

## **ANNEXE 3**

### **Annotated Bibliography of some reserves that people have investigated.**

Note : For the references to this bibliography see Appendix 2 of main report

#### **Mountain Forest Reserves**

Location Bunduki I and III Forest Reserves

##### **Year established**

Year gazetted = 1950 (anon).

##### **Location**

7° 01' S, 37° 38' E 10 km from Mgeta via Bunduki Village. Bunduki I covers the slope and valley of the Mgeta river from 1220 to 1540 m, Bunduki III is a small reserve on level ground by the Mgeta river south west of Bunduki I at 1220 m. Bunduki I is marked on the topographical map as Vinile FR (Lovett *et al* 1993 and Doggart *et al*, 2000).

##### **Area**

Gazetted area : Bunduki I, 252 acres (102 ha); Bunduki III, 7.41 acres (3 ha) (Lovett *et al* 1993 and Doggart *et al*, 2000).

Gazetted boundary length : Bunduki I, 4.9 km (plus some distance along the Mungulu River); Bunduki III, 0.7 km (Lovett *et al* 1993 and Doggart *et al*, 2000).

##### **Soils**

Brown sandy loams over crystalline gneiss (Lovett *et al*, 1993).

##### **Climate**

Oceanic rainfall with oceanic temperatures. Nearest rainfall station: Bunduki. Estimated rainfall: 2000 mm/year. Dry season: June - July. Temperature range: 22°C max. (Dec.) to 17°C min (July). (Lovett *et al*, 1993).

## Vegetation

Bunduki I is mostly a plantation of *Pinus* spp., *Eucalyptus* spp., Bamboo, *Cupressus* spp., *Grevillea robusta* and Avocado. In the undergrowth beneath the plantation, and occasionally within the plantation itself, montane forest trees and shrubs occur. Bunduki III is a small patch of montane or submontane forest on a swampy area by the river (Lovett *et al* 1993 and Doggart *et al*, 2000).

Montane forest: Trees to 20 m including: *Alangium chinense*, *Albizia gummifera*, *Anthocleista grandiflora*, *Bersama abyssinica*, *Cussonia spicata*, *Cylicomorpha parviflora*, *Draceana steudneri*, *Ficus sur*, *Harungana madagascariensis*, *Parinari excelsa*, *Polyscias fulva*, *Rauvolfia caffra*, *Syzygium guineense* subsp. *afromontanum*. (Lovett *et al* 1993 and Doggart *et al*, 2000).

## Biodiversity

Although most of the area is a plantation of exotics, some bird, reptile and amphibian species of restricted distribution remain in the reserves. Bunduki III is just downstream of the reserve, in the Mgeta valley. It is a small patch of submontane riverine forest that is of traditional cultural importance, and which may also contain some species of restricted distribution (Lovett *et al* 1993 and Doggart *et al*, 2000).

## Catchment values

The reserves protect part of the Mgeta river catchment. (Lovett *et al* 1993 and Doggart *et al*, 2000).

## Human impacts

Substantial amount of forest seems to have been cleared, but there is evidence that the forest has extended along the eastern edge and in the south.. In 1955 there was 1.15 km<sup>2</sup> of forest and in 1980 there was 1.09 km<sup>2</sup> of forest. (Quinn, n.d. and Brantock, n.d.).

Bunduki Forest reserve has been clear felled leaving only exotic plantations (Svendsen *et al*, 1993).

The reserve is largely converted to exotic plantations, some of which are presently being harvested. Firewood and building poles are also taken from the reserve. The reserve is a useful seed source for exotics (Lovett *et al* 1993 and Doggart *et al*, 2000).

Chameleons and butterflies have been collected for trade and larger mammals all appear to have been hunted (Doggart *et al*, 2000).

Tourists are beginning to visit the reserve. They stay at the Bunduki Fly Fishing Lodge and visit the forest and spectacular Hululu Falls in neighbouring Uluguru South Forest Reserve. They are specialist tourists interested in seeing birds particularly Mrs Moreau's warbler and Loveridge's sunbird (Doggart *et al*, 2000).

There is a road through the reserve, which was being improved in August 2000 (Doggart *et al*, 2000).

## Location Kasanga Local Authority Forest Reserve

### Year established

Year gazetted = 1907 (anon).

### Location

07°10' S, 037°45' E. 1 km north of Kasanga Village. After Mvuha on the Morogoro – Kisaki road, turn towards Kolero. Beyond Kolero the road is passable in the dry season as far as Kasanga Mission. Walk from the mission. The reserve covers a gentle north-facing slope from 660 m to 940 m asl east of Kimhandu Peak in Uluguru South Forest Reserve. In the north it is bordered by the Msuluzi River and in the west by the Mkwega Stream, a small permanent stream (Doggart *et al*, 2000).

### Vegetation

There is a mix of submontane forest and plantation forest. On the steep slopes above the Msuluzi River all forest has been burnt leaving an area of grass and scrub. Submontane forest begins in the north of the reserve at 720 m. Trees include *Syzygium guineense*, *Albizia gummifera* and *Spirostachys africana*. *Parinari* sp. and *Podocarpus* sp. are present but are not common. *Dracaena* is dominant in the understorey close to the river. During the German colonial administration *Khaya anthotheca* was planted in the centre of the reserve and *Mangifera indica* in the south. These are still dominant in those areas. Other exotics planted include *Theobroma cacao*. (Doggart *et al*, 2000).

### Biodiversity

Kasanga is important in being one of the few places in the Uluguru Mountains with natural forest between 700 m and 900 m asl. It is the only place in the Uluguru Mountains where the rodent *Beamys hindei* has been recorded. (Doggart *et al*, 2000).

### Catchment value

The reserve protects the Mkwega and Bustani streams that flow into the Msuluzi. The reserve is a source of water for the irrigation channels around Kasanga Village.

### Human impacts

Under the German administration there was a forest post in the south of the reserve. The forest here was cleared and replaced with mango trees. The German houses are still visible beneath a tangle of vegetation. After Independence the forest officer managed a small nursery in the south-east of the reserve. This was closed in 1983 when the forest officer was relocated to Mvuha (Doggart *et al*, 2000).

The land immediately above the Msuluzi River has been cleared and is subject to frequent burning. The village has been planting *Senna siamea* in this area. Along the western border 24.7 acres (10 ha) of *Cedrela odorata* has been planted. (Doggart *et al*, 2000).

Four active or recently abandoned pitsaw sites were observed during the survey. The density of pitsawing is high given the inaccessibility of the reserve. Bird traps were observed above the Bustani stream. A frequently used path leading to Mvuha passes through the forest. This is used for the bush meat trade from the Selous (Doggart *et al*, 2000).

## Location Nyandiduma Forest Reserve

### Location

7° 06' S, 37° 34' E. 8 km from Mgeta. Access is from Mgeta via Nyandira on the Luwale road which forms the upper boundary. The reserve is on a steep east facing slope above the Mbakama river covering an altitude of 1500 to 1600 m. There is a 14.6 ha (36 acre) enclave of public land (Lovett *et al*, 1993).

### Area

Gazetted area = 118 acres (48ha), 140 acres on Jb 647 (Lovett *et al*, 1993).  
Gazetted boundary length = 27,809 ft (8.5 km) (Lovett *et al*, 1993).

### Soil

Sandy brown loams over crystalline gneiss (Lovett *et al*, 1993).

### Climate

Oceanic rainfall with oceanic temperatures. Nearest rainfall station: Tchenzema Mission. Estimated rainfall: 1300 mm/year. Dry season: June - Oct. Temperature range: 20°C max. (Dec.), 15°C min (July). (Lovett *et al*, 1993).

### Vegetation

Much of the reserve is a *Cupressus* sp. plantation with some *Acacia melanoxylon*, *Podocarpus* sp. and possibly *Widdringtonia* sp. Small patches of indigenous much disturbed secondary montane forest occur. (Lovett *et al*, 1993).

Secondary montane forest: *Albizia gummifera* trees up to 10 m tall over 2-3 m tall scrub. Trees include: *Albizia gummifera*, *Cussonia spicata*, *Draceana steudneri*, *Ensete ventricosa*, *Halleria lucida*, *Millettia oblata*, *Myrianthus holstii*, *Trema orientalis*. (Lovett *et al*, 1993).

### Biodiversity

The reserve has no indigenous biodiversity values, but the planted *Podocarpus* sp. and other species might be useful seed sources (Lovett *et al*, 1993).

### Catchment Values

The reserve has limited catchment values, but does serve to protect some steep slopes from erosion. (Lovett *et al*, 1993).

## Human impact

The reserve is mostly a plantation. Although still rather small, the *Cupressus* sp. is being harvested by the village because it is infected by pests. 6000 seedlings of *Grevillea robusta*, *Cupressus* sp. and Black Wattle have just been planted in the tuangya system. *Albizia gummifera* poles are cut for building. Goats are grazed in the reserve. (Lovett *et al*, 1993).

## Location Shikurufumi Forest Reserve

### **Year established**

Reserve established in either 1948 or 1937. (Lovett *et al*, 1993 and Doggart *et al*, 2000).

### **Location**

7° 09' - 7° 11' S, 37° 31' E. 20 km from Mgeta, at an altitude of 1100 meters. Access is from Mgeta through Langali, Nyandira, Kibuko, Luale to Kidege. The road to the reserve is in poor condition, but the road to Kikeo mission passing through the reserve is in quite good condition and not under heavy pressure. (Lovett *et al*, 1993 and Doggart *et al*, 2000).

### **Area**

Gazetted area = 642 acres (269 ha) (Lovett *et al*, 1993 and Doggart *et al*, 2000).  
Gazetted boundary length = 29,753 ft (9.1 km) (Lovett *et al*, 1993 and Doggart *et al*, 2000).

