

COASTAL FOREST RESEARCH PROGRAMME

Site Description and Conservation Evaluation:
AMBONI CAVES AND MKULUMUZI RIVER VALLEY,
Tanga Municipality, Tanzania.

Paul Matthews

JANUARY 1995



THE SOCIETY FOR ENVIRONMENTAL EXPLORATION
AND
THE UNIVERSITY OF DAR ES SALAAM



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The Coastal Forest Research Programme

The coastal forests of Tanzania comprise small and geographically isolated forest remnants supporting large numbers of endemic and near-endemic species of plants and animals. The forests were once extensive but have been largely removed to provide timber and farmland. Their status, distribution and biology are poorly known. The Coastal Forest Research Programme was created as part of the Frontier Tanzania Project with the aim of producing an inventory of the mammals, birds, reptiles, amphibians, invertebrates and plants of each site and to study the ecology of selected taxa. So far over 40 forests have been identified of which 15 have been characterised thoroughly.

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Foreword to the Frontier Tanzania series of reports.

Global concern over the conservation of the world's biological diversity reached a new peak in June 1992, when many of the world's Heads of State signed the Biodiversity Convention in Rio de Janeiro at the Earth Summit (UNCED).

However, an accurate knowledge of the earth's biological richness is lacking in many countries. Without detailed information on the flora and fauna of a region its importance for the conservation of biological diversity remain undefined.

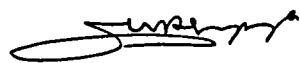
In Africa there are many areas of exceptional biological richness which have scarcely been studied. Even basic data on the status of resources may be lacking or outdated.

The Frontier-Tanzania project, a collaborative venture of the Society for Environmental Exploration and the Faculty of Science of the University of Dar es Salaam is tackling this problem head on.

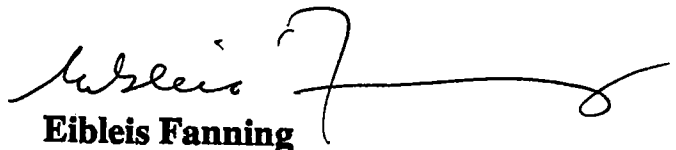
In 1989 Tanzanian scientists identified ecosystems in coastal Tanzania which were in particular need of study because of their biological richness and importance. Since that time, the Frontier-Tanzania project has provided the means and the man-power to investigate these sites, catalogue their importance and suggest management strategies for their conservation. Coastal monsoon forests, the coral reefs of Mafia Island, the mangroves and sediments of the Rufiji Delta, and the vegetation of the Mikumi National Park have been investigated over the past three years.

All of these projects have generated large quantities of new data on the biological importance of the sites and their place alongside similar systems elsewhere in Africa. This research has allowed biological-diversity priorities to be better determined and management actions to be suggested. Many of the recommendations are under consideration by the Tanzanian Government.

This report series forms a contribution to the Frontier-Tanzania project and to the knowledge of the biological diversity of Tanzania. We warmly endorse its publication and hope that many more reports and papers result from this collaborative project, and that they help to assure that the future of the biological heritage of these strategic sites is conserved.



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Director
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EXECUTIVE SUMMARY

SITE:	Amboni Caves and Mkulumuzi River Valley
MAP SHEET:	Ordinance survey Series Y742 Sheet 130E/1
GRID REF:	5 04'S, 39 03'E
LOCALITY:	Tanga Municipality
STATUS :	National Monument
MANAGED BY:	Department of Antiquities, Ministry of Education and Culture
TENURE:	Government land under Central Government control (Caves Conservation Area) and under Municipal control (other areas)

SITE DESCRIPTION

A deep limestone gorge created by the river Mkulumuzi, exposing extensive cave systems. Remnants of natural forest vegetation are found along the valley's slopes surrounding limestone outcrops. The area contains rich and diverse flora and fauna by virtue of the concentration of aquatic, forest, scrub, cave and rock habitats in one small area.

RECOMMENDED MANAGEMENT OBJECTIVES

- To improve conservation and management of the site. To propose, survey and demarcate a new conservation area boundary.
- To improve the condition of the site. To increase the quality of cave systems open to public view and to restore disturbed vegetation through the establishment of a nursery and a substantial replanting programme.
- To increase the tourist appeal of the site by provision of better amenities and information.
- To increase awareness among both local and international communities of the importance of the conservation of the site and of Tanzania's natural resources in general.



Figure 1: MKULUMUZI RIVER AS IT MAY ONCE HAVE LOOKED

(picture - Louise Elsworth)

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1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE OF THIS DOCUMENT

This document aims to provide a comprehensive description and evaluation of the physical and biological features of the Mkulumuzi river valley. Using this information a number of management recommendations are made. It is hoped that these will provide a sound basis for future management policies for the site.

1.2 NATIONAL AND REGIONAL BACKGROUND

There are approximately 50 coastal forests in Tanzania (i.e. forests of the Zanzibar - Inhambane Undifferentiated type, classification according to White, 1983), of which around 50% lie wholly or largely within forest reserves (Burgess et al, in press). Tanga Region has four forest reserves containing this forest type, but also contains numerous smaller forest patches which remain unprotected.

2.0 SITE FEATURES

2.1 GENERAL INFORMATION

2.1.1 LOCATION AND ACCESS

Site Name:	Amboni Caves and Mkulumuzi
River Valley	
Municipality:	Tanga
Access:	Access by vehicle from the main Tanga-Mombasa highway, via Kiomoni village. Access by bus from Tanga (to Kiomoni turning), then by foot (1.5km).
Grid Ref:	5 04'S, 39 03'E
Caves Conservation Area:	Approx 100Ha
Boundary length:	Approximately 4km

2.1.2 MAIN FEATURES

A limestone gorge formed by the perennial Mkulumuzi river with karst landforms and cave systems. Remnants of riparian and dry evergreen forest vegetation are scattered along the valley sides.

2.2 ESTABLISHMENT, STATUS, ADMINISTRATION AND MANAGEMENT

2.2.1 HISTORY OF ESTABLISHMENT

Caves declared a protected monument in 1937 under the Monuments Preservation Ordinance.

Protected after Independence by Antiquities Act of 1964

2.2.2 OFFICIAL STATUS

National Monument (Caves Conservation Area)

2.2.3 LAND TENURE AND RIGHTS OF WAY

Land within the Caves Conservation Area is owned by the Government of the United Republic of Tanzania. Land to the north of the river is owned by Amboni Estates Ltd. Land to the south falls within the boundary of Tanga Municipality.

2.2.4 MANAGEMENT AUTHORITY AND CURRENT MANAGEMENT

The Caves Conservation Area is controlled by the Department of Antiquities, Ministry of Education and Culture.

2.2.5 SITE DEFINITION AND BOUNDARIES

Boundaries were marked using stones put in place during the German colonial period. An extension to the Caves Conservation Area was surveyed and gazetted in 1957. Resurveying of the boundaries and preparation of a map were started in 1977 but not completed.

