FD	1
Expand the eco-tourism sub-zone to include a greater proportion of the forest, and focus on new developments.	KWS, FD, FADA	2
Carry out marketing and publicity aimed at increasing visitor numbers to the forest.	KWS (A Rocha, FADA)	1
Diversify the range of eco-tourism activities in the forest.	KWS (FD, A Rocha)	2
Promote the establishment of a mechanism to enable gate fees to be ploughed back into forest management and conservation.	KWS, FD	3

Enhancing community benefits from eco-tourism

Opportunities will be created for local communities to benefit more from eco-tourism. These will include support for basic accommodation facilities in adjacent villages, and opportunities for local people to work more closely with KWS and FD as Community Rangers. Visitor centres will be extended to include marketing of local products and crafts, and for cultural as well as educational programmes.

Actions	Lead responsibility	Priority
Support the development of low-cost accommodation facilities and campsites owned and run by local communities.	KWS, FADA	2
Develop a cadre of locally recruited and trained local forest guides.	KWS, FD (A Rocha, ASFGA)	1
Expand and diversify the existing visitor centre at Gede and develop other centres for the sale of locally made products and for cultural attractions.	KWS, FADA, (FoASF, ASFGA, FD)	1
Develop a village-based fund from eco-tourism incomes to be used for local development activities in forest-adjacent villages, using the same local institutions as for PFM.	FADA (A Rocha)	1

Increasing the long-term benefits of environmental education

In the long term, improved environmental education will lead to a better understanding of the importance of conserving Arabuko-Sokoke Forest. The strategy will be to target a range of groups in society through different actions, including school children, and national and international forest visitors.

Actions	Lead responsibility	Priority
Strengthen school environmental education programme.	KWS (FD, FADA Wildlife Clubs of Kenya, ASFGA, A Rocha)	2
Encourage the involvement of local clubs and schools to use the forest as an educational resource.	KWS, FD (FADA, Wildlife Clubs of Kenya, ASFGA, A Rocha)	3

Plate 4. Education: schoolchildren visiting the *Kipepeo* butterfly-farming project learn about the importance of the forest; over 7000 visitors to the project (to 2002) included over 50 school, university and polytechnic groups.

Plate 5. Problem animals: an elephant footprint in a maize plantation.

1.7.4 Problem animal management

Issues

Crop-raiding by forest elephants and baboons causes considerable damage and occasionally loss of life in areas and farms adjacent to the forest (Maps 7.1 and 7.2). These losses are the main causes of antagonism by forest-adjacent communities towards forest conservation, and it is therefore difficult to enlist local support for forest protection while their livelihoods are being threatened by wildlife. Currently, the Wildlife Management and Conservation Act does not allow animals to be culled. Options for animal barriers, such as electric fences, are prohibitively expensive (particularly when compared with the value of the crops being lost or damaged), and their effectiveness in Arabuko-Sokoke has yet to be assessed.

Information and understanding about elephant movements and the carrying capacity of the forest to support this population are inadequate, although the situation is known to be dynamic. For example, following the high rainfall associated with El Niño, there were considerably fewer elephant movements outside the forest as water sources within the forest were sufficient. At present, KWS takes the responsibility for problem animal control but is severely limited by inadequate infrastructure, personnel and communication facilities.

Addressing the issue of problem animal management is a priority in this Strategic Forest Management Plan (SFMP). If this is not done, local people will not support forest conservation, and pressures for settlement and agriculture will increase.

Objective

To reduce and mitigate damage caused by wildlife in forest-adjacent areas and farms while maintaining the biodiversity conservation importance of the forest.

Strategies and actions

Controlling animal movement

The priority strategy for addressing the problem of animal damage to crops, livestock and human beings is to use barriers (fences or game moats) to divert elephants away from sensitive areas and to channel their movements e.g. by providing access corridors to sources of water outside the forest. This strategy can be effective if there is a good understanding of elephant movements and of the capacity of the forest to support the current elephant population. In the case of baboons, trapping under licence needs to be permitted on private farms outside the forest.

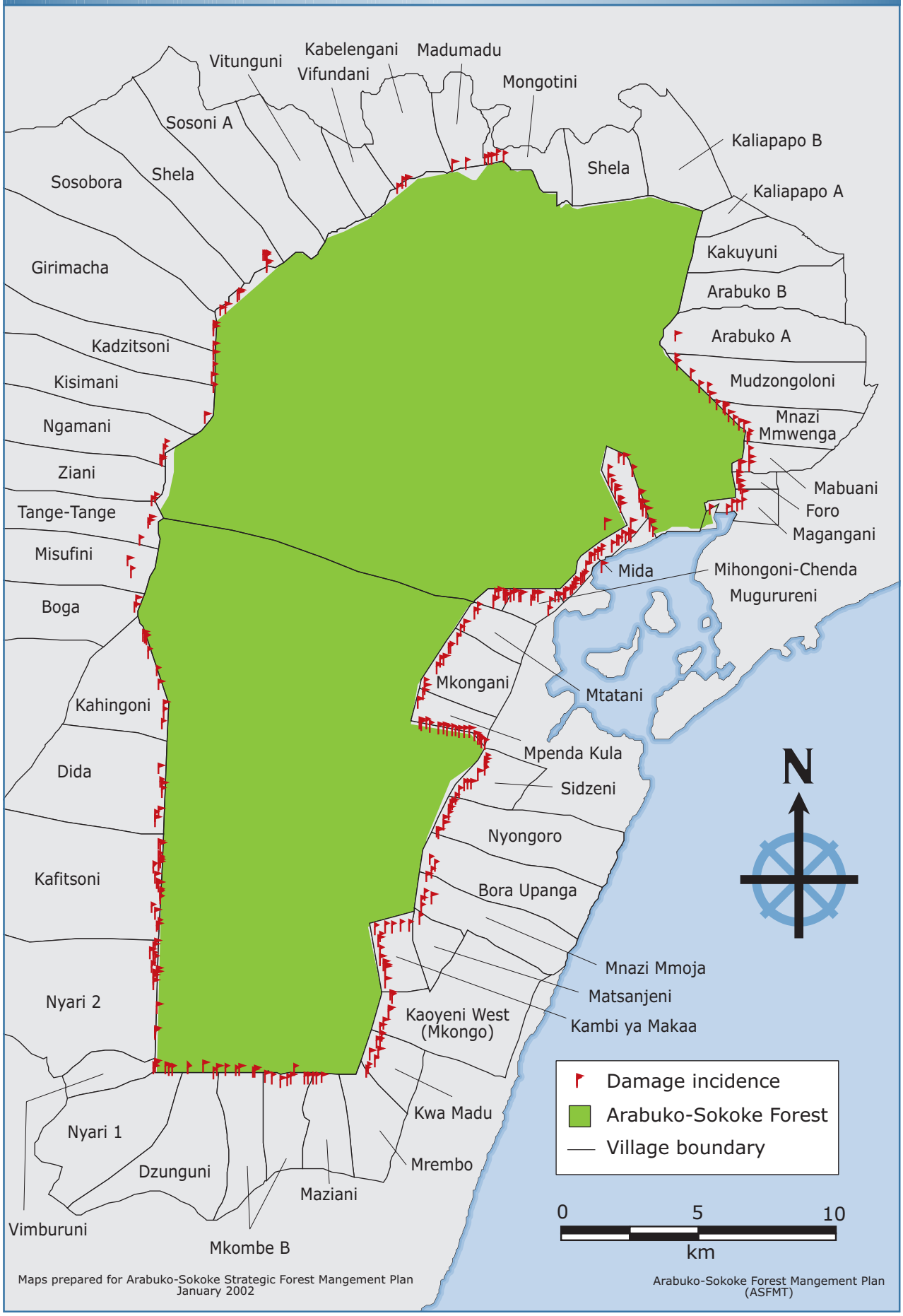
Actions	Lead responsibility	Priority
Construct elephant barriers at strategic locations identified through careful study of elephant movements.	KWS, FADA	2
Obtain a better understanding of forest carrying capacity through research and take appropriate management action.	KWS, FADA	1
Permit trapping of smaller problem animals on private land adjacent to the forest.	KWS, FADA	4
Investigate the applicability of animal control methods being used elsewhere and test them for effectiveness at Arabuko-Sokoke.	KWS, FADA, NMK	2
Explore the possibility of forest boundary rationalisation through land purchase or other arrangements which may reduce the incidence of animal damage on farms.	FD, FADA	4

Improving the effectiveness of patrolling

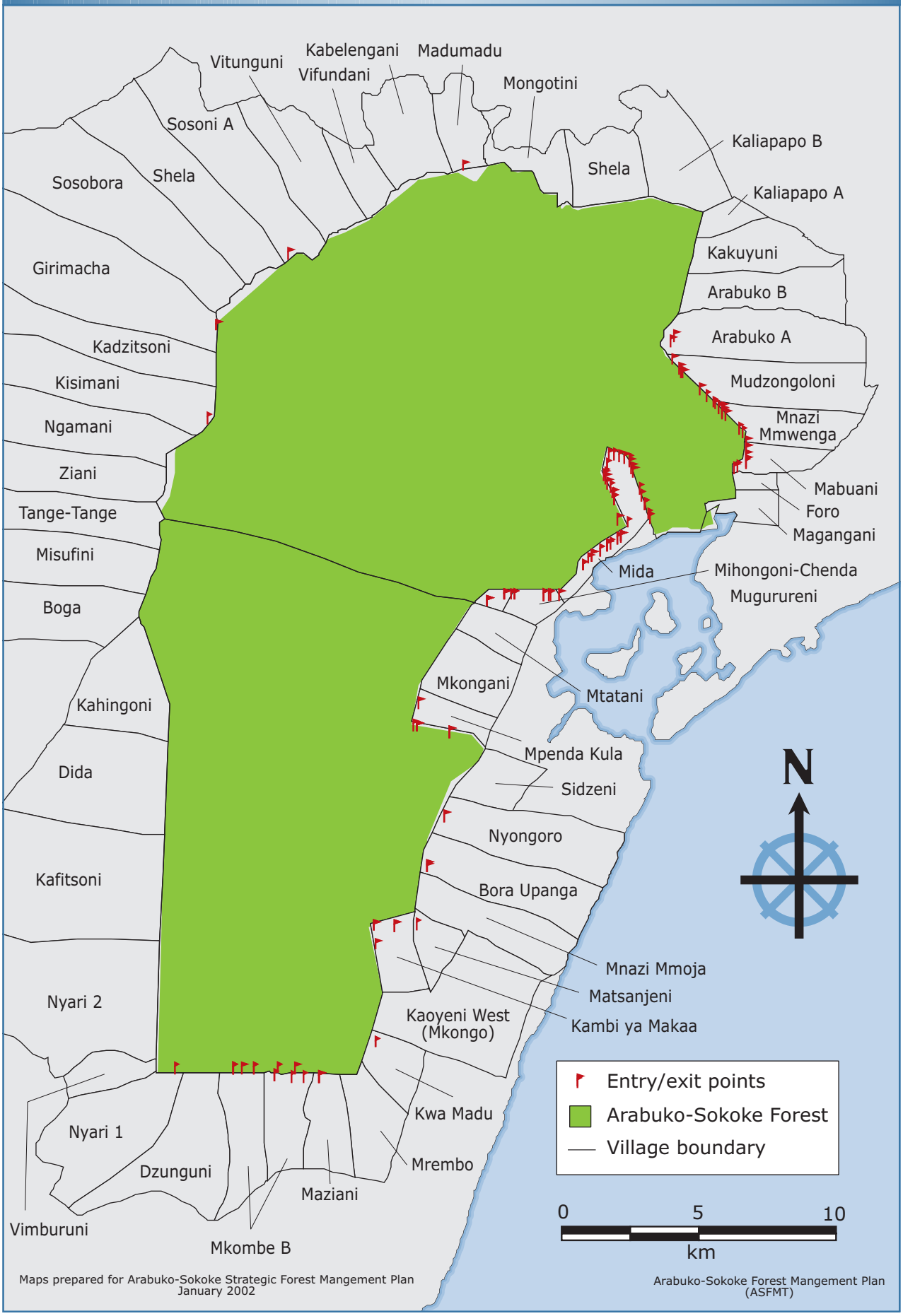
Patrolling can be a successful means of responding to crop-raiding by animals. The existing set-up should be made effective by improving the level of communication between KWS and local communities, and by ensuring that they both have adequate infrastructure and equipment. Patrolling should increasingly become a joint activity, with the close participation of local communities most affected by raiding animals.

Actions	Lead responsibility	Priority
Work with forest-adjacent communities to establish good communications and response to elephant raids.	KWS, FADA	1
Provide adequate infrastructure and equipment for patrolling operations by KWS and local communities.	KWS, FADA	2
Record, quantify and publish records of animal damage and make these widely available especially to policy makers.	KWS, FADA	2
Involve local communities directly in patrolling through the recruitment of community rangers, and provision of equipment with training on its use.	KWS, FADA	1

Map 7.1. Elephant raids before El Niño.



Map 7.2. Elephant exit and entry points in the year 2000, after El Niño.



Reducing the impact of animal damage

There will always be a certain level of unavoidable damage by animals. This can best be mitigated by ensuring that adequate compensation is available, and this will be more effective if village committees (similar to those being established for participatory forestry) can be closely involved in loss and damage assessment, and payment of compensation e.g. through a trust fund. Farmers' livelihoods are particularly vulnerable at present; their vulnerability will be reduced by a programme of support for the diversification of activities in the intervention zone.

Actions	Lead responsibility	Priority
Develop a system of compensation payments for losses arising out of animal damage.	KWS, FADA	1
Support diversification of local agriculture and livelihood strategies and practices that are less susceptible to animal raiding.	KWS, FADA	2
Initiate research into the effectiveness of local protection measures such as planting of live plant barriers.	KWS, FADA	2
Support promotion of other local benefits from the forest to offset losses due to animal damage.	KWS, FADA	1
Use extension activities to raise awareness of safe methods to prevent and respond to animal raids.	KWS, FADA	3
Build consensus and influence the development of practices and policies, addressing problem animal management through annual problem animal control policy meetings.	KWS, FADA	4

1.7.5 Forest protection

Issues

Human pressure in the form of illegal utilisation and harvesting of forest products is the main cause of forest degradation in Arabuko-Sokoke Forest (Map 8). Forest protection is a major function of the FD, often in the form of joint patrols conducted with KWS staff. Traditionally, patrolling has been relied upon as the main protection activity but, despite these efforts, it has not been possible to control the level of unregulated use.

The concept of legal and illegal use of forests has altered over time. Inappropriate forest policy and legislation has often caused problems for local communities, and has created unenforceable protection demands. Emerging trends support the participation of forest-adjacent communities as partners in forest management, and attempts are being made to devise systems where they can benefit from sustainable levels of forest use. On the other hand, a licensing system is still in force which, in practice, denies poorer households access to some of the resources they require. They therefore have to continue to use the forest illegally, and are alienated from the attempts by the Forest Department to protect the forest.

Most of the illegal use of Arabuko-Sokoke Forest is for domestic needs. Even where commercial extraction activities occur, the individuals concerned carry out these activities as a means of earning a living, since they have few sources of livelihood available to them. Although it may now be possible to adopt new approaches, such as Participatory Forest Management, to address the problems of subsistence use, patrolling is likely to remain an important strategy for addressing commercial poaching. However, resources to do this are inevitably limited, and this reduces both the effectiveness and efficiency of patrols. Studies have shown that a good road network deters poaching, but that excessive road building facilitates entry by both government staff and poachers. Illegal activities seem to increase where there are no good roads, and in forest locations furthest from the roads. However, maintaining the extensive road network of Arabuko-Sokoke is expensive.

There has been little success in addressing the issue of market demand for illegally harvested products, particularly carving-wood. While the demand remains high (and government policies also promote handicrafts as an economic activity), it is likely that illegal activities will continue. Current efforts to promote good wood for carving need to be emphasised.

Objective

To significantly reduce levels of illegal extraction of forest products.

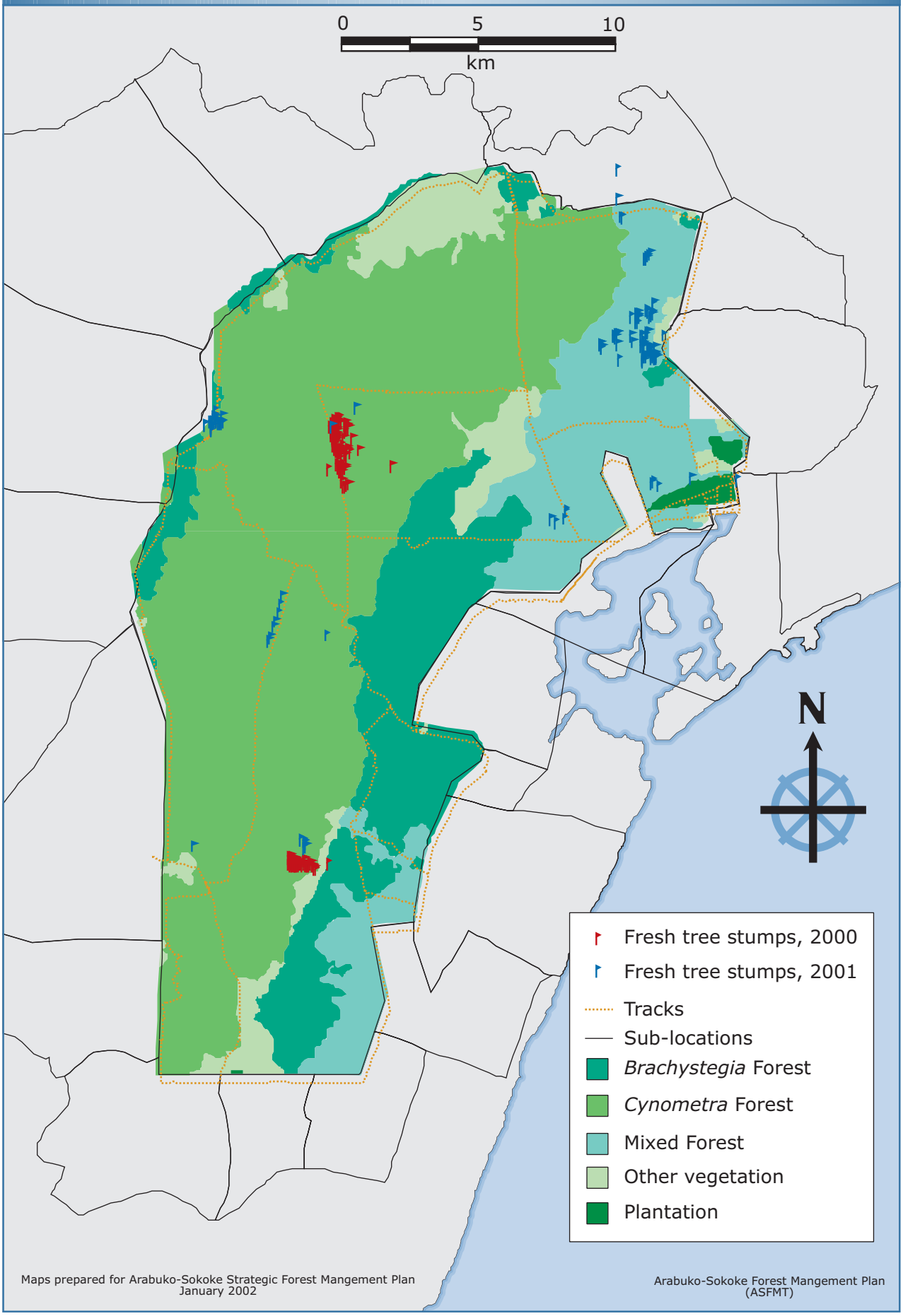
Strategies and actions

Involving forest-adjacent communities in forest protection

Experience has shown that adequate levels of forest protection cannot be achieved through confrontation and conflict between the managers and forest-adjacent communities. In practice, both local people and the

Plate 6. Illegal Activities: a site where valuable *Brachylaena huillensis* have been poached and rough carvings made.

