

**TECHNICAL PAPER 28**

**PROTECTED AREAS AND PUBLIC LANDS**

**Land use in the East Usambara Mountains**

**Stig Johansson & Richard Sandy**

**1996**



# **East Usambara Catchment Forest Project**

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**Tanga 1996**

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## Foreword

Since the land use classification exercise in 1993 (Hyytiäinen 1995) a considerable new forest estate has been surveyed in the East Usambara mountains. These new proposed areas are presently in various stages of the gazettment process. This brief report is an attempt to update the situation, especially the distribution of the forests into protected, i.e. the reserved forest, and un-reserved, so called public land forests.

There are however, several things to consider when using the data in the tables. The data with reference to Hyytiäinen (1995) is directly from the land use report, and reflects the information derived during the land use classification exercise in 1993. The new data, especially the surveyed part, is accurate in terms of surveyed areas. This also applies to those areas proposed for survey. The estimates for the corridors is also rather accurate and based on the feasibility study of the corridors in early 1996.

The present report provides the most up-to-date and accurate information on the extent of the sub-montane and lowland forests in the East Usambara mountains as it appears today by the end of 1996. Further, it provides the most accurate information on the classification based on stocking, however, it must be noted that the classification does not reflect disturbance. For example poorly stocked forest is found in areas where site quality is poor, vegetation is sparse because of natural reasons (e.g. drier sub-montane and lowland forests), and in areas of frequent fires and erosion. Poorly stocked forest may also reflect excessive logging or past encroachment. This report also shows the distribution between gazetted and non-gazetted forest, and future situations depending on the different gazettment proposals.

All this is quite important information for the management. We now know that most of the valuable (dense, and poorly stocked) forest areas are in the process of becoming legally protected. We also know size and where the important areas outside the forest reserves are located. This will guide conservation efforts other than gazettment. It also points at areas where there are still considerable tree cover, while the land is already cultivated. These should become target areas for farm forestry activities.

Stig Johansson  
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## 1. INTRODUCTION

The East Usambara forests, cover an area of 45.2 km<sup>2</sup> in Tanga Region. These forests form part of the Eastern Arc Mountains, which stretch from the Taita Hills in Kenya to Pare Mountains in the north further to the Udzungwa Mountains in the Southwest of the Tanzania. The area has been of considerable interest for more than 100 years, and the first agricultural and biological research station in East Africa was established in Amani by the German colonial government in 1902. The East Usambaras, as one of the most important elements of the Eastern Arc forests, are included as one of the global biodiversity hotspots (Myers 1988) and centres of plant diversity (WWF & IUCN 1994).

Various estimates of the original forest area and the changes have been presented (e.g. AFIMP 1988; Hamilton & Bendsted-Smith 1989; Homewood & Rodgers 1982; Iversen 1991). A comprehensive review of different area estimates was made by Iversen (1991). It appears that the area may have been reduced from “originally” around 100,000 ha (AFIMP 1988) to around 45,000—50,000 ha at present. One of the problems with the estimates is the differences in delineating the area to be included as “the East Usambaras”, which is one of the aspects of this report as well.

In 1993, the East Usambara Catchment Forest Project (EUCFP) conducted a land use classification and mapping exercise in the East Usambaras. According to Hyytiäinen (1995), the total area of under forest cover in 1993 was about 42,121 ha or 50.4 % of the total area (83,601 ha) which was classified. According to the same survey the area within the gazetted forest reserves was about 21,895.2 ha, while the total area inside the forest reserve boundaries was 23,187.8 ha (Hyytiäinen 1995).

Since then a considerable change has taken place. The inclusion of some of the northern areas, such as Bombo East and Mgambo, which were not included in the aerial survey in 1986 and hence also not in the 1993 classification, brings the forest area up to 45,137.7 ha. There was an omission in 1993 when the Manga Forest Reserve (F.R.) was left unclassified. These changes may also considerably affect land use in the East Usambara because a large forest estate has been transferred from the un-reserved open access public land into the territorial (central government) forest reserves or the Amani Nature Reserve. The main reason for updating the land use classification was to reflect these changes and to enable a better geographical focusing of project activities, whether in conservation or farm forestry.

## 2. LAND CATEGORIES AND TENURE

The legal land categories, especially for forest land, in the East Usambara are presently three:

1. Territorial forest reserves (“central government forest reserves);
2. Forests on un-reserved lands; and
3. Forests on land with title deeds.

There are no forests in the category Local Authority Forest Reserve, which are managed by the local authorities, at present in the East Usambaras.

### *Territorial forest reserves*

These are forests which have been reserved through the forestry legislation (presently Forests Ordinance) and which are presently managed by the Forestry and Beekeeping Division. In the East Usambara, these are managed by the Tanga Region Catchment Forest Office with the assistance of the East Usambara Catchment Forest Project since 1991. There has been a total of 27 F.R. in the East Usambaras (including Bombo West, Bwiti, Kwani (L.A.), Magogoni, Mzimbazi, and Tongwe). Some of these reserves date back to the German colonial period in the early 1910's. Others were gazetted in the 1920's and 1930's, while most of the remaining were gazetted in the 1950's before independence. So far only two forest reserves, Kambai F.R. and Mlinga F.R., which were gazetted in 1994, have been gazetted since independence. Presently, the number of reserves is has been reduced by joining some of them into more manageable units.

### *Forests on un-reserved lands*

These are forests which have not been reserved and are partly under the management of the District Councils (especially commercial utilisation and harvesting) and partly by the villages (for local use). Since, February 1996, the commercial utilisation and harvesting is controlled by the Tanga Region Catchment Forest Office in collaboration with the district authorities.

### *Forests on land with title deeds*

These are forests which are included in such land which have a registered title deed. Control of some aspects of these forests is still, however, within the mandate of the forestry authorities.

## **3. METHOD OF LAND USE CLASSIFICATION**

### **3.1 The 1993 land use classification**

The data and the classification of land in the present report is based on the land use classification in 1993 (Hyytiäinen 1995). Since the end of 1993 a considerable forest estate has been added into or is in the process of being added into the Amani Nature Reserve or the government forest reserves. In this report these new areas have been included but they have been classified according the old classification (Hyytiäinen 1995).

The 1993 classification was based on topographic maps produced by the Amani Forest Inventory and Management Plan Project (AFIMP) in 1988. These were complemented by existing topographic maps (1:50,000), and colour-infrared aerial photography from 1986. Preliminary delineation was sketched on the aerial photos. A general minimum compartment size was 2—3 ha, but even smaller compartments with distinctive characteristics were considered. This preliminary delineation was checked and corrected in the field. The corrected delineation was shifted from the aerial photographs to the plastic map sheets and later digitised.

The classification by Hyytiäinen (1995) was hierarchical, built up of seven main classes and a number of sub-classes. The classification was as follows:

MAIN CATEGORY	SUB-CLASS	SUB-CLASS
A. Forest	I. Sub-montane rain forest	1. Dense
		2. Poorly stocked
		3. Cultivation under forest
	II. Lowland forest	1. Dense
		2. Poorly stocked
		3. Cultivation and forest
		4. Eucalyptus
III. Plantations	5. Maesopsis	
	6. Teak & Terminalia	
	7. Other tree plantations	
	IV. Semi-deciduous savanna woodlands	
		V. Bush
	B. Woodlands	
	C. Grassland	
D. Agriculture	VI. Peasant farming	
	VII. Estate farming	8. Tea
		9. Sisal
		10. Cocoa
		11. Coconut
		12. Fruits
		13. Rubber
E. Ponds, Rivers		
F. Barren land		
G. Settlement		

The forests were divided into two forest types: (1) Sub-montane rain forest; and (2) Lowland forest. Altitude was the main factor determining the two classes, and although different authors use different altitude, and knowing that the border is far from uniform, the border was set at 850 m uniformly for the whole area (c.f. Hamilton 1989). The two forest types (sub-montane and lowland) were sub-divided according to forest density and degree of human disturbance. The classes are as follows:

<b>1. Dense forest</b>	Uneven-aged, more or less disturbed natural forest which has a species composition characteristic to the original forest type and has an unbroken crown cover.
<b>2. Poorly stocked forest</b>	A variety of primary or secondary forests which are poorly stocked because of various natural or man-made reasons. They are forests with low density, fairly open crown cover, modest volume and dominant height less than in dense forests belonging to the same forest type.
<b>3. Cultivation under forest</b>	Encroached areas which still have at least moderate forest cover.

The classification by Hyttiäinen (1995) does not reflect level of disturbance. For example poorly stocked forest were found in areas where site quality is poor, vegetation is sparse because of natural reasons, and in areas of frequent fires and erosion. It may also reflect excessive logging or past encroachment. The class included secondary forests and naturally regenerating areas such as abandoned tea and sisal fields, neglected “shambas” (farms) etc. Cultivation under forest was primarily areas where cardamom was cultivated under the forest cover. The plantations were

grouped according to the main species. The Amani Botanical Garden was classified as natural forest even though it is largely an arboretum. Woodlands were areas with 10 - 40 % crown cover (Iversen 1991), and a dominant height of less than 10 m. Swamps having no other land use and no forest cover were also categorised as bush.

