SECOND DRAFT REPORT

on

FOREST PRODUCTIVITY
(PLANTATIONS AND MULANJE CEDAR)

for

MULANJE MOUNTAIN
CONSERVATION
TRUST

by

FORINDECO

3841 Flatdal, Norway

March - 2000

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Cedar

EXECUTIVE SUMMARY

In May/June 1999 an inventory was conducted for the plantation in the Mulanje Mountain Forest Reserve covering about 5100 ha. Consisting of 2245 ha pine and 2850 ha eucalyptus.

On the basis of the 250 sample plots established, it was found that the standing volume of pine and eucalyptus was 330,000m³ and 802,000m³ respectively. The growth rate is 15 and 30 cu.m/ha/yr for pine and eucalyptus respectively.

Uncontrolled harvesting and fires have reduced the Chambe Pine Plantation on the Mulanje Mountain Plateau from 520 ha to the present 25 ha.

For a number of reasons such as lack of funding and manpower the FD is no longer able to look after the reserve in the prescribed manner. The work morale among department personnel appears low. There is almost a complete lack of records for the last 5 years.

Wood Industries Corporation, taking out large poles, is the only wood processing company operating in the area. All other harvesting is done by pitsawyers and people gathering fuelwood.

As very few pitsawyers are paying any stumpage there is no incentive to properly utilize the trees cut, resulting in a large amount of waste.

Present recovery of sawn timber from the pitsawyers varies between 8-20%. It is recommended that the FD encourage pitsawyers to go together to operate mobile sawmills. Such mills, properly run, will have a recovery factor of 50% with good quality sawlogs.

Most of the wood produced are marketed in Blantyre, as most of the pitsawyers are financed by people from Blantyre. The local communities are benefiting little from the harvesting activities in the reserve, apart from gathering fuelwood and some wages.

The yield in volume, as well as economic terms, from the reserve can be increased greatly with proper forest management and supervision of the harvesting. Potential gross revenue is MK43 million.

As the present land manager, the FD is no longer able to perform the forest management activities set out in the Forest Act, it is recommended that the reserve is handed over to Village Forestry Committees, with technical guidance from the FD.

Suggested management schedules are set up for both eucalyptus and pine.

Under the present management the benefits coming to the communities around the forest reserve is rather minor. This could be greatly improved on if some form of co-management could be worked out. It is suggested to set up two pilot project areas one in the Phalombe District, the other in the Mulanje District.

It is vital to come up with a system that will ensure maintaining the forest area, thereby avoiding a situation where the people will decide to use part of the reserve for agricultural purposes.

The role of MMCT should be that of financier, facilitator and bridge builder between FD and the communities around the mountain. There is presently considerable distrust between the FD and the communities. The Trust should not get involved in technical issues.

As for the management, protection and harvest of the scarce and protected Mulanje cedar, the consultant is of the opinion that it will disappear as an endemic species to the Mulanje Mountain if left in the hands of the FD.

In the period 1993 – 97 expenditure on cedar management was about Mk2.7 million. Revenue from cedar in the same period was MK0.5 million.

The considerable difference between the recorded and accounted volumes and revenues for cedar indicates that there is no unified system of record keeping.

It is recommended that a NGO such as the Wildlife Society of Malawi is approached regarding all aspect of protecting and harvesting of the cedar.

The present stumpage of MK1000/m^3 on per log basis should be increased to MK3000/m^3, preferably on a per tree basis.

To increase the community benefits from cedar a NGO should be approached or established to train local craftsmen making cedar chests and other artifacts. The same organization should also administer the purchase of cedar planks, quality control and sale of the finished products.

An export market exists for both cedar planks and artifacts. The domestic price for cedar planks is about US$200/cu.m. The export price FOB Blantyre is US$375.

The total volume of cedar remaining is about 95,000 cu.m including about 35,000 cu.m of dead trees.

Certain specific areas should be considered and agreed upon as cedar conservation areas for the total protection of all remaining cedar both alive and dead with no felling/cutting being permitted within these areas.

PART I

EXOTIC PLANTATIONS

1.0 INTRODUCTION

A contract dated August 12, 1998 between Mulanje Mountain Conservation Trust (MMCT) and Forest Integrated Development and Environmental Consultants (FORINDECO) was signed by FORINDECO on August 24, 1998.

The contract covers the work of a comprehensive inventory of the plantations inside the Mulanje Mountain Forest Reserve. Present, as well as future systems, used in harvesting, processing and marketing of wood products, are described. In addition, this study examines the present system used by the Department of Forestry (FD) for harvesting and marketing of Mulanje *cedar (Widdringtonia whytei/~~Cupressoides~~)* as well as making future recommendations for the same (See Annex I for complete Terms of Reference).

No field work was called for in the Mulanje Cedar part of the study. The consultant has for this reason relied on previous work done by others as to locations, volumes and suggested silvicultural treatment of the cedar (See Annex VI for Bibliography)

The main purpose of this study is to increase the productivity and profitability of the plantations inside Mulanje Mountain Forest Reserve, and to establish a conservation-based, efficient and profitable system of cedar harvesting and marketing.

Unfortunately the 30% advance stipulated in the contract to be received at the time of contract signing, to allow field work to start, was not received by the Consultant before November 11, 1998. The consultant was in the field to get acquainted with the area in December 1998. An attempt to start the fieldwork was made in January 1999 but failed due to access problems caused by rainfall and subsequent flooding.

The study area had dried up sufficiently to get the fieldwork done in the period May 26 – June 25, 1999. Even at that time the study team encountered access problems to the plantations far in excess of what was anticipated and planned for.

The composition of the Study Team was:

R. Gjessing	Team Leader and overall responsible for the study.
V. Msiska	Responsible for all field work, data compilation and data analysis.

The Regional Forestry Office (South) assisted in identifying the personnel for

the four inventory teams.