Map 8. Illegal woodcutting in the years 2000 and 2001.



government have a mutual interest in conserving the forest, and utilising forest products in a sustainable way. Consequently, the strategy will be to work together with communities to develop joint protection systems in return for agreed levels of utilisation and benefit-sharing within the capacity of the forest to meet subsistence needs sustainably.

Actions	Lead responsibility	Priority
Directly involve local people in forest protection by appointing them as community guards.	FD, FADA	3
Build teams and strengthen communication between local FD staff and local community.	FD (KWS, FADA)	2
Create partnerships between local people and FD to benefit the local communities from forest products in a legal and systematic way.	FD, KWS, FADA	1
Introduce local incentives for reporting or catching poachers.	FD	4
Determine sustainable utilisation levels through research and monitoring.	KEFRI	1

Improving the effectiveness of patrolling

The strategy will be one of continued patrolling, mainly targeting commercial users of the forest.

Actions	Lead responsibility	Priority
Initiate joint patrols between FD, KWS, and local communities.	FD, KWS	1
Increase the frequency of foot patrols with vehicle back-up.	FD, KWS	1
Improve patrolling plans, and systematic reporting of patrolling findings.	FD, KWS	1
Secure financial resources to keep roads in good condition and rationalise the road network for easier patrolling and reduced access for poaching.	FD, KWS	2
Provide resources for improved communications by radio, phones and transport to support forest protection.	FD, KWS	2
Promote a remuneration and rewards system for the most effective guards.	FD, KWS	4
Train staff and community members on skills needed for effective forest protection.	FD	1

Influencing formulation of appropriate legislation

While demand for wood carving remains high, pressure on the forest, particularly for *Brachylaena huillensis*, will be difficult to address. A complementary strategy of targeting the markets for illegal products should be instituted, with further efforts to seek alternative tree species which can be grown outside the forest. Since it is local communities who have closest contact with the forest and who are likely to be most aware of illegal activities, it is important that they should have the first opportunity to utilise any available forest resources through licensing systems.

Actions	Lead responsibility	Priority
Support and assist local wood carvers' co-operatives to use 'good wood'.	FD, Community-based Organisations, Wood carvers	2
Promote transparency and publicity for licensing procedures, which give priority to local communities.	Community-based Organisations, FD, NGO	1
Collaborate with the certification efforts to promote 'good wood' for carving.	FD (KEFRI)	1
Raise public awareness on policy and legislation and the impact of illegal activities on forest resources especially amongst the adjacent urban communities in Malindi, Mombasa and the tourism industry.	FD	3

1.7.6 Commercial use

Issues

Past commercial exploitation of Arabuko-Sokoke Forest for timber and other products has contributed significantly to its present degraded condition. Nowadays, most of the area of the forest would not be considered viable for commercial timber production, and this is therefore no longer an important management objective, except for the relatively small area totalling about 700 ha which already has established plantations of a range of species including *Gmelina arborea, Araucaria* sp., *Eucalyptus* sp., *Casuarina* sp. and *Azadirachta indica* (Neem). Existing plantations are in variable condition. Some are poorly stocked with species that have performed badly, while others are ready for harvesting or require some silvicultural intervention. Resources to establish and maintain plantations are limited. The local community has been involved in supporting plantation establishment through the shamba system, but this system has not succeeded well due to wildlife damage to agricultural crops. Many plantations have suffered from animal damage, which has reduced their commercial value.

Commercial use of the forest also encompasses other forest products which are sold through a licensing system. The value of poles, fuelwood, and non-timber products from ASF now exceeds that of timber. Suspension of licensed pole cutting in 1999, coupled with the ban on mangrove cutting, has increased illegal cutting of poles in the ASF and, even when the licensing system was in force, there was minimal transparency, with local people involved only as labourers with little benefit.

Objective

To maximise the commercial potential of available forest resources while ensuring their sustainable use.

Strategies and actions

Utilising the productive potential of plantations

Where plantations already exist, they should be brought under good management to protect, improve and utilise

Actions	Responsibility	Priority
Bring existing plantation areas under sound management, without creating new ones.	FD	1
Establish plantations within the plantation areas with species selected according to their local demand.	FD	1
Prepare site-specific management plans for plantation areas.	FD	1
Involve local communities in establishment and maintenance of plantations.	FD	1

Plate 7. Commercial forestry: a few plantations of exotic *Eucalyptus* and *Araucaria* exist; these should be managed for maximum benefit, but no increase in the area under plantation should be allowed.

their commercial potential. However, there should be no increase in the overall area under plantation. Improved utilisation will require a better understanding of the plantation resources available and the potential for commercialisation.

Promoting local involvement in commercial forest-based activities

A strategy should be developed to open up opportunities for local people to benefit from any commercial forest product utilisation. This should ensure that the greatest benefits from the forest are made available to those communities who are in the best position to work in partnership with the Forest Department.

Actions	Responsibility	Priority
Create employment opportunities for local people to work in the establishment and maintenance operations of plantations.	FD	1
Provide support for on-farm tree-planting, to provide alternatives to trees from the forest.	FD	1
Pilot Participatory Forest Management within plantation areas.	FD, KEFRI	1
Support applications by local communities and organised community groups when new licences are being issued.	FD	1

1.7.7 Infrastructure development

Issues

In order to achieve the forest management objectives for Arabuko-Sokoke Forest, a certain level of infrastructure is required (Map 9). Roads, buildings and vehicles are all essential to sound management of the forest, but they cannot be constructed, purchased or maintained without considerable financial expenditure. Since the forest itself yields very little in terms of direct revenue, the maintenance of a sound infrastructure base is an ongoing problem for forest management, where funds are always scarce. Maintenance of the extensive road network is a major issue, particularly as it has been shown that the incidence of illegal activities increases as road quality deteriorates. Similarly, to maintain sufficient and well-motivated staff, the provision of good quality housing and services is important. Lack of funds tends to reduce expenditure on such items, with the result that morale and work quality deteriorates.

Communications equipment is required for improving the effectiveness of forest management operations: particularly problem animal control and patrolling to control poaching. This requires vehicles, radios and telephones. For administrative functions, the provision of adequate office space, equipment and computers is required. Since the main constraint for all these infrastructure items is the same, namely a lack of financial resources, the key issues are

Map 9. Infrastructure within Arabuko-Sokoke Forest.

how to obtain such resources and, once these are available, how to prioritise amongst the various expenditure options where all needs are critical in some way.

Objective

To establish and maintain the infrastructure necessary to achieve the multiple objectives of forest management.

Strategies and actions

Maintaining the road network

The road network is critical to the effective functioning of the organisations involved in management of the forest. Although there has been a regular road maintenance programme under the ASFMCP, priorities for maintenance have not been identified in a systematic way. The strategy is to focus on road maintenance as a priority activity over other actions requiring infrastructure support.

Actions	Lead responsibility	Priority
Secure the financial resources needed to maintain existing roads and rationalise the road network.	FD	1
Initiate a system for planning the maintenance of road plan.	FD	2
Carry out annual surveys of road conditions to ensure that maintenance efforts are properly targeted and prioritised.	FD	4
Investigate and promote community participation in road maintenance operations.	FD	3

Maintaining buildings, services and equipment

As with roads, provision of buildings and services is critical to the achievement of the multiple management objectives of Arabuko-Sokoke Forest. Resources for maintenance and extension of the existing infrastructure are likely to be insufficient. The strategy should, therefore, ensure that available resources are allocated according to agreed priorities, and that there is a focus on maintaining existing assets, rather than creating new ones.

Actions	Lead responsibility	Priority
Secure financial resources for maintenance and repair of existing buildings and all outposts.	KWS, KEFRI, FD	1
Secure financial resources for provision of services for staff working in the forest.	ASFMT, FD, KWS, KEFRI	1
Seek financial resources for construction of new buildings in accordance with the strategic forest management objectives.	FD, KWS	2

Developing institutional partnerships to maximise the impact and utility of infrastructure

Much of the direct expenditure on infrastructure at Arabuko-Sokoke Forest is by the Forestry Department. However, there are numerous other stakeholders who benefit directly or indirectly. Local communities, tour operators and other government partners use this facility without contributing to its maintenance. The strategy should be to strengthen institutional partnerships in infrastructure development.

Plate 8. Infrastructure: the compound at Gede is the headquarters for most of the forest management and conservation activities.

Actions	Lead responsibility	Priority
Strengthen and improve the existing MoU arrangements by bringing partners on board including the local community.	KWS, FD	3
Develop and pilot new partnership arrangements with a view to reducing direct implementation by the Forest Department.	FD	1
Seek to bring non-governmental partners into the forest for the development of facilities for eco-tourism and recreation.	KWS	1

1.7.8 Human resource development

Issues

Human resource development concerns the institutions and the individuals who are responsible for implementing this Strategic Forest Management Plan for sustainable forest management. Society has gone through many changes during recent years, and the responsible institutions and individuals need to be able to respond to these changes in order to meet the current requirements of all stakeholder groups. In some cases there are inadequate skills amongst partner organisations, implying that new skills need to be acquired. Many people involved in the management of Arabuko-Sokoke Forest will need to adopt new responsibilities and roles. These will need to be clearly defined, as well as the skills needed to implement them. Individuals involved in the management of Arabuko-Sokoke Forest would also benefit from wider exposure to ideas and developments from elsewhere. This would enable them to learn from others' achievements and mistakes, and would strengthen the overall skills and knowledge base at Arabuko-Sokoke.

This SFMP requires that the institutions concerned operate in an open, accountable, and co-ordinated way. They need to ensure that the multiple stakeholders continue to be involved in the ongoing management of Arabuko-Sokoke Forest. This might include new institutional partners including non-government organisations and local communities. Specifically, management of Arabuko-Sokoke Forest cannot be assigned to a single institution or individual, and new ways of linking a range of organisations in partnerships are required. There have been some successes already, such as the MoU arrangement, which has involved close working relationship between the 4 government partners within the ASFMCP. This has reduced the level of mistrust between partners, and improved the level of their co-ordination. This partnership approach now needs to be extended and broadened to include community and non-governmental organisations. Even where institutional structures are in place, they cannot operate effectively if shared vision and agreed common purpose are lacking. Problems have arisen in the past because different institutions and partners have different strategies and objectives which are at times incompatible.

Plate 9. Forest Guards examining an illegally cut *Brachylaena huillensis* stump; law enforcement is carried out by joint Forest Department – Kenya Wildlife Service teams.

The government institutions involved as partners in the management of Arabuko-Sokoke Forest have similar constraints such as: high staff turnover, vacant posts, poor levels of pay, uncertainty about continuity of employment, limited promotional opportunities, inadequate infrastructure, and poor working and living conditions. This leads to poor motivation and less effective work. Team building and skills development for staff can only be effective if these underlying issues are addressed.

Objective

To build an efficient team for the management of the forest.

Strategies and actions

Developing partnership amongst stakeholders

The strategy should be to enhance existing partnership arrangements, which have been developed over the past four years, and to extend the approach to form new partnerships as appropriate. The MoU arrangements will be maintained, and broadened further to be representative of all stakeholders. It will be more responsible for making management decisions. The MoU should be strengthened by giving it legal status.

Actions	Lead responsibility	Priority
Wider dissemination of SFMP to all stakeholders.	FD	1
Strengthen the local partnerships and ASFMT to include representatives of other stakeholder groups, particularly non-governmental and local community groups.	ASFMT	2
Continue to pilot and support PFM partnerships between the government and forest-adjacent communities.	FD	1
Create an Arabuko-Sokoke Forest forum to bring together individuals representing different interest groups.	ASFMT	2

Improving skills for effective forest management

Skills development amongst the individuals and institutions concerned with the management of Arabuko-Sokoke Forest is critical to the long-term success of this SFMP. The required skills include: marketing, participatory processes, communications, micro-enterprise and small business development, information technology, GIS, appropriate technologies, documentation and recording, and also some of the more traditional technical forestry, research and monitoring skills. The strategy should be to conduct an assessment of necessary skills before embarking on any training programme, to ensure that key areas are addressed.

Actions	Lead responsibility	Priority
Identify training needs and implement training as necessary.	ASFMT	1
Implement training programme according to agreed priorities, with a focus on developing key competencies and a more diverse range of skills for different staff, especially those of front-line staff.	ASFMT	1
Conduct study visits to other areas and projects to gather practical and potentially useful experiences from elsewhere.	ASFMT	1

Enhancing teams and encouraging team-working

The causes of poor motivation and performance must be addressed. The infrastructure and services used by staff should be improved. Personnel needs should be re-assessed with a view to rationalising postings, as well as clarifying job descriptions and responsibilities in the light of the agreed strategies and actions of the SFMP. The emphasis should be on creating teams and working groups responsible for specific parts of the SFMP, and a system to review and reward performance. This may be a difficult process for those concerned, but it will provide benefits in the longer term.

Actions	Lead responsibility	Priority
Establish working groups made up of individuals from different stakeholder groups to take responsibility for implementation of identified themes and strategies.	ASFMT	2
Reorganise and refurbish forest stations, outposts and communications to increase the effectiveness and level of motivation of staff.	ASFMT	1
Contribute to improving the performance of team members through effective staff appraisals.	ASFMT	2
Re-assess staffing needs in all partner organisations in view of PFM, and advise accordingly.	ASFMT	1
Conduct regular SFMP review Workshops to assess progress on implementation.	ASFMT	3

1.7.9 Research and monitoring

Issues

Research provides information and data for the planning, implementation and monitoring of programmes. Target areas for research include: baseline data collection, development of new technologies, and trend analysis looking at past, present and future trends. Forest management needs to be guided by high quality data and improvements in technology. The role of research is to fill information gaps in management and to try out new technologies for adoption or adaptation to the site.

In the past, research studies have focused on the biological environment of the forest, without considering the users of the forest. It has now become clear that sustainable management of a natural resource must consider its users. The communities surrounding the forest have a long history of using the forest for their daily needs, and they have therefore accumulated much indigenous knowledge about the forest. Future research has to tap this knowledge so that research becomes a two-way learning process where researchers and community members share information.

Research should address management problems to make management more efficient. The SFMP process conducted several thematic workshops, focusing on particular themes. In each of these, some issues of information gaps, knowledge and skills emerged and have been included here. Strategies and actions in research require multiple stakeholders, who can be grouped into producers, practitioners, professionals and consumers/users. The role

and responsibility of each stakeholder group should be clearly defined. It is particularly important that research should be demand-driven by the needs of various stakeholders to achieve sustainable forest management. In the past there has been a tendency for research to be researcher-driven.

Research issues can be many and diverse with some requiring short-term strategies and others long-term interventions. It is therefore important to rank research strategies depending on the relevance of the issue to management, feasibility, urgency, cost-effectiveness, existing knowledge gap and capacity to carry out the activities.

The strategies and activities identified for the SFMP require monitoring to understand to what extent they are achieving the stated objectives. Monitoring is important for the re-prioritisation of activities and identifying new areas which need to be targeted. Monitoring involves identifying indicators for the objectives so that progress towards these can be measured. These should be jointly agreed. Once identified, further consideration is needed as to how and by whom these will be monitored. Participatory monitoring involving various stakeholder groups is increasingly being accepted as the best form of monitoring.

Objective

To obtain improved understanding of the forest and its usage for better management and monitoring

Strategies and actions

Improving evaluation of the biodiversity importance of the forest

The priority given to conservation of ASF is due to its unique biodiversity. To understand the value of biodiversity, it is necessary to know the range of fauna and flora in the forest. A biodiversity inventory of the forest is needed to document the location and extent of forest species. The information collected will form baseline data that can be used to compare past and future trends in biodiversity. The information will also expand and diversify the range of products and services available from the forest. Sustainable extraction levels of products and services from the forest need to be known and agreed by partners to ensure that it is utilised without compromising its biodiversity value. This requires data on the ecology and growth levels of particular species. Utilisation of indigenous knowledge is important in biodiversity research. Although the concept of forest zonation has been accepted in this plan, indicators for zonation and for describing forest condition are yet to be developed and agreed by partners. Finally, the information obtained needs to be disseminated to the local community and other stakeholders.