Peasant farming included small-scale rotational and continuous cultivation of food and cash crops. The estate farming was large-scale commercial cultivation of tea, sisal, and cocoa. Villages and estates larger than 1 - 2 hectares, and large ponds and dams (> 1 ha) as well as wider rivers were considered in the classification. Barren land included the rocky areas on summits and escarpments (Hyytiäinen 1995).

Forest reserve boundaries were checked from the official maps and the corrections were made in case inaccuracies were found. The forest reserve boundaries and area calculations may be subject to considerable inaccuracies because most reserves lack accurate co-ordinate information and boundaries were often impossible to locate on aerial photos.

Hyytiäinen (1995) included two new forest reserves: (1) Mlinga F.R. (839.4 ha); and (2) Nilo F.R. (5,872.1 ha). The latter a combination and expansion of the three former forest reserves (Lutindi, Kilanga and Nkombola). Moreover, the boundaries of Mtai F.R. had changed, and the enclaves inside the forest reserve were removed.

According to Hyytiäinen (1995) the major source of inaccuracy were related to the human impact in the forest. Delineation of forests into different classes with regard to canopy closure and the degree of human activity inside the forest was difficult. The main reasons was that the 1986 aerial photographs were old and partly unreliable for classification purposes. Secondly, because of the time and financial limits, exhaustive ground truthing was beyond the means. Moreover, encroachment was very difficult to detect by using aerial photos, especially in areas where there still was a lot of trees left in the fields. The old AFIMP delineation in the previously inventoried areas was retained unless new reliable information was available. Considerable areas, which were classified as dense forest, may in reality be occupied by scattered fields.

The boundaries of the overall classified area was delineated quite arbitrarily. The main emphasis was to determine an uniform area, including the surrounding forested areas around the main range. Thus, the area results (hectares and proportions in %) of this study are not directly comparably to the previous land use classifications (AFIMP 1988). Furthermore, the criteria for classification changed. Hyytiäinen (1995) observed several changes since the aerial photos had been taken in 1986. An attempt was made to detect those differences from a 1992 Spot satellite image. The unclear areas were surveyed more accurately. In 1993 Kambai, Segoma, Bamba-Ridge Forest Reserves and the surrounding lowlands were not visited. These were classified from aerial photos and based on comments given by the local forest officers.

Because of deviation in altitude the shifting of boundaries from aerial photos to the plastic map sheets caused scale changes. The delineation was subject to slight inaccuracy in areas where the map and the photo were difficult to adjust, i.e. in the steepest slopes and areas lacking adequately reference points. The aerial photo coverage was incomplete. Photos were missing in the SW part of the main plateau, north of Mnyuzi Scarp.

### 3.2 Updated land use classification in 1996

Since 1993 considerable changes have taken place. A large forest estate has been surveyed since 1992 (Tables 12—14). The tables presenting areas surveyed or the area of forest reserves are based on the survey data and the maps for each individual reserve. This includes variations, enlargements, and the survey of entirely new proposed forest reserves. The total area estimates were adjusted with the new areas; Bombo East I and II (1,671 ha) and Mgambo (1,346 ha), which were not included in the corresponding estimates by Hyytiäinen (1995). This report also corrected some of the omissions of the previous work by including the original Manga F.R. (761.0 ha).

The classification into lowland and sub-montane, or different classes in this report is largely based on the original classification. Only areas which were not covered by the land use maps, such as Bombo East I and II and Mgambo, were classified using the same criteria as Hyytiäinen (1995).

## 4. RESULTS

### 4.1 Area calculation

A considerable change has taken place since the time of the AFIMP (1988) and even since the time of the 1993 classification by Hyytiäinen (1995). The inclusion of some of the northern areas, such as Bombo East and Mgambo, which were not included in the aerial survey, brings the forest area up to 45,137.7 ha. Presently about 75% of the total forest area is or will be within the Amani Nature Reserve or the gazetted forest reserves. Of the natural forests, excluding plantations, 73.8 or 76.9% are gazetted, excluding and including proposed wildlife corridors respectively. The well stocked forests (classified as dense forests), which could relatively speaking be considered less disturbed, are largely (94.6—94.7%) within the reserves. Of the poorly stocked forests 67.1—73.2% are within the reserves, depending on the extent of implementation of the final proposed gazettement activities.

About 64.7% or 67.9% of the sub-montane forests are within existing forest reserves or in various stages of gazettement. Of the dense forests, 87.9% is within the reserves, while 40.6% or 48.1% of the forests with cultivation under forest (usually cardamom) are still outside. The larger estimate reflects the inclusion of the proposed wildlife corridors.

In a similar way of the lowland forests 77.8 % or 80.8% are within existing forest reserves or in various stages of gazettement. Of the dense lowland forests 99.7% or 97.8%, and 70.5% or 76.9% of the poorly stocked forests are within the forest reserves.

## 4.2 Tables and appendices

The Tables 1—4 and 6—9 in this report are directly from Hyytiäinen (1995), and are included to enable comparison between the situation in 1993 and mid-1996.

The new tables in this report are presented in the same format as in the earlier report by Hyytiäinen (1995) to make comparison easier. A number of new tables have also been included. These include Table 5 with a summary on the information on existing forest reserves in the East Usambaras, including various estimates that have been presented on their respective area. It also includes Table 16, which presented the information on the forest reserves managed by the EUCFP. Other tables present the present status of the gazettement process for various proposed reserves or boundary variations (Table 10), or lists the official forest reserve boundary maps. Table 23 presents the distribution of the land use classes in Korogwe and Muheza Districts.

The report includes three appendices. The first presents the new reserves, enlargements or corridors by reserve or forest area surveyed since 1994. The second presents the present up-dated area calculations by reserve. The third presents the area calculations for Amani Nature Reserve both by existing reserves, enlargements and covenanted (tea estate) forests, and as a total breakdown for the completed new Amani Nature Reserve.

## 5. DISCUSSION

Basically the problems and reservations which were mentioned by Hyytiäinen (1995) apply also for this report because the up date was relying on the method and basic classification done in 1993 (see p. 4). New classification, i.e. areas which were not covered by the 1993 maps, was done in Bombo East I and II and in Mgambo, although basing on the same classification principles. The new data, especially the surveyed part, is accurate in terms of surveyed areas. This also applies to those areas proposed for survey. The estimates for the corridors should also be rather accurate and are based on the feasibility studies of the corridors in early 1996.

The present report provides the most up-to-date and accurate information on the extent of the sub-montane and lowland forests in the East Usambara mountains as it appears today by the end of 1996. Further, it provides the most accurate information on the classification based on stocking, however, it must be noted that the classification does not reflect disturbance. This report also shows the distribution between gazetted and non-gazetted forest, and future situations depending on the different gazettement proposals.

The forest cover in the East Usambara area is about 45,000 ha or about 50% of the land area. These forests have been protected in forest reserves since the turn of the century. Many of the present forest reserves go back already to the 1930's and 1950's. This up date of the land use shows that at present the area which is either in forest reserves or in the process of being gazetted is about 33,000 ha or 75% of the total forest area. In sub-montane rain forest 65% is gazetted or in the process of being protected, and in the lowland forest the corresponding figure is 78%. This means that 11—12,000 ha of forest remain in the public lands outside formal, legal protection.



If all the proposed areas will be gazetted and a reasonable protection is possible to achieve, a considerable new forest estate, in fact the first since independence in the East Usambaras, has been brought under legal protection. However, by 1996, only Mlinga and Kambai F.R.s were gazetted of the ones which had been surveyed. A focussed effort is required to ensure that these proposals are actually brought to the stage of final gazetment, since the East Usambaras, as so many other areas in Tanzania, have a large number of proposed forest reserves, which have never been finalised.

Secondly, people in the East Usambaras depend on these forests. The new reserved forest estate is remarkably restricting the contingencies of local community land use. A serious effort has to be made to ensure their traditional entitlements through different forms of joint forest management of the forest reserves. Management means mainly discussing and agreeing with the local communities on their needs and how these needs should be met, whether from the public land forests or from the forest reserves. Unless this is taken care of the forest protection may be only something which appears on paper but with little foundation in the field.

The gazetment of the wildlife or forest corridors which will connect the major forest blocks in the East Usambaras should be implemented as soon as possible if they are to be implemented at all. Unless this is done soon, these forests will disappear and taken over for cultivation. A major question is whether these, especially the final inclusion of the corridors will reduce the contingencies too much and actually build up pressure towards the reserves and increase the tension between the forest authorities and the local communities. There is an obvious risk for this unless there is a major focus to assist the villages to adapt to the new land use situation by various form of support.