### **Soils**

Sandy brown loams over gneissic basement rocks. (Lovett *et al*, 1993 and Doggart *et al*, 2000).

### **Climate**

Oceanic rainfall with oceanic temperatures. Nearest rainfall station: Kibuko Coffee Plantation. Estimated rainfall: 1500 mm/year. Dry season: June - Oct. Temperature range: 22°C max. (Dec.), 17°C min (July). (Lovett *et al*, 1993 and Doggart *et al*, 2000).

### **Vegetation**

The reserve is mostly covered by submontane forest, part of which appears to be old secondary growth. The edges of the forest are scrubby regeneration and are probably influenced by fire. In the centre of the reserve is a clearing which may be edaphic or the site of an old village and is now influenced by fire. On the southern edge there is a *Eucalyptus* sp. plantation. (Lovett *et al*, 1993 and Doggart *et al*, 2000).

Submontane forest: Old secondary areas on the top of the ridge have a fairly open canopy 15-20 m high dominated by *Macaranga kilimandscharica* with: *Alangium chinense*, *Albizia gummifera*, *Bridelia micrantha*, *Cussonia spicata*, *Harungana madascariensis*, *Polyscias fulva*, *Trema orientalis*. *Aframomum* sp. dominates the herb layer. On more sheltered slopes, more mature areas of forest have a closed canopy 25-30 m high with: *Afrosersalisia cerasifera*, *Entandrophragma excelsum*, *Macaranga capensis*, *Myrianthus holstii*, *Newtonia buchananii*, *Odyndea zimmermannii*, *Parinari excelsa*, *Strombosia scheffleri*, *Trichoscypha madagascariensis*, *Trilepisium madagascariensis*. On the forest edge, scrubby regeneration includes: *Bersama abyssinica*, *Catha edulis*, *Cussonia spicata*, *Macaranga kilimandscharica*. The clearing in the forest is covered by bracken with occasional *Agauria salicifolia* and *Myrica salicifolia* trees. (Lovett *et al*, 1993 and Doggart *et al*, 2000).

### Catchment values

Shikurufumi stream originates in the reserve and flows through Lukungule village to Mbakana river through Kikeo mission. On the north east side water is taken from the forest via irrigation channels to Kododo Kitongoji Bomo. (Lovett *et al*, 1993 and Doggart *et al*, 2000).

### Biodiversity

The forest is of the Eastern Arc type and has various species of restricted distribution. (Lovett *et al*, 1993 and Doggart *et al*, 2000).

### Human impacts

Tchenzema region, the forest here has shrunk considerably between 1955 and 1980, with there being 1 km<sup>2</sup> of forest in 1955 and 0.44 km<sup>2</sup> of forest in 1980 (Quinn, n.d. and Bantock, n.d.).

On the ridge tops the forest appears to be in an old secondary successional stage, and the central clearing in the reserve may be the result of former inhabitation. Local people do not remember cultivation or habitation within the reserve and disturbance may date back several hundred years. (Lovett *et al*, 1993 and Doggart *et al*, 2000).

The road to Kikeo mission (the Kibuko to Mkinha road as mentioned in the schedule) passes through the reserve, but is no longer used by motor vehicles. Formerly there was a mica mine and small farm on the southern edge of the reserve this area is still cultivated by local people. There are many eucalyptus trees around the old mine buildings. (Lovett *et al*, 1993 and Doggart *et al*, 2000).

There is some cutting for firewood and building poles but this is not extensive. *Eucalyptus* sp. poles are taken for building from regeneration in the *Eucalyptus* sp. plantation. Medicine is taken from the reserve, notably bark from *Entandrophragma excelsum* and *Myrica salicifolia* trees. (Lovett *et al*, 1993 and Doggart *et al*, 2000).

## Location Uluguru North Forest Reserve

### Year established

Year established 1909 (Young and Fosbrooke, 1960)  
Year gazetted 1963 (Anon)

### Location

6° 51' - 7° 01' S, 37° 37' - 37° 45' E. 6 km from Morogoro. Access is from the Morogoro to Morningside road on the western side, and Tegetero on the eastern side. The reserve covers the steep summit ridge and easterly slopes of the northern half of Uluguru Mountains between Morogoro town and the Mgeta - Bunduki depression, within an altitudinal range of 1000 and 2340 m. From north east to south west the main summits are: Lupanga (2138 m), Kinazi (2150 m), Bondwa (2120 m), Nziwane (2270 m), Magari (2340 m), Miwa (1900 m), Mnyanza (2140 m) and Kifuru (2010 m) (Lovett *et al*, 1993).

### Area

Gazetted area = 20,649 acres (8356 ha) (Lovett *et al*, 1993).  
Gazetted boundary length = 223,628 ft (68 km) (Lovett *et al*, 1993).

### Soil

Acidic lithosols and ferralitic red, yellow and brown latosols have developed over Precambrian granulite, gneiss and migmatite rocks (Lovett *et al*, 1993).

### Climate

Oceanic rainfall with oceanic temperatures. Nearest rainfall stations: Kinole Primary School, Morningside Farm, Tegetero Mission. Estimated rainfall: 1200-3100 mm/year on the western slopes, 2900-4000 mm/year on the eastern slopes. Dry season: Not marked. Temperatures: 22°C max. (Dec.), 17°C min (July) at lower altitudes (Lovett *et al*, 1993).

### Vegetation

With the exception of rock outcrops, the reserve is entirely covered in moist forest. Submontane forest occurs on the eastern slopes between 800 and 1500 m above sea level, with the best stands above Kinole and Tegetero villages. On the western slopes this forest type is restricted to valley bottoms near to the lower edge of the forest reserve. Montane forest occurs between 1500 and 1900 m altitude. Upper montane forest occurs above 1900 m altitude on wetter slopes and ridges in the cloud belt, with stunted elfin forest on the highest ridges. Landslides occur (Lovett *et al*, 1993).

- Submontane forest: Canopy 30-50 m tall with: *Albizia gummifera*, *Allanblackia stuhlmannii*, *Aningeria adolfi-friedericii*, *Anthocleista grandiflora*, *Cephalosphaera usambarensis*, *Cylicomorpha parviflora*, *Funtumia africana*, *Myrianthus holstii*, *Sapium ellipticum*, *Syzygium guineense* subsp. *afromontanum*. Trees and shrubs include: *Chlamydistachya spectabilis*, *Lagynias pallidiflora*, *Micrococca holstii*, *Psychotria* spp. and *Pavetta* spp., *Pseuderanthemum campylosiphon*, *Memecylon cognauxii* and *M. myrtilloides*, *Mesogyne insignis*, *Micrococca holstii*, *Oxyanthus speciosus*, *Peddiea fischeri* and *P. subcordata*. *Commelinaceae* subshrubs include *Palisota orientalis*, *Polia condensata* and *P. bracteata*. Herbs include: the *Zingiberaceae*, *Aframomum* spp. and *Renealmia engleri* with broad leaved grasses such as *Leptaspis cocleata*. On shady cliffs the large *Antrophyum mannianum* fern is typical, and a common canopy epiphyte is the giant nest fern *Asplenium nidus*. In drier areas on the lower edge of the forest, usually below 1000 m, a semi-evergreen submontane forest type also occurs, dominated by *Albizia gummifera* and *Milicia excelsa*. (Lovett *et al*, 1993).
- Montane forest: The canopy is much less complex than in the previous type and usually consists of a single layer of 15-30 m tall trees. The dominant species are *Bridelia brideliifolia*, *Cornus volkensii*, *Cussonia spicata*, *Ficalhoa laurifolia*, *Ocotea usambarensis*, *Podocarpus latifolius*, *Syzygium guineense* subsp. *afromontanum* and *Zenkerella capparidacea*. Shrubs include: *Chassalia parviflora*, *C. violacea*, *Lasiotrochus usambarensis*, *Galineria coffeoides*, *Erythrococca usambarica*, *Euphorbia usambarica*, *Memecylon myrtilloides*, *Mostuea brunonis*, *Psychotria* spp. and *Pavetta* spp., and along streamlets large stands of the treefern *Cyathea manniana* occur. There are many epiphytic ferns and even in the ground layer ferns are the dominants, for example: *Asplenium hypomelas*, *Blotiella stipitata*, *Ctenitis lanuginosa*, *Diplazium pseudoporrectum*. On drier slopes and ridges a drier type of montane forests occurs with *Olea mildbraedii* and *Cussonia lukwangulensis* in the canopy, and *Blechnum ivohibense*, *P. punctulatum* and *Gleichenia* species in the herb layer. (Lovett *et al*, 1993).
- Upper montane forest: Canopy 15-20 m tall with: *Allanblackia ulugurensis*, *Balthasaria schliebenii*, *Podocarpus latifolius*, *P. ensiculus*, *Rapanea melanophloeos*, *Rauvolfia volkensii*, *Schefflera myriantha* and *S. barberi*. Epiphytes include the endemic orchids *Stolzia* spp. The trees and forest floor are thickly covered by bryophytes, which contribute to the catchment value. Shrubs include: *Lasianthus* spp. of which 8 are endemic, and the tree ferns, *Cyathea manniana*, the subendemic *C. pumila* and the endemic *C. fadenii* and *C. schliebenii*. On the mossy ground several endemic *Impatiens* spp. (like *I. uluguruensis*), *Cinnobotrys oreophila*, endemic *Linnaeopsis* spp. and *Streptocarpus* spp. (like *S. bullatus*) are typical. Elfin forests cover the highest summits and sharp ridges above 2100 m (but at windy, misty habitat sometimes down to about 1800 m altitude), where the shallow soil is completely leached and peaty. The canopy is 2-6 m tall with: *Agauria salicifolia*, *Allanblackia uluguruensis*, *Balthasaria schliebenii*, *Cussonia lukwangulensis*, *Garcinia volkensii*, *Podocarpus ensiculus*, *P. latifolius*, *Syzygium cordatum*, *Ternstroemia polypetala*, *Polyscias stuhlmannii* and *Lobelia lukwangulensis*. The trees form a tight, dense canopy, with masses of bryophytes and tiny, endemic orchids, like *Tridactyle brevifolia*. Dwarf shrubs, like the monotypic endemic *Dionychastrum schliebenii* (on Magari peak), the endemic *Stapfiella ulugurica* and *Streptocarpus hirsutissimus* (on Lupanga peak), also occur in this habitat. Bamboo (*Sinarundinaria alpina*) thickets occur in the elfin forest on the sharp north ridge of Magari peak. (Lovett *et al*, 1993).