Actions	Lead responsibility	Priority
Develop a set of indicators to guide forest zonation and describe forest use.	NMK, KEFRI, FD	1
Compile available information on biodiversity, identify existing gaps and conduct biodiversity assessments to fill the gaps.	KEFRI, NMK, KWS	1
Develop a database of indigenous knowledge to assist in forest management and conservation.	NMK, KEFRI	1
Explore new, and diversify existing, livelihood activities to reduce local dependence on the forest.	FD	1
Compile baseline information on forest condition which can be periodically updated.	FD	1
Identify methods for monitoring changes in biodiversity.	KEFRI	1
Conduct inventories of lower plants and fungi.	NMK	2
Improve co-ordination, prioritisation and dissemination of research findings.	KEFRI	1

Enhancing sustainable use of the forest by local communities

The strategy is to conduct research which will enable the communities living around the forest to continue getting its benefits without compromising its biodiversity value. This should be done through understanding the resources the community use in the forest, and the supply/demand status of those products and services in order to compute extraction levels. Equitable benefit-sharing mechanisms should be developed to act as incentives to those contributing to forest conservation. The problem of poverty should be handled through diversification and expansion of existing income-generation activities. Improvement in marketing strategies and adding value to products and services will give improved benefits for community members. Gender balance should be encouraged in all activities through the involvement of women in forest

Actions	Lead responsibility	Priority
Assess forest resources being used by forest-adjacent communities, and develop sustainable extraction levels.	FD	1
Develop modalities for benefit-sharing between communities and other stakeholders.	FD	1
Determine supply/demand status of products and services being obtained by the communities from the forest.	FD, KEFRI	1
Develop and promote alternative tree species for wood carving.	KEFRI	2
Carry out inventory of fruits, herbs, vegetables and mushrooms available in the forest, followed by their domestication.	KEFRI, NMK, FADA	2
Assess the potential for harvesting bush-meat from the forest and domestication of some of the popular small mammals.	KWS, FADA	2
Explore and develop the scope for non-consumptive uses of the forest.	NMK, FD, KEFRI, KWS	1
Explore and develop the scope for income-generation activities outside the forest, to reduce dependency on the forest.	NGOs, Alisei, Community-based Organisations, KEFRI, KWS, FD	1
Develop ways to reduce gender disparity, and empower women.	Alisei, EAWS, KEFRI, Community-based Organisations	1
Strengthen institutional linkages and networking for better dissemination and sharing of research information.	KEFRI, ASFMT	1

associations, and by working for attitude change to lessen the burdens women currently carry.

Improving production and management of the forest for commercial use

The strategy is to understand the factors that have led to poor performance of plantation species and put corrective actions into place. For the natural forest, there is a need to address the current stock and decide whether exploitation is possible. A monitoring system needs to be developed to address the dynamics of the forest ecosystem condition in relation to its use.

Actions	Lead responsibility	Priority
Review management of existing plantations.	FD	1
Improve seed and seedling quality.	KEFRI	1
Study regeneration and growth dynamics of some species, and develop growth-yield models for main commercial species.	KEFRI	3
Pilot Participatory Forest Management to reduce cases of illegal poaching and create more benefits for the community.	FD	1
Promote efficient utilisation of forest products.	FD	1
Improve marketing and pricing for forest products and services.	FD	1
Develop conventional participatory monitoring of materials extracted from forests.	FD	2

Improving tourism impacts and benefits for the community

Research will focus on ensuring that local communities realise tangible benefits from eco-tourism. Tourism growth will be monitored to establish the optimal numbers which would have least impact on the environment.

Actions	Lead responsibility	Priority
Expand and diversify tourism attraction packages.	KWS	1
Develop systems to monitor the impact of eco-tourism on biodiversity and the socio-cultural values of the host community.	NMK, KWS	3
Investigate benefits of various stakeholders and local communities from eco-tourism.	KWS	1
Develop benefit-sharing mechanisms for eco-tourism proceeds acceptable to local community and other stakeholders.	KWS, FD	1
Undertake a feasibility study of alternative charging methods for visitors entering the forest.	KWS, FD	1

Improving problem animal control mitigation

The strategy should be to use research data and findings to improve on the strategies adopted for mitigating damage caused by problem animals. This will be through better understanding of animal behaviour related to crop raids and carrying capacities, and through the quantification of damage caused by animals and the development of possible compensation schemes.

Actions	Lead responsibility	Priority
Understand animal behaviour in relation both to their movements and to crop raids.	KWS	1
Determine the carrying capacity of the habitat and current stocking of animals.	KWS, FADA	1
Explore possibilities for putting up animal movement barriers.	KWS, FD	2
Research baboon population control through fertility mechanisms.	IPR, KWS	2
Diversify crops grown by farmers to reduce risks.	KARI, MOA	3
Explore and pilot alternative compensation schemes for animal damage.	KWS	2
Carry out a comprehensive study on raided crops and develop a valuation system.	KEFRI (NGOs, NMK, KARI, FADA,FD)	1
Monitor use of water pools in the forest by humans and animals.	KWS, FD, FADA	1

Improving strategies in forest protection

Reporting systems for illegal activities in the forest should be improved and information about the relationship between poaching and market demand on one hand and infrastructure on the other should be improved to enable control and monitoring systems for forest protection to be made more effective.

Actions	Lead responsibility	Priority
Develop quantitative systems for reporting illegal activities.	FD, KWS, FADA	1
Develop a system for certifying sources of products.	KEFRI (NMK, FD, NGOs)	3
Develop protocols for monitoring illegal activities in the forest.	FD, KWS,KEFRI	4
Promote participatory forestry as a way of curbing illegal activities.	FD	1
Determine the relationships between infrastructure (roads etc.) and illegal activities.	FD	2

Carrying out general research and monitoring

The absence of criteria and indicators for biological monitoring has been a barrier to understanding trends or changes in biodiversity. The strategy is to develop such criteria and indicators which can be used for monitoring changes in biodiversity in the forest. Biodiversity surveys and inventories should be carried out to determine the current status, and act as baselines for future monitoring. Participatory monitoring should be combined with conventional monitoring.

Actions	Lead responsibility	Priority
Determine the role of emergent institutional structures in information dissemination, management, training and awareness-creation.	KEFRI	2
Conduct joint research activities with local community.	KEFRI	2
Identify, evaluate, pilot and adopt appropriate technologies.	KEFRI	2
Conduct a baseline study as a basis for long-term monitoring.	KEFRI, NMK	2
Identify criteria and indicators for monitoring changes in biodiversity.	KEFRI, NMK	2

1.8 Governance

Governance concerns the way in which the organisations responsible for making management decisions and carrying out management activities are accountable to the wider group of stakeholders. Arabuko-Sokoke Forest will continue to be managed under the existing partnership arrangements, involving a number of different stakeholder groups. The Forest Department has the legal mandate to manage the resources but has increasingly entered into partnership with other stakeholders; such partnerships are expected to expand.

The governance structure therefore sets out those who are responsible for taking action and for monitoring. The following governance structure is proposed for Arabuko-Sokoke Forest during the Strategic Forest Management Plan period.

Arabuko-Sokoke Forest Management Team

The partnership arrangements for managing Arabuko-Sokoke Forest are formalised in the form of various MoUs between the organisations involved. The MoU between the institutions has no legal structure, but builds on the mandates of the institutions and the need to work closely to achieve quality results and avoid duplication of effort. The current MoU is between FD and KWS, with NMK being enjoined in the Addendum. A Memorandum of Consultative Collaboration (MoCC) has also been developed between KEFRI and FD. The MoU needs to be strengthened to bring on board the four institutions as equal partners. It is worth noting that KEFRI and KWS are at an advanced stage of preparing a new MoU. Strengthening of the MoU will ensure that the ASFMT has greater ability to resist external pressures on the forest coming from conflicting interests, and will also have greater decentralised decision-making powers.

The ASFMT is expected to be responsible for day-to-day management of the forest. It will be composed of representatives of the 4 main government institutions concerned (Forest Department, Kenya Wildlife Service, National Museums of Kenya, and Kenya Forestry Research Institute). The management team will be extended to include local community representatives and representatives of local NGOs concerned with aspects of the forest. At present, day-to-day forest management activity is largely the responsibility of the Forest Department in collaboration with KWS. By using a series of working groups with a specific focus on different themes, it is expected that there will be more involvement of these 4 partners. The local community represented by FADA will be incorporated in the ASFMT. Other stakeholders working at ASF will be co-opted into specific working groups where they have an interest. The wider representation in the team will improve decision-making and ownership of actions decided by the group.

The Forest Management Team will be responsible for recommending operational plans for approval by the Chief Conservator of Forests or his representative. Approval will be on the basis of whether the operational plan "fits" within the overall strategy outlined in this Strategic Plan. Other factors to be considered include prioritisation of activities, availability of funds, adherence to the guidelines developed in this SFMP and technical feasibility. The approval of any operation plan will also depend on whether it fits within the overall national forest policy.

The ASFMT will be responsible for producing an annual progress report (Arabuko-Sokoke Forest Annual Report) with formats to be designated for each theme. The format will be circulated to all stakeholders and be discussed in the annual Arabuko Sokoke Forum meeting (see below). This report will be used for informing the annual Arabuko-Sokoke Forest Forum meeting, and in disseminating information and experiences concerning the forest, both nationally and internationally.

The ASFMT have had the ASFMCP project as their common funding agent and this has enhanced teamwork. This funding ended in January 2002. The challenge the team has now is to continue working together, with or without a common funding agency. Members of the team were in agreement that continuation of the team is necessary and will serve the interests of conservation of the forest. However, due to differences in institutional mandates and approaches, problems can arise on the ground. The SFMP should guide team members in realising the common vision for ASF. The heads of institutions are expected to support the team on the ground in realising the common vision.

Working Groups

A series of working groups will be established and will operate as at present, covering different themes. Working groups will have a more specific remit than the ASFMT and may not necessarily have representatives from all the partners. One organisation or individual will normally take the lead for each working group. It is expected that each identified strategy will come within the remit of one working group, which will be expected to report on its progress annually. The main responsibility of working groups will be to take the lead in implementing agreed operational plans after approval, and following the guidelines in the SFMP. ASFMT may create additional working groups when necessary. Working groups could also merge when funding levels are low.

Arabuko-Sokoke Forest Forum

This is a new part of the proposed governance structure, which follows directly from the broad stakeholder participation process used to prepare this plan. It is expected that the Arabuko-Sokoke Forest Forum will consist of representatives of all concerned stakeholder groups. The forum will meet at least once a year to review overall progress in implementation of the Strategic Forest Management Plan, and will consider whether:

a) the overall objectives and the thematic objectives of the SFMP are being met, and
b) prioritised actions are being implemented.

In order to inform this meeting, the ASFMT will produce an annual report covering all operational plans which will become the Annual Progress Report for the Arabuko-Sokoke Forest. The forum will be responsible for updating and revising the strategic plan.

Arabuko-Sokoke Forest Trust

Long-term partnership at ASF requires technical and financial support from participating stakeholders and other

interested parties in order to realise the goals set out in the plan. A Trust Fund has been proposed as a long-term measure for ensuring continued support for ASF. Participating institutions, the local community and other stakeholders will be able to contribute to and draw from the fund. The members of the Trust will seek funding and ensure that the money is used to support continued conservation of ASF.

1.9 Stakeholders

Table 4. Stakeholder impact matrix.

Primary stakeholders (users)			
		Expectations	
Stakeholder	**Stake**	**Positive**	**Negative**
Forest-adjacent communities	• Subsistence forest products (e.g. poles, fuelwood, fodder, medicinal herbs) • Other forest products (e.g. butterflies, honey, carving wood, bush-meat,timber) • Water supplies • Employment • Income • Crops and livelihood security • Land for agriculture • Cultural value	• Subsistence products will increase in the longer term through systematic management. • Certain other products will increase in the long term e.g. NTFPs, honey, butterflies. • Water supplies will be secured. • Crops and livelihoods will be secure through control of problem animals and through alternative income-generation opportunities.	• Products such as timber and bush-meat, which are at present illegally sourced, will decline as local institutions conform to their own rules and responsibilities. • Possibility of excisions for agriculture will decrease.
Commercial users	• Commercial forest products • Revenue	• Limited quantities of timber will become available through improvement of plantations.	• Most illegally sourced products will decline in availability. This may affect wood carvers. • Revenues may decline.
Eco-tourists	• Wildlife experience • Cost to enter the forest	• Better wildlife sightings due to less forest disturbance and more facilities. • More enjoyable experience.	• More expensive to visit the forest because of gate fees.
Biodiversity	• Suitable habitats • Functioning eco-system • Numbers of species	• Suitability of habitats will improve or remain the same. • Stability of the eco-system will improve thanks to better protection from threats.	• Some adverse effects on biodiversity in the subsistence use zone caused by disturbance.
Secondary stakeholders (delivery agencies)			
		Expectations	
Stakeholder	**Stake**	**Positive**	**Negative**
Front-line staff of FD and KWS (guards and rangers)	• Salary and employment • Job satisfaction • Status	• Current roles will stay the same. • Job satisfaction and status will improve.	• Workload may increase due to additional tasks. • Different skills needed.
Officers of FD and KWS	• Salary and employment • Job satisfaction • Status	• Current roles will stay the same. • Job satisfaction and status will improve.	• Workload may increase due to additional tasks. • Different skills needed.
Project MoU	• Salary and employment • Job satisfaction • Status	• Current roles will stay the same. • Job satisfaction and status will improve.	• Some risk if new approaches do not immediately succeed.
HQ/Department/CFs Office	• Reputation • Status • Achievement of objectives	• Learn about how to implement and apply learning from elsewhere.	• Some risk if new approaches do not immediately succeed.
Donors	• Reputation • Achievement of donor objectives	• Reputation will improve. • Local livelihood benefits.	• Reputation will suffer if approach fails.

Part 2. Operational Planning Guidelines

2.1 The planning framework

Multiple stakeholders and multiple objectives

Arabuko-Sokoke Forest, like all forests in Kenya, has to meet the requirements of multiple stakeholders in today's society. This is a complex and diverse group of people to involve in a planning process. It is no longer appropriate for one stakeholder to plan and implement actions without consensus and agreement from the others. Previous top-down and centralised planning models are therefore no longer appropriate.

If every stakeholder were involved in every planning decision from the start, the result would be an unwieldy and inflexible plan which would be unlikely to be implemented. To avoid this, there has been a long consultative process leading to this **Strategic Forest Management Plan**. This provides the framework within which future planning decisions for the next 25 years will be made. **Operational Plans** of different types and for different purposes will be prepared on an on-going basis during the 25-year implementation period of the Strategic Forest Management Plan. During preparation of Operational Plans, stakeholders will be closely involved through a participatory process, and conflicts will be resolved on a site-by-site basis. This is normally referred to as "bottom-up" planning. Operational Plans may only be approved if they conform with the provisions of the Strategic Plan and the guidelines within it.

The planning framework consists of the Strategic Forest Management Plan with a series of Operational Plans fitting within it.

The boxes below compare the features of the Strategic Forest Management Plan with Operational Plans.

Features of the Strategic Forest Management Plan

- Strategic, rather than prescriptive, allowing for bottom-up planning and accommodation of a wide range of stakeholder interests.
- More comprehensive. Covers a wider range of forestry interests, including the public, community, and government sectors.
- More open to public scrutiny due to public interest and the need for transparency.
- Long-term (25 years).
- Not expected to alter significantly over the plan period, although should be periodically reviewed, especially in the light of policy changes.
- Prepared through a participatory process (consultative) which is inclusive of all stakeholders or their representatives.
- Identifies strategies which are informed by real experience and good information.
- Sets out principles and guidelines for operational planning and provides a basis for approving and funding such actions.
- Interprets national policies in the local context of Arabuko-Sokoke Forest.
- Emphasis on map-based information presentation.
- Has no budget—only prioritised strategies.
- Approved centrally (CCF level).

Features of Operational Forest Management Plans

- Time-bound—between 1–5 years.
- Prepared following the principles and guidelines in the SFMP.
- Focus on achieving objectives through implementing actions for a specific, identified site.
- Approved locally (DFO level) according to compliance with the SFMP.
- Prepared by front-line staff (with specialised assistance if needed).
- Contain a budget which is approved and committed when the plan is approved.
- Site-specific and participatory: prepared through the involvement of all local stakeholders.
- Prepared following the principles and guidelines in the SFMP.

The purpose of operational guidelines

One of the important and agreed principles in the approach to forest management is that the way in which forest management actions are implemented is just as important as what is done. This means that best practice must be followed in planning and implementation. Guidelines will be needed to identify and support best practice for the preparation of operational plans of different kinds. The main part of the Strategic Forest Management Plan therefore identifies the actions needed to achieve the objectives. Operational guidelines show how to plan for those actions to ensure that they are as effective as possible. This means that it will become necessary for operational guidelines to be prepared for each different type of Operational Plan. In some cases these should be simple guidelines based on common sense and previous experience, while in others (for example, operational guidelines for Participatory Forest Management) these should emerge out of a process of testing and monitoring.

Types of Operational Plan

- Participatory Forest Management Plan (PFMP) (5 years)
- Commercial licence (for harvesting) (annual)
- Problem animal management plan (bi-annual)
- Patrolling plan (annual)
- Habitat management plan (5 years)
- Eco-tourism development plan (5 years)
- Infrastructure development plan (e.g. road maintenance) (annual)
- Research plan (5 years)

Approval

Approval is the means of deciding whether a particular Operational Plan complies with, or fits within, the framework of the Strategic Forest Management Plan. A

series of questions need to be asked before approving an Operational Plan:

- *Is it technically feasible?*
- *Are funds available to implement it?*
- *Has best practice been followed in the process of preparing the plan (as identified in the operational guidelines)?*
- *Does the plan comply with the prioritised strategies and actions in this SFMP?*

Monitoring

Monitoring should be included as part of the operational plan, rather than being treated as a separate exercise carried out after implementation. The operational guidelines should indicate the monitoring arrangements.

2.2 Operational guidelines

For each type of Operational Plan, the following need to be considered:

- *What is the type of plan to be prepared?*

Depending on the type of activity proposed, the Operational Plans would differ in their style and content.

- *What is its duration?*

What should be the period of the Operational Plan? Some can be annual plans, others may continue for several years.

- *Who should prepare it?*

Which institution should take the lead responsibility for preparing the plan? Participatory plans will clearly need to have the strong involvement of local people.

- *Which stakeholder groups need to be involved?*

As well as the lead institution, there may be a need for stakeholder consultation with different groups who are likely to be affected by the plan. These need to be identified at the outset and brought into the planning process.