Furthermore, the effort to legalise the management of the village forests (e.g. Mpanga, Handei etc.) in the un-reserved land through village forest management should continue. These forests, together with farm forestry efforts, should cater for the need and increase the supply of forest products for the local people in the East Usambaras. The EUCFP has made efforts to develop village forest management for example in the Mpanga forest in Maramba Division and in Handei forest in Amani Division. Farm forestry activities have been started in a number of pilot villages in an effort to develop a strategy to improve local land husbandry. The EUCFP has also started to work with environmental education in primary schools by involving elders and "forest specialists" in the villages. More emphasis has been given to farm forestry and extension activities since 1995.

The main mission of the East Usambara Catchment Forest Project, in collaboration with the local communities and other stakeholders, is to protect the natural forests in the East Usambara mountains. This can only be done by harmonising the local needs with the conservation objectives. Successful conservation of these valuable forests can only be achieved with local support, and through sustainable financial arrangements and benefit sharing.

## 6. LAND CLASSIFICATION IN 1993 (HYytiäinen 1995)

### 6.1 Land classes

**Table 1.** Distribution of main land use classes for whole area (83,601 ha) by 1993 (Hyttiäinen 1995).

Main land use class	Area, ha	%
Forest	42,121	50.4
Agriculture	35,909	43.0
Woodlands	4,113	4.9
Grassland	345	0.4
Ponds and rivers	101	0.1
Barren land	393	0.5
Settlements	620	0.7
<b>Total</b>	<b>83,601</b>	<b>100.0</b>

### 6.2 Agriculture

**Table 2.** Distribution of agricultural lands for the whole area (83,601 ha) by 1993 (Hyttiäinen 1995).

Agricultural lands	Area, ha	% of all agricultural land	% of the total area
<b>Peasant farming</b>	31,716.0	88.3	37.9
<i>sub-total</i>	<i>31,716.0</i>	<i>88.3</i>	<i>37.9</i>
<b>Estate farming</b>			
Tea	2,363.0	6.6	2.8
Sisal	535.1	1.5	0.6
Cocoa	1,107.4	3.1	1.3
Coconut	98.9	0.3	0.1
Fruits	34.5	0.1	0.0
Rubber	53.9	0.2	0.1
<i>sub-total</i>	<i>4,192.8</i>	<i>11.7</i>	<i>5.0</i>
<b>TOTAL</b>	<b>35,908.7</b>	<b>100.0</b>	<b>43.0</b>

### 6.3 Forest area

**Table 3.** Distribution of main forest classes for whole area (83,601 ha) by 1993 (Hyytiäinen 1995).

Forest class	Area, ha	% of forest	% of total area
Sub-montane rain forest	12,916.7	30.7	8.3
Lowland forest	26,480.4	62.9	31.7
Plantations	2,723.6	6.5	3.3
<b>Total</b>	<b>42,120.7</b>	<b>100.0</b>	<b>50.4</b>

**Table 4.** Distribution of the forest classes for the whole area by 1993 (Hyytiäinen 1995).

Forest class/sub-class	Area, ha	% of the all forests	% of the total area
<b>Sub-montane rain forest</b>			
Dense forest	6,940.2	16.5	8.3
Poorly stocked forest	470.6	1.1	0.6
Cultivation under forest	5,505.8	13.1	6.6
<i>sub-total</i>	<i>12,916.7</i>	<i>30.7</i>	<i>15.5</i>
<b>Lowland forest</b>			
Dense forest	15,179.6	36.0	18.2
Poorly stocked forest	5,790.7	13.7	6.9
Cultivation under forest	5,510.1	13.1	6.6
<i>sub-total</i>	<i>26,480.4</i>	<i>62.9</i>	<i>31.7</i>
<b>Plantations</b>			
Eucalyptus	493.4	1.2	0.6
Maesopsis	529.0	1.3	0.6
Teak	1,682.6	4.0	2.1
Other species	18.6	0.0	0.0
<i>sub-total</i>	<i>2,723.6</i>	<i>6.5</i>	<i>3.3</i>
<b>TOTAL</b>	<b>42,120.7</b>	<b>100.0</b>	<b>50.4</b>

## 6.4 Forest reserves

**Table 5.** Central (C.A.) and Local Authority (L.A.); proposed (P.F.R.) and de-gazetted (D.G.) Forest Reserves in the East Usambara Mountains.

Name	Original Year	Original status	Current status	Size, ha GN <sup>1</sup>	Size, ha FBD <sup>2</sup>	Size, ha Iversen <sup>3</sup>	Size, ha AFIMP <sup>4</sup>	Size, ha EUCFP <sup>5</sup>	Size, ha Current <sup>6</sup>	Government notice (GN)
Amani-East Amani Nature Reserve <sup>7</sup>	1955	C.A.	C.A. P.N.R.	98.7	98.7	99.0	123.2	122.2	122.2 8,327.1	GN 111 (1955) (1996)
Amani-Sigi	1934	C.A.	C.A.	1,141.2	1,173.6	1,174.0	1,152.7	1,153.5	1,153.5	GN 43 (1934); GN 212 (1961); GN 40 (1968)
Amani-West	1955	C.A.	C.A.	144.5	144.5	143.0	159.2	158.5	158.5	GN 196 (1955)
Bamba Ridge	1958	C.A.	C.A.	1,108.8	1,108.8	1,109.0	1,131.3	1,131.5	1,131.5	GN 409 (1958); GN 372 (1968)
Bombo East			P.F.R.						1,671.0	(1996)
Bombo West	1958	C.A.	C.A.		3,564.0					GN 1 (1959)
Bwiti	1934	C.A.	D.G.		3,005.6					German; (1934); GN 207 (1963)
Derema		C.A.	P.F.R.			3,930.0	836.5		790.5	GN 99 (1931); (1974)
Kambai	1994	C.A.	C.A.	1,050.0	1,046.3	1,050.0	1,050.1	1,046.3	1,046.3	GN 310 (1994)
Kihuhwi	1941	C.A.	C.A.	488.5	488.5	488.0	495.6	490.1	490.1	GN 105 (1941)
Kihuhwi-Sigi	1934	C.A.	C.A.	904.5	904.5	905.0	853.8	898.1	898.1	GN 43 (1934)
Kihuhwi teak	1955	C.A.	C.A.	26.5	26.5	27.0	33.9	33.6	33.6	German (1909); GN 194 (1955)
Kilanga	1931	C.A.	C.A.		379.2	917.0	791.4			GN 99 (1931); GN 165 (1932); GN 154 (1956); (1963)
Kwamarimba	1913	C.A.	C.A.	802.1	802.1	802.0	889.2	887.4	887.4	German (1913); (1934); (1951)
Kwamgumi	1955	C.A.	C.A.	1,148.5	1,148.5	1,149.0	1,151.6	1,128.8	1,128.8	GN 195 (1955)
Kwamkoro	1923	C.A.	C.A.	2,209.6	2,209.6	3,004.0	2,264.6	2,270.9	2,270.9	German (1923); GN 99 (1931); GN 194 (1954); GN 24 (1961)
Kwamsambia	1954	C.A.	C.A.	1,820.3	1,820.3	1,820.0	1,814.5	1,822.8	1,822.8	GN 95 (1954)
Kwani	1956	L.A.	?	2,545.1	2,545.1	2,903.0				GN 248, 288 (1956); GN 315 (1959)
Longuza	1954	C.A.	C.A.	1,541.5	1,541.5	1,542.0	1,558.5	1,579.9	1,579.9	GN 194 (1954)
Lutindi	1913	C.A.	C.A.			2,180.0	2,165.5			German (1913); (1928); GN 458 (1961)
Magogoni	1934	C.A.	D.G.	3,598.5		3,599.0				(1934)
Manga	1955	C.A.	C.A.	867.2	867.2	802.0			1,616.0	GN 112 (1955); GN 146, 204 (1961)
Marvera		C.A.	P.F.R.							
Mgambo		C.A.	P.F.R.			10,076.0		1,346.0	1,346.0	GN 99 (1931); (1995)
Mlinga	1994	C.A.	C.A.			190.0	190	839.4	839.4	(1988); (1994)
Mlungui			P.F.R.						200.0	

Mnyusi Scarp	1958	C.A.	C.A.	674.0	581.0	672.9	672.9	GN 296 (1958)
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Table 5. Cont.