## Biodiversity

The forests are of the Eastern Arc type and so are rich in species of restricted distribution. More than 40 endemic species of woody plant are recorded from the Uluguru mountains. The genera of *Impatiens*, *Lasianthus*, *Linnaeopsis* and *Stolzia* contain many endemics and monotypic endemics and near endemics are; *Chlamydostachya spectabilis*, *Dionychastrum schliebenii*, *Sooia macrantha* and *Urogentias ulugurica*. The Uluguru mountains have three endemic or subendemic giant *Lobelia* species: *L. morogoroensis* in submontane forest, *L. longisepala* in montane forest and *L. lukwangulensis* in upper montane forest. There are many subendemic species which also occur in the Usambara or Nguru mountains (Lovett *et al*, 1993).

## Catchment Value

The catchment value is very high as the area has one of the highest rainfalls in Tanzania without a marked dry season. On eastern side the reserve is part of the Ruvu river catchment, and supplies Dar es Salaam with water. On the western side it supplies Morogoro town and villages on the mountain slopes.

## Human Impact

Rubwe region, there have been slight changes in forest between 1955 and 1980 with a total of 1.31 km<sup>2</sup> of forest being lost. In 1955 there was 18.7 km<sup>2</sup> of forest while in 1980 there was 17.39 km<sup>2</sup> of forest. (Quinn, n.d. and Bantock, n.d.).

Bunduki region, 1.8 km<sup>2</sup> of forest was lost between 1955 and 1980. with there being 5.24 km<sup>2</sup> of forest cover in 1955 and 3.44 km<sup>2</sup> of forest cover in 1980 (Bantock, n.d.).

The area adjacent to the reserve is intensively cultivated. Although the forest boundaries are well marked and seemingly intact, many encroachments occur and illegal logging takes place. Pole collecting for building purposes has resulted in most regeneration being removed from areas near the edge of the reserve. Heavy rains have caused serious landslides several times in the area. Fires lit at the end of the dry season cause serious damage every year in the forest reserve. The steep slopes result in the fires spreading rapidly in dry bush and grasslands neighbouring the forest. The area most affected are the slopes of Lupanga above Morogoro town. (Lovett *et al*, 1993).

## Location Uluguru South Forest Reserve

### Year established

Year established 1909 (Young and Fosbrooke, 1960).

### Location

7° 01' - 7° 12' S, 37° 36' - 37° 45' E. 10 km from Morogoro, 5 km from Mgeta. Access is from Mgeta via Tchenzema or Bunduki. The reserve covers the southern half of the Uluguru mountains from about 1200 m upwards on the east and from 1800 m on the western slopes to the summits of Makumbaku (2420 m), Kimhandu (2634 m) and Lukwangule Peak (2638 m). The 20 km<sup>2</sup> Lukwangule Plateau lies between two parallel north - south ridges at an altitude of over 2300 m. (Lovett *et al*, 1993 and Doggart *et al*, 2000).

### Area

Gazetted area = 42,731 acres (17,293 ha) (Lovett *et al*, 1993 and Doggart *et al*, 2000).

Gazetted boundary length = 360,490 ft (36.3 km) (Lovett *et al*, 1993 and Doggart *et al*, 2000).

### Soils

A wide range of acidic lithosols and ferralitic red, yellow and brown latosols have developed on Precambrian granulite, gneiss and migmatite rocks. A large area of the Lukwangule Plateau is covered by peat deposits. (Lovett *et al*, 1993 and Doggart *et al*, 2000).

### Climate

Oceanic rainfall with oceanic temperatures. Nearest rainfall stations: Bunduki Kibungo mission, Tchenzema Mission. Estimated rainfall: 2500-4000 mm/year on the eastern slopes and summit to 2000 mm/ year on the western slopes. Dry season: On the eastern slopes there is no marked dry season, on the western slopes there is a dry season of from June - July. Temperature: 20°C max. (Dec.), 15°C min (July) at lower altitudes. On the Lukwangule plateau frosts are common on clear nights during the cool season (measured down to -7°C). (Lovett *et al*, 1993 and Doggart *et al*, 2000).

## Vegetation

Basal area on : -

(Svendsen *et al*, 1993 b).

	Total BA (m <sup>2</sup> /ha)	No. of stems	No. of individuals	No. of species	Canopy base	Height of mid-	Height of canopy	Height of emergent
Kimhandu (1510 m)	141.57	91	84	26	5-6 m	10-12 m	20-30 m	40 m
Kimhandu (1710 m)	39.64	152	145	34	3-4 m	6-8 m	20-30 m	55 m
Kimhandu (1940 m)	50.21	157	142	28	6-10 m	10-15 m	25-30 m	45 m
Kimhandu (2145 m)	136.12	146	141	27	6-8 m	10-12 m	20-25 m	35 m
Kimhandu (2520 m)	37.28	170	136	17	3-5 m	5-7 m	12-15 m	25 m
Lanzi (1710 m)	99.81	101	98	20	6-8 m	15-20 m	24-28 m	40 m
Lanzi (1920 m)	89.20	233	222	30	6-8 m	15-20 m	25-30 m	40 m
Lanzi (2110 m)	82.75	100	93	93	8-10 m	20-25 m	27-30 m	40 m

The eastern and western slopes are covered by moist forest, which surrounds the upland grassland, swamps and forest patches of the Lukwangule plateau. Montane forest occurs from 1500-2400 m, and upper montane forest above 2000 m. Bamboo thickets cover large areas in the upper Mgeta valley and on Kimhandu summit, usually above 2000 m, but also as low as 1600 m in the Mgeta River Valley above Hululu Falls. Landslides occur. (Lovett *et al*, 1993 and Doggart *et al*, 2000).

Montane forest. No data, but presumably similar to Uluguru North montane forest. (Lovett *et al*, 1993 and Doggart *et al*, 2000).

Upper montane forest: Canopy 10-15 m tall. Trees on the eastern side include: *Bersama abyssinica*, *Cassipourea malosana*, *Cornus volkensii*, *Cussonia lukwangulensis*, *C. spicata*, *Dombeya torrida*, *Draceana afromontana*, *Garcinia volkensii*, *Halleria lucida*, *Podocarpus latifolius*, *Rapanea melanophloeos*, *Maesa lanceolata*, *Mystroxydon aethiopicum*, *Nuxia congesta*, *Ocotea usambarensis*, *Polyscias stuhlmannii* and *Xymalos monospora*. Bamboo thickets form dense stands of *Sinarundinaria alpina* 12-15 m tall and 15 cm diameter, with the commonest species in the ground flora being *Selaginella kraussiana*. (Lovett *et al*, 1993 and Doggart *et al*, 2000).

Grasslands and tree clumps: Grasslands on the Lukwangule plateau consisting of *Panicum lukwangulense* and *Andropogon thystinus* with scattered trees of *Agauria saliciflora*, *Adenocarpus mannii*, *Myrica salicifolia* and *Berberis* sp. are thought to have replaced upper montane forest following fire. Forest patches contain the trees: *Apodytes dimidiata*, *Cussonia lukwangulensis*, *Ochna oxyphylla*, *Olea capensis*, *Pittosporum goetzei*, *Syzygium cordatum*, *S. parvulum*; and the giant herb *Lobelia lukwangulensis*. At the Ruvu river springs, peat bogs formed by *Sphagnum* spp, *Eriocaulon schimperi* and *Pycneus nigricans* occur. In boggy places afroalpine species, such as *Ranunculus oreophytus* and *Alchemilla johnstonii* occur. (Lovett *et al*, 1993 and Doggart *et al*, 2000).

## Catchment values

The catchment value of the reserve is extremely high. It covers one of the highest rainfall areas in Tanzania, feeding the Ruvu river which supplies Dar es Salaam. The locally important Mgeta river also originates in the reserve. (Lovett *et al*, 1993 and Doggart *et al*, 2000).

## Biodiversity

The forests are of the Eastern Arc type and so are rich in species of restricted distribution. The Uluguru mountain forests contain more than 40 endemic woody species, and they are particularly rich in endemic species of the genera; *Impatiens*, *Lasianthus*, *Linnaeopsis* and *Stolzia*. Monotypic endemics are; *Dionychastrum schliebenii* and *Sooia macrantha*. *Moraea callista* occurs on the Lukwangule plateau. The wetter eastern part of the reserve is not known botanically and is likely to contain many species of restricted distribution. (Lovett *et al*, 1993 and Doggart *et al*, 2000).

## Human impacts

Nyingwa area small clearing were appearing in 1980. In 1955 there was 7.82 km<sup>2</sup> of forest while in 1980 there was 6.65 km<sup>2</sup> of forest in total the Nyingwa region has lost 1.77 km<sup>2</sup> (Quinn, n.d. and Bantock, n.d.).