- *What are the proposed institutional or partnership arrangements for implementation?*

These should be agreed and described within the Operational Plan itself.

- *Who should approve the Operational Plan?*

This should be defined at the outset. Most Operational Plans would be locally approved because they fall within the framework of this Strategic Forest Management Plan, which is already approved at a national level.

- *Which zones would have such plans?*

It can be expected that since different activities are likely to take place in different zones, there will be different types of Operational Plan for activities in different zones.

- *Are there any technical criteria for carrying out operations under the plan?*

What are the means of ascertaining that Operational Plans are technically correct?

- *What are the monitoring arrangements for the plan?*

It is essential that the site-monitoring arrangements are detailed in the actual Operational Plan, and thus become part of the plan itself. Site indicators will need to be identified for each Operational Plan, to determine whether the plan's objectives are being achieved.

Plate 10. Participatory Forest Management: Dida Forest–Adjacent Area Forest Association (DIFAAFA) members mapping utilisation zones; involvement of local communities will be essential to the future management of Arabuko-Sokoke Forest.

Part 3. Planning Information

3.1 Institutions

The administrative framework and partnership were described in Section 2. In this section, the mandates of the four government partners are described in greater detail.

Forestry Department

This is the main institution in the forestry sector, and is located in the Ministry of Environment and Natural Resources (MENR). Among FD's functions are:

- formulation of policies for management and conservation of forests,
- preparation and implementation of management plans,
- management and protection of Kenya's gazetted forests,
- establishment and management of forest plantations,
- promotion of on-farm forestry, and
- promotion of environmental awareness.

FD operates some 160 forest stations, reporting to 65 District Forest Offices who in turn report to eight Provincial Forest Offices. In the past, FD has concentrated on industrial forestry (80% of the budget), but is now giving greater attention to afforestation on smallholder farmland and the conservation of natural forests. FD's resources are limited and its composition is inadequate for keeping the department fully operational. A high percentage of FD's total budget goes to salaries and allowances.

FD administers the Arabuko-Sokoke Forest Reserve. As the forest falls under two different Districts, two District Forest Officers (DFOs) manage it. The DFO Kilifi District is based at the District Forest Headquarters in Kilifi, and is responsible for the southern half of the forest, while the DFO Malindi is based at Gede Forest Station and is responsible for the northern half. Both DFOs report to the Provincial Forest Officer, Coast Province who is responsible to the Chief Conservator of Forests in Nairobi.

There are three forest stations in Arabuko-Sokoke: Gede, Jilore and Sokoke. The Forester in charge of each station is responsible for the day-to-day administration and management of the forest in his station.

Kenya Wildlife Service (KWS)

The forests provide one of Kenya's major wildlife habitats, and the parastatal KWS is responsible for the protection of the nation's wildlife. KWS's responsibilities include:

- formulation of policies for management and conservation of wild flora and fauna,
- advice to Government on the establishment of National Parks and Reserves,
- preparation and implementation of management plans for National Parks and Reserves,
- promotion of wildlife conservation education,
- co-ordination and implementation of wildlife conservation and management research, and
- advice to Government, local authorities and landowners on optimal methods for the conservation of wildlife.

KWS has the responsibility for controlling problem animals. This is a major issue at Arabuko-Sokoke. KWS requires resources for implementing forest-based tourism development and conservation education.

The FD-KWS Memorandum of Understanding

On 5 December 1991, a Memorandum of Understanding (MoU) was signed by the Directors of KWS and FD, covering the management of the forests and the protection of wildlife within indigenous forest reserves. Arabuko-Sokoke is one of these forests. Under the MoU, KWS has the responsibility for the development of forest-based tourism in conjunction with FD. It will assist FD in the management of selected natural forests. The National Museums of Kenya subsequently enjoined to the MoU under an Addendum which recognised their role in cataloguing, researching and conserving forest biodiversity.

Kenya Forestry Research Institute (KEFRI)

KEFRI was separated from the Kenya Agricultural Research Institute in 1986. Its mission is to enhance the social and economic welfare of Kenyans through user-oriented research for the sustainable development of forests, and allied natural resources. The mandate of KEFRI is to:

- conduct research in forestry,
- co-operate with other research bodies and NGOs within and outside Kenya carrying out similar research,
- liaise with other organisations and institutions of higher learning in training and on matters of forestry research, and
- disseminate research findings.

KEFRI has 94 university graduate research scientists at PhD, MSc and BSc level in forestry and allied natural resources, distributed within the research and development programmes in 17 research centres in various ecological zones of Kenya. There is a good infrastructure for research and training, which includes modern equipment, printing and communication facilities, catering and accommodation. KEFRI has developed methodologies for the establishment of exotic and indigenous tree species, and has also screened over 100 species, provenances and species for matching. It has developed water harvesting techniques for improved tree survival and growth in the dry areas. The Gede Regional Research Centre has 3 research scientists, who have experience in farm forestry, soil fertility management, botany, forest resource surveys, community forestry, extension and dissemination.

National Museums of Kenya (NMK)

The National Museum of Kenya (NMK) is the national repository for the prehistoric, cultural and biological specimens of Kenya. It maintains comprehensive reference collections and educational exhibits, and undertakes research in the botanical and zoological sciences. Until 1939, the Museum was administered by the East Africa Natural History Society. It was then handed over to the Government, becoming the National Museums of Kenya.

It remains an internationally recognised centre for research and education.

The mandate of NMK is to collect, document, preserve, study and present Kenya's past and present cultural and natural heritage, and enhance knowledge, appreciation, respect, management and use of these resources for the benefit of Kenya and the world.

3.2 Infrastructure

Buildings

These include the District Forest Offices, Forest Stations, KEFRI, KWS and NMK offices, outposts for both FD Forest Guards and KWS Game Rangers, and the accommodation facilities for all staff members housed in all the institutions.

There are two District Forest Offices: one in Malindi and one in Kilifi. The former has two forest stations (Gede and Jilore) and a new outpost at Malanga, while the latter has one station (Sokoke) and one outpost at Kararacha. Both KWS Game Rangers and FD Forest Guards occupy these outposts. The office of the KWS officer in charge (Warden) for the ASF is in Gede. The KEFRI and NMK offices are also situated at Gede. Table 5 shows the buildings and housing capacity for the ASF and the Gede Ruins Museum.

Buildings issues

There is an urgent need to repair the existing staff houses and put up extra accommodation facilities within the

Table 5. Buildings and housing capacity at Arabuko-Sokoke Forest.

Forest Department

Site/ Station	No. of houses	Year built	Category	Remarks on condition
Jilore	5	1976–1985	Class 9	Needs repair
Jilore	1	1975	Class 5	Needs repair
Jilore	1	1977	Office and store	Needs repair
Kakuyuni	1	1960	F/ Guard house	Needs repair
Arabuko	1	1947	F/Guard house	Collapsed
Pahali Peupe	1	1978	F/Guard house	Collapsed
Gede	1	1970	Class 5	Needs repair, ceiling falling
Gede	2	1971	Class 9	Needs repair
Gede	1	—	Petrol store	Good condition
Gede	1	—	Semi permanent	Needs urgent repair
Gede	1	—	Prefab house	Needs urgent repair
Gede	1	—	Prefab house	Needs urgent repair
Gede	1	1972	Nursery store	Good condition
Gede	1	1974	Semi permanent	Needs repair
Gede	1	1974	Permanent garage	Good condition
Gede	5	1975	Village houses	Needs urgent repair
Gede	4	1975	Staff houses	Needs urgent repair
Gede	4	1982	Permanent village houses	
Gede	1	1970	Office store	Needs painting
Gede	1	1986	Class 9	Needs painting
Gede	1	1984	Class 9	Needs painting and window panes
Kilifi	1	1983	DFO office	Needs repair and painting
Kilifi	1	1975	Office block	Needs repair and painting
Kilifi	3	1975/83	Class D	Residential; needs repair
Kilifi	4	1975/83	Class F	Residential; needs repair
Kilifi	2	1995/88	—	Central tool and vehicle shed
Kilifi	3		Class F	Residential; needs repair
Bahari Division	1	1985	—	Nursery shed; needs repair
Sokoke station	1	2000	New office block	In good condition; power required
Sokoke station	1	2000	New FG house	In good condition; needs power
Kararacha outpost		2001	FG outpost	Completed
Kilifi: various sites		1961/77/80	Guard posts	Needs repair

Kenya Forestry Research Institute (KEFRI)

Site/ Station	No. of houses	Year built	Category	Remarks on condition
Gede		1973/74	Class 5	Good
Gede		1976/77	Class 9	Good
Gede		1979/80	Class 9	Good
Gede		1973/74	Class 9	Good
Gede		1977	Office extension	Condemned
Gede		1974/75	Semi-permanent	Needs repair
Gede		1976/77	Semi-permanent	Needs repair
Gede		1976/77	Semi-permanent	Needs repair
Gede		1976/77	Semi-permanent	Needs repair
Gede		1977/78	Semi-permanent	Needs repair
Gede		1979/80	Semi-permanent	Needs repair
Gede		1980/81	Semi-permanent	Needs repair
Gede		1974	Prefab Seed drier	Needs repair
Gede		1979/80	—	

Kenya Wildlife Services (KWS)

Site/ Station	No. of houses	Year built	Category	Remarks on condition
Gede		1974	—	Condemned
Gede		1874	—	Condemned
Gede		1974	—	Condemned
Gede		1974	—	Condemned
Gede		1982	—	Needs repair
Gede		—	—	Needs repair
Gede		1999	—	Needs repair
Gede		1999	—	Needs repair
Jilore		2000	—	Good
Jilore		1974	—	Condemned
Jilore		1974	—	Condemned
Jilore		1974	—	Condemned

National Museums of Kenya (NMK)

Site/ Station	No. of houses	Year built	Category	Remarks on condition
Office block		1995	—	In good condition
Breeding shed		1993	—	Needs repair
Butterfly exhibit		2001	—	Under construction

different institutions. A full-time service camp is required for Dida. There is an urgent need for a KWS warden's house in Gede forest station and a forester's house in Sokoke forest station. Extra office space is needed, especially at Gede, with the priority being for FD, KEFRI, NMK and KWS in that order. Jilore station requires renovation. KEFRI and NMK require a fully equipped laboratory where they can conduct analysis of samples collected.

Equipment

Table 6 summarises the capital equipment in place within the ASFMT institutions.

Table 6. Capital equipment at Arabuko-Sokoke Forest in 2002.

Type	Year purchased	Location	Institution	Status/Remarks
Computer	1997	Gede	FD	In good condition
Printer HP 690	1997	Gede	FD	In good condition
Electric type writer	1998	Gede	FD	In good condition
Duplicating machine	–	Gede	FD	Serviceable
Manual type writer	–	Gede	FD	Serviceable
Calculators	–	Gede/Jilore	FD	Serviceable
Water pump	1979	Gede	FD	Boarded
Power saw	1974	Kilifi DFO	FD	–
VHF radio FM	–	Jilore	FD	At Gede
Power saw	–	–	FD	Gede
Tractor	–	–	FD	At DFO Kilifi
Out board engine	–	–	FD	At DFO Kilifi
3 Computers	–	–	NMK	At Kipepeo Office
3 Printers	–	–	NMK	At Kipepeo Office
Fridge	–	–	NMK	At Kipepeo Office
2 boat engines, Yamaha	1978	DFO Kilifi	FD	Boarded
2 power saws	–	Kilifi	FD	Grounded but serviceable
Duplicating machine	–	Kilifi	FD	Serviceable
3 typewriters	1998,93/95	Kilifi	FD	Serviceable
Fire extinguishers (3)	–	–	FD	Serviceable
Refrigerator	1994	DFO Kilifi	FD	Serviceable
Computer/ printer	2000	DFO Kilifi	FD	Serviceable
Computer	–	Gede	KWS	Needs repair
Printer	–	Gede	KWS	Serviceable
Radio	–	–	KWS	Needs repair
Calculator	–	–	KWS	Serviceable
VHF radio	–	–	KWS	Serviceable
VHF radio	–	–	KWS	Serviceable
VHF radio	–	–	KWS	Serviceable

Vehicles

ASF has nine serviceable vehicles, nine motorcycles and a boat (Table 7), as well as bicycles.

Vehicle issues

There is a need to look into the future requirements of vehicles and other means of transport for managers in all institutions, community extension officers and other community representatives and members. This is one of the factors that determines working efficiency. Both Jilore and Sokoke stations require independent vehicles. Other requirements include a mini-bus for awareness activities, a motor boat and canoe for the needs of aquatic areas, and a workshop for vehicle maintenance. Motorised mowers are also needed for all institutions, offices, stations and outposts.

Table 7. Transport facilities at Arabuko-Sokoke Forest in 2002.

Vehicle	Type	Model	Year purchased	Institution	Remarks
GK X 985	D/Cabin	Toyota	1995	KEFRI	Serviceable
GK T 433	Pickup	Toyota LC	1991	KEFRI	Serviceable
KAH 739 F	Pickup	Toyota	1997	FD MALINDI	Serviceable
KAH 742 F	Pickup	Toyota	1997	KWS	Serviceable
KAH 608 F	Pickup	L/Rover 110	1997	KWS	Serviceable
KAD 650X	L/Rover	Defender	1997	KEFRI	Serviceable
KAH 936F	Van	Suzuki	1997	NMK	Serviceable
KAH 604F	Lorry	Bedford	1997	KWS	Needs service
KAA 783 D	Caravan	L/Rover 109	–	KWS	Serviceable
8 M/Cycles	Suzuki	Suzuki	1998	PROJECT	Serviceable
GK Y 796	Pickup	Mitsubishi	1996	FD KILIFI	Serviceable
KAH 281 H	Pickup	Nissan	1997	NMK	Serviceable
KAD	Motor Cycle	Yamaha	1993	NMK	Serviceable
KAE	Motor Cycle	Yamaha	1997	NMK	Serviceable
GK 677U	Boat	O/B Engine	1978	FD	Under repair
Other vehicles under repair					
Vehicle	**Type**	**Model**	**Year purchased**	**Institution**	**Remarks**
GK C 197	L/Rover	L/Rover 109	–	FD GEDE	Under repair
GK S 981	Car	Suzuki	–	FD GEDE	Under repair
GK W127	Motor cycle	Suzuki	–	FD GEDE	Grounded

Forest roads

The recommendations of the road assessment survey (Otieno 2001) needs to be implemented. The extent of the forest road network requires careful consideration because excessive opening of the forest may lead to increased ecological disturbance through noise, and also reduced vegetation cover (habitat destruction) which would be harmful to shy animals and may possibly cause injury to wild animals via accidents. Serious consideration should also be taken into account because a good road system can lead to increased illegal activities.

Forest roads, tracks, footpaths and running trails (Map 9)

The forest boundary road is over 100 km whilst the motorable road network inside the forest is over 110 km. There is a 5 km walking trail close to Gede forest station for running and a 10 km running trail is also in place. The latter is used mainly by the Watamu Hash Harriers. The forest boundary road is, in some places, little more than a rough track. A network of old logging tracks of different classes further serves the boundary road. This has had the effect of increasing illegal activities.

Road network outside ASF

The Mombasa-Malindi Garissa B8 main tarmac road skirts the eastern boundary of the forest while the southern and south-western parts of the forest are served by the Kilifi-

Vitengeni road (see Map 9). The northern part of the forest is well served by the Malindi to Sala Gate road, which leads to the Tsavo East National Park.

Road issues

Establishment and maintenance of the necessary minimum road network inside the forest area is required taking into consideration the proposed campsites, picnic areas and other areas of special interest, as well as any possible ecological and habit destruction and disturbance. Routes which lead to habitat fragmentation must be avoided. All the roads should be well maintained at all times of the year.

Other infrastructure

Telephone and radio facilities

All the Kilifi and Malindi KWS bases can communicate with all other outlets by use of VHF radios, while the FD district offices, the Gede KEFRI and the NMK head office in Gede have telephone facilities. There are ten radio handsets.

Electricity supply

All the offices in Gede (KEFRI, FD, NMK and KWS) have electric power supply. The KEFRI office has an inverter which ensures electricity supplies when mains electricity is lacking. The offices in Sokoke, Dida and Jilore do not have a power supply, except for some solar panels which are used only for supporting communication equipment. The power extension at Gede needs to be expanded to cover the staff houses not yet having a supply.

Foot patrol equipment

The foot patrol team of Forest Guards and Rangers has been equipped with the items shown in Table 8. This not only boosts the morale of the staff, but also increases the efficiency and effectiveness of ground patrolling.

Table 8. Foot patrol equipment supplied to Arabuko-Sokoke Forest.

Equipment	FD Gede	FD Jilore	KWS	FD Sokoke
Water bottles	7	8	13	7
Rain coats	7	8	13	7
Machetes	5	4	4	6
Lanyards	6	7	10	10
Whistles	7	5	6	6
Torches	7	5	6	6
Military belts	6	7	13	8
Rechargeable torches	1	1	1	1
Caps/hats	4	4	6	4
Handcuffs	1	2	1	2

Fire-fighting equipment

A wide range of fire-fighting equipment, including a siren and fire beaters, was purchased in early 2000. However, more equipment is needed. Forest-adjacent communities have been sensitised to the dangers of forest fire and the action needed in the event of fires. Participatory Forest Management (PFM) is seen as an effective tool in early warning of fire outbreaks. In areas more prone to forest fires, establishment of firebreaks and fire towers is necessary.

Forest surveys

Spartan Air Services of Canada did the first reconnaissance for timber in 1967, based on 1966 photography. Their report indicated that more indigenous forest was to be opened and converted into plantations. However, this scenario changed in the early 1970s when the Government declared that no more indigenous forest would be cleared to create exotic plantations.

Forest beaconing

This exercise was undertaken in late 2000 and early 2001. By use of GPS, all the beacon positions were geo-located. All beacons which had been illegally removed were replaced. This exercise is now complete, and information has been forwarded to the Ministry of Land for processing of the title deed for the forest.

Water resources

The ASF is well endowed with 26 seasonal water pools. During the dry season, the surrounding community members also draw water from these pools. The pools contribute significantly as a source of water for wild animals within the forest. Some of the large water pools include Lake Arabuko to the north, Lake Jilore (west), Lake Sokoke in the south and Lake Kararacha to the south-east.