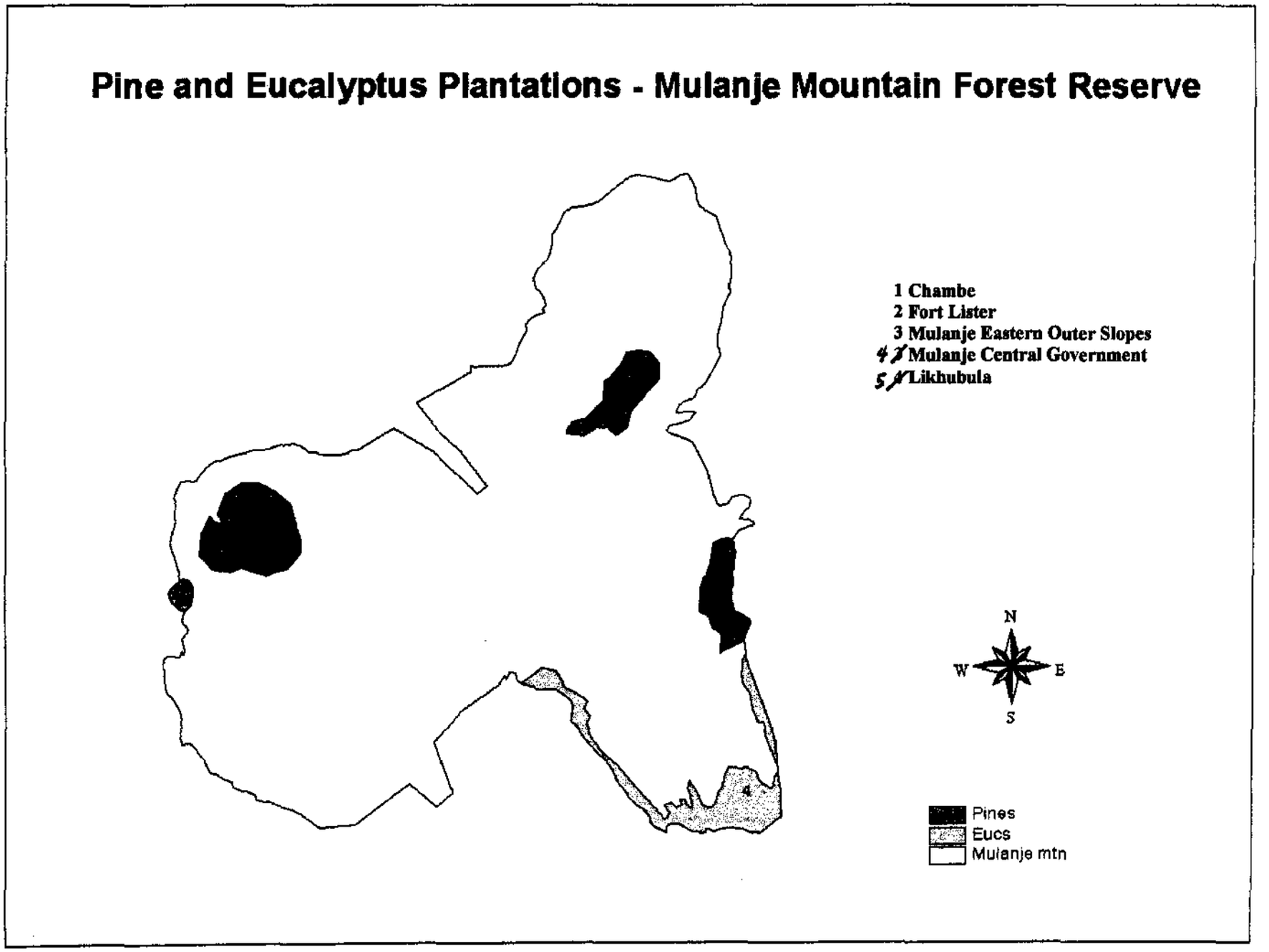
Due to serious family problems on the part of Mr. Msiska , this report has been delayed, for which we apologize.

A draft edition of the Study was presented in November,1999.

Comments from MMCT were received in January, 2000

A second draft edition of the study is hereby presented.

Figure 2


Pine and Eucalyptus Plantations - Mulanje Mountain Forest Reserve
1 Chambe
2 Fort Lister
3 Mulanje Eastern Outer Slopes
4 Mulanje Central Government
5 Likhubula
N
W
E
S
Pines
Eucs
Mulanje mtn

2.0 FOREST PLANTATION RESOURCES

2.1 Location and area

The Mulanje Mountain Forest Reserve lies in the southeastern part of the Southern Region between latitude S 15^0 50 - 16^0 02 and longitude E 30^0 30 -30^0 45. Access to Mulanje Mountain is shown in Map 1. It is one of the most important forest conservation and production areas in the country. Plantations, comprising of exotic tree species, have been established by the FD to harness potential timber production in the area.

Exotic plantations inside the Forest Reserve started off as small scale planting around 1950 aimed at supplying sawn timber for local consumption and industrial needs. There were also some conservation imperatives to the effect that traditional supplies of timber from the indigenous Mulanje cedar (*Widdringtonia whytei cupressoides*) could no longer meet increased demand without risking the species own survival and environmental degradation. There are currently five (5) exotic timber, poles and fuel wood plantations in the study area. These plantations, comprising mostly of pine and eucalyptus species, initially covered an area of 5,140 hectares. Due to forest fire incidences (Annex II), pit sawing and insignificant replanting of burnt and clear felled areas during the study period, the total plantation area has been decreased to 4,250 hectares (Table 1).

Table 1: Exotic plantations in Mulanje Mountain Forest Reserve

Forest Plantation	Major Species	Initial Area (ha)	Adjusted Area (ha)
Chambe	Pines	520	35
Likhubula	Pines	49	36
Eastern Outer Slopes	Pines	1,298	1,204
Fort Lister	Pines	426	332
Mulanje Central Government Plantations	Eucalyptus	2,850	2,649
Total		5,143	4,256

Planting commenced at Chambe basin up the plateau in the late 1940s and continued down at Likhubula in the 1950s and 60s. All stands established at the time were for supplying sawn timber.