Tchenzema region the forest does not seem to have changed between 1955 and 1980, with 4.34 km<sup>2</sup> of forest in 1955 and 4.32km<sup>2</sup> in 1980 (Quinn, n.d.).

Bunduki region, 3.02 km<sup>2</sup> of forest was lost between 1955 and 1980. With 7.52 km<sup>2</sup> of forest cover occurring in 1955 and 4.50 km<sup>2</sup> of forest cover occurring in 1980 (Bantock, n.d.).

The very south seems untouched by man. (Svendsen *et al*, 1993).

In Lanzi area pitsawing only occurs to a limited extent (Svendsen *et al*, 1993).

Above Tchenzema the forest is strongly disturbed, only being undisturbed above 2350 meters) (Svendsen *et al*, 1993).

Forest west of Lukwangule Plateau is heavily used for poles and firewood, with all the large timber having been extracted here (Svendsen *et al*, 1993).

Bunduki area nearly all the large timber has been extracted, with the forest being only 10-15 m tall below 2300 meters, it is more like secondary growth (Svendsen *et al*, 1993).

The reserve is surrounded by cultivation. The Mgeta valley is an important agriculture area producing vegetables which supply Morogoro and Dar es Salaam, the slopes above Tchenzema are cultivated up to 2000 m altitude. Building poles are intensively collected in areas adjacent to cultivation. Encroachment is common and logging is carried out. Heavy rainfall on steep deforested slopes has resulted in serious landslides. (Lovett *et al*, 1993 and Doggart *et al*, 2000).

Local people are hunting *Cercopithecus mitis*, *Colobus angolensis* and *Cephalophus spadix*. There is also trade in chameleons which are sold to a Uluguru trader in Dar es Salaam. (Doggart *et al*, 2000).

## Location Vigoza Forest Reserve

### **Year established**

Year established = 1947 (Lovett *et al*, 1993).

### **Location**

7° 06' S, 37° 35' E. 12 km from Mgeta. Access from Mgeta to Nyandira and then to Tchenzema and by foot on the old road to the mission. The reserve covers a slope above the Vigoza river from an altitude of 1700 m (Lovett *et al*, 1993).

### **Area**

Gazetted area = 23 acres (9 ha) (Lovett *et al*, 1993).  
Gazetted boundary length = 5,487 ft (1.7 km) (Lovett *et al*, 1993).

### **Soil**

Sandy brown loams over gneiss (Lovett *et al*, 1993).

### **Climate**

Oceanic rainfall with oceanic temperatures. Nearest rainfall station: Tchenzema. Estimated rainfall: 1200 mm/year. Dry season: June - Oct. Temperature range: 20°C max. (Dec.), 15°C min (July). (Lovett *et al*, 1993).

### **Vegetation**

The reserve was formerly a *Cupressus* plantation which was harvested and is now a vegetable garden. There is a *Polyscias fulva* tree still standing in the reserve. (Lovett *et al*, 1993).

### **Catchment Values**

The reserve is bounded by the Vigoza river on the north west side and the Mhongolo river on the south side. Reforestation would help control runoff and soil erosion into these rivers. (Lovett *et al*, 1993).

### **Human Impact**

The reserve is a cultivated field. The Mgeta to Tchenzema road traverses the reserve (Lovett *et al*, 1993).

## Foothill forest Reserves

### Location Mvuha and Chamanyani Forest Reserve

#### Location

07° 08' - 07° 13' S, 37° 47' - 37° 51' E. 30 km from Kimboza. Access is from the Kimboza to Mvuha road, which traverses Chamanyani FR near the eastern boundary, and by foot up the southern side of the Mvuha river to Mvuha FR. The reserve covers hilly country to the east of the Uluguru mountains and part of the Mvuha river valley from an altitude of 140 to 400 m (Lovett *et al*, 1993 and Doggart *et al*, 2000).

#### Area

Gazetted area = 3724 acres (1506 ha) (Lovett *et al*, 1993).  
Gazetted boundary length estimated to be 48 km (Lovett *et al*, 1993).

#### Soils

Brown sandy soils over crystalline gneiss under the woodlands with more humus and occasionally flooded sandy loams in the Mvuha valley. Richly calcareous slopes are recorded from the eastern side of Bewa Hill. (Lovett *et al*, 1993 and Doggart *et al*, 2000).

#### Climate

Oceanic rainfall with oceanic temperatures. Nearest rainfall stations: Bwikira Juu, Mkuyuni. Estimated rainfall: 1400 mm/year. Dry season: June - Sep. Temperature range 28°C max. (Dec.), 23°C min (July) (Lovett *et al*, 1993 and Doggart *et al*, 2000).

#### Vegetation

Most of the reserve is covered by woodland or wooded grassland, the more open areas of which appear to be maintained by fire. Valleys and valley heads are forested (Lovett *et al*, 1993 and Doggart *et al*, 2000).

Woodland: Trees 5-10 m tall with: *Albizia versicolor*, *Brachystegia boehmii*, *B. spiciformis*, *Cassia abbreviata*, *Pterocarpus angolensis*, *Sclerocarya caffra*. (Lovett *et al*, 1993 and Doggart *et al*, 2000).

Riverine forest: Canopy 20-25 m with: *Antiaris toxicaria*, *Khaya*, *Milicia excelsa*, *Ricinodendron* sp., *Sorindeia madagascariensis* and *Sterculia appendiculata*. (Lovett *et al*, 1993 and Doggart *et al*, 2000).

Riverine forest : The cycad *Encephalartos hildebrandtii* (to be confirmed) is common around the streams leading into Mvuha River (Doggart *et al*, 2000).

## **Biodiversity**

The woodlands are composed of widespread species, but it is likely that the riverine forests contain some Eastern Arc and Coastal Forest species of restricted distribution. The Red Colobus (*Mbega Nekundu*) was reported by the local forester but was not seen. If it occurs then it is an important indicator of high biodiversity (Lovett *et al*, 1993).

The reserve has many species typical of lowland forests. However the *Cercopithecus* sp. appear to be quite different to blue monkeys in the Usambara Mountains. Red fur extends from between the shoulders to the base of the tail on males and females, the forelegs and hind legs are black as is the nose and mouth. (Doggart *et al*, 2000).

## **Catchment values**

The reserve protects a number of small catchments feeding into the Mvuha river, and the banks of the Mvuha river itself. There are seasonal water courses in the woodland. (Lovett *et al*, 1993 and Doggart *et al*, 2000).

## **Human impacts**

Mvule and Mkangazi were extracted from the reserve many years ago. More recently the reserve was encroached due to lack of boundary marking. Building poles and firewood are taken for local use. Fire occurs every year. Ancient graves are marked on the 1910 border map on the western side of Mvuha FR (Lovett *et al*, 1993).

There is pitsawing in the reserve although most of the *Milicia excelsa* and *Khaya anthotheca* were extracted from the reserve many years ago. In the 1980's the reserve was encroached due to lack of boundary marking. The marking of the boundary has not been completed and beacons are missing. Along the Mvuha miners are panning for rubies and gold. They have established camps on the banks of the river. Building poles and firewood are taken for local use. Fire occurs every year. Ancient graves are marked on the 1910 border map on the western side of Mvuha FR. Maasai graze their cattle in the east of the reserve. (Doggart *et al*, 2000).

## Location Ruvu Forest Reserve

### Date established

Established in 1955 (Lovett *et al*, 1993 and Doggart *et al*, 2000).

### Location

6° 53' - 7° 02' S, 37° 49' - 37° 54' E. Access is from the Mkuyuni to Matombo road. The reserve is in the eastern Uluguru mountain foothills, covering a plateau on either side of the Ruvu River gorge at an altitude of to 200 m to 480 m asl. (Lovett *et al*, 1993 and Doggart *et al*, 2000).

### Area

Gazetted area 7,640 acres (Anon.).

### Soils

Tropical rendzina on dolomitic marble (in the western half) and red ferralitic latosols on Precambrian granulite and gneiss (in the eastern half). (Lovett *et al*, 1993 and Doggart *et al*, 2000).

### Climate

Oceanic rainfall with oceanic temperatures. Nearest rainfall station: Kibungo. Estimated rainfall: 1800 mm/year on the western edge with peaks in Dec. and May, decreasing rapidly eastwards. Dry season: July to Sept. on the western edge, longer in the east of the reserve. Temperature: 28° C max. (Dec.), 23° C min (July). (Lovett *et al*, 1993 and Doggart *et al*, 2000).

### Vegetation

The western half of the reserve is covered with seasonal lowland forest. (Lovett *et al*, 1993 and Doggart *et al*, 2000).

Lowland forest: Canopy trees include: *Albizia gummifera*, *Khaya anthotheca* (formerly *K. nyasica*), *Milicia excelsa*, *Parkia filicoidea*, with *Barringtonia racemosa* on the stream bank. Smaller trees include: *Scorodophloeus fischeri* with *Acridocarpus cf. scheffleri*, *Meineckia fruticans*, *Pycnocomma macrantha*, *Rawsonia reticulata*, *Afrosersalisia cerasifera*, *Diospyros* sp. Shrubs include: *Dorstenia cameruniae* and *Psychotria cf. riparia*. (Lovett *et al*, 1993 and Doggart *et al*, 2000).

In the east there is mixed woodland with *Brachystegia* sp. and *Acacia* sp. At the transition between lowland forest and woodland *Acacia polyocantha*, *Annona senegalensis*, *Markhamia obtusifolia* and *Lannea stuhlmannii* are common. (Doggart *et al*, 2000).

## **Biodiversity**

The forests are of the Eastern Arc and Coastal forest type and so will be rich in species of restricted distribution. An Eastern Arc endemic is *Pycnocomacrantha*. *Rawsonia reticulata* occurs here below its normal altitudinal range. Ruvu Forest Reserve might be an important link in the chain of coastal lowland forests. (Lovett *et al*, 1993 and Doggart *et al*, 2000).