Offices in Gede, Kilifi and Jilore have piped water. In addition to domestic consumption, the water is used in nursery seedling production. Sokoke has water catchment and storage tanks of up to 55,000 litre capacity. The new outposts at Malanga and Kararacha have water storage tanks of 30,000 litres each.

Visitor facilities

At Gede forest station, there is a well-manned information centre where visitors are given an insight into the forest before entering it. Refreshments are also available at a nearby kiosk. A tree platform located within walking distance (about 1.5 km) is available, especially for bird watchers. For visitors who wish to spend the night at Gede, a camping site is available.

Signboards and signposts

The ASFMT has put up extra signposts and is upgrading the existing signboards and fire rating boards. The signs help to direct visitors to all parts of the forest. All the entry points on the forest boundaries are elegantly indicated by sign boards depicting the endemic Golden-rumped Elephant Shrew.

Airports and sea routes

Arabuko-Sokoke Forest is 25 km south of Malindi Airport and 80 km north of Moi International Airport, Mombasa.

Other infrastructure needs

- Updated site plans for all stations and offices (especially Gede) to meet future demand for development, conservation, management and eco-tourism.
- A centralised well-linked computer system (including laboratory) and a new post of System Manager to oversee the running and maintenance of the computer system.
- An upgraded GIS system and a data centre to provide services to management institutions.
- A web site for ASF.
- Electrification of staff houses at all outposts currently without power. At Sokoke and Kararacha, step-down

transformers could provide mains electricity. At Jilore and Malanga other options need to be explored as there are no mains electricity supplies within reasonable distances.

- Community resource centres at various strategic sites such as Dida and Kakuyuni with one centre serving 3 sub-locations; these centres will serve as training and meeting bases for exchange of information.
- A canteen to meet the needs of staff and visitors at Gede.
- Improvements to security and communications inside and outside the forest to enable visitors to stay overnight at camp-sites without fear. All stations and outposts should be linked by an efficient HF/VHFR/UHF Radio communication system.
- Community-run campsites at strategic areas such as Nyari View point and selected water pool spots to improve eco-tourism options.
- Fire towers at various sites (including Kakuyuni, Kararacha, Sokoke and Mida) which will have multi-purpose uses.
- Connection of all offices and residential buildings to piped water with water meters. Boreholes may be an option in some places.

3.3 Human resources

The current status of the concerned government departments at Arabuko-Sokoke Forest is shown in Table 9.

3.4 Biodiversity

Arabuko-Sokoke Forest ranks highly as a site for conservation on all levels of biodiversity: from ecosystems and species to genes. It is the largest remaining protected fragment of a coastal forest mosaic that once stretched from southern Somalia to northern Mozambique. The endemic, threatened and rare species of Arabuko-Sokoke Forest are relics of the flora and fauna of this coastal forest mosaic (Burgess *et al.* 1998, Burgess and Clarke 2000). The East African coastal forests, together with those of the Eastern Arc, have been ranked as the eighth most important region for biodiversity on the planet and rank first in terms of density of endemics (Myers *et al.* 2000).

A large proportion of the forest species whose distribution is restricted to the coastal forests is threatened: 50% of plant species, 60% of bird species and 65% of mammal species. Most of the endemics have a narrow distribution range, often exhibiting single-site endemism or with a scattered, disjunct distribution range. A database is available at the Gede Forest Station library which includes an annotated bibliography and species lists for the main groups.

Vegetation

Approximately 600 species of plants are known at Arabuko-Sokoke. One of the reasons for this diversity is the variety of soils and climatic conditions (especially rainfall) across the forest. The vegetation has been variously classified, but the most widely accepted classification recognises three types as follows.

Table 9. Human resource status of institutions.

	Station	Designation	Number	Training level
KEFRI	Gede	Research Officers	3	MSc
		Foresters	2	Diploma
		Technician	1	Certificate
		Senior clerical officer	1	
		Supplies assistant	1	
		Personal secretary	1	
		Driver	1	
		Fitter (general)	1	
		Senior subordinate staff	9	
		Subordinate staff	24	
	Jilore	Subordinate staff	3	
Total			**47**	

Station	Designation	Number	Training level
FD, Malindi	Gede	DFO	1	BSc
		Forester	2	Diploma
		Driver	2	
		Subordinate staff 1&2	16	
		Forest guard	5	
		Assistant Forester	1	Diploma
	Jilore	Forester	1	Diploma
		Forest guard	8	
		Subordinate staff	16	
	Magarini Division	Forester	1	Diploma
	Malindi Division	Forester	1	Diploma
Total			**54**	
FD, Kilifi	DFO office	DFO	1	BSc
		Copy typist	1	
		Driver	1	
		SCO	1	
		Tel. Operator	1	
		Subordinate staff	4	

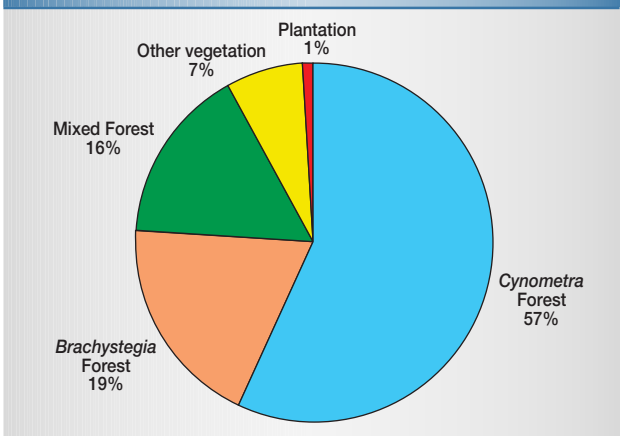
	Station	Designation	Number	Training level
FD, Kilifi (cont.)	Sokoke station	Forester	1	Diploma
		Forest guard	10	
		Coxswain	1	
		Clerical officer	1	
		Store man	1	
		Subordinate staff	7	
	Kaloleni Division	Forester	1	Diploma
		HCO	1	
		SS	5	
	Bahari Division	Forester	1	Diploma
		SS	11	
	Ganze Division	Forester	1	Diploma
		SS	1	
Total			**51**	

	Station	Designation	Number	Training level
KWS	Gede	Warden	1	BSc
		Sergeant	1	
		Corporal	1	
		Ranger/driver	1	
		Ranger/clerk	1	
		Rangers	6	
		SS	1	
	Jilore	Ranger	3	
	Sokoke	Corporal	1	
		Ranger	2	
	ASF, Malindi, Watamu	Ranger	1	
Total			**19**	

	Station	Designation	Number	Training level
NMK	ASF	Research Officer	1	MSc
Total			**1**	

Plate 11. *Brachystegia* Forest is a relatively open forest type, occupying 19% of the forest area.

Figure 1. Vegetation types and areas in Arabuko-Sokoke Forest.



Cynometra Forest — This is a Lowland Evergreen Dry forest and occupies about 220 km². The canopy is closed and the understorey is tangled with many saplings and lianas. Cycads are common in areas with the highest rainfall. The richest forest is in the south, with a canopy height of over 15m; in the north, the forest is more impoverished and shorter (4 m or lower). *Cynometra webberi* and *Manilkara sansibarensis* are the dominant tree species in this forest type. *Brachylaena huillensis*, which has been heavily poached for the wood carving industry, was formerly common in this vegetation type.

Brachystegia Forest — This is a form of "miombo" woodland or Lowland Woodland which occupies about 70 km². It is floristically and structurally defined; however, it merges with the *Cynometra* zone and there is evidence that *Cynometra* may be invading it. Canopy coverage rarely exceeds 50% and the shrub layer is diverse due to adequate sunlight. Numerous thickets, cycads and knee-high grasses are also present. *Brachystegia spiciformis* is the dominant tree species.

Mixed Forest — This is Lowland Rain Forest which occupies an area of about 6.5 km². The forest is dense, with a nearly continuous canopy as low as 10–12 m and an understorey of tangled shrubs and small trees with moderate leaf litter. Structurally it is similar to the southern, high *Cynometra* Forest. *Afzelia quanzensis* was formerly one of the more important tree species although recent surveys have shown that regeneration of this species is poor. Close to the Gede Forest Station the canopy is higher and the under-storey less tangled.

Mammals

There are thought to be 52 mammal species in Arabuko-Sokoke Forest. Several are of particularly high conservation concern. Three species, the Golden-rumped Elephant-Shrew (*Rhynchocyon chrysopygus*), Ader's Duiker (*Cephalophus adersi*) and the Sokoke Bushy-Tailed Mongoose (*Bdeogale (crassicauda) omnivora*) are globally threatened, near-endemic species. Ninety percent of the world's population of the Golden-rumped Elephant Shrew is found in the forest, and Ader's Duiker is only found in ASF and in Jozani Forest in Zanzibar. The six other antelope species are Red, Blue and Common Duikers (*Cephalophus natalensis, Cephalophus monticola* and *Sylvicapra grimmia*); Common Waterbuck (*Kobus ellipsiprymnus*), Bushbuck (*Tragelaphus scriptus*) and Suni (*Neotragus moschatus*). Larger mammals are fewer, but there are between 80-100 African Elephant (*Loxodonta africana*) in the forest which cause much

damage to crops in adjacent farmlands. Carnivores include African Civet (*Viverra civetta*); Blotched Genet (*Genetta tigrina*) and Caracal (*Felis caracal*). The African Golden Cat (*Felis aurata*), which is rare in Kenya, is thought to occur in the forest but this has yet to be confirmed. Primate species include Sykes' Monkeys (*Cercopithecus albogularis*), Yellow Baboons (*Papio cynocephalus*), Vervet Monkeys (*Cercopithecus aethiops*) and Bush babies (*Galago* spp.).

Birds

Arabuko-Sokoke Forest and several other much smaller forest fragments in coastal Somalia, Kenya and Tanzania together form the East African coastal forests Endemic Bird Area. Arabuko-Sokoke Forest has been ranked as the second most important forest for the conservation of threatened bird species on the mainland of Africa. The 270 bird species known from it include six globally threatened and three

Table 10. Key bird species at Arabuko-Sokoke Forest.

Globally threatened or near-threatened species

Common name	Scientific name	Threat category
Southern Banded Snake Eagle	*Circaetus fasciolatus*	Near-threatened
Fischer's Turaco	*Tauraco fischeri*	Near-threatened
Sokoke Scops Owl	*Otus ireneae*	Endangered
Spotted Ground Thrush	*Zoothera guttata*	Endangered
Sokoke Pipit	*Anthus sokokensis*	Endangered
East Coast Akalat	*Sheppardia gunningi*	Vulnerable
Amani Sunbird	*Anthreptes pallidigaster*	Endangered
Plain-backed Sunbird	*Anthreptes reichenowi*	Near-threatened
Clarke's Weaver	*Ploceus golandi*	Endangered

Source: BirdLife International (2000)

Regionally threatened bird species

Common name	Scientific name	Threat category
Great Egret	*Casmerodius albus*	Vulnerable
White-backed Duck	*Thalassornis leuconotus*	Endangered
Ayres' Hawk Eagle	*Hieraaetus ayresii*	Vulnerable
African Crowned Eagle	*Stephanoaetus coronatus*	Vulnerable
African Finfoot	*Podica senegalensis*	Vulnerable
African Pitta	*Pitta angolensis*	Vulnerable
Scaly Babbler	*Turdoides squamulatus*	Vulnerable
Little Yellow Flycatcher	*Erythrocercus holochlorus*	Vulnerable

Sources: Bennun and Njoroge (1999), Fishpool and Evans (2001)

Table 11. Habitat requirements and management implications for the 6 most important forest bird species of Arabuko-Sokoke.

	Mixed		*Brachystegia*		*Cynometra*			Density	Foraging level	Habitat requirements	Management implications
	D	U	D	U	W	I	T				
Sokoke Scops Owl	x	x	x	x	xxx	x	x	7 per km² in tall *Cynometra* (750 birds). 1.2 per km² in intermediate *Cynometra* (250 birds). 3 per km² in white soil *Afzelia-Cynometra* (25 birds).	Mid-level	Tall *Cynometra* Forest with closed canopy. Nest trees unknown but suspected to be *Brachylaena*. Feeds largely on beetles.	No removal of old or dead trees with potential nest holes. No further removal of *Brachylaena*. Limit dead wood removal because of negative effect on beetle abundance.
Sokoke Pipit	x	xxx	x	xxx	x	x	x	79 per km² in disturbed *Brachystegia* (2,450 birds in 31 km²). 19 per km² in disturbed *Brachystegia* (680 birds in 36 km²). Densities in undisturbed mixed forest are probably similar to *Brachystegia.*	Ground-level	Tall forest with good canopy cover and extensive, deep leaf litter. Key factors are densities of ants and termites.	No selective logging: avoid disruption of canopy. No removal of dead wood to maintain good termite populations.
East Coast Akalat	x	x	x	x	xxx	x	x	23 per km² in mixed forest, in parts where it occurs (900 birds in 40 km² of habitat). 37 per km² in northern *Cynometra* woodland (1,200 birds). 81 per km² in southern *Cynometra* woodland (5,300 birds).	Ground and under-storey	Dense forest with high canopy cover and few cut stems; high percent cover at 2 m height. Large amounts of dead wood, especially mossy logs.	No selective logging to avoid disruption of canopy. No pole extraction. No removal of dead wood.
Spotted Ground Thrush	x	xx	x	x	x	x	x	Unknown. Very patchy.	Ground	Dense well-shaded forest with deep leaf litter and patches of tangled stems.	No selective logging: avoid disruption of canopy. No pole extraction.
Amani Sunbird	x	x	x	xxx	x	x	x	37 per km² in *Brachystegia* (ca. 2,800 birds). About 4 times more abundant in undisturbed than in disturbed *Brachystegia.*	Canopy	Tall *Brachystegia* woodland with good canopy cover.	Avoid selective logging of *Brachystegia*.
Clarke's Weaver	x	x	xx	xxx	x	x	x	Unknown.	Canopy and mid-level	*Brachystegia* woodland; less susceptible to habitat alteration than some other species.	Avoid selective logging of *Brachystegia.*
Other forest specialists	xx	xxx	x	xx	xxx	x	x	Unknown.	Various	Extensive high canopy (Little Yellow Flycatcher). High stem density (Olive Sunbird). Extensive middle-level cover (Tiny Greenbul, Crested Flycatcher).	Avoid selective logging. No pole cutting.

D = Disturbed; U = Undisturbed; W = Woodland; I = Intermediate; T = Thicket

near-threatened species (including 5 restricted-range species), and 8 regionally threatened species.

Clarke's Weaver is an endemic while the Sokoke Scops Owl (which is known from only one other site in Tanzania), the Sokoke Pipit and Amani Sunbird are near-endemics. Important populations of the Spotted Ground Thrush and the East Coast Akalat also occur in the Forest.

Most forest birds at Arabuko-Sokoke depend on habitat of a certain structure, unlike other animals (e.g. butterflies) which respond to plant species. This means that disturbance (e.g. from selective logging) that changes forest structure can have a significant impact on these forest birds. The three main forest types differ in their structure with vegetation density decreasing from *Cynometra* > Mixed > *Brachystegia*.

Disturbance differs according to forest type although disturbed Mixed (*Afzelia*) Forest changes least in structure, perhaps because of its greater floristic diversity. The other two types show significant structural change in terms of canopy density and stem numbers as a result of pole and fuelwood removal and logging. Pole removal opens up the understorey and fuelwood removal (including dead wood removal) reduces invertebrate abundance (especially termites and beetles) and removes nest sites for hole- or ground-nesting birds.

Threatened and forest-specialist birds show preferences for particular habitat types. All of the six threatened species show strong reactions to disturbance, and some already have very patchy distributions as a result. Large parts of the forest are probably 'sinks' for particular threatened species; this means that they hold low-density populations which cannot maintain themselves and persist by recruitment from higher-quality habitat nearby. Therefore protection of high-quality habitat is essential for the survival of these species.

Reptiles and amphibians

Arabuko-Sokoke Forest holds at least 41 species of snake, 21 lizards and 2 tortoises. Despite this richness in reptiles, the amphibian fauna includes rarer species: among the 25 amphibian species are Bunty's Dwarf Toad (*Mertensophryne micranotis*), a coastal endemic, and Ornate Tree Frog (*Leptopelis flavomaculatus*), a near-endemic.

Insects and other invertebrates

This group comprises the largest number of species although (with the exception of butterflies) it is the least studied. More than half of the 263 butterfly species known from the Kenyan coast have been recorded in the forest, of which *Acraea matuapa, Charaxes blanda kenyae, Baliochila latimarginata* and *Baliochila stygia* are endemic. Some taxa in the group have potential to be used as ecological indicators, which can complement the information already used for the birds. Dragonflies are also an important invertebrate group which contains a number of rare and unusual species in Arabuko-Sokoke.

3.5 Socio-economics

Local communities

Arabuko-Sokoke Forest is surrounded on all sides by village communities. There are 18 sub-locations with a total population of about 130,000 people extending around the forest including 54 villages actually bordering on the forest and having a population of about 104,000 people. These people are predominantly of the Giriama tribe who settled in the area west of the forest over 100 years ago and moved

Plate 12. Local fishermen use Lake Arabuko, an attractive wetland site in the forest.

on to areas east of the forest in the 1950s and 1960s. Average household size is more than 13, and 55% of the households consist of multiple families. The population density of Kilifi District has risen from 47 to 60 people per km^2 between 1989 and 1997 (Government of Kenya 1997b). The original population of the surrounding area were the hunter-gatherer Sanya tribe. Prior to forest gazettement in 1932, they used the forest freely for their subsistence needs. A small group of Sanya still lives on the northern side of the forest.

Subsistence agriculture is the main occupation of the surrounding population. This is based on production of maize, cassava and beans, with income supplemented by cash crops such as cashew, mango and coconut. Agricultural land is generally poor, and crop yields are low. The mean size of farm holdings is 6.9 ha (0.5 ha per capita), with farms growing an average of 1.6 ha of maize. Most households own goats (average of 5 per household) but tsetse fly and a lack of grazing are constraints to cattle keeping. Many illegal uses of the forest for subsistence or income generation still continue. Forest use includes collection of fuelwood, poles and herbs, and hunting of wildlife for meat. Participatory assessments with local communities indicate that building-poles are perhaps the single most important product used from the forest. Communities on the eastern side of the forest rely on it more heavily than those on the west, because of differences in the availability of trees on private land.