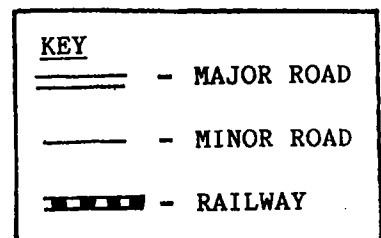
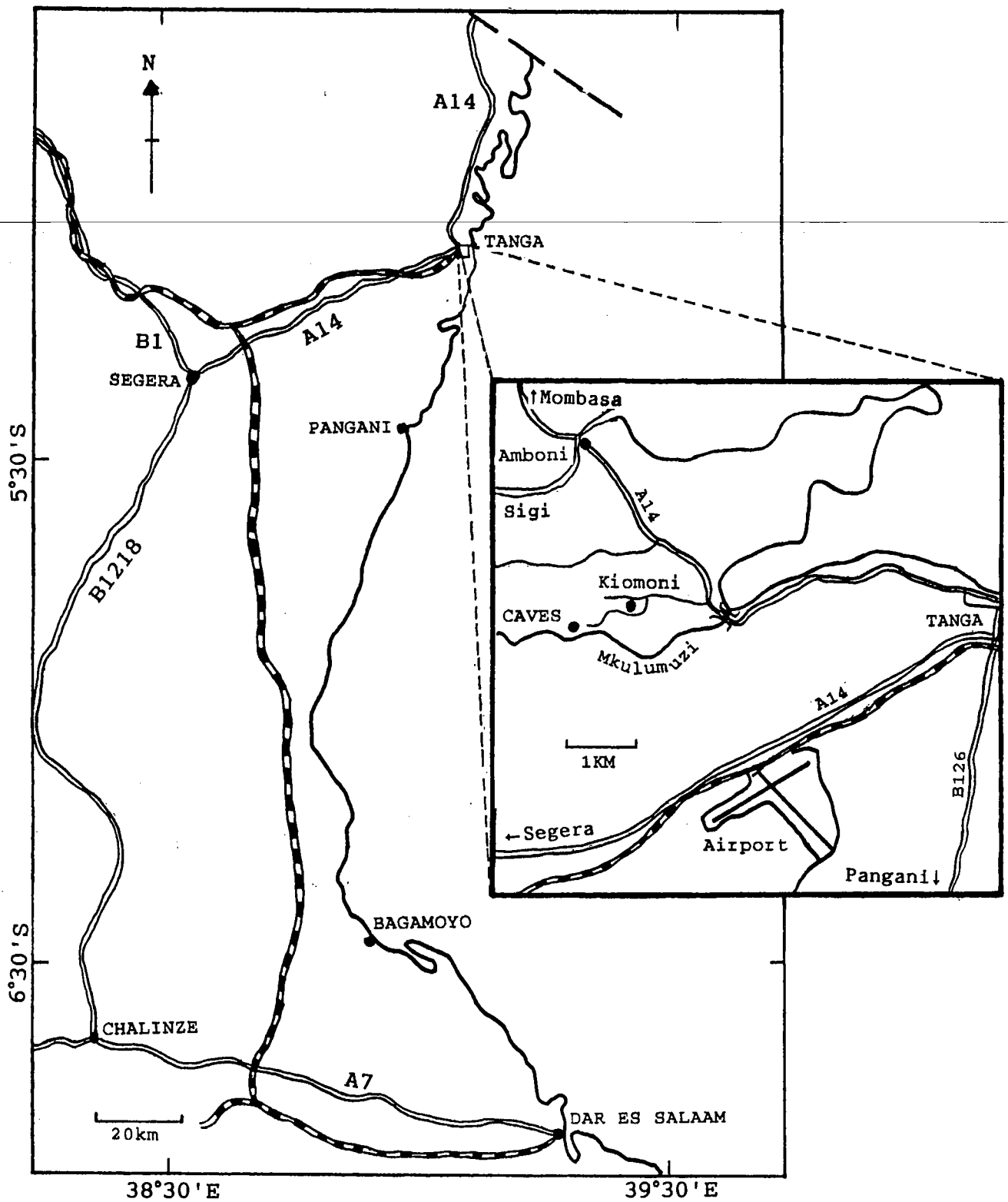


Figure 2 : NORTHERN COASTAL TANZANIA WITH INTERSECT SHOWING MKULUMUZI RIVER AND AMBONI CAVES

2.3 ENVIRONMENTAL FEATURES

2.3.1 PHYSICAL ASPECTS

2.3.1.1 Climate

The Tanga limestone area receives an average annual rainfall of 1337mm (often with great variation between years) dispersed over an average of 126 rain-days, most of the rain falling in the long rainy season between March and the end of May. January and February are the driest months. Average annual temperature is 26 C, no month having a mean below 23.5 C. It is coolest between July and September, when average temperatures can be up to 5 cooler than at other times. (Cooke, 1973). See Appendix 3 for climatic diagram.

2.3.1.2 Hydrology

The headwaters of the Mkulumuzi river are on the eastern slopes of Mt Mlinga, of the East Usambara range. The river terminates in mangrove swamp at Tanga Bay to the north of the town. Discharge during the driest period was measured as 0.093 m³ s⁻² (end of February).

2.3.1.3 Geology

The Tanga limestone is of Jurassic Bathonian - Bajocian age. It covers an area of some 130 square kilometres and consists of porcellanous, oolitic and pisolitic varieties. The weathering of the limestone has led to the creation of a 'karst' scenery (limestone outcropping) in the lower lying areas (Cooke, 1973).

There have been three theories advanced concerning the formation of the caves. Firstly, Harpum (1948) proposed that the caves were 'vadose' in origin, the dissolving action of the Mkulumuzi river (then below ground) resulting in a main cavern with associated passages. The subsequent collapse of the cavern then would have formed the gorge we see today, with the caves or subsidiary channels exposed. Peet (1957) postulated a 'phreatic' origin; the caves resulting from the solution of the limestone below the water table. The third theory (Smith, 1963) suggests that they are 'sea caves' formed by exposure to wave action during a period of higher sea level. In fact it seems that the best explanation may incorporate elements of all three theories; fluctuation of the water table brought about by changes in sea level leading to phreatic solution and the ensuing surface erosion by vadose waters enlarging and altering the caves to their present form.

2.3.1.4 Soils

Soils of the Mkulumuzi gorge can be characterised according to their topographical position.

Ridgetop soils are exposed and are therefore subject to erosion. They are generally shallow (20cm) reddish brown clays derived from sedentary weathered products of the underlying limestone.

On the steep slopes of the valley sides there is movement of surface soil by colluviation leading to the formation of pockets between rocks. These soils are of comparatively high nutrient content as they are less exposed, with vegetation acting as a buffer against leaching and returning high rates of organic matter to the soil.

Soils of the lower slopes and valley floor are deeply weathered, probably colloidal secondary clays. Generally these soils are hard and of low nutrient status; where exposed by cultivation they are susceptible to erosion.

2.3.1.5 Altitudinal Range

The site has an altitudinal range of 5-40m asl.

2.3.2 BIOLOGICAL ASPECTS

2.3.2.1 Habitats

In order of size area covered by each habitat:

- Dry coastal scrub and thicket
- Freshwater perennial river and fringing vegetation (elephant grass, marsh grass, reeds)
- Dry coastal forest remnants
- Moist riparian forest remnants

Vegetation types are shown in Figure 3.

2.3.2.2 Flora

i) Vascular Plants

At least 89 forest species have been recorded from the Amboni Caves area (Hawthorne, 1984; Verdcourt, 1958). These species are listed in Appendix 1.

Among botanical features of importance are the endemic species *Tricalysia elegans*, a shrub from the valley bottom, and an uncommon form of the tree *Uvariadendron kirkii*. Several other species found in the gorge are only known from a few other sites in Tanzania. The area is the type locality of several plant and tree species including the African Violet, *Saintpaulia ionantha*, first collected by Baron Hofmarshal Saint Paul in 1892. A second species of violet, *Saintpaulia diplotricha*, has been found further west along the valley. These celebrated European house plants are rarely found in their natural environment, particularly at such low altitudes. Both species are narrowly endemic and classified as endangered.

ii) Vegetation Communities

Hawthorne (1984) identifies four vegetation communities occurring in the area, though admits they are frequently very finely intermixed.

In the moister riverine fringe, trees such as *Ficus sycomorus*, *Ficus lutea* and *Barringtonia racemosa* are found, often with associated shrubs such as *Cremaspora triflora*, *Psychotria schliebenii*, *Angylocalyx braunii*, and *Acalypha neptunica*.

Further up the sides of the valley one encounters dry evergreen forest typical of the coastal plain containing trees of *Scorodophloeus fischeri* and *Cynometra webberi* and commonly associated dry forest understory species such *Uvaria acuminata*, *Croton pseudopulchellus* and the cycad *Encephalartos hildebrandtii* (this also seems to survive well in isolation on the tops of exposed outcrops).

On the tops and sides of the slopes vegetation consists of dry thicket, sometimes with an evergreen forest element, but more often comprised of heliophilous perennials and weeds.

Hawthorne goes on to include the exposed rock niches occupied by lithophytic species such as *Saintpaulia spp*, *Dorstenia hildebrandtii* and *Polystachya bicarinata*.

iii) Vegetation of Importance to Other Biotic Groups

Many of the trees (particularly the MORACEAE) provide an important source of food in the form of fruit to bird, bat and primate species.