## **Catchment values**

The area protects the banks of the Ruvu river, and is part of the catchment. The Ruvu River supplies Dar es Salaam with water. (Lovett *et al*, 1993 and Doggart *et al*, 2000).

## **Human impacts**

Ruby mining takes place in the reserve (Svendsen *et al*, 1993).

The most serious disturbance in the forest is caused by ruby mining as the reserve is one of the most important localities for this gemstone in Tanzania. Licensed mining causes much damage, but is restricted to a licensed area. Unlicensed mining is carried out in many places in the reserve, the soil cover is removed and the whole area is much disturbed by the digging. Miners have also established camps on the banks of the Ruvu River where they can pan for gold. (Lovett *et al*, 1993 and Doggart *et al*, 2000).

Encroachment by small scale farming and fire also causes damage near the villages of Kibungo and Kibangile. (Lovett *et al*, 1993 and Doggart *et al*, 2000).

Duiker and bush pig are being hunted. (Doggart *et al*, 2000).

## Lowland Forest Reserves

### Location Kimboza Forest Reserve

#### Year established

Year established = 1964. (Lovett *et al*, 1993).

#### Location

7°00'S, 37°48'E. Kimboza Forest lies astride the Ruvu River and is crossed by the main Morogoro to Kisaki road (Rodgers *et al*, 1983).  
6° 59' - 7° 02' S, 37° 47' - 37° 49' E. Access is from the Morogoro to Kisaki road between Mkuyuni and Matombo villages. The reserve is in the eastern Uluguru foothills covering a karstic plateau south of Kibungo Mission at an altitude of 300 to 400 m. (Lovett *et al*, 1993).

#### Area

Gazetted area: 951 acres (385 ha) (Rodgers *et al*, 1983).  
Gazetted boundary length: 11 km (Lovett *et al*, 1993).

#### Topography

The reserves goes from 180 m to 500 m (Rodgers *et al*, 1983).

#### Soils

Kimboza Forests is on calcite and dolomite marbles of the Matombo Group. The marble gives rise to a karstic landscape, with large isolated blocks and pinnacles of marble. (Rodgers *et al*, 1983).  
Soil are moderately good for agriculture, but are probably highly leached of their calcium parent material due to the high rainfall (Rodgers *et al*, 1983).  
Tropical rendzina on Precambrian dolomitic marble base rocks. (Lovett *et al*, 1993).

#### Climate

Annual rainfall 1683 mm with only 3 months getting less than 50 mm (records over 13 years) . The major rainy season is from November to April. Temperatures are high with a cool season from May to August. Humidities remain high for much of the year. (Rodgers *et al*, 1983).  
Oceanic rainfall with oceanic temperatures. Nearest rainfall station: Kibungo. Estimated rainfall: 1700 mm/year with groundwater. Dry season: June - Aug. Temperature: 28°C max. (Dec.), 23°C min (July) (Lovett *et al*, 1993).

## Vegetation

- Kimboza forest is virtually all lowland rain forest with a closed canopy to 20 m, in places 30 m and with emergent up to 40 m. A distinct middle story at 10-15 m and a shrub layer from 2-5 m are present. Trees of the Leguminosae, *Moraceae* and *Sapotaceae* dominate the canopy layer. (Rodgers *et al*, 1983).
- Major emergent species are *Antiaris toxicaria*, *Aningeria pseudoracemosa*, *Chlorophora exelsa*, *Cordyla africana*, *Ficus* spp., *Parkia filicoidea*, *Rhodognaphalon scumaniuanum*, *Ricinodendron heudelottii*, *Sterculia appendiculata*. (Rodgers *et al*, 1983).
- Main canopy species are, *Cussonia zimmermannii*, *Dialium holtzii*, *Newtonia paucijuga*, *Scorodophleus fischeri* and *Tessmanai* sp. nov. (Rodgers *et al*, 1983).
- The middle story is dominated by *Scorodophleus* and *Sorindela madagascariensis*. These two trees are the commonest trees above 20 cm in diameter in the forest. Other components are *Bequartiodendron natalense*, *Diospyros brucei* and *D. verrucosa*, *Drypetes natalensis*, *Funtumia africana*, *Lannea antiscorbutica*, *Lettowianthus stellatus*, *Rauvolfia mombasiana*, *Pandanus goetzel* and *Uvariadendron gorgonis*. (Rodgers *et al*, 1983).
- The shrub layer is variable, but the following are most frequent *Allophyllus* spp. *Cola* spp., *Diospyros greenwayi*, *Grandidiera boivinii*, *Leptonychia usambarensis* (rarely seen as a tree), *Ophrypetalum odoratum* and several *Rubiaceae*. (Rodgers *et al*, 1983).
- The herb layer depends on surface conditions. *Costus* is frequent in damper areas. Several *Acanthaceae* occur and grasses are not common, although *Olyra latifolia* and *Setaria megaphylla* are conspicuous in patches. A rocky community with many succulent herbs: *Amorphophallus*, *Dorstenia denticulata*, *Gonatopus*, *Impatiens cinnabarina*, *Laportea*, *Steptocarpus*, *Kimbozanus* and *Zamioculcas* is widespread (Rodgers *et al*, 1983).
- Lianess are common and include *Acacia* sp., *Combretum* spp., *Coccinia*, *Entada*, *Grewia*, *Hippocratea*, *Landolphia*, *Paullinia* and *Saba*. (Rodgers *et al*, 1983).
- Epiphytes are conspicuous due to the abundance of large ferns, *Platyserium* and *Asplenium nidus*, Orchids are rare and include small *Aerangis*, *Angraceum* and *Bulbophyllum*. (Rodgers *et al*, 1983).
- The predominant natural vegetation type is seasonal lowland forest formerly with a 30-40 m high canopy of tall emergent, most of which have now been extracted. Within the forest protruding metamorphosed limestone karsts are a prominent feature (Lovett *et al*, 1993).
- Lowland forest: Large trees include: *Antiaris toxicaria*, *Aningeria pseudoracemosa*, *Bombax rhodognaphalon*, *Cordyla africana*, *Elaeis guineensis* (native, up to 20 m tall), *Khaya anthotheca* (formerly *K. nyasica*) (almost all exploited), *Isobertlinia scheffleri*, *Lettowianthus stellatus*, *Milicia excelsa*, *Newtonia paucijuga*, *Parkia filicoidea*, *Ricinodendron heudelottii* and *Sterculia appendiculata*. In the canopy large nest epiphytes, such as *Platyserium elephantotis* and *Davallia chaerophylloides*, are common. A second or third storey is formed by many smaller trees, such as *Cola stelenacantha* and *C. greenwayii*, *Cussonia zimmermannii*, *Dialium holtzii*, *Drypetes parviflora*, *Filicium decipiens*, *Garcinia livingstonei* and *G. semsei*, *Grandidiera boivinii*, *Ixora tanzaniensis*, *Leptonychia usambarensis*, *Scorodophloeus fischeri*, *Uvariadendron gorgonis* and *Zenkerella egregia*. Near springs and streamlets *Pandanus* cf. *englerii* forms large stands. The herb layer is often dominated by *Nephrolepis biserrata* and rare aroids occur such as *Amorphophallus stuhlmannii*, *Anchomanes difformis*, *Calloopsis volkensii*, *Gonatopus boivinii*. On shady limestone or marble rocks an interesting community occurs containing *Zamioculcas zamiifolia* and the endemic *Impatiens cinnabarina*. At the northern edge of the reserve dry, semi-deciduous forests also occur. Along the road *Cedrela* sp. and teak plantation forests are cultivated (Lovett *et al*, 1993).

## Biodiversity

The forest is of the Eastern Arc and Coastal forest type, and so is rich in species of restricted distribution. For example the blue dwarf gecko (*Lygodactylus williamsi*) is an endemic lizard species found only on *Pandanus* sp. stems in Kimboza Forest Reserve. Compared to the small area a very high number of plant species are endemic: two *Asystasia* species, *Baphia pauloi*, *Chassalia discolor* var. *grandifolia*, *Cynometra uluguruensis* (a tall tree), *Garcinia bifasciculata* (tree), *Impatiens cinnabarina*, *Pavetta crebrifolia* var. *kimbozensis*, *Streptocarpus kimbozana*, and an epiphyllous liverwort: *Cololejeunea jonesii*. (Lovett *et al*, 1993).

## Catchment Value

Plays a minor catchment role, having several springs, all the water flows directly to the Ruvu and does not supply local communities with water. (Rodgers *et al*, 1983).

There are several springs producing water all year and supplying several streamlets carrying water to the Ruvu River (Lovett *et al*, 1993).

## Human Impact

There is extraction of timber by pit sawing, some is legal and some is illegal, the industry is not locally based (Rodgers *et al*, 1983).

Local people use the forest to collect food stuff, medicines (over a hundred collected by local herbalists, building material and firewood, hunting is rare as animal populations are low. (Rodgers *et al*, 1983).

Heavy extraction of building poles, especially near roads. (Rodgers *et al*, 1983).

Firewood is collected in areas of forest near villages (Rodgers *et al*, 1983).

Has been some destruction to the natural forest by the Forestry Division (Rodgers *et al*, 1983).

Kimboza Forest Reserve contains several plantations of varied size of exotic and native trees species (Rodgers *et al*, 1983).

The border of the reserve is well marked but cultivation pressure goes right up to the border

Logging has almost completely deprived the forest of its tall canopy trees causing great damage. Most large Mkangazi trees were pitsawn in the early seventies. Large specimens of *Aningeria pseudoracemosa* existed in the late eighties but by now have almost all disappeared. Minor forest products include building poles and medicines. *Cedrela* sp. from nearby plantations has invaded the forest, replacing the indigenous canopy trees (Lovett *et al*, 1993).