For 20% of households, wage employment provides the major source of income, while additional income is earned from sales of cash crops and forest products. In 1991, 8% of forest-adjacent households earned income from the forest. This included income from legally or illegally obtained forest products, employment as local forest station staff, fuelwood licensees and cutters, woodcarvers and herbalists. More recently, bee-keeping and butterfly-farming have been developed as new income-generating activities which, although based on the forest, are non-destructive. In the past, most cash beneficiaries from the forest were men, although this is changing; for example, more than 70% of registered butterfly farmers are women.

About 35–40% of households are headed by women (absent husbands, widows, divorcees or single women). Women tend to be marginalised in decision making and resource allocation, and undertake a disproportionate burden of work, including fuelwood and water collection.

Secondary forest users outside the immediate forest-adjacent community include carvers working through handicraft co-operatives in Malindi, and, more significantly, illegal cutters of timber, poles and fuelwood.

Pressure on the forest for both subsistence and income needs appears to be increasing. A comparison of 1991 data with a study undertaken in 2000 has shown that fuelwood collection, pole cutting and hunting have all increased. This is despite the current moratorium on issuing licences for fuelwood, and the best attempts at control by the Forest Department and KWS.

Subsistence use of the forest

Subsistence use of Arabuko-Sokoke Forest is long-established, and predates its gazettement as a reserve. At present, most subsistence use is illegal, although in practice it cannot be controlled by regulation alone. Subsistence can be considered in two ways:

- domestic use through direct harvesting for home consumption, mainly of fuelwood, building poles, mushrooms and meat; and
- commercial use through products harvested for sale rather than for domestic consumption (such as carving-wood, poles, butterflies and bush-meat); income from these sources is often critical to the survival of the household.

There has been a tendency for previously domestic usage to become more commercialised. This pushes prices up and over-exploitation results.

Fuelwood

60–90% of the forest-adjacent community use the forest for their supplies of heating, cooking and lighting fuel. This is obtained both legally (through licences) and illegally. Mogaka (1991) showed that people moved up to 1 km into the forest to collect their subsistence needs for fuel, but more recent information from a participatory forest mapping exercise at Dida in 2000 shows that this distance has now increased to more than 2 km. Fuelwood preferences have also altered over the past 10 years, partly in response to diminishing supplies of preferred species.

Table 12. Shifts in the most preferred fuel wood species between 1991–2001.

	Local name	Scientific name
1991	Muhuhu	*Brachylaena huillensis*
	Mfunda	*Cynometra webberi*
	Mkonga	*Balanites wilsoniana*
	Mugurure	*Combretum schumannii*
	Mrihi	*Brachystegia spiciformis*
	Mtsedzi	*Manilkara sulcata*
Source: Mogaka (1991)		
	Local name	**Scientific name**
2001	Mugambo	*Manilkara sansibarensis*
	Mbambakofi	*Afzelia quanzensis*
	Mtandarusi	*Hymenaea verrucosa*
Source: Ndirangu (personal communication, 2001)		

Fuelwood use is location-specific with the communities on the eastern side of the forest relying more heavily on it than on the western side where people have greater access to fuel from their farms.

Grass

Grass is used by farmers through direct livestock grazing, and/or grass-cutting. This is important during the dry season and it is suggested that dairy farmers could maintain the forest boundary and beat boundaries by cutting grass for their animals.

Fruits and vegetables

A range of fruits and vegetables are collected from the forest. These are eaten as snacks, which are important dietary supplements, particularly during lean food times. In 1991 no fruits were being sold outside the area, but, by 2000, fruit from Arabuko-Sokoke was being sold as far away as Kongowea Market in Mombasa. The forest also has many vegetables which forest-adjacent communities

Table 13. Common fruits and vegetables of Arabuko-Sokoke Forest.

Fruits Local name	Scientific name	
Pepeta	*Dialium orientale*	
Mango		
Tsedzi	*Manilkara sulcata*	
Matongazi	*Ancylobothrys petersiana*	
Pudu/Fudu		
Vitoria	*Vitex ferruginea*	
Vitoria	*Landolphia kirkii*	
Ngambo	*Manilkara sansibarensis*	
Virori		
Vipo		
Mkwaju	*Tamarindus indica*	
Mudungatundu	*Flacourtia indica*	
Mtundukula	*Ximenia americana*	
Murori	*Uvaria acuminata*	
Madzada	*Uvaria lucida*	
Mungambo (Ka-pehe)	*Mimusops fruticosa*	
Mbugu Bafe	*Strychnos panganiensis*	
Mkone	*Grewia plagiophylla*	
Kitsapu	*Encephalartos hildebrandtii*	
Mudzipo	*Salacia madagascariensis*	
Mudziponzala	*Salacia elegans*	
Vegetables Local name	Scientific name	Seasonality
Thalakushe	*Tridax mulensis*	All year round
Mutsunga	*Asthesia sp.*	All year round
Kikosho		All year round
Munavu		All year round
Kadera		All year round
Kidemu		All year round
Logatsi		Rain Season
Kimbiri		
Mbuyu	*Adansonia digitata*	
Budzi		
Mwangani		
Mahako Gaazhere		
Vitoria	*Ladorphia kirkii*	
Virunji	*Nymphaea caerulea*	
Mkwaju	*Tamarindus indica*	

harvest for food. Some of these may also have potential to be domesticated.

Medicinal plants

Lukando (1991) identified 80 medicinal plants used in Arabuko-Sokoke Forest and estimated that there were 219 herbalists working around the area. Use of medicinal plants from the forest is becoming increasingly commercialised, with plants now being collected for sale in herbal clinics in Nairobi and other urban centres.

Poles

Poles are an important forest product used by the communities to build houses and sheds. They are mostly obtained from the forest. Alternatives such as *Casuarina* are suitable for roofing but not for the walls where they tend to rot. The licence system for poles used to operate through licensed individuals who were often urban-based. This system encouraged the local communities to cut poles illegally. Under a moratorium introduced in 2000, such licensing was suspended. It is anticipated that pole-wood extraction will resume under the framework of Participatory Forest Management and therefore benefit the communities directly and legally.

Table 14. Preferred species for poles.

Local name	Scientific name
Mutsedzi	*Manilkara sulcata*
Muhuhu	*Brachylaena huillensis*
Mkone	*Grewia plagiophylla*
Mtandarusi	*Hymenaea verrucosa*
Mgurure	*Combretum schumannii*
Mgambo	*Manilkara sansibarensis*

Wood-carving

Wood-carving is an income-generating activity which began in Arabuko-Sokoke in the 1950s and expanded greatly in the 60s and 70s. The Kamba community used to carve the parts of trees that were not suitable as timber. With the intensified patrolling that began in the 1990s, they have changed their approach: they now train local people to prepare unfinished masks which are then completed by the experienced carvers in Malindi. This strategy has contributed to the livelihoods of the local people, but has also increased pressure on the forest.

Table 15. Indigenous wood-carving trees.

Local name	Scientific name
Muhuhu	*Brachylaena huillensis*
Mbirandu	*Oldfieldia somalensis*
Mguruwe	*Combretum schumannii*
Mfunda	*Cynometra webberi*
Source: Ndirangu (personal communication, 2001)	

Timber

The timber used for subsistence is obtained from the forest illegally. This applies to both domestic use and (in small quantities) for sale to urban-based furniture, construction and tourism industries.

Honey

There are very few traditional honey gatherers in the forest. The positioning of 'Kenya top bar' hives inside the forest has been affected by security concerns. In the Participatory Forest Management site near Kafitsoni, five beehives have been sited in the forest. Now that bee-keepers' user groups have been formed, these security issues will be resolved.

A recent study indicated that hives in the Arabuko-Sokoke area have a mean productivity of 4.7 kg per hive per year, although this is highly variable. About 500 hives were maintained by bee-keepers supported by the ASFCMP in 2001. Assuming that two-thirds of these hives are productive, about 330 hives were productive. Other hives maintained by traditional bee-keepers add a total of about 50 traditional log-hives.

Butterflies

Butterfly farming is the most successful income-generating activity around Arabuko-Sokoke Forest. Farmers produce pupae from flying cages located in forest-adjacent villages, and sell these to the Kipepeo Project in Gede for export.

Table 16. Butterfly production at Arabuko-Sokoke Forest.

Kipepeo export earnings 1994–2000								
Year	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**Totals**
No. of pupae	10,262	12,593	18,807	21,823	21,390	54,939	56,023	19,5837
US$ earned	15,888	18,286	27,163	41,378	39,397	105,289	103,659	351,060
Community earnings from pupae sales 1994–2000								
Year	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**Totals**
No. of pupae	4,315	7,458	11,408	15,594	17,182	36,277	56,023	148,257
KSh earned	263,828	329,905	538,216	780,480	882,371	2,726,928	2,806,415	8,328,143

Mushrooms

Nine species of mushrooms are eaten by forest-adjacent communities, but these are too perishable to allow commercial exploitation.

Bush-meat

Mogaka (1991) estimated the total number of small mammals trapped annually to be about 576,450, with a cash value for meat of about KSh 807,000. Patrol teams now report a rise in the number of traps laid by poachers, but that fewer animals are being caught, suggesting that small mammals are becoming scarce. Reported sightings of antelopes are also declining. Animal traps can be found right in the heart of the forest. However, the largest forest animals such as elephant and buffalo are not hunted for meat.

Table 17. Animals hunted for meat in Arabuko-Sokoke Forest.

Local name	Common name	Scientific name
Udzora/Tali	Spiny Mouse	*Acomys dimidiatus*
	Wild Cat	*Felis (sylvestris) libyca*
Yonda/Nyani	Yellow Baboon	*Papio cynocephalus*
Nguruwe	Bush Pig	*Potamochoerus porcus*
Nugu	Crested Porcupine	*Hystrix cristata*
Sungura	Cape Hare	*Lepus capensis*
	Mongoose (various sp.)	*Herpestes* spp.
Panya/Kuhe	Giant Pouched Rat	*Cricetomys gambianus*
Kima/Tsala	Sykes' Monkey	*Cercopithecus albogularis*
Pala	Duiker	*Cephalophus* spp.
Fugu	Golden-rumped Elephant Shrew	*Rhynchocyon chrysopygus*
Fungo	African Civet	*Viverra civetta*
Paa	Suni	*Neotragus moschatus*
Tsanje	Four-toed Elephant Shrew	*Petrodromus tetradactylus*
Kulungu	Waterbuck	*Kobus ellipsiprymnus*

Sources: Mogaka (1991), Alex Mwalimu (personal communication 2001)

Table 18. Some edible birds of Arabuko-Sokoke Forest.

Local name	Common name	Scientific name
Bata Maji	White-faced Whistling Duck	*Dendrocygna viduata*
Kanga	Helmeted Guineafowl	*Numida meleagris*
Karengenze	Crested Francolin	*Francolinus sephaena*
Giya	Red-eyed Dove	*Streptopelia semitorquata*
Puji	Tambourine Dove	*Turtur tympanistria*
Msanya Randu	Yellowbill	*Ceuthmochares aereus*
Mwasaku	Common Bulbul	*Pycnonotus barbatus*
Mwambeyu	Black-headed Tchagra	*Tchagra senegala*
Kolobilo	Black-headed Oriole	*Oriolus larvatus*
Kozi	Black-bellied Starling	*Lamprotornis corruscus*

Source: Alex Mwalimu (personal communication 2001)

Socio-economic changes and perceptions of the forest, 1991–2001

In 1991, a socio-economic study showed that:

- annual income was usually KSh 5–10,000
- poorer households earned mainly from hunting
- mean annual income per capita was KSh 1,470
- 96.6% of the households around the forest were headed by men, with an average family size of 13.05 persons
- farm size averaged 4.8 ha, and
- although there were no *Kayas* (sacred forests) in ASF, the forest had cultural value for the making of *Koma* (a human statue curved from a log to represent a dead relative) and *Kigongo* (a human statue that represented a prominent relative who could have been a herbalist or traditional doctor).

Also in 1991, many local people thought that the forest should be given up for settlement: 41,763 ha of forest could settle at least 7,585 farmers. This was especially the view of the people to the south (Ngerenyi) and east (Roka-Matsangoni), where land pressure was already high. The *Sanya* people wanted to go back to the forest for hunting and gathering as they had done before. An annual review of forest product prices resulted in increased illegal activities including corruption, and local people preferred to bribe or compromise Forest Guards in order to collect fuelwood. Instead of paying for the monthly fuelwood licence of KSh 30, they paid KSh 5–20. This led to unsustainable and uncontrolled exploitation of the forest. Local people also wanted a ban on the issue of licenses to outsiders for poles and fuelwood, so that they themselves could control the removal and use of such products.

An economic evaluation (Contingent Valuation Method) was conducted in 2001, covering 322 persons (0.48% of the population), targeting forest-adjacent dwellers or the forest community who have a traditional association with the forest in relation to their livelihood, culture or religion (Wandago 2001). This revealed significant changes in perceptions and attitudes since 1991. The forest is still referred to as *foro* (belonging to the forest people or the government), but local people are better aware of their rights to use resources. In 2001, most people interviewed still saw the forest as a liability because of losses from animal damage without compensation.

Other observations were that:

- fuelwood is not in short supply; most farms have plenty of dry mango, cashew and coconut waste for cooking, while others rely on trust land for their needs;

- rural development priorities were provision of hospitals, schools and water;
- clearing the entire forest and converting it to agriculture cannot solve the land problem;
- newly-formed associations like FADA, DIFAAFA are useful, but they should be independent of the provincial administration and change their approach in recruiting new members;
- bee-keeping and butterfly-farming are ranked high as revenue sources for locals;
- poverty and malnutrition are common among the forest community, but highly nutritious local foods exist; and
- sanitation is a problem: most people use the forest as a toilet, yet most fresh water wells are in the forest, raising the risk of water-borne disease.

3.6 Forest resources

History

Prior to the 20th century, Arabuko-Sokoke Forest was much more extensive than it now is. It provided a range of locally important forest products for trade including timber, gum copal and for musk (from civets). The forest was also used for a variety of traditional subsistence uses, such as hunting and other foods, mainly by the *Sanya*, who were a forest-dwelling tribe of hunter-gatherers.

After the 1920s, Swedish and other European timber merchants arrived, and began to remove commercially viable timber—particularly *Afzelia quanzensis* and *Brachylaena huillensis*—thereby creating employment and opportunities which resulted in an influx of people. Greater populations put greater pressure on the land, and areas were cleared for agricultural settlements and for sisal and cashew plantations. Quarrying for sand also began. Increasing populations in the coastal towns of Malindi and Mombasa provided an expanding market for timber, poles and fuelwood, which exacerbated the pressures. The demand for building materials for the hotel and tourism industry has added to this.

With the increase in logging and pressure on the forest, concern over the status of the forest arose and Arabuko-Sokoke was proclaimed a Crown Forest in 1932 and was gazetted in 1943 covering an area of 39,100 ha. In the 1960s part of the forest covering 4,300 ha was again gazetted as a Strict Nature Reserve by the Forest Department. All forestry-related activities were terminated within the Nature Reserve in an effort to conserve biodiversity and provide data on tree regeneration. In 1968, the Kararacha extension was added totalling 2,700 ha. This extended the forest as far as the coast at Mida Creek and increased the range of key habitats available.

Forest condition

A forest inventory was carried out in 1991 (Blackett 1994). The results are summarised in Table 19, according to the three main forest types, along with those of another inventory was completed under the ASFMCP during 2000–01 (Muchiri *et al.* 2001).

It is difficult to compare the results from the two inventories because the parameters being used are not the same. In general, all the forest types have low basal area and growing stock, indicating that forest condition is generally poor. This is probably due to several decades of commercial logging and subsistence use. Regeneration is adequate overall. However another study (Omenda 2001) has shown that although overall figures for regeneration are high, certain species do not appear to be regenerating well; these include *Afzelia* and *Brachylaena*. This has given some cause for concern for the future of the forest in terms of species composition.

Commercial volume is calculated in both inventories by applying volume formulae to the growing stock. However, local volume tables for the main species concerned do not exist, and the equations used are general ones derived from elsewhere and may not be particularly accurate. Although Muchiri *et al.* (2001) does not attempt to calculate commercial volumes, Blackett (1994) estimated very low commercial volume figures (based on stems > 50 cm diameter at breast height, dbh). These were from zero in *Cynometra* Forest, 3.5m^3/ha in Mixed Forest, and 8.6m^3/ha in *Brachystegia* Forest. This indicates that there is effectively no commercial potential for timber harvesting in the forest.

Table 19. Statistics on forest area and condition 1991–2001 (nd = no data).

Forest type	Area (ha) [A]	Basal area (m^2/ha) [B]	Growing stock (m^3/ha) [C]	Regeneration (per ha) [D]	Stocking (stems/ha) [E]
Blackett 1994					
Cynometra Forest	23,600	5.4	115	nd	nd
Brachystegia Forest	7,700	9.5	93	nd	nd
Mixed Forest	6,300	7.5	104	nd	nd
Muchiri *et al.* 2001					
Cynometra Forest	23,600	12.4	151	16,665	437
Brachystegia Forest	7,700	16.0	134	11,941	233
Mixed Forest	6,300	24.9	159	8,584	342

Notes:
A. Area of each forest type is the same for both inventories. An additional area of about 4,000 ha includes undifferentiated scrub plus plantations.
B. Blackett calculates basal area for trees > 20 cm dbh; Muchiri for trees > 5cm dbh.
C. Both Blackett and Muchiri calculate growing stock for all trees > 5cm dbh.
D. Blackett does not calculate this. Muchiri figure includes seedlings plus saplings.
E. Blackett does not calculate this. Muchiri figure is for all stems > 5cm dbh.

Yield estimates are difficult due to the absence of growth information about these forest types and the main constituent species. Blackett (1994) calculates projected yields based on an increment of 1% of the growing stock, giving an average of 39,000 m^3 per year for the whole forest, of which most would be in the form of fuelwood.