The forested areas and areas of mature thicket provide a suitable habitat for many of the vertebrate and invertebrate species found in the river valley, their existence being dependent on the cover and microclimate provided by this vegetation.

Vegetation fringing the river supports amphibian and reptile life, and is an important nesting zone for weaver birds and kingfishers.

2.3.2.3 Fauna

i) Mammals

The valley is populated by three species of monkey which live in surprisingly close association. These are: the Tanzanian black and white colobus *Colobus angolensis palliatus*, Sykes' monkey *Cercopithecus albogularis* and the Vervet monkey *Cercopithecus aethiops*. The former two species are normally associated with closed canopy forest and their presence indicates a good degree of adaptability to shrinkage of this habitat.

Hyrax have been reported as present in the valley (Bech, pers. comm.) though the species has not yet been identified.

Seven species of bat have been identified (Matthews, in prep.), most of which roost in the gorge's caves in large numbers.

ii) Birds

55 species of bird have been identified in the Amboni Caves area (Faldborg et al., 1991, Matthews, in prep.), though considerably more are probably present. Many of those known are forest dependant species.

Among the less common species found in the valley are the plain-backed sunbird, *Anthreptes axillaris*, the brown-hooded kingfisher, *Halcyon albiventris* and the grey heron, *Ardea cinerea*. (See Appendix 3 for a full list)

iii) Reptiles

The rocky crevices found along the valley host various species of skink, gecko and sand lizard as well as Colubrid snakes.

Larger examples are plated lizards, *Gerrhosaurus sp.* (up to 50 cm) and the Nile crocodile, *Crocodylus niloticus* which breeds in the Mkulumuzi, burying its eggs in the sandy banks and hiding out in crevices and caves during drought periods. Specimens up to 2m long have been seen.

The river also contains terrapins, of which one species, *Pelusios sinuatus*, has so far been identified.

iv) Amphibians

The gorge is populated with a host of frog species, including species associated with watercourses, such as *Ptychadena anchietae* and numerous morphs of *Phrynobatrachus*, in addition to treefrogs such as *Afraxalus fornasini* and toads such as *Bufo gutturalis*. Leaf litter frogs, *Arthroleptis spp.*, are found in the patches of forest.

v) Fish and Freshwater Invertebrates

Six fish species, freshwater crabs, shrimps and snails can be found in the Mkulumuzi river.

2.4 TOURISM, LAND USE AND SOCIO-ECONOMIC FEATURES

2.4.1 HISTORICAL ASPECTS

The village of Kiomoni was established in 1942. It was originally intended by the then British Government to be a temporary (5 year) settlement, but has remained at the site ever since. The village was established on land owned by Amboni Estates, later to be purchased by the Government.

2.4.2 PAST AND PRESENT LAND USES

2.4.2.1 Tourism

Guided tours of the caves, given by the Department of Antiquities, have been available since the mid 1960's. Only one cave ('Amboni' cave) is currently open to the public. Parties of up to thirty people are taken through the cave on a tour that can last two hours. The guide points out interesting formations and relates these to stories and folklore that have grown up around the caves.

Official visitor numbers given by the Department of Antiquities (for years where the information was available) are shown in Table 1, below. Actual numbers are likely to be considerably higher as student parties are not always fully registered. The Amboni Caves have been one of the Department's biggest visitor attraction after the Olduvai Gorge, in Arusha Region.

An admission fee was first levied in 1988. Residents currently pay in Tanzanian shillings and tourists in US dollars.

Traditionally, entrance tariffs were paid into the central government treasury. In January 1992 however, a special fund for antiquities was created ensuring that the money raised by visitors is put back into conservation of the sites themselves.

The tourist facilities currently consist of a simple unfurnished rest house, three benches, a parking area and toilet, all of which are located in the vicinity of the 'Amboni' cave. Visitors are asked to sign a guest book.

Table 1: Official visitor numbers for the Amboni Caves
(From Department of Antiquities Annual Reports)

PERIOD/YEAR	NO. VISITORS
1966	2641
1970	4772
1971	3905
1977	3855
1987	2422
1988-1989	3174
1990-1991	1680

2.4.2.2 Quarrying

Limestone quarrying is taking place immediately to the east of the Cave Conservation Area, and to a lesser extent on the northern ridge of the valley. This is both large scale (Tanga contractors) and small scale (local villagers). Large scale stone removal is being achieved by dynamite blasting. On removal the stone is either broken up for gravel or burned to produce lime. Quarrying has been kept to areas predominantly outside the current Conservation Area, though appears to have destroyed part of at least one cave system.

The Department of Antiquities first drew attention to the threat posed by the quarrying in 1965. It reported then that mining licences had been revoked by the Ministry of Industries, Mineral Resources and Power. However, this seems to have had little effect, as in 1971 the Department of Antiquities again mentioned the problem. In its 1971 Report, the Department recommended that quarrying be moved away from Kiomoni to the area of Amboni village. Again, this has not happened.

2.4.2.3 Agriculture

Crops grown along the river banks include coconuts, spinach, oranges and bananas. Maize and cassava are grown further from the watercourse on the tops of the slopes. Much of the farming is subsistence in nature, although some crops (e.g. spinach, bananas) are sold at market in Tanga town.

The valley is used as pasture land for herds of goats and cows owned mostly by Kiomoni residents. Some livestock is kept corralled in the village and grass gathered from the valley to serve as feed.

Local villagers collect leaves from the river weed 'Mkojwa' from which they extract oil for cooking.

2.4.2.4. Water Supply

Villagers at Kiomoni are not able to use Mkulumuzi water for drinking as salt water inundation from the coast makes it brackish. Drinking water is available for villagers for limited periods from the Sigi pumping station, though Kiomoni is not connected to the main Tanga system. Further west, however, the Mkulumuzi's water is drinkable. River water is also used to irrigate crops during dry periods.

2.4.2.5 Extraction of Forest Products

All forested areas remaining in the river valley have been heavily disturbed by the practices of pole removal and firewood collection. In many locations pole removal has left few saplings to replace the present canopy trees.

2.4.2.6 Extraction of Bat Guano

Extraction of guano from inside the caves to be used as fertilizer has taken place in the past, though it is not known to be occurring at present. Rights to the guano were given by the Department of Antiquities in 1971 to Tanga Municipal Council, the Regional Director of Agriculture and to schools and prisons in Tanga.

Guano should be treated with care as it carries the spores of the disease pulmonary histoplasmosis or 'cave disease'. The form present at the Amboni caves is a relatively mild

form of the disease, giving rise to transient fever and respiratory difficulties. A few cases of the disease has been reported in people who have visited the Amboni caves (Manson-Bahr, 1958).

2.4.2.7 Scientific Research

Exploration of the cave systems seems to have begun with the work of the Germans at the beginning of the century. The best known caves were surveyed and mapped by T.C. James in 1952, though his report and maps seem to no longer be available. Peet (e.g. 1957) also spent much time exploring the area, though a more extensive survey was that undertaken by Cooke (1967). He identified and explored many new caves and divided them into three groups; the Kiomoni group, which includes the best known and most accessible caves ('Amboni', 'High' and 'Guano'), the South group clustered on the opposite side of the river and the Giant Grike group, scattered along the gorge to the West. Cooke notes that in many places the caves occur at two levels and many of them must be accessed from the plateau top rather than the valley sides. Since Cooke's visits, however, little further survey work appears to have been carried out.

Verdcourt (1952) made a small collection of molluscs in the valley.

Numerous botanical collections have been made around the caves and along the river (Polhill, 1988). Hawthorne (1984) conducted a good botanical inventory of the area, venturing as far west as the Steinbruch Forest Reserve (now degazetted). Johannson (1978) has researched the distribution and habitats of Saintpaulia species along the gorge.

The Danish-Tanzanian ICBP Expedition visited the area in August 1990, compiling an inventory of bird species. (See Appendix III)

Frontier - Tanzania expedition TZ11 visited the site between February and March 1992, undertaking surveys of forest extent and condition, collecting specimens of flora and fauna and gathering general information about the area. Some of these findings are included in this report.