Name	Original Year	Original status	Current status	Size, ha GN <sup>1</sup>	Size, ha FBD <sup>2</sup>	Size, ha Iversen <sup>3</sup>	Size, ha AFIMP <sup>4</sup>	Size, ha EUCFP <sup>5</sup>	Size, ha Current <sup>6</sup>	Government notice (GN)
Msimbazi	1934	C.A.	D.G.	699.7		700.0				German; (1934)
Mtai	1913	C.A.	C.A.	6,070.0	6,070.0	6,070.0	1,765.2		2,836.9	German (1913); (1928); (1965); GN 306 (1967); GN 25 (1968)
Nilo <sup>8</sup>		C.A.	P.F.R.				5,276.0	5,872.1	5,872.1	(1988); (1994)
Nkombola	1957	C.A.	C.A.	191.8	191.8	192.0	184.8			GN 38 (1957)
Segoma	1955	C.A.	C.A.	1,505.4	1,505.4	1,505.0	1,091.1	1,168.2	1,168.2	GN 113 (1955)
Semdoe			P.F.R.						970.0	
Tongwe	1956	C.A.	C.A.	1,201.9		1,202.0				GN 249, 288 (1956)
<b>Total</b>										

<sup>1</sup> Catchment Forestry Project. 1994. Forestry laws and prosecution. Catchment Forestry Report 94.8, Catchment Forestry Project, FBD, Dar es Salaam

<sup>2</sup> File cards on Central Government Forestry Reserves, FBD Survey and Mapping Section.

<sup>3</sup> Iversen, S.T. 1991. The Usambara mountains, N.E. Tanzania. history, vegetation and conservation. Uppsala University, Uppsala.

<sup>4</sup> AFIMP. 1988. East Usambara Mountains. Forests and forestry. Amani Forest Inventory and Management Plan Project, Forest Division & Finnmap-Silvestria, Dar es Salaam & Helsinki

<sup>5</sup> Hyytiäinen, K. 1995. Land use classification and mapping for the East Usambara Mountains. - East Usambara Catchment Forest Project Techn. Pap. 12, Forest and Beekeeping Division & Finnish Forests and Park Service, Dar es Salaam & Vantaa.

<sup>6</sup> Situation as of present in the East Usambara Catchment Forest Project (May 1996)

<sup>7</sup> Combining the Amani-East, Amani-Sigi, Amani-West, Kwamkoro, Kwamsambia, and Mnyusi Scarp F.R.'s, including an enlargement of 2,128.0 ha.

<sup>8</sup> Kilanga, Lutindi, Nkombola and new areas combined into proposed Nilo F.R.

**Table 6.** Distribution of forests between reserved (Forest Reserves) and non-reserved lands by 1993 (Hyttiäinen 1995).

Forest class/sub-class	Total, ha	Outside F.R., ha	% of total	Inside F.R., ha	% of total
<b>Sub-montane rain forest</b>					
Dense forest	6,940.2	2,046.9	29.5	4,893.3	70.5
Poorly stocked forest	470.6	453.9	96.5	16.7	3.5
Cultivation under forest	5,505.8	3,753.8	68.2	1,752.0	31.8
<i>sub-total</i>	<i>12,916.6</i>	<i>6,254.7</i>	<i>48.4</i>	<i>6,662.0</i>	<i>51.6</i>
<b>Lowland forest</b>					
Dense forest	15,179.6	4,711.9	31.0	10,467.7	69.0
Poorly stocked forest	5,790.7	3,592.2	62.0	2,198.5	38.0
Cultivation under forest	5,510.1	5,124.6	93.0	385.5	7.0
<i>sub-total</i>	<i>26,480.4</i>	<i>13,428.7</i>	<i>50.7</i>	<i>13,051.7</i>	<i>49.3</i>
<b>Plantations</b>					
Eucalyptus	493.4	491.7	99.7	1.7	0.3
Maesopsis	529.0	20.5	3.9	508.5	96.1
Teak	1,682.6	11.2	0.7	1,671.4	99.3
Other species	18.6	18.6	100.0	0.0	0.0
<i>sub-total</i>	<i>2,723.6</i>	<i>542.1</i>	<i>19.9</i>	<i>2,181.5</i>	<i>80.1</i>
<b>TOTAL</b>	<b>42,120.6</b>	<b>20,225.5</b>	<b>48.0</b>	<b>21,895.2</b>	<b>52.0</b>

**Table 7.** Distribution of natural sub-montane and lowland forests into density classes (plantations excluded) inside and outside forest reserves by 1993 (Hyttiäinen 1995).

Forest class	Total, ha	Outside F.R., ha	% of total	Inside F.R., ha	% of total
Dense forest	22,119.80	6,758.80	30.6	15,361.00	69.4
Poorly stocked forest	6,261.30	4,046.10	64.6	2,215.20	35.4
Cultivation under forest	11,015.90	8,878.40	80.6	2,137.50	19.4
<b>TOTAL</b>	<b>39,397.00</b>	<b>19,683.30</b>	<b>50.0</b>	<b>19,713.70</b>	<b>50.0</b>

**Table 8.** Distribution of forest classes for the forest reserves (23,187 ha) by 1993 (Hyytiäinen 1995).

Forest class	Area, ha	% of forest in F.R.	% of total area in F.R.
Submontane rain forest	6,662.0	30.4	28.7
Lowland forest	13,051.7	59.6	56.3
Plantations	2,181.5	10.0	9.4
<b>TOTAL</b>	<b>21,895.2</b>	<b>100.0</b>	<b>94.4</b>

**Table 9.** Distribution of the forest classes for the whole area by 1993 (Hyytiäinen 1995).

Forest class/sub-class	Area, ha	% of the all forests	% of the total area
<b>Sub-montane rain forest</b>			
Dense forest	6,940.2	16.5	8.3
Poorly stocked forest	470.6	1.1	0.6
Cultivation under forest	5,505.8	13.1	6.6
<i>sub-total</i>	<i>12,916.7</i>	<i>30.7</i>	<i>15.5</i>
<b>Lowland forest</b>			
Dense forest	15,179.6	36.0	18.2
Poorly stocked forest	5,790.7	13.7	6.9
Cultivation under forest	5,510.1	13.1	6.6
<i>sub-total</i>	<i>26,480.4</i>	<i>62.9</i>	<i>31.7</i>
<b>Plantations</b>			
Eucalyptus	493.4	1.2	0.6
Maesopsis	529.0	1.3	0.6
Teak	1,682.6	4.0	2.1
Other species	18.6	0.0	0.0
<i>sub-total</i>	<i>2,723.6</i>	<i>6.5</i>	<i>3.3</i>
<b>TOTAL</b>	<b>42,120.7</b>	<b>100.0</b>	<b>50.4</b>



## 7. LAND CLASSIFICATION IN 1996

### 7.1 Forest reserves and gazettment

**Table 10.** Stage of gazettment of forest reserves or forest areas proposed for gazettment by May 1996 (EUCFP 1996).

Remaining stages in gazettment	Forest reserve or area
Village and ward meetings	Kwamarimba
Border survey or resurvey	Bamba Ridge-Kwangumi-Segoma, Kwamarimba
Border map production	Bamba Ridge-Kwangumi-Segoma, Bombo East, Kwamarimba, Manga, Mgambo
Payment of compensations	For none presently in process
Final clearance from claims	Bamba Ridge-Kwangumi-Segoma, Bombo East Kwamarimba, Manga, Mgambo, Mlungui
Signing of gazettment or variation order	Bamba Ridge-Kwangumi-Segoma, Bombo East Kwamarimba, Manga, Mgambo, Mlungui, Semdoe
Publication of gazettment notice	Bamba Ridge-Kwangumi-Segoma, Bombo East, Kambai, Kwamarimba, Manga, Mgambo, Mlungui, Semdoe.

**Table 11.** Forest Reserve map JB numbers and scales of F.R. maps of new East Usambara forest areas surveyed for enlargement of existing forest reserves or as new forest areas proposed for gazettment during Phase I and II (by May 1996) of the East Usambara Catchment Forest Project.

Forest Reserve	Map JB No.	Scale
Mlinga F.R.	JB. 2213	1:10,000
Nilo F.R.	JB. 2229	1:25,000
Mtai F.R.	JB. 2241	1:20,000
Mlungui F.R.	JB. 2247	1:5,000
Amani Nature Reserve	JB. 2260	1:20,000
Semdoe F.R.	JB. 2261	1:10,000
Manga F.R.	JB. 2282	1:10,000
Mpanga Village F.R.	JB. 2273	1:2,500
Mgambo F.R.	In process, DSM	
Bombo East I & II P.F.R.	In process, DSM	



**Table 12.** East Usambara forest areas surveyed for enlargement of existing forest reserves or as new forest areas proposed for gazettment during Phase I and II (May 1996) of the East Usambara Catchment Forest Project.

Forest Reserve	Area, ha	Year	Phase
Mlinga F.R. (new)	841.0	1992	Phase I
Nilo F.R. <sup>1</sup>	2,870.0	1993	
Mtai F.R. (enlargement)	1,234.0	1993	
Mlungui P.F.R.	200.0	1994	
Amani Nature Reserve <sup>2</sup>	2,128.0	1994	
Semdoe P.F.R.	970.0	1994	
<i>Sub-total</i>	<b>8,243.0</b>		
Manga F.R. (enlargement)	855.0	1995	Phase II
Mgambo P.F.R.	1,346.0	1995	
Mpanga Village F.R.	30.0	1995	
Bombo East I & II P.F.R.	1,671.0	1996	
<i>Sub-total</i>	<b>3,902.0</b>		
<b>TOTAL</b>	<b>12,145.0</b>		

<sup>1</sup> Combining and enlargement of the Kilanga, Lutindi, and Nkombola F.R.'s

<sup>2</sup> Combining and enlargement of the Amani-Sigi, Amani-East, Amani-West, Kwamsambia, Kwamkoro, and Mnuyzi Scap F.R.'s

**Table 13.** New forest areas or forest reserves surveyed, and in various stages of gazettment, which were not included in Hyytiäinen (1995) (EUCFP and FBD Survey and Inventory Unit 1996).