Natural regeneration

Omenda (2000) assessed natural regeneration for two of the key tree species: *Brachylaena huillensis* and *Brachystegia spiciformis*.

Brachylaena huillensis

Results

- The forest structure of *Cynometra* thicket and *Cynometra-Manilkara-Brachylaena* shows a history of disturbance, particularly with regard to *B. huillensis*.

Table 20. Species representation in canopy strata of *Cynometra* Forest.

Species name	Stem numbers per hectare: Upper storey > 12 m		Middle storey 3.9–7.9 m		Lower storey < 3.9 m		Total	
Cynometra webberi	260	74%	528	74%	0	0 %	788	74%
Manilkara sulcata	28	8 %	120	17%	0	0 %	148	14%
Brachylaena huillensis	56	16 %	8	1%	0	0 %	64	6%
Combretum volkensii	4	1 %	24	3%	0	0 %	28	3%
*Others	4	1 %	36	5%	0	0 %	40	4%
Total	352		716		0		1068	

* *Strychnos madagascariensis, Ochna thomasiana, Haplocoelum inoploeum, Psydrax faulknerae.* Top height 12.0 m.

Table 21. Species representation in canopy strata of the *Cynometra* thicket.

Species name	Upper storey > 9.4 m		Middle storey 3.1–6.3 m		Lower storey < 3.1 m		Total	
Cynometra webberi	517	52 %	1776	44 %	11	69 %	2304	46 %
Combretum volkensii	130	13 %	1301	32 %	0	0 %	1431	28 %
Manilkara sulcata	80	8 %	416	10 %	5	31 %	501	10 %
Brachylaena huillensis	160	16 %	106	3 %	0	0 %	266	5 %
Strychnos madagascariensis	53	5 %	256	6 %	0	0 %	309	6 %
*Others	59	6 %	181	5 %	0	0 %	240	5 %
Total	999		4036		16		5051	

* *Strychnos madagascariensis, Ochna thomasiana, Haplocoelum inoploeum, Psydrax faulknerae.*

- *B. huillensis* is disproportionately well represented in the lower size class (for dbh < 5 cm) with very few reproductive stage mature trees.
- Overall, latent regeneration of *B. huillensis* is lower than is necessary to perpetuate the species into the mature stages in the long term.
- There is lower representation in the smaller seedling size class, which is contrary to the norm.

As would be expected, the majority of the dominant and co-dominant crown class trees are of *Manilkara sulcata, Cynometra webberi* and *B. huillensis.* In this dominant crown class, *B. huillensis* accounts for around 16% of the upper storey stems but only 5–6 % of the total in both forest types.

Another factor that may compound the situation is poor seed dispersal in *B. huillensis*: up to 98% of seed lands within 14 m of the parent tree. Furthermore, the species has heavy pre-dispersal predation by insects: 10–20% of viable seeds at time of dispersal and only about 2% of dispersal seed capable of germinating.

Management implications for *Brachylaena*

- There is a need to understand the reproductive cycles of the species and the ideal sex ratio in a forest.
- Mature reproductive trees (seed bearers) must be protected, otherwise there will be a shortage of seed for regeneration.
- Adequate populations at all stages of development should be selected and protected to ensure a more stable population structure.
- Outside the natural forest, the species should be planted in an admixture with other species, as height performance and form are both undermined when raised in a monoculture.

Brachystegia spiciformis

Results

- The forest structure of *B. spiciformis* woodland shows signs of past disturbances.
- *B. spiciformis* species is the dominant upper storey species in a loose association with a few other co-dominant species.
- Latent regeneration of *B. spiciformis* is extremely low: little regeneration is taking place.
- Specific environmental factors seem to be decisive in triggering germination and thus also regeneration; the critical factor is likely to be light.
- Dense over-storey by any species or group of species appears to inhibit germination and regeneration of *B. spiciformis*; this implies that some canopy opening

Table 22. Species representation in the various canopy strata within *Brachystegia* woodland.

Species name	Stem numbers per hectare: Upper storey > 24 m		Middle storey 8–16 m		Lower storey < 8 m		Total	
Brachystegia spiciformis	54	52%	17	13%	5	2%	76	15%
Hymenaea verrucosa	20	19%	16	12%	3	1%	39	8%
Unidentified	14	13%	25	19%	40	15%	79	16%
Ximenia americana	0		16	12%	32	12%	48	10%
Psydrax faulknarae	0		3	2%	31	12%	34	7%
Others *	15	14%	38	29%	139	52 %	192	38%
Total	103		131		266		468	

* *Lannea stuhmanii, Cassipourea euriyoides, Phyllanthus* sp., *Maytenus undata, Grewia plagiophylla, Margaritiana* sp., *Boscia angustifolia, Strychnos madagascariensis, Haplocoelum inoploeum, Rinorea squamosa, Lannea welwetschii, Mimusops fructicosa, Flacourtia indica.* Top Height: 24 m.

and disturbance may encourage this species to regenerate.

- Height and diameter figures indicate that the population/age structure of *B. spiciformis* is not ideal for a mature undisturbed forest.

3.7 Eco-tourism

Eco-tourism trends

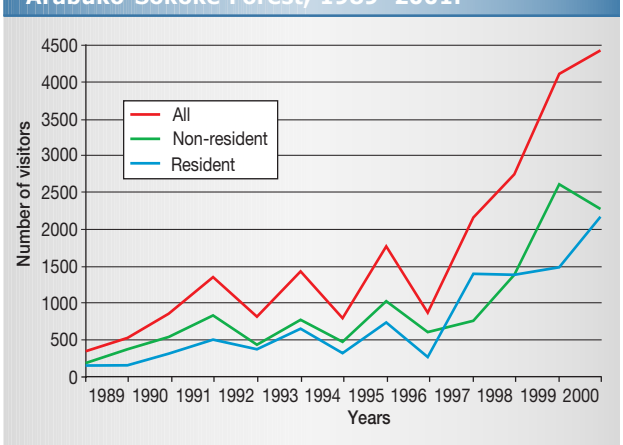
Arabuko-Sokoke Forest has achieved a reputation as one of Africa's most remarkable forests for birds. Increasingly it is reported in journals and magazines, and it is rapidly gaining a position where anyone who has an interest in birds and who is holidaying in Kenya will wish to visit it.

The forest has attracted tourists since at least the early 1970s. The number has increased only slowly because of a lack of serious marketing to tourists. However, specialist birdwatching tours already visit and the number of such visits is increasing. Birdwatching is a rapidly growing leisure activity in the west, and the large potential market created by the forest's unique bird fauna can be tapped further. Many birdwatching tours to East Africa include Arabuko-Sokoke on their itinerary, and other birdwatchers visit the forest as individual enthusiasts, because of what they have heard from friends and read in journals or other publications.

On the ground, the Arabuko-Sokoke Forest Guides Association (ASFGA) supplies forest guides to such groups. ASFGA is gaining increasing recognition from foreign birdwatchers, helping the association to market forest birdwatching activity internationally.

Recognition of the importance of environmental awareness amongst tourists is growing. Private tour operations, environmental organisations, local communities, professional associations and even airlines play an increasingly important role in educating visitors. There is a growing body of information about the forest in the local hotels of Malindi and Watamu, and these hotels have been organising forest excursions for some of their visitors, mostly for the specific purpose of birdwatching. Hemingway's, Turtle Bay Beach Club and Ocean Sports have all arranged for tourists to visit the forest.

Figure 2. Numbers of eco-tourists visiting Arabuko-Sokoke Forest, 1989–2001.



Fortunately Arabuko-Sokoke is one of the safest forests in Kenya, and visitors can walk without fear of being injured by wild animals or harassed by bandits. Members of the local community also pass through the forest without problems.

Visitor facilities

Information and Education Centre

The Information and Education Centre at Gede Forest Station is managed by KWS personnel. From here, guides to the forest can be arranged through ASFGA on payment of a small fee. In addition, there is equipment available (binoculars, telescopes), as well as interpretation displays about the forest and its wildlife.

Self-guided trails

Visitors can follow several trails of varying length on foot at their own pace. Brochures from the Information and Education Centre show routes and features of interest. These ensure that there is minimal disturbance from tourists, and that visitors can confidently find their own way in the forest. Additional trails have been designated as running routes.

Visitor accommodation

There is no permanent accommodation for visitors in the forest at present, although a small campsite has been established at Gede, for which visitors need to bring their own tents and camping equipment. Hotel accommodation is available at the nearby resorts of Malindi and Watamu, and transport from these locations to the forest can be easily arranged.

Tree house and observation points

A tree platform at the old sand quarry (near Gede) is popular with visitors. This can provide overnight accommodation (camping) for birdwatchers who wish to be in the forest at dusk and in the early morning. The centre of the forest has a viewing point at Nyari Cliffs, which can be reached by vehicle.

Driving trail

There is a 63 km of driving trail in the forest. Drives are possible from the southern area at Kararacha up to the Nyari Cliffs viewpoint. Visitors can use four wheel drive vehicles, particularly during the dry season when the sandy soils are soft.

Revenue collection

Entrance to the forest is presently free for all visitors. However, surveys have shown that price is a relatively unimportant factor when choosing an eco-tour, and that even when price is a concern tourists are willing to pay if they know that the fees are being used to enhance their experience or conserve the special area they have come to see. In a recent study undertaken at the Information and Education Centre, about 95% of tourists questioned indicated that they would not have cancelled their trip if there were entrance fees pegged at US$ 5 for non residents or KSh 100 for residents. This willingness to pay has also been demonstrated by the ASFGA who have been collecting guiding fees from the visitors.

For entry into the forest, there are effectively 3 gates: at Sokoke Station, Kararacha and Gede Station. There is

potential at these points to establish other tourism-related activities such as handicraft shops and kiosks to bring some benefits to local communities.

3.8 Economic evaluations

Two economic evaluations of Arabuko-Sokoke Forest have been carried out recently, by Emerton (1992) and Wandango (2001).

Emerton calculated the Net Present Value (NPV) of the forest under three different future options taking into consideration management costs.

1. A continuation of the (then) prevailing management regime. This yielded a NPV of KSh 38 million in 1992 (equivalent to KSh 368 million in 2001, using a real interest rate of 6.2%).
2. A strategy of conservation and sustainable development through KIFCON intervention. This gave an additional NPV of KSh 134 million, making a total of KSh 172 million (equivalent to KSh 1.6 billion in 2001)
3. To clear fell the entire forest and convert it to the prevailing smallholder agricultural system. This yielded a NPV of KSh 170 million (equivalent to KSh 1.6 billion in 2001)

These figures assumed that substantial revenues from sustainable utilisation under the second option would come from plantation development and eco-tourism. However, in practice, neither of these yielded any significant revenues in the nine years since the valuation. The NPV in the first option is far less than that of the third—and even with conservation interventions a conversion to agriculture still seems better. Option and existence values were ignored, as they were considered unquantifiable with the data available at that time.

Direct-use value

The direct-use value of an indigenous forest comprises the total value of all direct uses including wood and non-wood products (NTFPs), and non-extractive activities such as recreation, education and habitation.

For wood, data from the recently concluded inventory (Muchiri *et al.* 2001) are used. Although the information contained in this is sufficient for this exercise, the projected yield estimates are somewhat unreliable because they assumed a mean annual increment of 0.5% of the total volume in the absence of any growth data. For Arabuko-Sokoke a lesser figure taking into consideration the unmanaged nature of the forest, its condition, and site quality would be implied. Therefore a figure of 0.2% of the volume has been assumed to be a better estimate of the Mean Annual Increment.

Summary of the 2001 study of the Forest-adjacent community

- Forest products (apart from timber) mentioned include poles, fuelwood, honey, butterflies, medicines, water, fruits, vegetables, habitat, rain and mushrooms. Most of these products are for local consumption and not for sale so estimation of quantities removed and their costs was not easy. On average an individual can earn about Ksh 16,000 per annum.
- The agro-economy is sustained by settled mixed farming. The main cash crops grown are: coconut, pineapple, cashew nut, banana, citrus, mango, and pawpaw. These are normally intercropped with food crops including maize, cowpea, green pea, cassava, pigeon pea and beans.
- Average farm size 3.9 ha (range 0.2–20 ha).
- Annual income KSh 500–166,440 (mean KSh 27,000).
- Male:female ratio 1:1.08; over 95% of homes visited were male-headed.
- Average household size 7.03
- Per capita income KSh 3,863 per annum.

Table 23. Projected yields (m^3/yr) of wood products from Arabuko-Sokoke Forest.

Produce	*Cynometra* Forest (m^3)	*Brachystegia* Forest (m^3)	Mixed Forest (m^3)	Total (m^3)
Sawlogs	4,410	2,248	1,915	8,574
Poles/fuel wood	4,248	4,758	5,468	14,475
Total	8,658	7,007	7,483	23,049

The value of the total available production (23,049 m^3 per annum) is obtained by multiplying this by current prices. These can be calculated from known volumes of commercial indigenous species. For saw logs the price range is from KSh 1,982–4,681 per m^3, with a mean price of KSh 3,515 per m^3. For poles, stacked wood prices for fuelwood can be used, giving KSh 77 per m^3.

Table 24. Value of wood products in KSh per annum.

Produce	Volume	Price (KSh per m^3)	Total KSh
Saw logs	8,574	3,519	30,135,895
Poles/fuel wood	14,475	77	1,114,590
Total			31,250,485

If the forest is harvested sustainably with only the Mean Annual Increment being removed each year, more than KSh 31 million would be realised annually.

NTFPs form the second set of products from the forest. Surveys indicate that subsistence use of these appears to be increasing, although most is carried out illegally. Most respondents were only able to state what they collected, but could not quantify it or place a market value on the products.

Butterfly farming and bee-keeping are examples of NTFP business enterprises and conservation projects that have potential for future expansion. An individual can earn up to KSh 16,000 per year from these, giving potential earnings from the whole forest as slightly over KSh 1 billion per year. The sustainability of these activities needs continuing assessment, and much needs to be done on pricing, marketing and quantification of the products.

The third direct benefit is recreation. Preliminary results of a 'willingness to pay' estimate for conserving forests for recreation gives KSh 964 per person. This therefore implies that the whole forest has a recreational value of approximately KSh 65 million for local people.

The total direct use value of the forest is therefore approximately KSh 1.2 billion per annum. Based on the standing stock data, the capital stock value of the forest is about KSh 17 billion. Addition of flora and fauna would increase this value further.

Indirect-use value

The indirect-use value refers to the environmental goods and services that forests provide, including:

- carbon storage or sink function,
- reduced air pollution,
- water catchment areas,
- nutrient cycling, and
- regulation of microclimate.

Forest destruction and degradation implies loss of many of these environmental benefits, although this would depend on the subsequent alternative land use. Forests provide long-lived storage sinks in the carbon cycle, by tying up carbon in wood and soil and accumulating it for hundreds of years before returning it to the atmosphere by respiration, decomposition, erosion or burning. It has been estimated by Wandago (2001) that Arabuko-Sokoke Forest has potential for storing carbon worth KSh 12.2 billion

Option and existence value

Non-use values are difficult to estimate because in most cases they are not reflected in people's behaviour and are unobservable. The non-use values of a forest are made up of both option and existence values.

Option value is the value people put on conserving a forest for future uses which are not carried out now, but where future opportunities would be forgone if the forests were to be destroyed today. This value is additional to the direct use values. For ASF, using the mean values of compensation to locals (KSh 1,400,852) and the population figures (67,622) the product of the two gives a value of about to KSh 94.67 billion. Adding this value to the direct use value (KSh 1.2 billion) then ASF has an option value of KSh 95.87 billion.

Existence value relates to the intrinsic worth of the forest, regardless of its actual use. It is the value people derive from knowing that a forest exists, even if they never visit it. It includes cultural, aesthetic, heritage and bequest values. This value category can be estimated by deducting people's use value from their total 'willingness to pay' for conservation.

Using the figures obtained from the survey the total 'willingness to pay' for the conservation of ASF is KSh 1.87 billion. The direct use value was KSh 1.1 billion, so the existence value is the difference between the two: KSh 670 million.

Comparison of forest conservation with agriculture

Current data show that a farmer can earn KSh 10,007 per ha annually from crops and KSh 14,867 per ha from animals, giving a total of KSh 24,874 per ha. If the whole of ASF (41,763 ha) were converted to agriculture, the potential earnings would be about KSh 1 billion per annum.

This value can be added to the value of timber sold when the whole forest is cleared, giving an opportunity cost of KSh 16.089 billion. This figure is part of the conservation costs. Another benefit would be lack of crop damage by wild animals if the forest were cleared but there would be no indirect, option or existence values in this case.

3.9 Physical geography

Climate

Rainfall is the most important climatic factor, which, together with soil type, determines the type of vegetation in each zone. Rainfall is bimodal in pattern, beginning in April with the advent of the monsoon which ends in June, with a second period of rainfall during November and December. January and February are the driest months. The annual average rainfall varies from less than 600 mm in the north-west part of the forest to over 1000 mm at Gede in the east.

Temperatures remain high for most of the year with a daily mean of 25° C, varying little from month to month, although March is usually the hottest month. Humidity remains high all year because of the proximity of the Indian Ocean.

Topography

The eastern part of the forest lies on a flat coastal plain at an altitude of about 45 m. The remainder is plateau which begins its rise along a line running roughly SW–NE through the centre of the forest. The plateau reaches a height of 60–135 m above sea level.

Geology, soils and water resources

The coastal plain is characterised by deep, loose, coarse sands and coral rags. These are largely infertile soils, although well drained. The plateau consists of underlying Jurassic sediments and has very characteristic red Magarini soils, which are deep and heavily leached. The dividing line between these two soil types is very distinct and is also marked by a series of seasonal pools at the base of the plateau, which disappear during the dry season. There are no perennial rivers or streams within the forest. The dividing line between these soils is reflected in a sharp vegetation change from *Cynometra* Forest on the red soils to *Brachystegia* Forest on the sands.

Plate 13. The boundary between the white sands and coral rags of the coastal strip, and the red 'Magarini' soil inland, is abrupt, and often corresponds with the transition from *Brachystegia* Forest to *Cynometra* Forest.