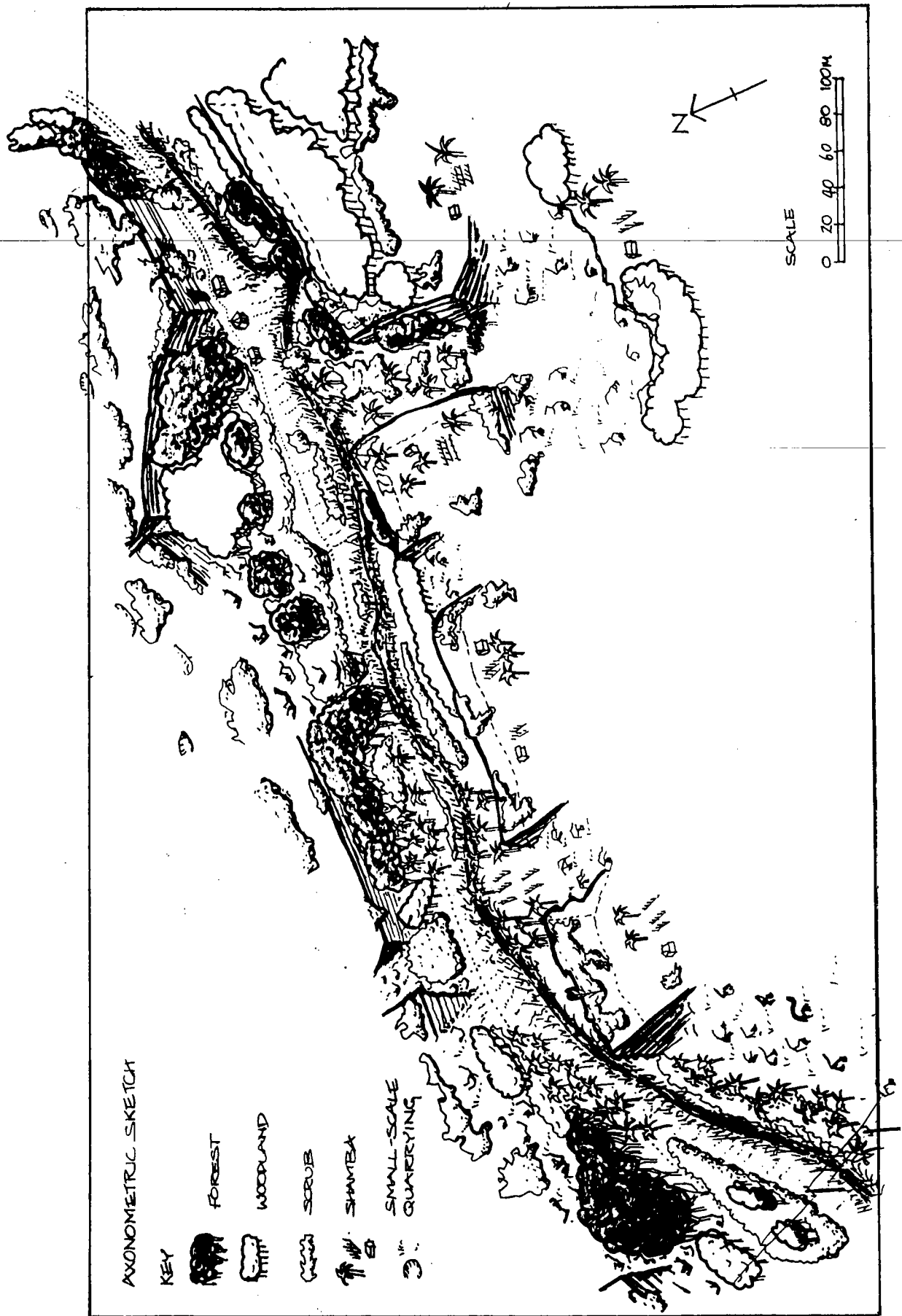
2.4.3 SURROUNDING LAND USE

To the north of the Mkulumuzi gorge are the sisal estates of Amboni Ltd. covering an area of 15,000 Ha (45,000 Ha of land are owned by the company altogether). However, much of the land bordering the gorge is now cultivated by locals or is now disused and overgrown.

Further west along the Mkulumuzi, to the south of the former Steinbruch Forest Reserve, there remains a sizable area of dry forest on either side of the river, interspersed with frequent rock outcrops. This area, known as Msitu wa Mbogo, supplies charcoal, firewood and building poles for local residents. Pitsawing is also practiced but to a lesser extent.

2.4.4 CURRENT HUMAN POPULATION IN AND AROUND THE CONSERVATION AREA

Kiomoni village, the nearest large settlement, has a population of approximately 900. Huts surrounded by cultivation are scattered along the plateau (mainly on the south side of the river) and to the west along the gorge.



(picture - Louise Elsworth)

Figure 3 : 3-DIMENSIONAL SKETCH SHOWING LAND-USE IN THE MKULUMUZI GORGE

3.0 EVALUATION

3.1 EVALUATION OF FEATURES

3.1.1 GEOLOGICAL FEATURES

3.1.1.1 Size

The full extent of the cave system is not known. Some 3-4 km are thought to have been surveyed to date, ('Kiomoni' and 'South' groups) with the longest passages extending back some 200m from the entrances in the valley side. Many passages still need to be surveyed in full.

3.1.1.2 Fragility

Cave systems may be suffering secondary damage from quarry blasting. Shock waves can be transmitted through the 'rogue' passages, fissures and weaknesses that connect many of the systems (Dr T.R. Shaw, pers comm.).

3.1.2. BIOLOGICAL FEATURES

3.1.2.1 Extent

The sum of forest patches contained in the 2km strip west along the river from the Kiomoni cave group can cover no more than about 2/3 ha

3.1.1.2 Diversity

The site has a notably high biodiversity. The variation of species present can be attributed to the range of exploitable microhabitats created by rock outcrops, forest patches and the generally decreasing moisture gradient from the valley bottom to the ridgetop .

3.1.1.3 Forest Condition

Natural forest has been reduced to the extent where the largest patches consist of only five or six mature trees. The understory of these patches show considerable disruption with forest shrubs often replaced by secondary thicket.

The last vestiges of forest show the general trend of conversion to secondary thicket. Removal of vegetation from the ridgetops poses a serious threat by exposing slopeside forest and soil to the full brunt of sun, wind and rain. Furthermore, the removal of forest from around cave mouths could result in changes in the caves' microclimate. It is known that cave fauna, especially bat colonies, are extremely sensitive to fluctuations in humidity and to exposure to draughts (A. Cockle, pers comm.)

3.1.1.4 Endangered Species

African violet sites, particularly lowland sites, are extremely limited and all are threatened (Johansson, 1978; Mather, 1989).

The plain-backed sunbird is listed as "near-threatened" in the IUCN's Red Data Book. The Nile crocodile is fairly widespread in Tanzania, but its numbers have been seriously depleted even in reserved areas (IUCN report).

3.1.1.5 Global Significance

There is probably under 4000 square km of coastal forest left in East Africa. The coastal forest block is highly fragmented into over 200 separate forest patches. Most of these forests are less than 25 square km in area. In Tanzania approximately 800 square km of fragmented coastal forest remain

The East African coastal forests are thought to have been separated from the main African rainforest of the Congo Basin for 30-40 million years, resulting in comparatively high levels of endemism, particularly amongst plants, amphibians, reptiles and invertebrates.

3.1.2 POTENTIAL FOR TOURISM

The 'Amboni' cave is already a major tourist attraction. Other caves with different or more impressive features exist which may be accessible to the public .

The gorge's forest areas harbour many rare species of plants, birds, mammals and reptiles. The flora and fauna would be of educational and scientific interest to both specialists and novices.

The area offers a pleasant and interesting environment in which the foreign visitor or busy town dweller can spend a relaxing day.

3.1.3 DAMAGING ACTIVITIES

- a) Extension of limestone quarrying into cave systems.
- b) Secondary damage to cave systems by dynamite blasting.
- c) Removal of trees for timber and fuelwood.
- d) Clearance for cultivation. Continued cultivation on immediate ridgetops causing exposure of remaining forest patches to fire, soil erosion and nutrient depletion.
- e) Continued grazing of domestic livestock.
- f) Downstream river pollution caused by the discharge of sisal processing waste.