A projected shortfall in industrial round wood supply later in the 1970s and the desire to broaden the forest industries' base spurred further planting. A plantation programme to produce splints for the match industry and sawn timber was initiated at Fort Lister and Sukasanje on the Eastern Outer Slopes. Wood

produced from the plantations was destined for transportation and processing in Blantyre, since plantable land close to the city had run out.

Extending forest plantation areas to the eastern side of Mulanje Mountain re-kindled conflict between local people and the FD.

While the local people wanted to use the land for growing crops, FD used the land for plantations of exotic trees. When the land conflict for crop growing first surfaced in the early 1980s the FD planted lines of exotic trees along the Forest Reserve boundary in sensitive areas to contain encroachers. This planting has been subsequently incorporated into the major plantation areas, but the boundary is frequently breached by local people in search of land.

Planting further increased from 1988 through to 1992. The crop established under this programme ~~of planting~~ was to provide fuelwood and construction poles for local and urban use. The development was financed by the World Bank through the Wood Energy (Phase I) and (Phase II) projects to support the Malawi government between 1986 and 1994. Planting was conducted using a rate per hectare in order to keep costs down and accomplish set targets.

2.2 Compartment records

Compartments and sub-compartments are the basic units for organizing plantation management in the study area. Forest management practices require that changes taking place during the year be endorsed for each compartment by the end of the year.

Older plantations at Chambe, Likhubula and Fort Lister have finally been surveyed with compartments drawn up. Later planted areas at Mulanje Central Government Plantations have incomplete survey and compartment information. The Eastern Outer Slopes plantations have not been surveyed and compartment records do not exist apart from rough estimates made by the station officer.

There is lately, no effort put into updating compartment records by forest managers in the study area. The exercise appears so neglected that no updates have been made during the past five years. This has greatly hindered the production of this report.

Master copies (transparencies) for working (compartment) maps are not available at both the District and Regional Forestry Offices in Mulanje and Limbe respectively since these are kept in Forest Headquarters in Lilongwe if available.

This complicated field work in that crews had to share the available copies of compartment maps since new ones could not be reproduced. The absence of maps also has implications for the quality of plantation management by constraining supervision and field inspections.

elaborate for reader here.

why not.?

ref ?

3.0 PLANTATION PRODUCTIVITY

3.1 Inventory design and procedure

A pencil line (transect) was drawn on each compartment and sub compartment following the direction of longest length. From known points,(e.g. road junctions), bearings were taken for each transect and plot centres marked off at four hundred metre (400 m) intervals down the transects. Distances and bearings were recorded for future use. A total of 250 sample plots of 0.04 ha were measured. 100 of these plots were laid out in pine stands and 150 in eucalyptus stands.

Is this standard procedure? ref.?
Why 100 / 150

3.1.1 Parameters recorded

In the field, plots were located as indicated on the compartment maps. All the plots were measured for all the key parameters, i.e. stocking, mean and dominant height, and diameter at breast height (dbh). Pruning and thinning were also recorded. Site factors were also noted. These include accessibility, tree damage, encroachment (cultivation) and degree of slope for adjusting marginal distances for plot boundaries. To ensure good quality results, random checks were made on the work by using one quality control team.

Back in the office, the value of each parameter was calculated on a subcompartment basis using the software programme STANDIN. All the relevant subcompartment information was then entered onto a spreadsheet using the software Excel (Annex III).

3.2 Results

3.2.1 Standing Volume Estimate

Indicative standing volume was calculated using the equation:
Volume = basal area (m^2) x mean height (m) x 0.45; where 0.45 is the average form factor for pines and eucalyptus (FRIM, 1987). Table 2. gives a summary of total volumes by species and age class.

same for both pine? blue gum?

how is age estimated? DBH? height?

10000 / .04 = 400 m^2

Table 2: Total Standing Volumes Distribution by Species and Age Class (Yrs)

Species	Age Class (Yrs)						Total (cu.m)
	0-5	6-10	11-15	16-20	21-25	26-30	
E. grandis	0	634,770	141,940	9,456	14,802	1,029	801,997
P. kesiya	0	28,634	148,464	54,911	0	0	232,009
P. pseudos	0	0	35,279	30,567	33,219	0	99,065
Total	0	663,404	325,683	94,934	48,021	1,029	1,133,071

spell out -

Table 2 above shows that no planting or restocking of harvested areas has taken place in the past five years. Over 90% of the volume is concentrated in age classes 6-10, 11-15 and 16-20 years. This may result in premature clear felling.

Lack of replanting does constrain sustainable supply of plantation wood. Normalization of these plantations will require heavy capital investment which is not readily available to FD in the current strict financial environment.

suggestions .

3..3 Mean Annual Increment (mai)

Table 3 . below gives a summary of mean annual increment (mai.) for the plantation species in the study area.

explain how calculated in text.

Table 3: Mean Annual and Weighted Mean Increments (mai) (m^3/ha/yr)

Species	Simple MAI	Weighted MAI by Area
E. grandis	30	30
P. kesiya	14	11
P. oocarpa	17	18
P. patula	15	12

The average mai for *Eucalyptus grandis* is 30 m^3/ha/year. This value is lower than the mai of 42m^3/ha/yr obtained by the FD Planning Unit inventory results of 1992 for the same area. The 1992 inventory was conducted prior to commencement of harvesting, increased thefts, unrecorded harvesting, wild fires and extension of plantings in marginal areas (rocky areas) over the years. These are some of the reasons attributable to the reduction in mean annual increment.

The mai for *Pinus kesiya* and *Pinus oocarpa* are 14 and 17 cubic metres respectively. Poor site/species match for *Pinus patula* and *Pinus pseudostrobus* growing on the lower slopes of Mount Mulanje have resulted in the low mai of 15m^3/ha/yr. This is compounded by inadequate tending and fire protection measures. *P. patula* and *P. pseudostrobus* do well at higher elevations with deep soils, above average rainfall and occasional summer mist.