Part 4. Annexes

Annex 1. Important documents consulted

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Annex 2. Organisations and individuals involved in the planning process

	Name	Designation	Organisation*	Workshops attended**
1	Mr Stanley Baya	ASSETS coordinator	A Rocha Kenya	11
2	Ms Jacque Kaye	A Rocha volunteer	A Rocha Kenya	11
3	Mr Colin Jackson	Director, A Rocha Kenya	A Rocha Kenya, FoASF	1, 2, 4, 9, 10, 11
4	Mr Alex Mwalimu	Chairman	ASFGA	1,2, 4, 6, 9, 10, 11
5	Mr Willy Kombe	Guide	ASFGA	8
6	Mr Tsofa Mweni	Education officer	ASFMCP	1–11
7	Mr Roland Bahari	Extension officer	ASFMCP	3, 10
8	Mr Samuel Katoi	Extension officer	ASFMCP	3, 10
9	Mr Rashid Munga	Extension officer	ASFMCP	3, 10,
10	Mr Edger Mshelle	Extension officer	ASFMCP	3, 10
11	Mr Joram Kagombe	Forest Management Co-ordinator	ASFMCP	1–11
12	Mr Peter Branney	Forestry Consultant	ASFMCP	2, 3
13	Dr Ian Gordon	Project Co-ordinator	ASFMCP	1–9, 11
14	Mrs Susan Mlamba	Project management assistant	ASFMCP	1–11
15	Mr James Mathenge	Project Volunteer	ASFMCP	1–11
16	Mr David Ngala	Monitoring assistant	ASFMCP	6, 9
17	Miss Maria Fungomeri	Project Volunteer	ASFMCP	10, 11
18	Mr E. Mwamuye	Project Volunteer	ASFMCP	10, 11
19	Mr Suleiman Bakari	Representative	FADA	5
20	Dr Roger Safford	Representative	BirdLife International	1
21	Dr Gary Allport	Representative	BirdLife International	1
22	Mr Charles Mkale	Chairman	CWCG	4,
23	Mr Bakari George	Secretary	CWCG	11
24	Mrs Peris Shida	Chairwoman	Dida VDC	6, 7, 8, 9
25	Mr Richard Wambua	Chairman	DIFAAFA	6, 7, 8, 9, 11
26	Mrs Beatrice Charo	Member	DIFAAFA	6, 9
27	Mr Josiel Ferneli	Member	DIFAAFA	7
28	Mrs Lydia Benjamin	Member	DIFAAFA	7
29	Mrs Alice Kasika	Member	DIFAAFA	6, 9
30	Mr Douglas Barawa	Secretary	DIFAAFA	1, 2, 6–11
31	Mr Athuman Mamu	Chairman	FADA	2–11
32	Mr Silas Mweri	Chairman	FADA	1
33	Mr Julius Katana	Secretary	FADA	2–11
34	Mr Dickson Kalama	Treasurer	FADA	4, 6, 7, 8, 9
35	Ms Sarah Kamango	Asst. Treasurer	FADA	5
36	Mr Suleiman Bakari	Representative, Mida	FADA	5
37	Mr Charo Ngubao	Kipepeo farmer	Farmer	3
38	Mr Lucas Chengo	Forest Guard	FD	8
39	Mr Kahuki	Asst. Chief Conservator of Forests, Natural forest	FD	4, 5
40	Mr Kennedy Jumba	Assistant Forester, Gede	FD	9
41	Mr F. Muchiri	DFO Kilifi	FD	1–11
42	Mr B. Kivyatu	DFO, Malindi	FD	1–11
43	Mr Charles Ndirangu	Forest Assistant, Gede	FD	3, 7
44	Mr Mona Lewa	Forest guard	FD	6, 9
45	Mr Saidi Ruwa	Forest guard	FD	6, 9
46	Mr Kahindi Mwaro	Forest guard	FD	6, 9
47	Mr Evans Jefwa	Forest guard	FD	6, 8, 9
48	Mr Lenox Chome	Forest guard	FD	6, 9
49	Mr Wanyiri	Forest Plantations	FD	7
50	Mr Mangee	Forester, Gede	FD	1, 4, 5
51	Mr S. Mwangi	Forester, Gede station	FD	2, 3, 6–11
52	Mr W. Mwamela	Forester, Jilore station	FD	1–11
53	Mr C. Mwakoro	Forester, Sokoke station	FD	1–11
54	Mr J.K. Ndambiri	Management Plan section	FD	7, 8, 10, 11
55	Mr Samuel Mureithi	MOU secretariat	FD	1, 2, 3, 4, 5,
56	Mr E. Kanyanya	MOU secretariat	FD	6, 7, 8, 9
57	Mr D.O. Otieno	Forest Engineer	FD	7, 8
58	Mr M.W. Muniu	Natural Forest Cons. HQ	FD	6–11
59	Mr D.G. Nderitu	PFO Coast	FD	1, 3, 6, 7–11
60	Mr D.M. Mbithi	Senior Conservator of Forest, HQ	FD	2, 3,
61	Mr Lukem Njuguna	Senior Conservator of Forest, HQ	FD	6
62	Mr D.K. Mbugua	Deputy Chief Conservator of Forest	FD	6, 9
63	Mr Ngunjiri	FD HQ	FD	10
64	Mr Kaleb Mwendwa	National coordinator	FFNRCP	7–11
65	Dr Mariella Sandini	Project manager, Alisei	FFNRCP	6, 9
66	Mr Joseph Mwango'mbe	Community adviser	FFNRCP	10, 11
67	Mr Jonathan Baya	Representative, FOAS	FOASF	4
68	Ms Sally Crook	Secretary, FOAS/ Kipepeo	FOASF	7, 10, 11
69	Mr H.N. Wanderi	Chairman, Malindi & Watamu Sub-region	KAHKC	4
70	Mr Kaleb Mwendwa	Ag. Centre Director	KEFRI	1–9
71	Dr B. Kigomo	Deputy Director	KEFRI	6, 9
72	Mr Kimani	Forester, Coast	KEFRI	1, 2, 10
73	Mr Joseph Muthini	Forester, Gede	KEFRI	9
74	Mr P. Ongugo	NPC Natural Forest, HQ	KEFRI	6, 9
75	Mr Tom Omenda	Research Officer, HQ	KEFRI	2
76	Mr David Lagat	Research Scientist	KEFRI	3
77	Mr Simon K. Choge	Research Scientist	KEFRI	3
78	Mr Simon Wairungu	Research Scientist	KEFRI	1, 2, 6–11

	Name	Designation	Organisation*	Workshops attended**
79	Mr T. Mbuvi	Research Scientist	KEFRI	
80	Dr E. Chagalla	Asst. Director	KEFRI	10
81	Ms D. Muttah	Research officer	KEFRI	10, 11
82	Dr Oballa	Principal research officer	KEFRI	11
83	Mr Harrison Onganda	Research Officer/GIS expert	KEMFRI	1, 10
84	Ms Elizabeth Amayo	Training Officer, HQ	KWS	6, 9
85	Mr Ben Kavu	Asst. Director, Coast	KWS	
86	Mr Ali Kaka	Asst. Director, Ecotourism, HQ	KWS	4
87	Cpl. Simon Githae	Corporal	KWS	6
88	Mr G. Gathaara	Forest Co-ordinator	KWS	4, 5
89	Mr Hewson Kabugi	MOU secretariat	KWS	2, 3, 4, 5, 6, 7, 9, 10
90	Mr Yasin Gambere	Ranger	KWS	4, 5, 8
91	Mr Erastus Kanga	Research Scientist	KWS	2, 3, 11
92	Mr Matthias Mwavita	Warden, ASF	KWS	
93	Mr Godfrey Wakaba	Warden, Watamu Marine Park	KWS	
94	Mr Litoro	Research Scientist, Kwale	KWS	
95	Mr Mwaluma	Sergeant	KWS	5
96	Mr Charles Passi	Councillor, Sokoke ward	Local leader	1, 2, 3, 4, 9, 11
97	Mr Ali Didi	Councillor, Watamu ward	Local leader	2,4, 5, 7,
98	Ms. Grace Mulisho	Asst. Town Clerk	Malindi Municipality	11
99	Mr Mohammed	Chairman	MGBM	10, 11
100	Mr Mwatsuma Kitti	Agriculture, Malindi	MOA	3, 5
101	Mr H. C. Kazungu	Asst. Agricultural Officer, Mida	MOA	5
102	Ms Esther Odhiambo	District Agriculture office	MOA	10, 11
103	Mr Simon Baya	WCK chairman Eastern Zone	MOE	2, 4, 11
104	Mr Lenox Faini	WCK Co-ordinator	MOE	4
105	Mr James Halle	WCK, Chairman Western Zone, Sokoke Sec.	MOE	2, 4, 11
106	Mr Chai	Zonal Inspector of Schools, Gede	MOE	4,
107	Mr Kirimi	District Public Works Officer	MoPW	7, 8
108	Ms Antje Ahrends	Project Volunteer	NABU	9–11
109	Mr Njoroge Mutonya	Head, Coast Bureau	Nation Newspapers	11
110	Ms. Jacklin Kiage	DECO, Kilifi/Malindi Districts	NES	1, 2, 4
111	Mr Paul Matiku	Executive Director	NK	1, 2, 11
112	Ms Fleur Ng'weno	Representative	NK	4,5
113	Mr Musila Musonye	Nature Kenya	NK	10, 11
114	Ms Ann Robertson	Botanist	NMK	1, 4, 9, 10, 11
115	Mr Jembe	Coast Forest Conservation Unit	NMK	9
116	Mr Anthony Githitho	Coast Forest Conservation Unit	NMK	1, 2, 10, 11
117	Mr Ali Hassan	Gede Ruins	NMK	4
118	Dr Silo Masinde	Herbarium, HQ	NMK	9
119	Mr Paul Njuguna	HQ, Nairobi	NMK	2
120	Mr Washington Ayiemba	Manager, Kipepeo	NMK	1–11
121	Mr Naka Shunichi	Volunteer, Kipepeo	NMK	3, 10, 11
122	Mr David Kitsao	Extension officer, Kipepeo	NMK	3
123	Dr Leon Bennun	Ornithologist	NMK	1
124	Mr Patrick Muthoka	Research Scientist	NMK	2,
125	Mr P.K. Muoria	Research Sceintist	NMK	5
126	Mr Pius Namachanjo	Research officer, NMK, Nairobi	NMK	10, 11
127	Dr H. Oyieke	Deputy Director General	NMK	10
128	Mr Julius Ziro	Asst. Chief, Chumani	PA	4
129	Mr Ole Tuitui	D.O. Malindi Division	PA	
130	Mr Naphtal Birya	Asst./Chief, Kakuyuni	PA	9
131	Mr Joseph M. Baya	Asst./Chief Dabaso	PA	5, 9, 11
132	Mr Mwarimbo	Chief, Gede	PA	4, 5
133	Mr Dickson Kahindi	Chief, Ngerenya Location	PA	1, 2, 3, 4, 6, 7, 9, 11
134	Mr Francis Chengo Ngoa	Chief, Ngoshi Location	PA	1, 6, 7, 9, 11
135	Mr	Chief, Roka	PA	
136	Mr	Chief, Minjomboni Location	PA	5
137	Mr Joseph K. Luguaru	Assist. Chief	PA	11
138	Mr Benson Tsoka	Chief, Sokoke	PA	1, 3, 7, 11
139	Mr William Keusch	Volunteer	Peace Corps	11
140	Mr Said Tohiri	Fuelwood licensee	Private	7
141	Mr Ali K. Ali	Pole licensee	Private	7
142	Mr Kibwana Alison	Pole licensee	Private	7
143	Mr Tsuma Hare	Kombe furniture	Private	6, 7, 9
144	Mr Ndanji	Malindi sawmills	Private	7
145	Mr Ucema Bakari		Private	9
146	Mr Charles Murungi	Manager, CMSCC	Private	7
147	Mr Sammy Kinyae	Malindi Handicraft Industry	Private	6, 9
148	Mr Edison Kaingu	Malindi Handicraft Industry	Private	6, 9
149	Mr Hussein Kassim	Manager, Hafswa Sawmills Ltd	Private	7
150	Mr Fredrick Karenga	Tourism Officer, Malindi	Tourism deparment	4, 8, 11
151	Mr Kasiti	Tourism officer, Malindi	Tourism department	4, 10
152	Mr Edger Ndubi	Tourism officer	Tourism department	4

* The following acronyms used in this table do not appear elsewhere in this document:

CWCG	Clark's Weavers Conservation Group	MGBM	Malindi Green Belt Movement
MoA	Ministry of Agriculture	MoE	Ministry of Education
MoPW	Ministry of Public Works	NES	National Environment Secretariat
PA	Provincial Administration	WCK	Wildlife Clubs of Kenya

** Workshop numbers: 1 = Zonation, 2 = Biodiversity conservation, 3 = Subsistence use, 4 = Eco-tourism and environmental education, 5 = Problem animal management, 6 = Forest protection, 7 = Commercial use, 8 = Infrastructure development, 9 = Human resource development, 10 = Research and monitoring, 11 = Final workshop

Annex 3. The Strategic Forest Management Plan preparation process

Activity	Objective	Date/Timing
1. Visioning	To draft an overall vision for the SFMP	9 September 2000
2. Drafting strategic Management Objectives	To identify and draft the strategic management objectives	9 September 2000
3. Indicative Zonation	To draw up indicative zones which reflect the strategic objectives	9 September 2000
4. Identification of working principles (forest management approach)	To clarify and agree on working principles which will determine the approach to implementing actions under the SFMP	9 September 2000
5. Issue identification	To identify the core issues (themes) which the SFMP will tackle	9 September 2000
6. Stakeholder identification	To identify the key stakeholders (or representatives) who need to be involved in the SFMP planning process	9 September 2000
7. SFMP structure	To identify and agree on the format for the SFMP	September 2000
8. Assessment of information requirements for each theme	To bring together relevant information for each theme and identify key areas where it is lacking	October 2000
9. Further information gathering	To collect information on specific themes (as required)	November 2000–May 2001
10. Map preparation (for each theme)	To produce maps to illustrate themes and issues	November 2000–May 2001
11. Zonation workshop	To agree on criteria for zones identified in the visioning workshop	30 November 2000
12. Preparation of position paper (for each thematic workshop)	To summarise issues, information, and options for each theme	November 2000–April 2001
13. Eco-tourism and environmental awareness workshop	To develop the strategy and actions for eco-tourism and environmental awareness	8 February 2001
14. Problem animal management workshop	To develop the strategy and actions for problem animal management	9 March 2001
15. Subsistence use workshop	To develop the strategy and actions for subsistence use	28 March 2001
16. Biodiversity workshop	To develop the strategy and actions for biodiversity conservation	29 March 2001
17. Commercial use workshop	To develop the strategy and actions for commercial use of the forest	4 May 2001
18. Infrastructure workshop	To develop the strategy and actions for development and maintenance of infrastructure	5 May 2001
19. Forest Protection workshop	To develop the strategy and actions for forest protection	12 July 2001
20. Human resource development workshop	To develop the strategy and actions for human resource development	13 July 2001
21. Monitoring and research workshop	To develop the strategy and actions for monitoring and research	5 November 2001
22. Summarise workshop proceedings	To record all the agreements reached during the workshops	December 2000–November 2001
23. Drafting of plan	To use the workshop material to prepare the first SFMP draft	October 2000–September 2001
24. Prepare management guidelines for each theme	To provide implementation guidelines	October 2000–September 2001
25. Final Review Workshop	To discuss the draft SFMP with key stakeholder representatives and seek their approval	3 and 4 December 2001
26. Consultation with key Institutional Stakeholders	To clarify and agree on outstanding issues within the plan content	November–December 2001
27. Finalising Plan	To finalise the SFMP	December 2001
28. Approval	To get the SFMP approved officially by the CCF	January 2002
29. Editing and printing	To develop the plan into an attractive and user-friendly document	January 2002
30. Dissemination and distribution	To ensure that copies of the plan are available to all the appropriate stakeholders and stakeholder groups	February 2002

Annex 4. The Arabuko-Sokoke Forest Management Team

a. ASFMT members during development of the plan, 2000–2002

Name	Position
Dr Ian Gordon	Project coordinator
Mr Joram K. Kagombe	Forest Management Coordinator
Mr Francis Muchiri	DFO, Kilifi District
Mr Bernard Kivyatu	DFO, Malindi District
Mr Mathias Mwavita	Warden, ASF
Mr Tito Mbuvi	Centre Director, KEFRI Coast
Mr Washington Ayiemba	NMK/Kipepeo Manager
Mr Simon Wairungu	Research Officer, KEFRI
Mrs Susan Mlamba	Project Management assistant
Mr Tsofa Mweni	Education officer
Mr Stanley Mwangi	Forester, Gede Forest Station
Mr Wellington Mwamela	Forester, Jilore Forest Station
Mr Charles Makworo	Forester, Sokoke Forest Station
Mr Relen Bahari	Extension officer
Mr Samuel Katoi	Extension officer
Mr Rashid Katama	Extension officer
Mr Edger Mshelle	Extension officer

b. ASFMT members who prepared discussion papers for thematic workshops

Thematic area	Name of presenter/s
Forest zonation	Mr Kaleb Mwendwa
Eco-tourism and environmental education	Mr Marthias Mwavita
Problem animal management	Mr Mathias Mwavita
Infrastructure development	Mr Bernard Kivyatu
Commercial use of the forest	Mr Francis Muchiri
Subsistence use of the forest	Mr Tito Mbuvi and J. Mathenge
Biodiversity conservation	Mr Washington Ayiemba
Human resource development	Mr Joram K. Kagombe
Research and monitoring	Mr T. Mbuvi and Mr J. Kagombe

c. Technical assistance for development of the plan

BirdLife International (UK)	Permanent technical assistance
Mr Peter Branney, through LTS International (UK)	External consultant

Copies of this plan are available from:

Forest Department
Ministry of Environment and Natural Resources, PO Box 30513, Nairobi, Kenya

Kenya Wildlife Service
PO Box 40241, Nairobi, Kenya

Kenya Forestry Research Institute
PO Box 20412, Nairobi, Kenya

National Museums of Kenya
PO Box 40658, Nairobi, Kenya

Nature Kenya
PO Box 44486, 00100 GPO, Nairobi, Kenya

BirdLife International
Wellbrook Court, Girton Road, Cambridge CB3 0NA, UK