3.2 POTENTIAL VALUE OF THE AREA

3.2.1 POTENTIAL CONSERVATION VALUE

Reasons for the conservation of the Ambosi/Mkulumuni site are manifold . The cave systems are the most extensive and accessible in the country. It has long been recognized by the Department of Antiquities that a good, representative sample of limestone caves should be conserved as a Tanzanian national monument.

Aspects of the original natural vegetation remain which are of considerable genetic importance. The two African violet species have been identified by specialists as endangered. Conservation of their habitat should therefore be a priority.

The proposed conservation of the remaining forested areas would be in accordance with the principal aims of the Forestry Action Plan for Tanga Region (Massawe & Kajiru, 1991) and the Tanzania Forestry Action Plan (Bensted-Smith & Msangi-Msangi, 1989).

3.2.2. POTENTIAL ECONOMIC VALUE

There is great scope for increasing the site's tourist appeal and popularity. Development of the area should aim to balance an improved environmental quality with increasing access to public information and services. This should lead to increases in numbers of both resident and foreign visitors. Non-concessionary entry fees could then be increased as a way of raising funds for the sustainable management and upkeep of the site.

3.2.3 POTENTIAL RESEARCH, RECREATIONAL AND EDUCATIONAL VALUE

The site is readily studied being easily accessible. The range of microhabitats make the area biologically diverse. The site is also of interest for geological studies.

Great potential exists for visitor recreation at the site. Tours of the caves, walking along the valley or simply relaxing are all highly pleasurable activities at this locality.

The caves and surrounding area have a high educational value which could be better exploited.

3.2.4. POTENTIAL LAND ACQUISITIONS

Extension of the reserved area might entail the acquisition of some land from Amboni Estates (a maximum of 40-50Ha). The land in question is not currently under cultivation.

3.2.5 POTENTIAL ROLES OF NGOs AND BUSINESS IN RESERVE DEVELOPMENT

Development of the area would benefit greatly from the input of finance and experience from NGOs. Parties with a possible interest include the Society for Environmental Exploration (Frontier - Tanzania), the Wildlife Conservation Society of Tanzania and the World Wildlife Fund (Tanzania),

Hotels and tour operators in the Tanga area might consider investing/contributing to the Project as it could potentially become a major attraction.

The Amboni Group could possibly contribute by relinquishing some unused land to the Caves Conservation Area.

3.2.7. RATIONALE FOR THE MAINTENANCE OF AMBONI CAVES AND THE MKULUMUZI RIVER VALLEY

The Mkulumuzi Valley is a site of great natural beauty and interest. The valley's vegetation, though known to contain rare species, is being rapidly degraded due to insufficient protection of the area. Some cave systems are important to the indigenous cave fauna, and others have a high tourism value.

Conservation of the site would reflect the concern shown by Tanga residents as well as international agencies for its deterioration.



(picture - Louise Elsworth)

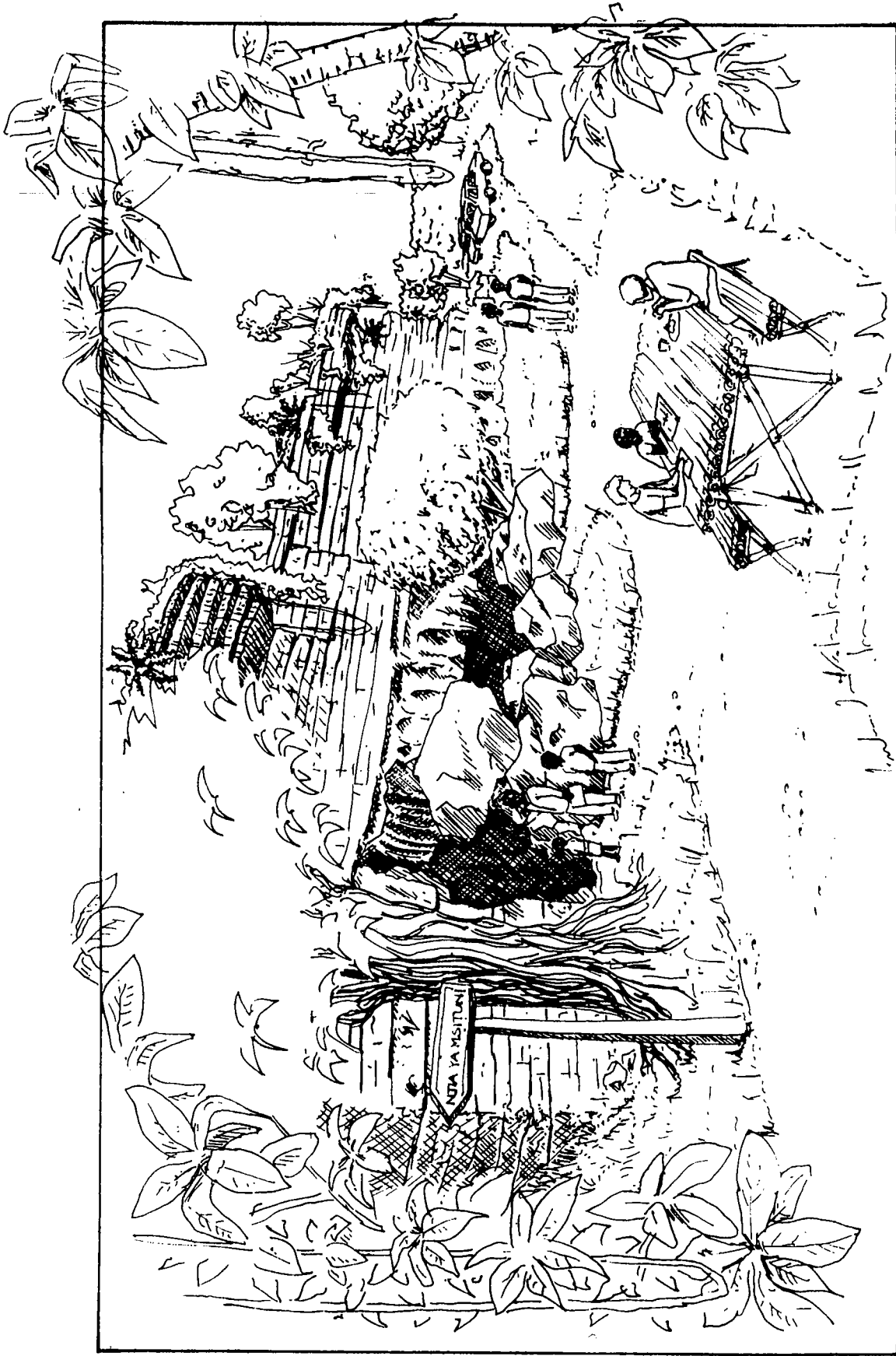
Figure 4 : MKULUMUZI VALLEY LOOKING EAST

4.0 RECOMMENDED MANAGEMENT OBJECTIVES

1. To improve conservation and management of the site by proposing, surveying and demarcating a new conservation area boundary. There may also be a case for imposing some restrictions on quarrying on the basis that revenue from tourism be used to develop alternative means of livelihood.
2. To improve the condition of the site. To increase the quality of cave systems open to public view and to restore disturbed vegetation through the establishment of a nursery and a substantial replanting programme.
3. To increase the tourist appeal of the site by provision of better amenities and information.
4. To increase awareness among both local and international communities of the importance of the conservation of the site and of Tanzania's natural resources in general.

5.0 MAIN FACTORS INFLUENCING MANAGEMENT AND DEVELOPMENT

- a) Resources available: The input of substantial funding and the use of both local and external expertise is key to the development of the site. Thereafter the income generated through tourism should meet maintenance costs.
- b) Reserve administration and authority: Expanding the scope of the Reserved area will probably require the involvement of other authorities at local and National levels. The establishment of a clear administrative framework is essential for the efficient management of the site.
- c) Local goodwill: protection of a small reserved area will involve the cooperation of local people, some of whom are currently cultivating the existing conservation area. Much care will be needed to ensure that they are properly compensated for apparent loss of land rights.