Forest area / Reserve	Status	Surveyed	Area, ha
Mtai	F.R.	1993	1,234.0
Amani Nature Reserve	P.N.R.	1994	2,128.0
Mlungui	P.F.R.	1994	200.0
Semdoe	P.F.R.	1994	970.0
Manga <sup>1</sup>	F.R.	1995	1,616.0
Mgambo	P.F.R.	1995	1,346.0
Bombo East I & II	P.F.R.	1996	1,671.0
<b>TOTAL</b>			<b>9,165.0</b>

<sup>1</sup> Original Manga F.R. (761.0 ha) was not included in Hyytiäinen (1995). Total includes the 855.0 ha enlargement of 1995.

**Table 14.** Forest reserves enlargements to be surveyed which were not included in Hyytiäinen (1995) (EUCFP and FBD Survey and Inventory Unit 1996).

Forest area / Reserve	Status	Proposed survey	Area, ha
Bamba Ridge	F.R.	1996	255.4
Kwamarimba	F.R.	1996	38.4
Kwangumi	F.R.	1996	579.6
Segoma	F.R.	1996	765.6
<b>TOTAL</b>			<b>1,639.0</b>

**Table 15.** New forest corridors proposed for survey, which were not included in Hyytiäinen (1995) (EUCFP and FBD Survey and Inventory Unit 1996).

Forest area / Reserve	Status	Proposed survey	Area, ha
Bombo East I - Mtai corridor	P.F.R.	1996-97	283.0
Derema P.F.R.	P.F.R.	1996-97	790.5
Kwamarimba-Kambai corridor via Longuza F.R.	P.F.R.	1996-97	182.0
Makanya corridor	P.F.R.	1996-97	478.5
Manga-Bamba Ridge corridor <sup>1</sup>	P.F.R.	1996-97	4.0
Mlinga-Marimba corridor	P.F.R.	1996-97	354.8
Mtai-Kwangumi corridor <sup>1</sup>	P.F.R.	1996-97	31.0
Segoma-Semdoe corridor <sup>1</sup>	P.F.R.	1996-97	35.0
Semdoe-Nilo corridor	P.F.R.	1996-97	162.5
<b>TOTAL</b>			<b>2,321.3</b>

<sup>1</sup> Classified by Hyytiäinen (1995) as agriculture (peasant farming).

**Table 16.** East Usambara nature and forest reserve managed by the EUCFP by 1996.

Forest Reserve / Nature Reserve		Area, ha <sup>1</sup>	Sub- category	% of category	% of all
<b><u>Managed by EUCFP:</u></b>					
1.	Amani Nature Reserve	8,328.8		28.4	25.7
	1..1 Amani-East Forest Reserve		122.2		
	1..2 Amani-Sigi Forest Reserve		1,153.5		
	1..3 Amani-West Forest Reserve		158.5		
	1..4 Kwamkoro Forest Reserve		2,270.9		
	1..5 Kwamsambia Forest Reserve		1,822.8		
	1..6 Mnyusi Scarp Forest Reserve		672.9		
	1..7 ANR enlargement		1,063.0		
	1..8 ANR covenant		1,065.0		
2.	Bamba Ridge F.R.	1,131.5		3.9	3.5
3.	Bombo East I & II P.F.R.	1,671.0		5.7	5.2
4.	Kambai F.R.	1,046.3		3.6	3.2
5.	Kwamarimba F.R.	887.4		3.0	2.7
6.	Kwangumi F.R.	1,128.8		3.8	3.5
7.	Manga F.R.	1,616.0		5.5	5.0
8.	Mgambo P.F.R.	1,346.0		4.6	4.2
9.	Mlinga F.R.	839.4		2.9	2.6
10.	Mlungui P.F.R.	200.0		0.7	0.6
11.	Mtai F.R.	3,145.6		10.7	9.7
12.	Nilo P.F.R.	5,872.1		20.0	18.2
13.	Segoma F.R.	1,168.2		4.0	3.6
14.	Semdoe P.F.R.	970.0		3.3	3.0
<b>Nature Reserves and Forest Reserves</b>		<b>29,351.1</b>		<b>100.0</b>	
<b><u>Not managed by EUCFP:</u></b>					
1.	Kihuhwi F.R.	490.1		16.3	1.5
2.	Kihuhwi-Sigi F.R.	898.1		29.9	2.8
3.	Kihuhwi-Teak F.R.	33.6		1.1	0.1
4.	Longuza F.R.	1,579.9		52.6	4.9
<b>Forest reserves</b>		<b>3,001.7</b>		<b>100.0</b>	
<b>GRAND TOTAL RESERVES</b>		<b>32,352.8</b>			<b>100.0</b>

<sup>1</sup> Includes all reserved and surveyed proposed enlargements and new reserves, but excludes the non-surveyed proposed areas.

**Table 17.** Distribution of the surveyed forests and wildlife corridors not included in Hyytiäinen (1995) (EUCFP and FBD Survey and Inventory Unit 1996). Including Mgambo P.F.R. and Bombo East I and II P.F.R.

Forest class/sub-class	Surveyed, ha	Proposed enlargement, ha	Proposed corridors, ha	Total, ha
<b>Sub-montane rain forest</b>				
Dense forest	1,207.8	-	-	1,207.8
Poorly stocked forest	-	-	-	-
Cultivation under forest	-	-	899.0	899.0
<i>sub-total</i>	1,207.8	-	899.0	2,106.8
<b>Lowland forest</b>				
Dense forest	2,545.9	1,191.0	117.2	3,854.1
Poorly stocked forest	3,350.9	391.5	768.8	4,511.2
Cultivation under forest	1,299.4	56.5	536.3	1,892.2
<i>sub-total</i>	7,196.2	1,639.0	1,422.3	10,257.5
<b>TOTAL</b>	<b>8,404.0</b>	<b>1,639.0</b>	<b>2,321.3</b>	<b>12,364.3</b>
<b>Lowland forest <sup>1</sup></b>				
Dense forest	527.9			527.9
Poorly stocked forest	233.1			233.1
<i>sub-total</i>	761.0			761.0
<b>TOTAL <sup>1</sup></b>	<b>9,165.0</b>			<b>13,018.5</b>

<sup>1</sup> The original Manga F.R. (761.0 ha) was omitted by mistake in Hyytiäinen (1995)

**Table 18.** Updated forest area distribution for surveyed <sup>1</sup>, proposed F.R. enlargements <sup>2</sup>, and proposed forest corridors <sup>3</sup>. For areas which are gazetted, in process of gazettment or proposed for gazettment. (Hyytiäinen 1995, EUCFP and FBD Survey and Inventory Unit 1996).

Forest class	Area, ha <sup>1</sup>	Area, ha <sup>2</sup>	Area, ha <sup>3</sup>
Sub-montane rain forest	7,869.8	8,353.9	8,768.8
Lowland forest	21,008.9	22,954.3	24,070.2
Plantations	2,723.6	2,723.6	2,723.6
<b>TOTAL</b>	<b>31,602.3</b>	<b>34,031.8</b>	<b>35,562.6</b>

**Table 19.** Distribution of the East Usambara forests into forest types, density classes, and between reserved (Forest Reserves) and non-reserved forest lands including the surveyed and the proposed forest reserve enlargements but excluding the proposed forest corridors (EUCFP 1995, Hyytiäinen 1995, EUCFP and FBD Survey and Inventory Unit 1996).

Forest class/sub-class	Total, ha <sup>1</sup>	Outside F.R., ha	% of total	Inside F.R., ha <sup>2</sup>	% of total
<b>Sub-montane rain forest</b>					
Dense forest	6,940.2	839.1	12.1	6,101.1	87.9
Poorly stocked forest	470.6	453.9	96.5	16.7	3.5
Cultivation under forest	5,505.8	3,269.7	59.4	2,236.1	40.6
<i>sub-total</i>	<i>12,916.6</i>	<i>4,562.7</i>	<i>35.3</i>	<i>8,353.9</i>	<i>64.7</i>
<b>Lowland forest</b>					
Dense forest	15,179.6	348.8	2.3	<sup>2</sup> 14,830.8	97.7
Poorly stocked forest	<sup>3</sup> 8,756.7	2,582.7	29.5	<sup>2</sup> 6,174.0	70.5
Cultivation under forest	<sup>3</sup> 5,561.1	3,611.6	64.9	1,949.5	35.1
<i>sub-total</i>	<i>29,497.4</i>	<i>6,543.1</i>	<i>22.2</i>	<i>22,954.3</i>	<i>77.8</i>
<b>Plantations</b>					
Eucalyptus	493.4	491.7	99.7	1.7	0.3
Maesopsis	529.0	20.5	3.9	508.5	96.1
Teak	1,682.6	11.2	0.7	1,671.4	99.3
Other species	18.6	18.6	100.0	0.0	0.0
<i>sub-total</i>	<i>2,723.6</i>	<i>542.1</i>	<i>19.9</i>	<i>2,181.5</i>	<i>80.1</i>
<b>TOTAL</b>	<b>45,137.6</b>	<b>11,647.9</b>	<b>25.8</b>	<b>33,489.7</b>	<b>74.2</b>

<sup>1,3</sup> Figures from Hyytiäinen (1995) adjusted by surveyed areas of Bombo East I & II P.F.R. and Mgambo P.F.R.