## Location Konga Local Authority Forest Reserve

### Location

06° 55' S, 37° 36' E 12 km south-west of Morogoro and adjacent to Konga Village. From the old Morogoro – I Ringia road stop at Konga Village. The reserve is behind the village. The forest covers a level area at 540 m asl beside the Ngerengere Stream which forms the south-eastern border of the reserve. (Doggart *et al*, 2000).

### Vegetation

Dry lowland forest with a canopy at 20 m. The canopy is dominated by *Synsepalum msolo* and *Sterculia appendiculata*. Other common trees are *Sorindeia madagascariensis*, *Albizia gummifera* and *Diospyros mespiliformis*. *Milicia excelsa*, *Ficus exasperata*, *Bombax rhodolnaphalon* and *Vangueria infausta* were also present. *Syzygia coffeoides* forms a closed low understorey at 1–3 m. *Lantana camara* is common close to the forest edges. (Doggart *et al*, 2000).

### Biodiversity

The reserve is one of few examples of lowland forest along the Ngerengere / Mkurunge valley. The vegetation and fauna are typical of closed lowland forest. The absence of the diurnal primates typical, *Cercopithecus mitis* and *Colobus angolensis* suggests that some species are under stress from the small size of the forest. (Doggart *et al*, 2000).

### Catchment values

The forest is close to the Ngerengere stream. (Doggart *et al*, 2000).

### Human impacts

Forest has been cleared from the land immediately adjacent to the Ngerengere Stream. This appeared to be for cultivation although no crops were growing at the time of the survey. Firewood and poles are collected from the forest and there is almost no dead wood on the forest floor. There are graves in the west of the reserve. Duiker are being hunted. (Doggart *et al*, 2000).

## Location Mangala Local Authority Forest Reserve

### Location

06° 58'S, 037° 44' E. Travelling south on the Morogoro – Kisaki road turn right just after Mkuyuni towards Changa. The reserve covers Mangala Hill between 280 m and 640 m asl. The Mvuha River forms the southern border. The upper slopes in the south of the reserve are very steep with a 50 m high rock face mid-slope. The northern part of the reserve is less steep (Doggart *et al*, 2000).

### Vegetation

Most of the reserve is dominated by bracken with a few trees, mainly *Brachystegia* sp. and *Julbernardia* sp. Lowland forest remains between 500 m–620 m. In this area the canopy of the east-facing slope is dominated by *Tabernaemontana* sp which is present in almost pure stands at higher altitudes. Lower down there is also *Bombax rhodognaphalon*, *Khaya anthotheca*, *Newtonia* sp. and two species of CAESALPINACEAE (ULU 350 and ULU 357). The canopy of the south-west facing slope is more diverse, dominated by *Terminalia brownii* with *Khaya anthotheca* and *Albizia gummifera* also common. In the shrub layer the climber *Acacia brevispica* is common. (Doggart *et al*, 2000).

### Biodiversity

Although much of the reserve is highly disturbed the forest on the steep southern slopes forms a diverse, closed canopy with many tree species typical of lowland Eastern Arc forest. The abundance of *Tabernaemontana* sp appears to support a substantial population of *Cercopithecus mitis*. The fruits are also popular with the bush pig, which were common in the reserve. The forest supports a number of vertebrate species endemic to the Eastern Arc. This is also the first time that the East coast akalat has been recorded in the Uluguru Mountains (Doggart *et al*, 2000).

### Catchment values

The reserve is adjacent to the Mvuha River however there is almost no forest on the banks of the river. A small spring was found close to the top of Mangala Hill, this had been dammed to provide water for the pitsaw camps. No other running water was seen. (Doggart *et al*, 2000).

### Human impacts

Much of the reserve has been cleared, according to local people this has occurred quite recently. Rice cultivation extends into the Northeast of the reserve where substantial areas of forest have been cleared. According to our guide the chairman of Ludewa has been proposing to clear the whole forest in order to plant coffee and has been issuing permits to cultivate within the forest reserve (Doggart *et al*, 2000).

Active pitsaws were observed and most of the *Milicia excelsa* has already been extracted. *Albizia* sp (not *gummifera*) is also being cut (Doggart *et al*, 2000). According to our guide there is commercial hunting for *Colobus angolensis*. The skins are sold to traders from Arusha (Doggart *et al*, 2000).

## Location Milawilila Local Authority Forest Reserve

### Location

06° 59' S, 37°45' E. Travelling south on the Morogoro – Kisaki road turn right just after Mkuyuni towards Changa Village. The forest is 4 km walk from Changa. The reserve is on a gentle north-east slope between 320 m and 400 m asl. The Mvuha River forms the northern border of the reserve (Doggart *et al*, 2000).

### Vegetation

Lowland forest with a closed canopy at 15 m becoming more open towards the forest edge. The canopy is dominated by ULU 350 (unidentified), *Tabernaemontana elegans*, *Albizia gummifera* and *Bombax rhodognaphalon*. Other canopy trees include *Diosphyros mespiliformis*, *Bridelia micrantha*, *Cussonia zimmermannii*, *Ficus exasperata*, *Sorindeia madagascariensis*, *Deinbollia borbonica*, *Milicia excelsa* and *Sterculia appendiculata*. *Lamprosannos* sp. is present in the understorey and *Piper capensis* is common in the shrub layer. Close to the river, *Dracaena montana* and *Afromomum* sp are common. Close to the forest edge *Dalbergia metidula* and *Sclerya* sp are common. There are *Brachystegia* sp. trees outside of the forest. (Doggart *et al*, 2000).

### Catchment values

The reserve protects the banks of the Mvuha River. (Doggart *et al*, 2000).

### Human impacts

Timber is being extracted from the reserve although at a lower rate than in the neighbouring forest reserves of Mangala and Ngambaula. A frequently used path runs through the middle of the reserve. (Doggart *et al*, 2000).

## Location Ngambaula Local Authority Forest Reserve

### Location

06° 59' S, 037° 44' E. Travelling south on the Morogoro – Kisaki road turn right just after Mkuyuni towards Changa. The reserve is on a steep north facing slope above the Mvuhia River covering an altitude of 280 m to 500 m asl. There are many rock outcrops. The Mvuhia River forms the northern border. (Doggart *et al*, 2000).

### Vegetation

Dry lowland forest with an open canopy at 20 m with emergent reaching over 30 m. There is a mixed canopy of ULU 350, ULU 357, *Albizia gummifera*, *Tabernaemontana elegans*, *Syzygium guineense*, *Diospyros mespiliformis*, *Newtonia buchanani* and *Bombax rhodognaphalon*. In the understorey there is *Psychotria* sp. and *Ketia* sp. At the forest edge there is *Dalbergia metidula* and outside of the forest there is *Brachystegia* sp. (Doggart *et al*, 2000).

### Human impacts

In the south of the reserve at the top of the hill, forest within the reserve has been cleared for rice cultivation. The stumps of the forest trees are still visible and some *Milicia excelsa* stumps were coppicing. (Doggart *et al*, 2000).

Pitsaws were observed throughout the reserve. Most were on dry river beds, which are used as shutes to transport the planks down the steep slopes. Timber being taken included *Milicia excelsa*, Mkongo and *Cussonia zimmermannii*. The removal of many tall trees has opened up the canopy so that the understorey is now scrubby and dominated by thorny woodland plants (Doggart *et al*, 2000).

A local villager specialises in providing colobus and blue monkey skins for trade in Arusha. Duiker are also hunted. (Doggart *et al*, 2000).

# Outlying Hills Forest Reserve

Location Dindili Forest Reserve

## Year established

Year established = 1953 (Lovett *et al*, 1993).  
Year gazetted (Anon.).

## Location

6° 42' S, 37° 52' E. 25 km east north east of Morogoro town. Access is from Mikese village on the Morogoro to Dar es Salaam road. The reserve covers a north south running ridge north of Mikese to an altitude of 849 m (Lovett *et al*, 1993).

## Area

Gazetted area = 2488 acres (1006 ha) (2735 acres before variation). 1005 ha on Jb 2069 (Lovett *et al*, 1993).  
Gazetted boundary length: 15.3 km (Lovett *et al*, 1993).

## Soils

Acidic lithosols and ferralitic latosols on the steeper slopes with deeper deposits of ferruginous sandy clay at the foot. The ridge is built up of Precambrian migmatites and gneisses (Lovett *et al*, 1993).

## Climate

Oceanic rainfall with oceanic/continental temperatures. Nearest rainfall station: Kingolowira Mission. Estimated rainfall: 700-1000 mm/year. Dry season: June - Oct. Temperatures: 26°C max. (Dec.), 21°C min (July) (Lovett *et al*, 1993).

## Vegetation

Woodland covers about 40% of the area, mostly the lower ridges and the drier western slopes. Dry evergreen forest covers 60% of the area on the wetter eastern slopes and summit ridge (Lovett *et al*, 1993).

Woodland: The canopy is rich in species with: *Acacia hockii*, *A. senegal*, *Brachystegia boehmii*, *B. microphylla*, *B. spiciformis*, *Combretum zeyheri*, *Dalbergia melanoxylon*, *Diplorhynchus coldylocarpon*, *Heteromorpha arborea*, *Ozoroa reticulata*, *Pavetta crassipes*, *Pteleopsis myrtifolia*, *Pterocarpus angolensis* and *Sclerocarya caffra*. In the undergrowth *Cyperus hemisphaericus*, *Hyparrhenia rufa*, *Indigofera garckeana*, *Ocimum suave* and *Themeda triandra* are important (Lovett *et al*, 1993).