Weighted mai by area were also calculated to explore the impact of external

factors on the growth of plantation tree species. Fire being the most notable one. The results show that eucalyptus are not adversely affected as the weighted mai is the same as the simple mai.

Most fires result in butt scorch, which, does not necessarily kill the trees. If harvested there will be regeneration through coppices provided affected stands are cut back in time. On the other hand pines do not usually survive hot fires and they have to be physically replaced. Lack of replanting results in the loss of annual increment hence lower weighted mai for pines, especially *Pinus kesiya* and *P. patula.*

Mulanje Mountain Massif is broadly classified as class M in the preliminary silvicultural classification of Malawi (Hardcastle, 1978). However, micro site variations in soils and moisture regimes seem to influence the productivity (mai) of the various species in addition to the quality of forest plantation management.

3.4 Revenue

Revenues were estimated by using thinning and clear fell volumes simulated from the Variable Yield Tables (VYTL) and ruling (gazetted royalties). The results are presented in Table 4 below.

Table 4: Potential Gross Revenue (1999)

Species	Operation	Area (ha)	Yield (m^3/ha)		Rate (Mwk)	Amount (Mwk)
P. kesiya	1st Thin	143	Fuelwood	8	60	69,000
P. kesiya	2nd Thin	575	Fuelwood	25	60	862,000
P. pseudostrubus			Sawlogs	4	500	1,149,000
		118	Fuelwood	25	60	176,000
			Sawlogs	4	500	235,000
P. kesiya	3rd Thin	258	Fuelwood	107	60	1,656,000
			Sawlogs	43	500	5,547,000
P. pseudostrobus		117	Fuelwood	107	60	751,000
			Sawlogs	43	500	2,515,000
E. grandis	Clear/Fell	92	Sawlogs	450	400	16,560,000
E. grandis	2nd Thin	2,109	Fuelwood	50	60	6,327,000
			Sawlogs	8	400	6,749,000
	Total	3,412				42,596,000

The reason for the difference in total area between Table 1 and Table 4 is that not all subcompartments can generate revenue at present. This is particularly the case for eucalyptus stands that have been burnt or are at early coppice stage (1-4 years old).

4.0 METHODS USED IN HARVESTING, PROCESSING AND MARKETING

4.1. Plantations– mountain base

4.1.1 Harvesting

Wood Industry Corporation (WICO) is presently the only serious commercial wood products company doing any harvesting at the base of the mountain, taking out eucalyptus poles for transportation to Blantyre. Most felling, limbing and topping is done by inefficient traditional axes. Occasionally a power saw is used. Farm tractors with or without a winch do the skidding.

The WICO logging crews are allotted a compartment and allowed to go in and harvest poles only. The supervision by FD appears to be minimal as a considerable amount of standing trees to be left are damaged. Neither does it appear to be any requirement by FD to take out, and pay stumpage for all trees felled. If a tree after felling does not make the quality required for poles, it is left on the ground, increasing the possibility of Phoracantha beetle attacks.

There are unfortunately no mechanized sawmill operating in the area. There is instead a multitude of pitsawyers, mainly cutting pine. The harvesting tool used is the traditional axe. Again the waste after these operators is huge and should be a concern to FD. These operators take out only big trees, leaving all the smaller ones (creaming the stand). A small amount of eucalyptus sawn timber is also produced.

During the World Bank funded Wood Energy projects in the period 1980-85 and 1986-94 fuelwood was harvested and a lot of charcoal was made for transportation to Blantyre. This has since stopped, so some of the waste described above is now only harvested and used for local consumption.

There is also, a considerable amount of small building poles harvested, using only the traditional axe.

4.1.2 Processing

As indicated above the only "processing" taking place is the sawn timber produced by the pitsawyers. Most of them are financed and administered by mainly Blantyre based entrepreneurs.

4.1.3 Marketing

The small building poles produced are sold to local end users as well as business people who transport and sell them at the Blantyre markets.

There are two customers for large poles in Malawi, the Electricity Supply Commission of Malawi (ESCOM) and Malawi Post and Telecommunications Corporation (MPTC). Any poles produced in the Mulanje area can be readily sold for use in the south, because of the much lower transportation costs compared to the ones coming from the Viphya plantations in northern Malawi.

Again, during the World Bank project charcoal was produced in half orange kilns for the Blantyre markets. After 1994 only small amounts of charcoal are produced in traditional earth kilns by local people for the local markets.

Some of the sawn wood produced by the pitsawyers is sold locally to building contractors and woodworking shops. The last one also take some eucalyptus.

4.2 Plantations – Chambe basin

4.2.1 Harvesting

This was a 520 ha. pine plantation. A considerable harvesting activity (largely uncontrolled and illegal) by pitsawyers has taken place in the last eight years. At one time (1994-95) it was reported that at least 120 pairs of pitsawyers were operating.

The large amount of slash left behind, made it impossible to stop forest fires in 1995-96 caused by these operators, with the result that only 5% of this plantation is still standing. The fires resulted in calls by the FD for salvage operations making it possible for the sawyers to continue their wasteful harvesting. (Some of the fires were most likely set by the sawyers to assure them a continuous supply of timber).

The FD reported that 20 pairs of pitsawyers were presently operating in the Chambe plantation. The Consultant having visited all the harvesting sites counted over 50 pairs. The total is probably higher, as all pairs are not working all the time.Few had crosscut saws which reduces the waste.

Table 5 . Pine Sawlog Sales by Volume (m^3) and Revenue (Mk)

Year	Volume (m^3)	Scheduled Royalty (Mk^3)	Amount (Mk)
1992	1,304	100	130,400
1993	237	"	23,700
1994	1,881	"	188,100
1995	1,480	"	148,000
1996	1,507	"	150,700
1997	1,326	"	132,600
1998	1,442	"	144,200
Total	9,177	"	917,700

Table 5 shows revenues realized from sales of pine logs to pit sawyers during the study period. The revenues were checked and summarized from official receipts (Annex.IV.). Mean annual sales for pine sawlogs stands at 1,310 cubic metres with a turnover of K130,000 per annum. These figures bear little resemblance to the harvesting activity at Chambe.