<sup>2</sup> Figures from Hyytiäinen (1995) including the new areas.

**Table 20.** Distribution of the East Usambara forests into forest types, density classes, and between reserved (Forest Reserves) and non-reserved forests, including the proposed forest corridors (EUCFP 1995, Hyytiäinen 1995, EUCFP and FBD Survey and Inventory Unit 1996).

Forest class/sub-class	Total, ha <sup>1</sup>	Outside F.R., ha	% of total	Inside F.R., ha <sup>2</sup>	% of total
<b>Sub-montane rain forest</b>					
Dense forest	6,940.2	839.1	12.1	6,101.1	87.9
Poorly stocked forest	470.6	453.9	96.5	16.7	3.5
Cultivation under forest	5,505.8	2,854.8	51.9	2,651.0	48.1
<i>sub-total</i>	<i>12,916.6</i>	<i>4,147.8</i>	<i>32.1</i>	<i>8,768.8</i>	<i>67.9</i>
<b>Lowland forest</b>					
Dense forest	15,179.6	329.9	2.2	14,849.7	97.8
Poorly stocked forest	8,756.4	1,813.6	20.7	6,942.8	76.9
Cultivation under forest	5,561.4	3,283.7	59.1	2,277.7	40.9
<i>sub-total</i>	<i>29,497.4</i>	<i>5,427.2</i>	<i>18.4</i>	<i>24,070.2</i>	<i>80.8</i>
<b>Plantations</b>					
Eucalyptus	493.4	491.7	99.7	1.7	0.3
Maesopsis	529.0	20.5	3.9	508.5	96.1
Teak	1,682.6	11.2	0.7	1,671.4	99.3
Other species	18.6	18.6	100.0	0.0	0.0
<i>sub-total</i>	<i>2,723.6</i>	<i>542.1</i>	<i>19.9</i>	<i>2,181.5</i>	<i>80.1</i>
<b>TOTAL</b>	<b>45,137.6</b>	<b>10,177.1</b>	<b>22.4</b>	<b>35,020.5</b>	<b>77.1</b>

<sup>1</sup> Figures from Hyytiäinen (1995) adjusted by new surveyed areas of Bombo East I & II P.F.R. and Mgambo P.F.R.

<sup>2</sup> Figures from Hyytiäinen (1995) including the new areas.

**Table 21.** Distribution of the East Usambara natural forests into density classes, and between forest reserves and non-reserved forests (excluding plantations and the proposed corridors) (EUCFP 1995, Hyytiäinen 1995, EUCFP and FBD Survey and Inventory Unit 1996).

Forest class/sub-class	Total, ha <sup>1</sup>	Outside F.R., ha	% Total	Inside F.R., ha <sup>2</sup>	% of Total
Dense forest	22,119.8	1,187.9	5.4	20,931.9	94.6
Poorly stocked forest	9,227.3	3,036.6	32.9	6,190.7	67.1
Cultivation under forest	11,066.9	6,881.3	62.2	4,185.6	37.8
<b>TOTAL</b>	<b>42,414.0</b>	<b>11,105.8</b>	<b>26.2</b>	<b>31,308.2</b>	<b>73.8</b>

<sup>1</sup> Figures from Hyytiäinen (1995) adjusted by new surveyed areas of Bombo East I & II P.F.R. and Mgambo P.F.R. Excluding plantations (2,723.6 ha)

<sup>2</sup> Figures from Hyytiäinen (1995) including the new areas.



**Table 22.** Distribution of natural sub-montane and lowland forests including surveyed forests, proposed forest areas to be surveyed and proposed wildlife corridors to be surveyed.

Forest class/sub-class	Total, ha <sup>1</sup>	Outside F.R. ha	% of Total	Inside F.R., ha <sup>2</sup>	% of Total
Dense forest	22,119.8	1,169.0	5.3	20,950.8	94.7
Poorly stocked forest	9,227.3	2,544.5	26.8	6,959.5	73.2
Cultivation under forest	11,066.9	6,144.5	55.5	4,928.7	44.5
<b>TOTAL</b>	<b>42,414.0</b>	<b>9,858.0</b>	<b>23.1</b>	<b>32,839.0</b>	<b>76.9</b>

<sup>1</sup> Figures from Hyytiäinen (1995) adjusted by new surveyed areas of Bombo East I & II P.F..R. and Mgambo P.F.R. Excluding plantations (2,723.6 ha)

<sup>2</sup> Figures from Hyytiäinen (1995) including the new areas .

**Table 23.** Distribution of the East Usambara main land use classes in Korogwe and Muheza Districts (Hyytiäinen 1995; EUCFP & FBD Survey and Inventory Unit 1996).

Land class	Total area, ha	Korogwe			Muheza		
		Inside F.R.	Outside F.R.	Total Korogwe	Inside F.R.	Outside F.R.	Total Muheza
<b>Forest</b>							
<i>Sub-montane forest</i>							
Dense forest	6,940.2	1,330.3	133.6	1,463.9	4,770.8	705.5	5,476.3
Poorly stocked forest	470.6	1.3	208.7	210.0	15.4	245.2	260.6
Cultivation under forest	5,505.8	1,525.2	566.9	2,092.1	1,125.8	2,287.9	3,413.7
<i>Sub-total:</i>	<i>12,916.6</i>	<i>2,856.8</i>	<i>909.2</i>	<i>3,766.0</i>	<i>5,912.0</i>	<i>3,238.6</i>	<i>9,150.6</i>
<i>Lowland forest</i>							
Dense forest	15,179.6	1,279.0	165.1	1,444.1	13,570.7	164.8	13,735.5
Poorly stocked forest	8,756.4	1,588.1	746.0	2,334.1	5,354.7	1,067.6	6,422.3
Cultivation under forest	5,561.4	308.6	39.7	348.3	1,969.1	3,244.0	5,213.1
<i>Sub-total:</i>	<i>29,497.4</i>	<i>3,175.7</i>	<i>950.8</i>	<i>4,126.5</i>	<i>20,894.5</i>	<i>4,476.4</i>	<i>25,370.9</i>
<i>Plantations</i>							
Eucalyptus	493.4		24.6	24.6	1.7	467.1	468.8
Maesopsis	529.0				508.5	20.5	529.0
Teak	1,682.6				1,671.4	11.2	1,682.6
Other species	18.6		3.8	3.8		14.8	14.8
<i>Sub-total:</i>	<i>2,723.6</i>		<i>28.4</i>	<i>28.4</i>	<i>2,181.6</i>	<i>513.6</i>	<i>2,695.2</i>
<i>Forests sub-total:</i>	<i>45,137.6</i>	<i>6,032.5</i>	<i>1,888.4</i>	<i>7,920.9</i>	<i>28,988.1</i>	<i>8,228.6</i>	<i>37,216.7</i>
<b>Woodland</b>							
<i>Semi-deciduous savanna</i>	240.4		218.6	218.6		21.8	21.8
<i>Bush</i>	3,872.7	136.2	2,273.7	2,409.9	331.2	1,131.6	1,462.8
<i>Woodlands sub-total:</i>	<i>4,113.1</i>	<i>136.2</i>	<i>2,492.3</i>	<i>2,628.5</i>	<i>331.2</i>	<i>1,153.4</i>	<i>1,484.6</i>
<b>Agriculture</b>							
<i>Peasant farming</i>	31,716.0	269.3	6,600.5	6,869.8	609.3	24,236.9	24,846.2
<i>Sub-total:</i>	<i>31,716.0</i>	<i>269.3</i>	<i>6,600.5</i>	<i>6,869.8</i>	<i>609.3</i>	<i>24,236.9</i>	<i>24,846.2</i>
<i>Estate farming</i>							
Tea	2,363.0		95.8	95.8	6.5	2,260.7	2,267.2
Sisal	535.1		9.5	9.5		525.6	525.6
Cocoa	1,107.4					1,107.4	1,107.4
Coconut	98.9	10.0		10.0	20.0	68.9	88.9
Fruits	34.5					34.5	34.5
Rubber	53.9				26.5	53.9	80.4
<i>Sub-total:</i>	<i>4,192.8</i>	<i>10.0</i>	<i>105.3</i>	<i>115.3</i>	<i>53.0</i>	<i>4,051.0</i>	<i>4,104.0</i>
<i>Agriculture sub-total:</i>	<i>35,908.8</i>	<i>279.3</i>	<i>6,705.8</i>	<i>6,985.1</i>	<i>662.3</i>	<i>28,287.9</i>	<i>28,950.2</i>
<b>Grassland</b>	344.6		225.5	225.5			119.1
<b>Ponds &amp; rivers</b>	100.7	20.0	15.1	35.1	35.0	30.0	65.0
<b>Barren land</b>	393.1	13.9	39.1	53.0	290.0	50.1	340.1
<b>Settlement</b>	620.0		90.6	90.6	20.6	508.8	529.4
<b>GRAND TOTAL:</b>	<i>86,643.8</i>	<i>6,481.9</i>	<i>11,456.8</i>	<i>17,938.7</i>	<i>30,327.2</i>	<i>38,377.9</i>	<i>68,705.1</i>

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**Appendix 1**

Area calculations for each new forest area surveyed between 1994 and May 1996 (EUCFP and FBD Survey and Inventory Unit 1996).