Dry forest: Tall closed forest with trees up to 30 m in valleys. The trees include: *Brachylaena huillensis* (dominant at many places), *Azelia quanzensis*, *Bombax rhodognaphalon*, *Commiphora madagascariensis*, *C. pteleifolia*, *Diospyros consolata*, *Erythrina sp.*, *Euphorbia candelabrum*, *E. nyikae* (both *Euphorbia* tall trees up to 20 m), *Manilkara sulcata*, *Pandanus engleri*, *Ricinodendron heudelotii*, *Scorodophloeos fischeri*, *Teclea simplicifolia*, *Vepris eugenifolia*. Shrubs and minor trees: *Chazaliella abrupta*, *Croton pseudopulchellus*, *Excoecaria madagascariensis* and *Tarenna nigrescens*. (Lovett *et al*, 1993).

### **Catchment values**

Seasonal streams supply water to the relatively densely populated area along Tanzam Highway. There are shallow wells on the eastern foothills for rural water supply. The western slopes drain into the Ngerengere river and to the Ruvu River (Lovett *et al*, 1993).

### **Biodiversity**

The reserve is a typical coastal lowland forest, a forest type which was very much reduced during the last century. A characteristic coastal endemic species (in spite of its name) with a very restricted distribution is *Commiphora madagascariensis*. Species with Madagascan affinities restricted to the coast in mainland Africa include *Tarenna nigrescens* and *Excoecaria madagascariensis*. The *Brachylaena huillensis* population is valuable as a seed source. (Lovett *et al*, 1993).

### **Human Impacts**

Fires occur regularly in the woodland, especially above Mikese Police Station. Illegal charcoal making takes place close to the main road. The dry forest is relatively intact, except for exploitation of *Brachylaena huillensis* for construction. Traps are set for small forest antelopes. A small amount of encroachment is reported (Lovett *et al*, 1993).

## Location Kitulanghalo Forest Reserve

### Year established

Year established=1955 (Lovett *et al*, 1993).

### Location

6° 39' - 6° 43' S, 37° 57' - 38° 01' E. .35 km East north east of Morogoro town. Access is from the Morogoro to Dar es Salaam road. The reserve covers a ridge between the main road and the Sangasanga river from an altitude of 350 to 774 m. (Lovett *et al*, 1993).

### Area

Gazetted area = 6518 acres (2638 ha) (Lovett *et al*, 1993).  
Gazetted boundary length = 59 120 ft (18 km) (Lovett *et al*, 1993).

### Soils

Acidic lithosols, ferralitic latosols and ferrisols developed, depending on the depths, over Precambrian gneisses. (Lovett *et al*, 1993).

### Climate

Oceanic rainfall, oceanic/continental temperatures. Nearest rainfall station: Kingolowira Prison. Estimated rainfall: 700-900 mm/year. Dry season: June - Oct. Temperature: 27°C max. (Dec.), 21°C min (July) (Lovett *et al*, 1993).

### Vegetation

Woodland covers about 60% of the reserve on the lower and higher slopes, except the summit and those parts, where the spread of fires was prevented by gullies or higher soil moisture. Dry semi-evergreen forest covers about 30 % of the area, mainly on the eastern slopes and summit (Lovett *et al*, 1993).

Woodland: Dominant species include: *Brachystegia boehmii*, *B. spiciformis*, *Combretum zeyheri*, *Dichrostachys cinerea*, *Diplorhynchus condylocarpon*, *Julbernardia globiflora*, *Markhamia zanzibarica*, *Pterocarpus angolensis*, *Sclerocarya caffra* and *Spirostachys africana*. Low, open dry, deciduous *Combretum* spp. woodland replaces *Brachystegia* spp. woodland on drier soils and is dominated by: *Acacia nigrescens*, *Combretum apiculatum*, *C. collinum*, *C. psidioides* and *Pseudolachnostylis maprouneifolia*, with a dense grass layer (Lovett *et al*, 1993).

Dry forest: Trees 15-20 m tall, forming a dense canopy dominated by *Manilkara sulcata* with: *Bequaertiodendron natalense*, *Croton sylvaticus*, *Cussonia zimmermannii*, *Ricinodendron heudelotii*, *Scorodophloeus fischeri* and *Terminalia sambesiaca*. The cycad *Encephalartos hildebrandtii* occurs as 6 m tall trees with stems 60-90 cm diameter. In the lower canopy and shrub layer there is an undescribed *Coffea* species, with *Commiphora pteleifolia*, *Grandidiera boivinii* and *Excoecaria madagascariensis* (Lovett *et al*, 1993).

### **Catchment values**

The reserve is part of the Sangasanga river catchment. There are no permanent surface streams. Underground runoff is collected by streamlets at the foot such as Lubungo stream near Mikese and tributaries of the Ngerengere river (Lovett *et al*, 1993).

### **Biodiversity**

*Grandidiera boivinii* and *Excoecaria madagascariensis* are typical Madagascan - coastal East African species with restricted distributions. The cycad stand in the dry forest is one of the largest in the country, with very tall specimens and therefore warrants attention. The still undescribed coffee species (*Coffea* sp. E of Bridson in the Flora of Tropical East Africa) is a unique endemic of the area of potential importance for coffee breeding. It grows on the ridge south of the summit at 550 m altitude, on the border of the dry forest. (Lovett *et al*, 1993).

### **Human Impact**

Large scale charcoal making is carried out at the northern end of the reserve. The whole woodland area is burnt regularly (Lovett *et al*, 1993).

## Location Mindu Forest Reserve

### Year Established

Year established 1954 (Lovett *et al*, 1993).

Year gazetted = 1964 (Anon.).

### Location

6° 50' S, 37° 35' E. .6 km west of Morogoro. Access is from the main Morogoro to Mikumi road or from Mafiga. The reserve covers an isolated ridge at the north western end of the Uluguru Mountains above the Mindu reservoir to an altitude of 1260 m. (Lovett *et al*, 1993).

### Area

Gazetted area = 5647 acres (2285 ha) (Lovett *et al*, 1993).

Gazetted boundary lengths = 68 032 ft (20.7 km) (Lovett *et al*, 1993).

### Soil

The foot is covered by alluvial sand and sandy loam deposits (up to 600 m altitude). The rocks are muscovite-biotite migmatites and hornblende gneisses of Usagaran (Precambrian) age. The slopes are steep, but the base rocks are exposed only at a few places, above Mafiga and Kasanga (Lovett *et al*, 1993).

### Climate

Oceanic rainfall with oceanic/continental temperatures. In the rain shadow of the Uluguru mountains. Nearest rainfall station: Morogoro. Estimated rainfall: 800-1500 mm/year with a mist effect on the summit. Dry season: June - Oct. Temperatures: 25°C max. (Dec.), 20°C min (July) at lower altitudes (Lovett *et al*, 1993).

### Vegetation

Wetter woodland covers about 50% of the reserve area on the slopes and ridges. The tree cover, when undisturbed, reaches 70%. Dry woodland covers about 20% of the area at the base of the hill and has a tree cover of not more than 40-50%. Dry semi-evergreen lowland forest covers about 20% of the area and has 85% tree cover. It has survived in, and is presently restricted to, the fire protected gorges and to parts of the slopes where gullies act as firebrakes. Submontane evergreen forest remains only in fragments on the summit ridge (2%), replaced mainly by secondary grassland (4%) as after logging and fires. Rock outcrops occupy less than 4% of the area (Lovett *et al*, 1993).

- Woodland: Dominated by *Brachystegia microphylla*, *B. spiciformis* and *Julbernardia globiflora* with *Diplorhynchus condylocarpon*, *Pterocarpus angolensis*, *Sterculia quinqueloba* and *Xeroderris stuhlmannii*. *Uapaca sansibarica* forms almost pure stands on the southern end of the summit ridge. The loose sandy soil at the base of the hill below 600 m is covered by dry *Combretum* woodland and wooded grassland. The trees are scattered, bushy, 4-8 m high. In valleys, *Acacia nigrescens* and *Sclerocarya caffra* dominate. On ridges and drier sites *Combretum collinum*, *C. ghasalense*, *C. apiculatum*, *C. zeyheri*, *Dalbergia melanoxydon*, *Pteleopsis myrtifolia* and *Markhamia* sp. dominate (Lovett *et al*, 1993).
- Dry lowland forest: The canopy is of varying height from 10 to 30 m. Evergreen trees include: *Afzelia quanzensis*, *Cussonia zimmermannii*, *Euphorbia nyikae*, *Parkia filicoidea*, *Scorodophloeus fischeri*. Deciduous trees include *Albizia glaberrima*, *Albizia versicolor*, *Brachystegia microphylla*, *Ricinodendron heudelotii*, *Tamarindus indica* and *Terminalia sambesiaca*. (Lovett *et al*, 1993).
- Submontane forest: The multi-layered canopy is dominated by *Newtonia buchananii* and tangled by many climbers (Lovett *et al*, 1993).
- Rock vegetation: Vegetation on cliffs and rocky summits is dominated by the dwarf bush *Xerophyta scabrida* and is a community rich in rare or endemic species (Lovett *et al*, 1993).

### Catchment values

Surface watercourses are seasonal and dry up during the dry season. During the rains (and in form of underground runoff) Mindu Hill supplies water to the Ngerengere River, which is important in supplying water to Morogoro township. Mindu Hill also supplies water to the Mindu water reservoir in the Ngerengere valley under its south eastern slopes (Lovett *et al*, 1993).