(picture - Louise Elsworth)

Figure 5 : AMBONI CAVES - POTENTIAL MANAGEMENT FOR CONSERVATION AND TOURISM

6.0 MANAGEMENT RECOMMENDATIONS

6.1 PROTECTION AND MANAGEMENT OF BIOLOGICAL AND PHYSICAL RESOURCES

6.1.1 BOUNDARY RESURVEYING AND MARKING

It is strongly suggested that the existing Conservation Area boundary is too poorly defined to allow for the proper protection of the site. It is therefore recommended that the area be resurveyed and demarcated after consultation with local farmers.

A new boundary should encompass as much as possible of the following areas/aspects:-

- a) The underground extent of the main cave systems
- b) The surface openings of cave systems
- c) The ridgetops, which are vital to soil and forest conservation.
- d) The surviving forest patches which extend westwards along the gorge

The boundary should be appropriately demarcated with a tree buffer. Notification of the boundary line should be given to locals and information should be displayed on maps and boards.

6.1.2 CAVE SURVEYING AND MAPPING

It is recommended that all caves in the area are surveyed and mapped (preferably by a qualified speleologist), with a view to investigate and evaluate additional systems potentially usable by the public. The positions of any surface openings in such systems should be located above ground and their position marked.

6.1.3 STATUS OF LOCAL FARM PLOTS

The presence of two cultivated areas within the proposed reserve presents several problems. These plots prevent the growth of natural vegetation; exposing soil to erosion and nutrient depletion.

Buffer zones, including a fire break, could be established. Intensive and unsustainable farming activities could be restricted to an area designated outside the buffer zone beyond the reserve boundary. Permits to cultivate within the reserve could be introduced. Cultivation could be zoned according to intensity. Use of the core zone should be restricted to the collection of natural forest products. This would enable farming to be monitored and controlled within the reserve boundary; ensuring that management guidelines with respect to conservation are respected.

6.1.5 GRAZING

The grazing of domestic livestock is damaging to the site, preventing regrowth of forest vegetation. It is recommended that livestock are limited to the outer zones of the reserve.

6.1.6 REPAIR TO DISTURBED AREAS

It is suggested that a nursery be established for the cultivation of indigenous tree and shrub species from seed. Replanting of cleared areas could commence with hardy colonizer species. These could then be underplanted once a shady environment had been established.

6.2 HUMAN USE: TRADITIONAL USE BY LOCAL POPULATIONS

6.2.1 FOOTPATHS AND RIGHTS OF WAY

The footpath along the river is currently used frequently by local people as a means of accessing farm plots, both upriver on the south bank and across river on the north bank and on the plateau. These traditional rights of way should be respected provided that local people observe the appropriate rules when inside the reserved area.

6.2.2 SPIRITUAL USES OF CAVES

Use of caves for traditional fertility ceremonies should be allowed to continue. It should be the responsibility of the guards to see that these activities do not conflict with tourism uses.

6.3 HUMAN USE: NATURE TOURISM AND EDUCATION

6.3.1 IMPROVEMENT TO CAVE TOURS

In addition to the possibility of opening more caves to the public, the existing cave should be improved. A power line to the caves is already in place, and internal lighting can be installed with relative ease. Lighting need not be extensive, but instead a soft light (probably filtered) can be focused at strategic points along cave tunnels.

A leaflet or pamphlet containing information about the caves in several languages and possibly photographs could be prepared and sold to visitors.

Graffiti around the cave entrances is a major problem which should be addressed. Persons defacing the caves should be harshly dealt with (possibly fined). Some of the existing graffiti can possibly be removed by sandblasting.

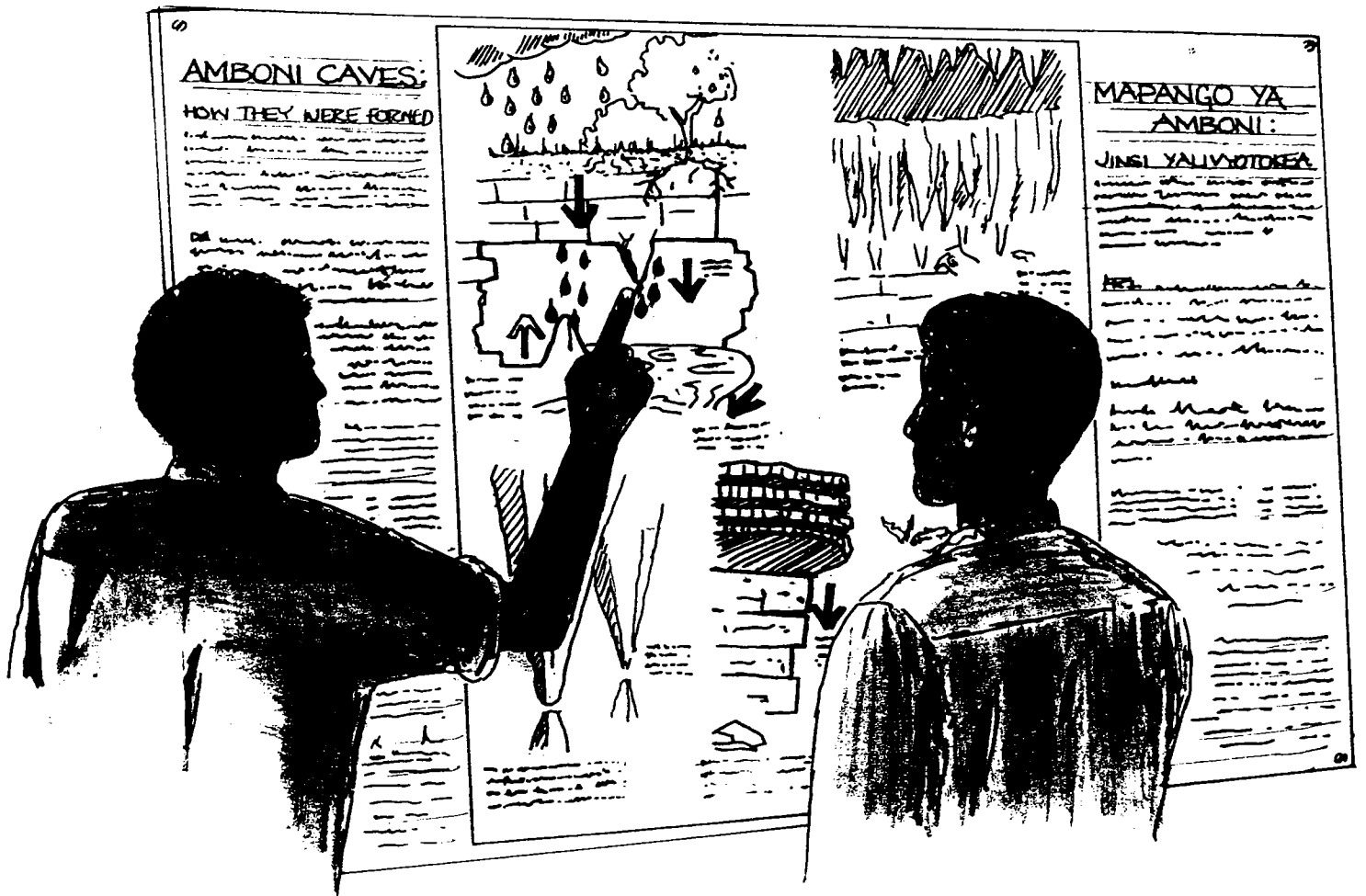
6.3.2 NATURE TOURS AND TRAILS

A 'nature trail' could be marked out, incorporating areas of biological interest along the river valley. This could either be guided, or information could be provided on signs placed along the trail (e.g. names of tree species, forest types, information on primate species).

It is suggested that the indigenous monkey troupes are actively habituated to humans. Their proximity during nature walks would greatly add to the enjoyment and appeal of the tour.

6.3.3. REFRESHMENT AND SHOPPING FACILITIES

A small hut could be constructed on the site stocked with cold drinks and snacks to cater for tourist parties. This enterprise could possibly be managed privately by a local resident.