Forest Reserve/ Forest Area	Surveyed area (by May 1996), ha	Proposed enlargements, ha	Proposed corridors, ha
<b>Amani Nature Reserve</b>			
<i>Sub-montane forest</i>			
Dense forest	1,207.8		
Poorly stocked forest			
Cultivation under forests			
<i>Lowland forest</i>			
Dense forest	313.7		
Poorly stocked forest	337.0		
Cultivation under forest	269.5		
<i>Total for the reserve:</i>	<i>2,128.0</i>		
<b>Bombo East I &amp; II P.F.R.</b>			
<i>Lowland forest</i>			
Poorly stocked forest	1,671.0		
<i>Total for the reserve:</i>	<i>1,671.0</i>		
<b>Manga P.F.R.</b>			
<i>Lowland forest</i>			
Dense forest	820.9		
Poorly stocked forest	25.2		
Cultivation under forest	8.9		
<i>Total for the reserve:</i>	<i>855.0</i>		
<b>Mgambo F.R.</b>			
<i>Lowland forest</i>			
Poorly stocked forest	1,295.0		
Cultivation under forests	51.0		
<i>Total for the reserve:</i>	<i>1,346.0</i>		
<b>Mlungui P.F.R.</b>			
<i>Lowland forest</i>			
Dense forest	200.0		
<i>Total for the reserve:</i>	<i>200.0</i>		



Forest Reserve/ Forest Area	Surveyed area (by May 1996), ha	Proposed enlargements, ha	Proposed corridors, ha
<b>Mtai F.R.</b>			
<i>Lowland forest</i>			
Dense forest	1211.3		
Poorly stocked forest	22.7		
<i>Total for the reserve:</i>	<i>1,234.0</i>		

***Semdoe P.F.R***

<i>Lowland forest</i>			
Cultivation under forests	970.0		
<i>Total for the reserve:</i>	<i>970.0</i>		

**PLANNED ENLARGEMENTS****Bamba Ridge F.R. enlargement**

<i>Lowland forest</i>			
Dense forest		242.4	
Poorly stocked lowland forest		13.0	
<i>Total enlargement area:</i>		<i>255.4</i>	

**Kwamarimba F.R. enlargement**

<i>Lowland forest</i>			
Dense forest		38.4	
<i>Total enlargement area:</i>		<i>38.4</i>	

**Kwamgumi F.R. enlargement**

<i>Lowland forest</i>			
Dense forest		579.6	
<i>Total enlargement area:</i>		<i>579.6</i>	

**Segoma F.R. enlargement**

<i>Lowland forest</i>			
Dense forest		330.6	
Poorly stocked forest		378.5	
Cultivation under forest		56.5	
<i>Total enlargement area:</i>		<i>765.6</i>	

**PLANNED CORRIDORS****Bombo East I - Mtai corridor**

<i>Lowland forest</i>			
Poorly stocked forest			276.7

Cultivation under forest	6.3
<i>Total corridor area:</i>	<i>283.0</i>



<b>Forest Reserve/ Forest Area</b>	<b>Surveyed area (by May 1996), ha</b>	<b>Proposed enlargements, ha</b>	<b>Proposed corridors, ha</b>
<b>Derema P.F.R.</b>			
<i>Sub-montane forest</i>			
Cultivation under forests			484.1
<i>Lowland forest</i>			
Dense forest			98.3
Cultivation under forests			208.1
<i>Total corridor area:</i>			790.5
<b>Kwamarimba-Kambai corridor</b>			
<i>Lowland forest</i>			
Poorly stocked forest			92.6
Cultivation under forest			89.4
<i>Total corridor area:</i>			182.0
<b>Makanya corridor</b>			
<i>Sub-montane forest</i>			
Dense forest			
Poorly stocked forest			
Cultivation under forest			414.9
<i>Lowland forest</i>			
Dense forest			18.9
Poorly stocked forest			44.7
<i>Total corridor area:</i>			478.5
<b>Manga-Bamba Ridge corridor</b>			
<i>Lowland forest</i>			
Cultivation under forest			4.0
<i>Total corridor area:</i>			4.0
<b>Mlinga-Kwamarimba corridor</b>			
<i>Lowland forest</i>			
Poorly stocked forest			354.8
<i>Total corridor area:</i>			354.8
<b>Mtai-Kwangumi corridor</b>			
<i>Lowland forest</i>			
Cultivation under forest			31.0
<i>Total corridor area:</i>			31.0

<b>Forest Reserve/ Forest Area</b>	<b>Surveyed area (by May 1996), ha</b>	<b>Proposed enlargements, ha</b>	<b>Proposed corridors, ha</b>
<b>Segoma-Semdoe corridor</b>			
<i>Lowland forest</i>			
Cultivation under forest			35.0
<i>Total corridor area:</i>			35.0
<b>Semdoe-Nilo corridor</b>			
<i>Lowland forest</i>			
Cultivation under forest			162.5
<i>Total corridor area:</i>			162.5
	<b>Sub-total</b>	<b>8,404.0</b>	<b>1,639.0</b>
	<b>TOTAL (all categories)</b>		<b>2,321.3</b>
			<b>12,364.3</b>

**Appendix 2**

Area calculations as of May 1996 for each forest reserve separately based on Hyytiäinen (1995) and EUCFP and FBD Survey and Inventory Unit (1996).

Forest or nature reserve	Area, ha	%
<b>Amani Nature Reserve</b>		
<i>Sub-montane forest</i>		
Dense forest	4,026.0	48.3
Poorly stocked forest	1.8	-
Cultivation under forest	13.8	0.2
<i>Lowland forest</i>		
Dense forest	2,513.1	30.2
Poorly stocked forest	758.3	9.1
Cultivation under forest	273.8	3.3
<i>Plantations</i>		
Eucalyptus	83.9	1.0
Maesopsis	508.5	6.1
<i>Bush</i>		
	96.5	1.2
<i>Peasant farming</i>		
	36.7	0.4
<i>Estate farming (tea)</i>		
	6.5	0.1
<b>Ponds &amp; rivers</b>		
	1.1	-
<b>Barren land</b>		
	1.5	-
<b>Settlement</b>		
	7.3	0.1
<i>Total for the reserve:</i>		8,328.8 100.0
<b>Bamba Ridge F.R.</b>		
<i>Sub-montane forest</i>		
Dense forest	36.9	3.3
<i>Lowland forest</i>		
Dense forest	878.3	77.6
Poorly stocked forest	79.5	7.0
<i>Peasant cultivation</i>		
	36.0	3.2
<b>Barren land</b>		
	100.8	8.9
<i>Total for the reserve:</i>		1,131.5 100.0
<b>Bombo East I &amp; II P.F.R.</b>		
<i>Lowland forest</i>		
Poorly stocked forest	1,671.0	100.0
<i>Total for the reserve:</i>		1,671.0 100.0

Forest or nature reserve	Area, ha	%
<b>Kambai F.R.</b>		
<i>Lowland forest</i>		
Dense forest	849.6	81.2
Poorly stocked forest	78.8	7.5
Cultivation under forests	40.0	3.8
<i>Bush</i>	65.0	6.2
<i>Peasant cultivation</i>	10.4	1.0
<b>Barren land</b>	2.5	0.2
<i>Total for the reserve:</i>		1,046.3 100.0
<b>Kihuhwi F.R.</b>		
<i>Plantations</i>		
Teak	477.7	97.5
<i>Peasant cultivation</i>	6.6	1.3
<b>Barren land</b>	5.8	1.2
<i>Total for the reserve:</i>		490.1 100.0
<b>Kihuhwi-Sigi F.R.</b>		
<i>Lowland forest</i>		
Dense forest	307.5	34.2
Poorly stocked forest	24.0	2.7
<i>Plantations</i>		
Teak	534.6	59.5
<i>Peasant cultivation</i>	23.7	2.6
<b>Settlement</b>	8.3	0.9
<i>Total for the reserve:</i>		898.1 100.0
<b>Kihuhwi-Teak F.R.</b>		
<i>Plantations</i>		
Teak	31.4	93.5
<i>Peasant cultivation</i>	2.2	6.5
<i>Total for the reserve:</i>		33.6 100.0
<b>Kwamarimba F.R.</b>		
<i>Lowland forest</i>		
Dense forest	763.0	86.0
Poorly stocked forest	124.4	14.0
<i>Total for the reserve:</i>		887.4 100.0