4.2.2. Processing and Marketing

The "processing" is all done by traditional pit sawing. The transportation is by foot to the base of the mountain, since the skyline ceased to function some 8 years ago.

All the sawyers questioned by the Consultants said they were hired by businessmen/women who supplied them with saws and gave them advance payment in form of food. These business people are either local or from Blantyre. Almost the entire production of sawn timber coming off the Chambe plantation is marketed in Blantyre.

4.3 Evaluation of Present Methods and Systems for Wood Products

The present methods and systems described earlier are inefficient, wasteful, uncontrolled and, apart from some meager wages, of very little benefit to the local communities.

In December 1988, FORINDECO, at the request of the Chief Forestry Officer at that time, wrote a letter to the FD offering to take over all harvesting and processing of sawn timber and charcoal in the Chambe plantation. All timber to be paid for at gazetted stumpage prices. This was to be accomplished as follows:

Felling and cross cutting	Bow saws and cross cut saws
Skidding	Oxen
Sawing	Mobile circular sawmill

Transport	Ox-cart or manual push carts to the top of the skyline Rehabilitation of the skyline
Charcoal	Processing logging waste and windthrow in half orange kilns

The total investment was calculated at US$115,000 of which the skyline rehabilitation was almost half. No official reply was ever received concerning this request. Subsequent follow-ups with the two succeeding Chief Forestry Officers again did not result in an answer. Although privately all three applauded the offer.

The above is brought up because most of the original concept can still be used. It is of course too late for the Chambe plantation, but not for a number of other plantations around the mountain.

The methods of harvesting presently used are not only extremely wasteful, but leaves a compartment that is going to be very costly to regenerate.

Due to lack of operating funds/manpower and dishonesty on the part of some FD officials only a fraction of timber harvested is being paid for. The fact that most of the trees converted by the pitsawyers are "free" leaves no incentives to utilize the trees properly.

but again not quantified
values given on the next page

Many will argue that a mechanized mill will put a lot of pitsawyers out of work. That might be right, though many of them could be employed as logging and sawmilling crews.

ref ref.

A mechanized sawmill will normally convert 50% of the total log volume in a tree to saleable sawn timber. Earlier studies by FORINDECO, in Malawi as well as Tanzania and Zambia, indicates that for pitsawing the saleable sawn timber output will be 8-20%. When in addition most pitsawyers do not pay stumpage, then the society is paying a heavy price for keeping these people employed.

From a FD point of view one or two mechanized operations will be easier to supervise and control (both for waste and stumpage) than dozens of pitsawyers. However, the National Forestry Policy encourages pitsawyers to form associations that would assist/overcome the weaknesses associated with pitsawyers individually.

5.0 EXISTING AND POTENTIAL MARKETS FOR PLANTATION PRODUCTS

5.1. Eucalyptus

5.1. 1. Existing markets

As mentioned earlier all the big poles and most of the smaller building poles are sold in Blantyre. The same could be said for the sawn timber. However, in this case, local contractors contacted by the consultant complained of a shortage, as the sawn timber business is largely controlled by people residing outside Mulanje District. These people will only sell to the local contractors for prices giving them the same net profit as if sold in Blantyre. Fuelwood and charcoal are all sold locally, to individuals or the tea estates.

5.1.2 Potential markets

For big poles not much can be done to expand. WICO is the only primary customer, being the only company in Malawi with suitable pressure treatment tanks. WICO is also totally dependent on their two main customers, ESCOM and MPTC.

Zambia Forest and Forest Industries Corporation (ZAFFICO) has over 20 years exported treated poles to Botswana, Namibia and South Africa. As their supply of suitable eucalyptus timber for poles is dwindling, ZAFFICO's market is now taken over by others, primarily private operators in Tanzania and Mozambique. If WICO, or others in Malawi, were interested, it appears to be possible to get a share of this market. There are presently 800ha of pole size eucalyptus stands in the study area that could give an annual yield of 25,000 poles.

With correct species and proper forest management the study area could easily increase the harvesting of building poles, for which there is a ready market in Blantyre. There should also be a ready market for eucalyptus sawn timber in Blantyre as well as other centers in the south. Although a little more difficult to saw and season (dry), if properly done, it will yield good material for furniture ,doors, window frames and scaffolding.

Eucalyptus sawn timber has also proven to be a very suitable raw material for the manufacturing of blockboard. However, this is a rather complicated technical process requiring a considerable investment.

5.2 Pine

5.2.1. Existing Markets

There is also a good market for pine sawn timber in Blantyre. Zomba mountain ~~do~~ no longer have the raw material base to satisfy the Blantyre market. The study area is much closer to this market than other sources of supply like Dedza and Viphya.

5.2.2. Potential Markets

Any increase in the pine sawn timber production in the study area can be readily sold in the Blantyre market.

A market for treated pine telephone and electricity poles can be developed. As the quality requirement for poles as to straightness and size is much stricter than for sawlogs, greatly improved forest management is needed before this market can be explored.

As mentioned elsewhere,the bulk of the pine sawn timber production is controlled by people residing outside the Mulanje District. There is good potential for value added production in Mulanje if more sawn timber could be made available for the local market. Production of window frames, doors, furniture and prefabricated housing do not necessarily require large. investments

6.0 HOW TO IMPROVE PRODUCTIVITY FOR ECONOMICALLY VIABLE PRODUCTS

6.1 Eucalyptus

6.1.1 Forest Management

The yield from any plantation is most of the time just measured in the form of volume. For that volume to be converted into wood products, another aspect is just as important, but often neglected , that of the quality of the standing tree. A crooked tree will not make a pole and the yield of sawn timber, if any, will be low.

The yield in economic terms can be dramatically increased with proper forest management throughout the rotation of a plantation. At the present there is too much focus on planting often with the result that there is no money to carry out tending of the plantation, pruning and thinning. Too often forest statistics emphasis how many hectares have been planted, very seldom do the same statistics say anything about survival rate in earlier planted areas. Forestry statistics will give yield in terms of volume, but never in the form of financial yield. It is, on a sustainable financial basis, of little interest to have a compartment consisting of limby, crooked tress, mainly suitable for firewood.