### Biodiversity

The forest is of the Eastern Arc type, and so contains species of restricted distribution. The biodiversity values of the reserve are concentrated in certain vegetation types. The submontane forest fragments on the summits have an undergrowth of gingers (*Aframomum angustifolium* and *A. usambarensis*), both rare species and the latter so far otherwise only known from the Usambara Mountains. The upper, mist effected belt of miombo woodland is rich in epiphytes with rare orchids such as *Polystachya isochiloides*, *P. fischeri*; ferns such as *Belvisia spicata*; and interesting mosses and liverworts such as *Squamidium brasiliense*, *Rhodobryum perspinidens*, *Macromitrium tristratosum*, *Schlotheimia schweinfurthii*. The moss *Frullania* spp. occurs in large masses and is important in mist interception. In the dry semi-evergreen forest *Grewia forbesii* (a climbing shrub), *Polysphaeria braunii* (a shrub) and *Commiphora madagascariensis* (a medium sized tree) are rare species restricted to coastal Tanzania. In the open woodland rare bulbiferous plants occur, for example *Amorphophallus goetzei*. The granitic rock outcrops are also rich in rare species, for example *Aloè morogoroënsis* occurs in large clumps (Lovett *et al*, 1993).

## Human impacts

Charcoal making and regular burning have a serious impact on the wetter woodland.

During the past 5 years the canopy has disappeared or reduced from 70 to 20% on the lower slopes between 600 and 800 m altitudes. The most utilised species are *Brachystegia* spp. and *Pterocarpus angolensis*. (Lovett *et al*, 1993).

Mining takes place on the lower slopes, with stone quarries and sand mines near the main road. Loose soil from the mines currently washes out onto the highway. In particular, sand mines have devastated large areas just behind Mafiga village. Cultivation does not take place on the slopes and grazing (goats) is very limited (Lovett *et al*, 1993).

## Location Mkungwe Forest Reserve

### Date of establishment

Reserve created in 1954 (Lovett *et al*, 1993 and Doggart *et al*, 2000).

### Location

6° 51' - 6° 55' S, 37° 53' - 37° 57' E. 15 km from Mikese, 3 km east of Kikundi village. Access is from Mikese on the Mikese to Msumbisi road. The reserve covers an isolated hill at the north east edge of the Uluguru Mountains from an altitude of 360 m to 1104 m. (Lovett *et al*, 1993 and Doggart *et al*, 2000).

### Area

Gazetted area = 4,860 acres (1967 ha) (Lovett *et al*, 1993).  
Gazetted boundary lengths = 30 km (Lovett *et al*, 1993).

### Soils

Ferrallitic latosols developed on Precambrian gneiss and granulite rock. (Lovett *et al*, 1993 and Doggart *et al*, 2000).

### Climate

Oceanic rainfall with oceanic temperatures. Nearest rainfall stations: Tegetero Mission. Estimated rainfall: 1700-2900 mm/year on the wetter eastern and upper slopes, mist effect on the summit. Dry season: not marked, on the eastern side, 2-3 months on the western side at lower altitudes. Temperatures: 24°C max. (Dec.), 19°C min (July). (Lovett *et al*, 1993 and Doggart *et al*, 2000).

### Vegetation

Submontane forest covers the largest part of the reserve, with transitions to lowland rain forest below 800 m. Dry forest occupies some lower side ridges on the western slope, where the soil is shallow. Woodland occupies the lower slopes below 700 (to 400) m altitude. (Lovett *et al*, 1993 and Doggart *et al*, 2000).

Submontane forest: Canopy tall with emergent trees up to 50 m, with: *Allanblackia stuhlmannii*, *Cephalosphaera usambarensis*, *Cylicomorpha parviflora*, *Isobertinia scheffleri* and *Newtonia buchananii*. In the lower part of canopy *Allophylus pervillei* *Drypetes natalensis* and *Polyceratocarpus scheffleri* occur. In the transition to lowland rainforest *Tetrapleura tetraptera* and *Zenkerella egregia* occur. In the ground layer *Aneilema aequinoctiale*, *Leptaspis cochleata*, *Nephrolepis biserrata* and *Polia condensata* are typical. (Lovett *et al*, 1993 and Doggart *et al*, 2000).

Dry forest: Canopy to 10 m with *Bequaertiodendron natalense*, *Manilkara* sp., *Scorodophloeos fischeri*. Undergrowth with xero-tolerant ferns such as *Pellea doniana*, *P. adiantoides*, *Phymatodes scolopendrium* and *Davallia chaerophylloides*. (Lovett *et al*, 1993 and Doggart *et al*, 2000).

Woodland: Dominated by *Brachystegia boehmii*, *B. microphylla* and *Vitex doniana*. (Lovett *et al*, 1993 and Doggart *et al*, 2000).

### **Catchment value**

The reserve is part of the Ruvu river catchment. About 9 streamlets carry water from the reserve, supplying Nyagule, Kikundi, Kibungo, Kidugalo and Lukangazi settlements, and Lusanga Estate with water. Around Kikundi many small scale rice fields are irrigated with the water (Lovett *et al*, 1993 and Doggart *et al*, 2000).

### **Human impacts**

In the central area of the forest *Newtonia buchananii* is under exploitation by pitsawing. Bushfires occur in the woodland every year and often damage the edge of the closed forest, which is therefore retreating. Encroachment or grazing was not observed (Lovett *et al*, 1993).

The forest is under intense pressure from pitsawing. Six active pitsaws were observed on the eastern side and seven on the west. Damage is most intense close to the forest edge on the western side of the reserve. Close to the ridge a semi-permanent camp had been established beside one of the larger pitsaw camps. Bushfires occur in the woodland every year and often damage the edge of the closed forest, which is therefore retreating. (Doggart *et al*, 2000).

Hunting is common and the size of the traps suggests that it is for bush pig as well as duiker, although surrounding villages are predominantly Muslim. (Doggart *et al*, 2000).

## Location Nguru Ya Ndege Forest Reserve

### Location

6° 41' - 6° 44' S, 37° 35' - 37° 37' E. 10-15 km from Morogoro. Access is from the Morogoro to Dodoma road. The reserve covers the slopes and ridges of an isolated hill north of the Uluguru mountains on the west side of the Morogoro to Dodoma road from 700 to 1357 m. (Lovett *et al*, 1993).

### Area

Gazetted area = 94,367 acres (2407 ha). (Lovett *et al*, 1993).  
Gazetted boundary length = 25 km (Lovett *et al*, 1993).

### Soil

Shallow lithosols are formed on the upper slopes and ferralitic latosols on the lower slopes under woodland. At the base of the hill, where sandy alluvial deposits are widespread, arenosols cover large areas. The parent rocks are Precambrian muscovite-biotite migmatites and hornblende gneisses. (Lovett *et al*, 1993).

### Climate

Oceanic rainfall with oceanic/continental temperatures. Nearest rainfall station: Kingolwira Prison and Morogoro. Estimated rainfall : 850 mm/year over woodland; 1500-1800 mm/year with a mist effect over forest. Dry season: June - Oct. Temperatures: 25°C max. (Dec.), 20°C min (July). (Lovett *et al*, 1993).

### Vegetation

Woodland is the main vegetation type on all slopes and covers about 60% of the reserve area. On the summit submontane forest occurs. On the foot of the hill, around the 600 m contour line, remnants of once more widespread rich dry semi-evergreen forests occur. The steep rock towers and cliffs bear an interesting vegetation rich in endemics (Lovett *et al*, 1993).

Woodland: Canopy 7-25 m tall, dominated by *Brachystegia microphylla*, *B. boehmii* and *Julbernardia globiflora*. Other trees include: *Albizia harveyi*, *A. versicolor*, *Brachystegia spiciformis*, *Dalbergiella nyasae*, *Parinari curatellifolia*, *Pericopsis angolensis*, *Pterocarpus angolensis*, *Sterculia africana*, *S. quinqueloba* and *Xeroderris stuhlmannii*. The shrub layer contains *Ozoroa reticulata*, *Heteromorpha arborea*, *Steganotenion araliacea* and *Pavetta crassipes*. On both southwest ridges between 800 and 1100 m there are stands of *Monotes elegans*. Above 800 m on east facing slopes there is a mist effect and rainforest epiphytes occur on the branches of the woodland trees, for example: *Polystachya isochiloides*, *Oberonia disticha*, *Peperomia* spp. and *Lycopodium* spp, *Belvisia spicata*, *Drynaria laurentii* and many bryophytes (Lovett *et al*, 1993).

Submontane forest: Dominated by *Newtonia buchannanii* with *Cassipourea gummiflua* and *Antidesma venosum*. The forest goes down the northern valley where it is dominated by *Albizia gummifera* and *Bequaertiodendron natalense* with *Canthium guenzei*, *Phoenix reclinata*, *Crassocephalum mannii* and a *Diospyros* species (Lovett *et al*, 1993).

Dry forest: with *Azelia quanzensis*, *Commiphora madagascariensis*, *Obetia radula* and *Euphorbia candelabrum* in the canopy and with many other succulents in the lower strata.(Lovett *et al*, 1993).

Rocks and cliffs: on the cliffs *Coleochate microcephala* forms a community, while on the rock summits *Aloe morogoroensis* is dominant. At the edge of rock and forest *Lobelia morogoroensis* occurs in two places (Lovett *et al*, 1993).

### **Biodiversity**

The *Monotes elegans* stand has a high seed production every year and so could be important in seed production and breeding of this prospective timber species. The many endemics of the huge rock faces have high genetic and conservational value (Lovett *et al*, 1993).

### **Catchment value**

Only very local with no permanent watercourses, though there will be a contribution to ground water (Lovett *et al*, 1993).

### **Human impacts**

Fires occur every year on the slopes, pushing back the edge of closed forest. The north west slope of the summit is already completely deforested. The fires also damage many trees in the woodland. The lower slopes are being deforested for charcoal making. There is encroachment near villages (Lovett *et al*, 1993).