Forest or nature reserve	Area, ha	%
<b>Kwamgumi F.R.</b>		
<i>Sub-montane forest</i>		
Dense forest	16.9	1.5
<i>Lowland forest</i>		
Dense forest	1,071.6	94.9
<i>Peasant cultivation</i>	3.1	0.3
<b>Barren land</b>	37.2	3.3
<i>Total for the reserve:</i>		<i>1,128.8 100.0</i>
<b>Longuza F.R.</b>		
<i>Lowland forest</i>		
Dense forest	271.3	17.2
Poorly stocked forest	725.8	45.9
Cultivation under forest	0.6	0.0
<i>Plantations</i>		
Teak	543.8	34.4
<i>Peasant cultivation</i>	2.9	0.2
<b>Ponds &amp; rivers</b>	32.4	2.1
<b>Settlement</b>	3.1	0.2
<i>Total for the reserve:</i>		<i>1,579.9 100.0</i>
<b>Manga F.R.</b>		
<i>Lowland forest</i>		
Dense forest	1,348.8	83.5
Poorly stocked forest	258.3	16.0
Cultivation under forest	8.9	0.5
<i>Total for the reserve:</i>		<i>1,616.0 100.0</i>
<b>Mgambo P.F.R.</b>		
<i>Lowland forest</i>		
Poorly stocked forest	1,295.0	96.2
Cultivation under forest	51.0	3.8
<i>Total for the reserve:</i>		<i>1,346.0 100.0</i>
<b>Mlinga F.R.</b>		
<i>Sub-montane forest</i>		
Dense forest	47.4	5.6
<i>Lowland forest</i>		
Dense forest	419.0	49.9
Poorly stocked forest	198.5	23.6
Cultivation under forest	4.8	0.6
<i>Peasant cultivation</i>	92.7	11.0
<b>Barren land</b>	77.0	9.2

*Total for the reserve:*      839.4    100.0

Forest or nature reserve	Area, ha	%
<b>Mlungui P.F.R.</b>		
<i>Lowland forest</i>		
Dense forest	200.0	100.0
<i>Total for the reserve:</i>	<i>200.0</i>	<i>100.0</i>
<b>Mtai F.R.</b>		
<i>Sub-montane forest</i>		
Dense forest	293.7	9.3
Poorly stocked forest	15.0	0.5
<i>Lowland forest</i>		
Dense forest	2,675.4	85.1
Poorly stocked forest	135.0	4.3
<i>Peasant cultivation</i>	22.0	0.7
<b>Barren land</b>	4.5	0.1
<i>Total for the reserve:</i>	<i>3,145.6</i>	<i>100.0</i>
<b>Nilo P.F.R.</b>		
<i>Sub-montane forest</i>		
Dense forest	1,670.7	28.5
Cultivation under forest	1,738.1	29.6
<i>Lowland forest</i>		
Dense forest	1,190.3	20.3
Poorly stocked forest	356.1	6.1
Cultivation under forest	335.8	5.7
<i>Bush</i>	169.7	2.9
<i>Peasant cultivation</i>	372.3	6.3
<b>Barren land</b>	37.2	0.6
<b>Settlement</b>	1.9	0.0
<i>Total for the reserve:</i>	<i>5,872.1</i>	<i>100.0</i>
<b>Segoma F.R.</b>		
<i>Sub-montane forest</i>		
Dense forest	11.2	1.0
<i>Lowland forest</i>		
Dense forest	1,053.6	90.2
Poorly stocked forest	77.7	6.6
<i>Peasant cultivation</i>	0.7	0.1
<b>Ponds &amp; rivers</b>	1.5	0.1
<b>Barren land</b>	23.5	2.0
<i>Total for the reserve:</i>	<i>1,168.2</i>	<i>100.0</i>

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Forest or nature reserve	Area, ha	%
<b>Semdoe P.F.R.</b>		
<i>Lowland forest</i>		
Cultivation under forest	970.0	100.0
<i>Total for the reserve:</i>	<i>970.0</i>	<i>100.0</i>





**Appendix 3.****Breakdown of Amani Nature Reserve by old forest reserves and enlargement area**

<b>Reserve</b>	<b>Area, ha</b>	<b>%</b>
<b>Amani-East F.R.</b>		
<i>Lowland forest</i>		
Dense lowland forest	122.2	100.0
<i>Total for the reserve:</i>		
	122.2	100.0
<b>Amani-Sigi F.R.</b>		
<i>Sub-montane forest</i>		
Dense forest	572.6	49.6
<i>Lowland forest</i>		
Dense forest	560.4	48.6
Cultivation under forest	4.3	0.4
<i>Peasant farming</i>		
	16.2	1.4
<i>Total for the reserve:</i>		
	1,153.5	100.0
<b>Amani-West F.R.</b>		
<i>Sub-montane forest</i>		
Dense forest	128.1	80.8
Cultivation under forests	4.9	3.1
<i>Lowland forest</i>		
Dense lowland forest	12.3	7.8
<i>Plantations</i>		
Maesopsis	6.4	4.0
<b>Settlement</b>		
	6.8	4.3
<i>Total for the reserve:</i>		
	158.5	100.0
<b>Kwamkoro F.R.</b>		
<i>Sub-montane forest</i>		
Dense forest	1,718.9	75.7
Poorly stocked forest	0.5	0.0
Cultivation under forest	8.9	0.4
<i>Lowland forest</i>		
Dense forest	16.7	0.7
<i>Plantations</i>		
Eucalyptus	1.7	0.1
Maesopsis	502.1	22.1
<i>Peasant cultivation</i>		
	12.7	0.6
<i>Estate farming, tea</i>		
	6.5	0.3
<b>Ponds &amp; rivers</b>		
	1.1	0.0
<b>Barren land</b>		
	1.3	0.1
<b>Settlement</b>		
	0.5	0.0

*Total for the reserve:*     2,270.9     100.0

Reserve	Area, ha	%
<b>Kwamsambia F.R.</b>		
<i>Sub-montane forest</i>		
Dense forest	363.1	19.9
<i>Lowland forest</i>		
Dense forest	1,293.9	71.0
Poorly stocked forest	81.3	4.5
<i>Plantations</i>		
Teak	83.9	4.6
<i>Peasant cultivation</i>	0.6	0.0
<i>Total for the reserve: 1,822.8 100.0</i>		
<b>Mnyusi Scarp F.R.</b>		
<i>Sub-montane forest</i>		
Dense forest	33.8	5.0
Poorly stocked forest	1.3	0.2
<i>Lowland forest</i>		
Dense forest	193.9	28.8
Poorly stocked forest	340.0	50.5
<i>Bush</i>	96.5	14.3
<i>Peasant cultivation</i>	7.2	1.1
<b>Barren land</b>	0.2	0.0
<i>Total for the reserve: 672.9 100.0</i>		
<b>Amani Nature Reserve</b>		
<b>Sub-montane forest</b>		
Dense forest	1,207.8	56.8
<b>Lowland forest</b>		
Dense forest	313.7	14.7
Poorly stocked forest	337.0	15.8
Cultivation under forest	269.5	12.7
<i>Total for the reserve: 2,128.0 100.0</i>		
<b><u>of which:</u></b>		
<b>Amani Nature Reserve (enlargement)</b>		
<b>Sub-montane forest</b>		
Dense forest	142.8	13.4
<b>Lowland forest</b>		
Dense forest	313.7	29.5
Poorly stocked forest	337.0	31.7
Cultivation under forest	269.5	25.4
<i>Total for the reserve: 1,063.0 100.0</i>		

Reserve	Area, ha	%
<b>Amani Nature Reserve (covenant, EUTCO)</b>		
<b>Sub-montane forest</b>		
Dense forest	1,065.0	100.0
<b>Lowland forest</b>		
Dense forest		
Poorly stocked forest		
Cultivation under forest		
<i>Total for the reserve:</i>		
	1,065.0	100.0

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The East Usambara Catchment Forest Project Technical Papers Series consists of reports on forestry issues in the East Usambara Mountains. This series started in 199. These reports aim to make information more widely available to staff members of the East Usambara Catchment Forest Project, to the Forestry and Beekeeping Division, and to other institutions and individuals concerned and interested in the conservation of the East Usambara forests.

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