Protection of plantations from damage/destruction is another area that has to be looked into. Fire management strategies in the study area are ad-hoc-based on short-term arrangements by way of an annual fire plan. Long term strategies based on fire hazard reduction are not implemented in the study area. The annual fire plan has also become ineffective and often difficult to operationalise in that it requires considerable amounts of human, financial and material resources; the very resources not available to the FD at present.

It is far better to plant less hectares and instead make sure that what is planted is tended properly. At the normal accepted intervals in the life of a plantation, both eucalyptus and pine, thinning and pruning should take place. This will result in a compartment at the end of the rotation age consisting of mainly straight, large trees, yielding poles and good quality sawn timber.

The standing timber value can be increased greatly if the land manager ahead of planting has decided (or are told) what forest products are to be processed when the trees to be planted reach maturity. Different products, especially in eucalyptus, require different species, forest management and rotation age as the crop matures. Table 6 below outlines suggestions for improved Eucalyptus management.

Table 6: Suggested Eucalyptus Management Schedule

Product	Species	Treatment	Stems/ha remaining	Age (Yrs)	Rotation (Yrs)
Transmission Poles	E grandis	Tending	2500	-	8
Sawn Timber	E grandis	1st Thinning 2nd Thinning	1250 250	5 8	16
Firewood/Charcoal/ Construcution poles	E grandis	Tending	2500	-	6

Different species of eucalyptus have often wide differences in requirement as to soil and precipitation. This must also be taken into account when planning the final crop. Of the trees in the above table only *E. grandis* is presently found in the reserve. *E cloeziana* and *microcorys* is suggested for its strength properties, *E camaldulensis* and *tereticornis* for its adaptability to stony and dry soil conditions.

6.1.2 Processing

The considerable amount of waste left behind by the pitsawyers and pole entrepreneurs in the plantation is due to:

1) System of stumpage payment
2) Lack of stumpage payment
3) Method of processing

For the two first items see below under Forest Department Administration.

It is surprising to note that the utilisation of eucalyptus, for sawn timber, in the study area is almost negligible. No doubt, eucalyptus is more difficult to both process and utilise than pine. Internal stress makes it more difficult to saw as well as dry the timber afterwards. During drying it has a tendency to warp and end splits will often appear. Both can be remedied. The first by drying the planks under pressure (pile logs or a few layers of already dry planks on top of a pile to be dried) the second by giving the ends a coating of wax to stop drying from the end surface.

ZAFFICO in Zambia has ever since they started in the early seventies produced eucalyptus sawn timber for use as construction timber, doors, window framing and furniture. Another species found in the study area that could be utilised much better is Gmelina spp. More so because it is much easier to both saw and dry than eucalyptus. Only occasionally is Gmelina species pitsawn in the study

area. Wood working shops visited by the consultant both in Mulanje and Blantyre reported that they would like to work more with eucalyptus and *Gmelina spp* (at the expense of pine) if they could buy suitable planks. (In the Forest Department records there are only three small plots totalling 0.84 hectare of Gmelina. Since 1992, 7.76 cu. m at an average stumpage of MK45 have been sold. There is some Gmelina growing on smallholder farms).

6.2 Pine

6.2.1 Forest Management

Pruning and thinning schedules for pine crop management in the study area closely follow recommendations by FRIM (1987) for Class A forests. Pruning is done in three (3) lifts between four (4) and thirteen (13) years. Thinning is carried out four times between seven (7) and twenty-four (24) years. The crop is pruned up to a height of eleven (11) metres and stocking reduced from 1320 down to 250 stems per hectare.

The treatment regime outlined above presently appears less effective in producing the required amount of large diameter trees at the end of the rotation. This is so due to delayed thinnings. Third and fourth thinnings take place in the latter half of the rotation beyond peak growth age for the crop, thereby adding little volume and quality to the stand. As growth in pine stands peaks off between 13 and fifteen years in Class A sites, all key silvicultural operations should be confined to the first half of the rotation in order to produce good quality sawlogs. A suggested pruning and thinning schedule is provided in Table 7.

Table. 7. Proposed Pruning and Thinning of *Pinus patula*

Age (Yrs)	Operation	Stems/ha Remaining
4	brashing	1320
5	1st pruning	600
6	2nd pruning	250
7	lst thinning	600
13	2nd thinning	250

6.2.2 Processing

The major reasons for the waste left behind is listed in 6.1.2.

At the present there is no incentive for the pitsawyers to properly utilise all trees felled. However, even ~~if it was~~ so, this method of "processing" will never come close to the recovery rate of a mobile mechanised sawmill. It is safe to say that about three times as much sawn timber will be produced in any given compartment by mechanised sawmilling, compared to that of pitsawing.

Presently most of the pine sawn timber produced in the area has developed blue sap stain. This mainly affects the appearance only of finished products. To avoid sap stain, logs must be sawn within one week of felling. All planks should be dipped in an anti stain chemical. Thereafter the planks should be properly stacked with sticks between each layer.

All piles to be dried should have a roof to avoid direct sunlight as well as rain. Such a roof can be cheaply made using slabs. Proper drying and anti stain treatment will greatly increase the marketability, appearance and price of the timber.

6.3 Forest department administration

Present basis of stumpage payments in the study area is per tree, making it possible for the contractor to pick the trees to be harvested, leaving all the low quality trees, which the FD will have great difficulty getting any payment for. At the same time it is almost impossible to regenerate such an area before it has been harvested clean. This will often take years thereby losing valuable time before a new crop of trees can be established.

One reason for the tremendous amount of waste left behind by the pit sawyers is the fact that most of the trees they cut are not paid for, or a token payment is made to a FD employee. There is simply no incentive to properly utilise the trees that are cut down.