(picture - Louise Elsworth)

Figure 6 : EXAMPLE OF AN INFORMATION DISPLAY

The same or a separate establishment could be installed for the sale of souvenirs, T-shirts and postcards. Such merchandise would not only be an additional source of revenue, they would act as advertising for the site.

6.3.4 CAMPING OR OVERNIGHT ACCOMMODATION FACILITIES

A plot of land in the reserved area could be set aside for camping. Visitors would be charged a standard rate per night's stay. Alternatively (or in addition) a furnished or unfurnished visitor's shelter could be installed. Again, a standard charge could be levied, with foreign nationals paying in dollars.

6.3.5 EDUCATION CENTRE AND NATURE OBSERVATION POINTS

A permanent education centre could be established on site with displays giving information on various subjects, a few are suggested below:-

- a) Geomorphology of area
- b) History of caves and area
- c) History of Tanga town
- d) Biological information on flora and fauna of area.
- e) Status of Tanzania's coastal forest resource

Additionally, a more complete education package could be prepared for visiting school parties. This could consist of a standard lecture, administered with visual aids to stimulate learning.

For visitors with an interest in wildlife, some small simple hides could be constructed from which wildlife could be observed at close quarters. These would be especially successful if focussed on birdlife - possibly along the river.

6.4 ADMINISTRATION AND MANAGEMENT

6.4.1 ON-SITE PERSONNEL

It is recommended that in addition to the current guides the following positions be created:-

- a) A gardener/groundsman responsible for the upkeep of the site's flora.
- b) Two or three guards/nightwatchmen responsible for the security of the site
- c) An on-site manager responsible for the day to day running of the site. This person should also be able to give education talks.

Additional personnel would naturally be contracted temporarily for initial building and development operations.

6.4.2 SITE ADMINISTRATION

It is recommended that the Department of Antiquities retain control of the site and negotiate for further land acquisitions. At a regional level, the Regional Development Director could oversee a committee comprised of Regional, District and Municipal Officers with areas of expertise in park management, forestry, natural resources, planning, game and tourism, education and culture, handling details of development and administration. The committee's chairman could be nominated by, and answerable to, the Director of Conservation at the Department of Antiquities.

The legal framework for this system of management is already in place, given in section 16 of the Antiquities Act of 1964. This empowers municipal authorities to take action and pass bylaws relevant to the conservation of protected monuments.

6.4.3 LINKS WITH NGOs AND BUSINESS

It is suggested that links be sought with NGOs and business over the possible joint development of the site (parties with a possible interest are listed in section 3.2.6)

6.5 RESEARCH AND MONITORING

Project 1: It is highly recommended that seismic prospecting techniques be employed to assess the effects of dynamiting on limestone strata, monitoring any changes over time. This is possibly the only way that any damage to cave systems caused as a result of shockwaves can be detected.

Project 2: Given the suggested policy of reforestation, the Mkulumuzi Gorge would be an excellent site for research into the regeneration of coastal and riparian forest habitats. This project could have two aspects: the natural spread of remnant forest into surrounding land (given protection from fire, grazing etc.) and the creation of forest habitats from scratch by planting.

Project 3: Pollution levels in the Mkulumuzi river should be regularly tested to ensure it continues to provide a safe environment for the aquatic species and the numerous other species living around the river. This ongoing study could be conducted in collaboration with the Tanga Water Authority.

Project 4: It is recommended that a large-scale socioeconomic survey be carried out among local populations. This should aim to co-ordinate local needs with conservation objectives. Local participation will help to ensure the dissemination of information and the observation and respect of management priorities.

Project 5: Visitors to the caves should be given a short questionnaire to fill out on which they can place their comments on the site and any suggestions for improvement to the area. This could be used also to discover how people hear about the site, how far they travel to visit it, the number of resident and number of tourist visitors and so on. This sort of information is invaluable to site management plans.

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APPENDIX 1 : VASCULAR PLANTS RECORDED FROM
THE MKULUMUZI RIVER VALLEY

SOURCE:

1 - Hawthorne (1984)

2 - Verdcourt (1952)

ACANTHACEAE

*Chlamydacanthus lindavianus*1
*Hypoestes forskalii*1
*Justicia fittonioides*1
*Justicia pseudorungia*1,2
*Lankesteria alba*1
*Pseuderanthemum hildebrandtii*1
*Sclerochiton vogelii holstii*1
*Thunbergia kirkii*1
*Whitfieldia stuhlmanni*1,2

ANNONACEAE

*Uvaria acuminata*1
*Uvariadendron kirkii*1

ARACEAE

*Anchomanes abbreviatus*1
*Culcasia orientalis*1
*Stylochiton henningii*1
*Zamioculcas zamiifolia*1

BALSAMIFERAE

*Impatiens walleriana*1

CAESALPINIACEAE

*Cynometra webberi*1,2
*Scorodophloeus fischeri*1

CAPPARACEAE

*Maerua triphylla*1

CELASTRACEAE

*Maytenus mossambicensis*1
*Maytenus putterlickioides*1
*Salacia lehbachii*1

COMPOSITAE

*Gynura colorata*1

CRASSULACEAE

*Rhipsalis baccifera*1

CUCURBITACEAE

*Coccinia sp.*2
*Gerrardanthus lobatus*1
*Gerrardanthus grandiflorus*2
*Kedrostis leloja*1

CYCADACEAE

*Encephalartos hildebrandtii*1,2

DICHAPETALACEAE

*Dichapetalum arenarium*1

*Dichapetalum mossambicense*1

EUPHORBIACEAE

*Acalypha neptunica*1

*Croton pseudopulchellus*1

*Drypetes natalensis leiogyna*1

*Mallotus oppositifolius*1

*Margaritaria discoidea*1

*Meineckia fruticans*1

*Micrococca scariosa*1

*Mildbraedia carpinifolia*1

*Phyllanthus kaessneri*1

*Pycnocomma littoralis*1

FLACOURTIACEAE

*Grandidiera boivinii*1

FLAGELLARIACEAE

*Flagellaria guineensis*1

GESNERIACEAE

*Saintpaulia diplotricha*1

*Saintpaulia ionantha*1

GRAMINEAE

*Cyrtococcum chaetophoron*1

LECYTHIDACEAE

*Barringtonia racemosa*1

LILIACEAE

*Anthericum suffruticosum*1

*Chlorophytum heynei*1

*Dracaena cf steudneri*1

MALVACEAE

*Hibiscus faulknerae*1

*Hibiscus rostellatus*1

MIMOSACEAE

*Acacia clavigera usambarensis*1

MORACEAE

*Dorstenia alta*1

*Dorstenia hildebrandtii*1

*Ficus lutea*1

*Ficus sur*1

*Ficus sycomorus*1

ORCHIDACEAE

*Polystachya bicarinata*1

PANDANACEAE

*Pandanus rabaiensis*1,2

PAPILIONACEAE

*Angylocalyx braunii*1

*Erythrina sacleuxii*1,2

*Milletia usaramensis*1,2

PASSIFLORACEAE

*Adenia lindiensis*1

*Passiflora foetida*1

RUBIACEAE

*Chazaliella abrupta*1

*Coffea pseudozanguebariae*1

*CreMASpora triflora*1

*Oxyanthus zanguebaricus*1

*Pavetta sphaerobotrys lanceisepala*1

*Psychotria schiebenii*1

*Rothmannia ravae*1

*Tricalcia elegans*1

*Vangueria randii acuminata*1

RUTACEAE

*Toddaliopsis sansibarensis*1

*Zanthoxylum chalybeum*1

SAPINDACEAE

*Crossonophelis africanus*1

*Haplocoelum inopleum*1

*Lecaniodiscus fraxinifolius*1

SAPOTACEAE

*Manilkara sulcata*2

STERCULIACEAE

Pterygota sp.1,2

Sterculia sp.2

TILIACEAE

*Grewia forbesii*1

ULMACEAE

*Celtis africana*1

ULTICACEAE

*Urera fischeri*1

VIOLACEAE

*Rinorea ilicifolia*1

Rinorea sp.1

VITACEAE

*Cissus quinquangularis*1

PTERIDALES

*Adiantum incisum*1

*Asplenium buettneri*1

*Asplenium nidus*1

*Pleopeltis excavata*1

APPENDIX 2 : BIRD SPECIES RECORDED FROM THE MKULUMUZI RIVER VALLEY

SOURCE:

- 1 - Faldborg et al (1991)
- 2 - Matthews et al (1992)

ACCIPITRIDAE

*Gypohierax angolensis*1
Aquila wahlbergi

Palm Nut Vulture
Wahlberg's Eagle

ALCEDINIDAE

*Ceryle maxima*1
Alcedo cristata
*Halcyon albiventris*1
*Ispidina picta*2

Giant Kingfisher
Malachite Kingfisher
Brown Hooded Kingfisher
Pygmy Kingfisher

APODIDAE

*Apus affinis*1
*Cypsiurus parvus*1
*Neafrapus boehmi*1

Little Swift
Palm Swift
Böem's Spinetail

ARDEIDAE

*Ardea cinerea*2

Grey Heron

BUCEROTIDAE

*Tockus alboterminatus*1

Crowned Hornbill

CAMPEPHAGIDAE

*Campephaga flava*1

Black Cuckoo Shrike

CAPITONIDAE

*Lybius melanopterus*1

Brown-breasted Barbet

COLIIDAE

*Colius striatus*1

Speckled Mousebird

COLUMBIDAE

*Streptopelia semitorquata*1
*Turtur chalcospilos*1
*Turtur tympanistria*1
*Treron australis*1

Red Eyed Dove
Emerald Spotted Wood Dove
Tambourine Dove
Green Pigeon

CUCULIDAE

*Centropus superciliosus*1

White-browed Coucal

DICRURIDAE

*Dicrurus adsimilis*1

Drongo

ESTRILDIDAE

*Hypargos niveoguttatus*1
*Spermophaga ruficapilla*2
*Estrilda astrild*2
*Lonchura cucullata*1

Peter's Twinspot
Red-headed Bluebill
Waxbill
Bronze Mannikin

HIRUNDINIDAE

*Hirundo abyssinica*1
*Hirundo smithii*1

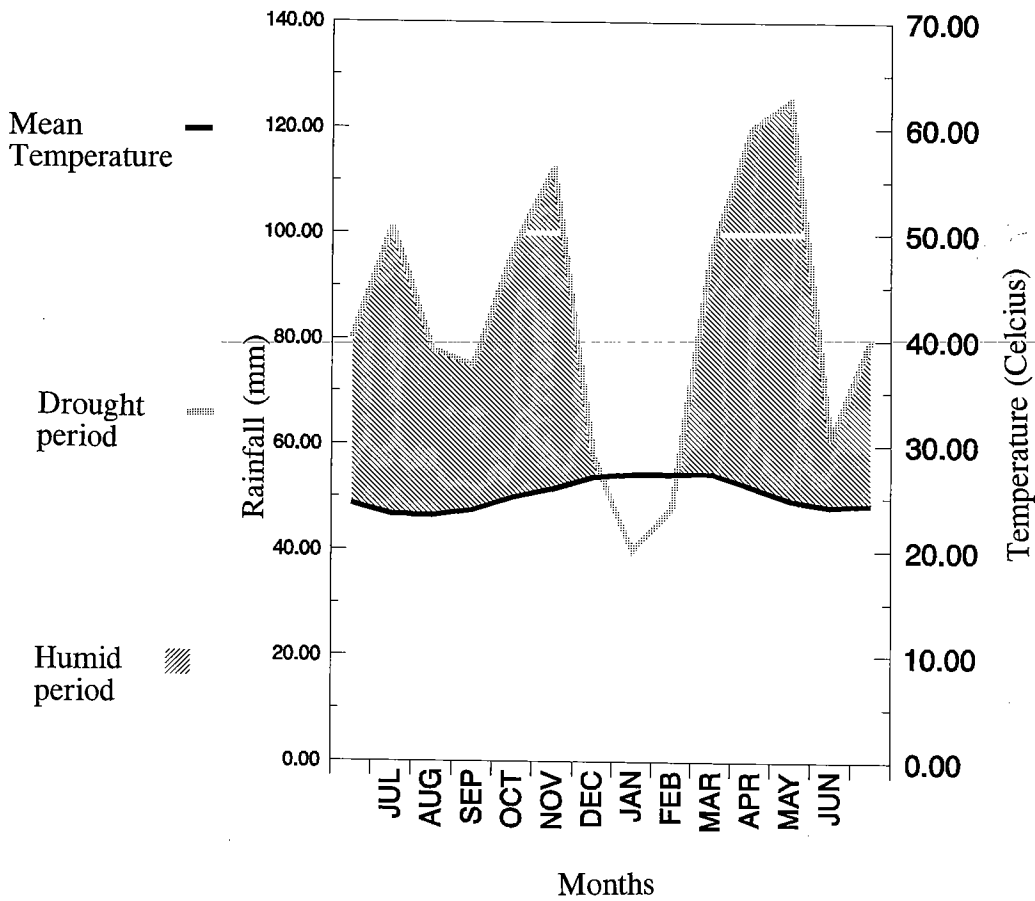
Striped Swallow
Wire-tailed Swallow

<i>Psalidoprocne pristoptera</i> 1	Black Rough-wing
INDICATORIDAE <i>Indicator Minor</i> 1	Lesser Honeyguide
MALACONOTIDAE <i>Dryoscopus cubla</i> 1	Black-backed Puffback
MEROPIDAE <i>Merops superciliosus</i> 1 <i>Merops nubicus</i> 2	Madagascar Bee-eater Carmine Bee-eater
MUSCICAPIDAE <i>Batis molitor</i> 1 <i>Platysteira peltata</i> 1 <i>Terpsiphone viridis</i> 1	Chin-spot Batis Black-throated Wattle-eye Paradise Flycatcher
NECTARINIIDAE <i>Anthreptes collaris</i> 1 <i>Anthreptes reichenowi</i> 1 <i>Nectarinia bifasciata</i> 1 <i>Nectarinia olivacea</i> 1	Collared Sunbird Plain-backed Sunbird Little Purple-banded Sunbird Olive Sunbird
ORIOOLIDAE <i>Oriolus auratus</i> 1	African Golden Oriole
PICIDAE <i>Dendropicus fuscescens</i> 1	Cardinal Woodpecker
PICNONOTIDAE <i>Chlorocichla flaviventris</i> 1 <i>Phyllastrephus terrestris</i> 1 <i>Phyllastrephus strepitans</i> 1	Yellow-bellied Greenbul Brownbul Northern Brownbul
PLOCEIDAE <i>Amblyospiza albifrons</i> 1 <i>Ploceus subaurens</i> 2 <i>Ploceus bojeri</i> 1 <i>Ploceus ocularis</i> 2 <i>Ploceus intermedius</i> 1 <i>Euplectes nigroventris</i> 1	Grosbeak Weaver Golden Weaver Golden Palm Weaver Spectacled Weaver Masked Weaver Zanzibar Red Bishop
PSITTACIDAE <i>Agapornis fischeri</i> 1	Fisher's Lovebird
RALLIDAE <i>Limnocorax flavirostris</i> 2	Black Crake
SYLVIIDAE <i>Prinia subflava</i> 1 <i>Cisticola spp.</i> 1	Tawny-flanked Prinia
STURNIDAE <i>Onychognatus morio</i> 2	Red Winged Starling
TROGONIDAE <i>Apaloderma narina</i> 1	Narina's Trogon

APPENDIX 3 : TANGA CLIMATE DIAGRAM

28m asl 15 Year records

(Data from Walter & Steiner, 1936)



Mean annual temperature - 25.4 C

Mean daily temperature range - 6.9 C

Mean annual rainfall - 1524 mm

THIS PUBLICATION FORMS PART OF THE FRONTIER TANZANIA SERIES.

OTHER TITLES IN THIS SERIES INCLUDE:

1. May 1990. The feasibility of road improvement and construction within the southern sector of Mikumi National Park, Morogoro Region, Tanzania.
2. June 1990. Preliminary results of biological surveys in seven coastal forests of Tanzania: July to September 1989. N.D. Burgess.
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