FORINDECO was in 1995 part of a two-man team who carried out the ODA funded study "Ownership and Management Options, for Industrial Plantations in Malawi". The main reason this study recommended private ownership/management of the plantations, was the fact that after going through Forest Department accounts and recorded/established volumes harvested each year, it appeared that stumpage was only paid for about 20% of the volume harvested. There is no reason to believe that the present situation is any different

words missing there

presently growing, let alone any expansion of the country's wood resources. It is however natural to assume that the FD's inability to collect stumpage is a major contributing factor to the above situation.

2) Inadequate manpower resources

In the 14 years the consultant has worked in Malawi at least one third of the established posts have at any one time been vacant. At the present over 50% of the professional staff positions are not filled. It appears that staff development has not been among the priorities for the department's top management, despite the fact that donor financing for university level education, for qualified candidates, is relatively easy to obtain.

Some effort has been made lately by the FD to reduce the over 50% vacancy rate among the professional staff ranks. Those recruited are often university graduates without formal training in forestry. These have to be trained in forestry. Training opportunities are getting fewer and there is competition from other stakeholders (e.g. NGOs). Training opportunities also favour social forestry training, rather than plantation forestry.

3) Forestry policy and legislation

In the past, emphasis of the FD was on regulatory functions (policing forest land) and revenue functions. Due to the very low level of recruitment for the departments top positions, present staff appears to have difficulty changing their priorities outlined in the New Forest Act that became operational in May 1997. Present penalties set out in the legislation for illegal forest practices are so low that it provides a rather ineffectual deterrent.

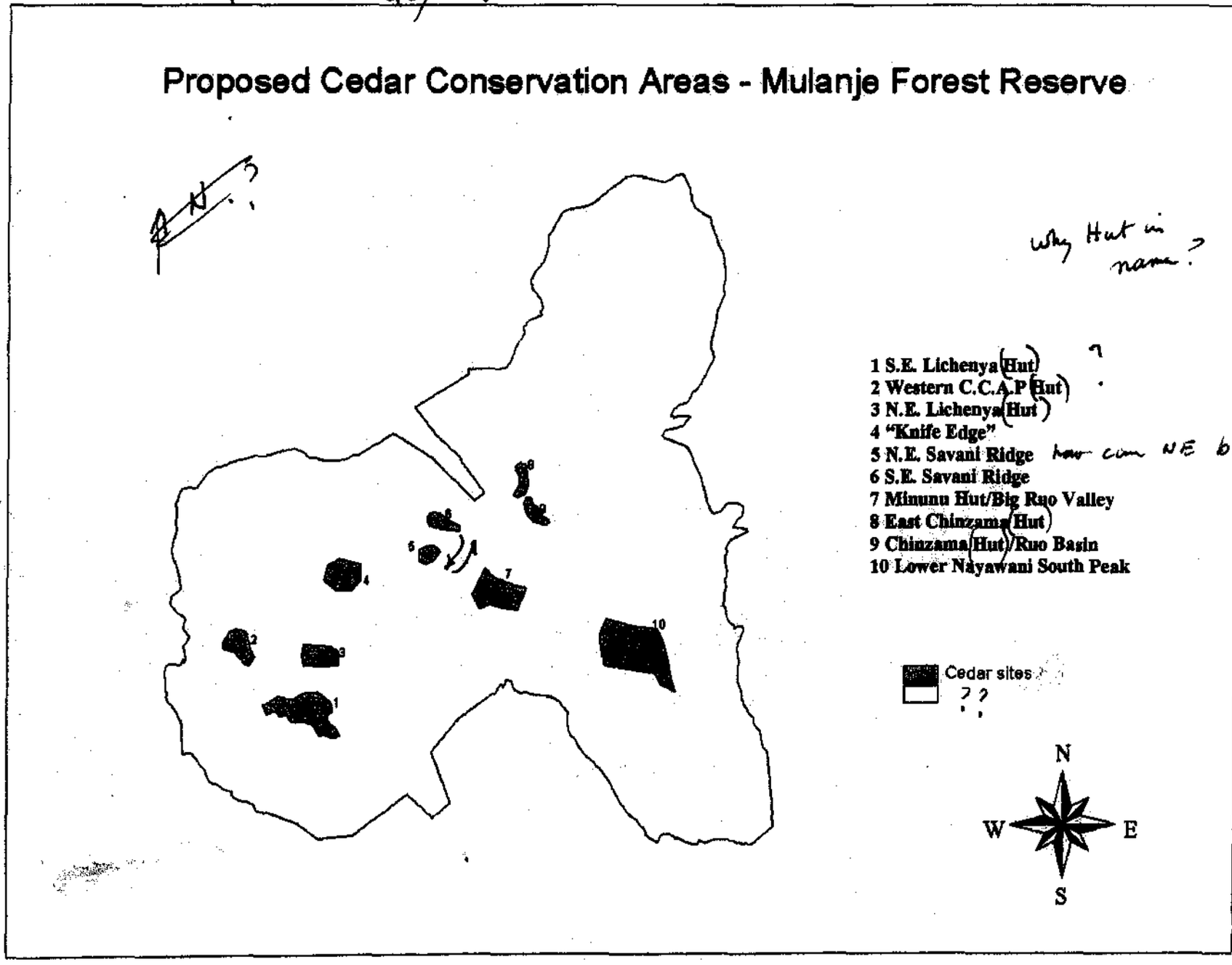
4) Inadequately trained staff

As a consequence of past priorities, forestry staff lacks proper orientation in the planning, implementation and management of participatory forestry activities. This is also reflected in the apparently rather poor working relationship with local communities and weak institutional co-operation with other sectors, for example, the Ministry of Agriculture, who have wide experience in extension services.

Documentation? Much too superficial.

↑ binder

Figure 3 Not placed correctly in ms.



empowering rural communities to manage the forest resources, fostering ownership and ensuring that forests are sustainably utilised for the benefit of both present and future generations. Therefore, handing over the forest resources to local communities will be consistent with Government policy.

The local communities have for years supplied the needed labour for establishing, maintaining and harvesting these forest resources. This has made people develop skills in plantation establishment, management, protection and harvesting. It will therefore be against this background that the local communities will be able to apply their skills, if given the opportunity, to manage these resources.

In this local setting, land is a very important resource. It is therefore vital to come up with a system that will ensure maintaining the forest area, or better increasing it, thereby avoiding a situation where the people will decide to use part of the reserve for agricultural purposes.

One of the major reasons for depletion of the forests in the reserve is outright theft. Most are never caught. Those caught get such a low sentence that it is in no way a deterrent for repeated theft. The local community if given a chance, will look after their forest resources in a more effective way. The thieves caught will be dealt with far more severely than the FD is able to do.

In any participatory forestry development or community forestry the approach should be to start small. By doing so the benefits may come faster and they are more visible for any one concerned.
It is suggested to designate two pilot project areas, one in the Phalombe District, the other in the Mulanje District. In both areas two distinctly different projects should be set up. One should concentrate on co-management of some of the plantations, the other should concentrate on getting the community involved in the protection and harvesting of the cedar.

MM short on specifics.

6.6 The Role of MMCT

The Trust should look upon itself as a financier, facilitator and bridge builder between FD and the communities around the mountain. The Trust should not get involved in technical issues.

There is presently considerable distrust between the FD and the communities. For this reason it will take a long time to set up projects in the two areas mentioned above and to get interested and good people to participate.

If possible it might be a good idea for the Trust to either hire their own extension staff or finance such people from a suitable organisation. The Trust has initially to rise up to the necessity of moving the FD from a "hands-off" to a proactive stance for piloting co-management initiatives in the study area.
The Trust needs to build up confidence and explain benefits that can accrue to the community through their understanding and participation in the pilot co-management initiatives

The first to be approached will be the traditional authorities from the Chief down to the Village Headman. There might already be Village Natural Resource Management Committees (VNRCMC) in the areas. These must be approached after having hopefully laid a foundation of trust with the traditional leaders.

If acceptable to the villagers the Trust may also offer to take on the financial management of any co-management project.

PART II

MULANJE CEDAR

1.0 PRESENT SYSTEM OF HARVESTING AND MARKETING CEDAR

Legalised harvesting of cedar is, due to what are termed "conservation reasons" restricted to the dry season between May and October each year.

Forestry Department invites through advertisements in the press interested sawyers to apply to saw Mulanje cedar. Veteran sawyers in the area normally respond through familiarity with the calendar of events and forward their applications when time comes irrespective of the advertisements.

Once the applications have been received, FD convenes through the Ministry of Natural Resources and Environmental Affairs a meeting to select and approve names of sawyers. Once approval has been granted, the FD informs the approved sawyers on dates for briefing on pitsawing before sawyers formally start operations. Fire protection and other forest rules relevant to work in the forest reserve are discussed at the meeting.

Licensing procedures are long and not easily adhered to by FD. For last year, licensed sawyers have not been able to start sawing by the end of October although plans to pitsaw that year was never dropped.

This arrangement suggests that legal sawyers may not have enough time to plan, set up shop and sell cedar planks produced each year. The temptation to collude with dishonest FD staff and engage in illegal harvesting may be high.

It is also the case that curtailing cedar sawing in the month of October, may be difficult to enforce given the strong financial pressure on the part of the sawyers. Furthermore no significant natural regeneration of cedar has taken place under the current sawing regime and is no strong reason to stop sawing.

As for marketing the FD only sells the logs to the pitsawyers. They have no influence over where the planks are sold or the price paid for them.

1.1 Cedar Production costs

There are 35 patrolmen, 4 forest guards and 3 forestry assistants employed full time in the management of cedar. A forester overseeing cedar management, based at Likhubula, reports directly to the District Forestry Officer. Each of the stations at Fort Lister, Eastern Outer Slopes and Chambe have one Forestry Assistant, one Forest Guard, and a number of patrolmen/women.

Apart from the forestry assistants these people work out of their home villages. This means they are supposed to police some of their fellow villagers, who are

engaged in the harvesting of the cedar. This in practise means that they are hardly ever to be seen in the cedar areas, preferring to avoid trouble by staying safely at home.

To encourage forest staff to go and work up the plateau, forestry department previously used to offer "foot allowances" to field staff. This was a top up over the normal daily rate. The shortage of financial resources in the department has been cause for the stoppage. Poor supervision of staff who have no incentive to work up the plateau is another factor mitigating against cedar protection.

While there are specific personnel supposed to work on cedar, the supervision role of the District Forestry Officer and Foresters-in-Charge at the stations is part time. One former District Forestry Officer estimated that around five percent (5%) of his time was spent on cedar matters. Foresters at Fort Lister and Eastern Outer Slopes estimated spending 14% to 15% respectively on cedar matters.

The major category of expenditure related to cedar management is wages and salaries paid to staff. The cost of managing cedar has therefore gone up in line with a general increase in public sector wages and benefits. The cutback in manning levels experienced five years ago did not include cedar employees, according to forestry staff in the study area.

No expenditures have been recorded for such items as tools and protective clothing for field work over the same period.

Table 1. Major Expenditure Items for the Mulanje Cedar Management

Year	Wages/ Annum	House Allowance	Leave Grants	Total (Mk)	Percent Change
1992	414,000	51,500	9,100	205,500	
1994	453,000	56,200	9,100	474,000	131
1995	502,000	61,800	18,200	518,300	9
1997	529,000	65,200	18,200	582,000	12
1998	529,000	65,200	18,200	612,000	5

All data is missing for 1993 and 1996

1.2 Revenues from Mulanje Cedar

Revenues realized from sales of cedar logs in the study area were checked against official sales receipts (Annex 4) and summarized in the Table 2 below:

Table 2. Cedar Sawing by Volume and Revenue

Year	Reported Volume (Cu. M)	Accounted Volume (Cu. M)	Scheduled Royalty MK/m^3	Reported Revenue (MK)	Accounted Revenue (MK)
1992	206.49	105.36	280	57,816.64	36,431
1993	432.05	990.87	280	120,973.20	277,445
1994	145.53	149.93	475	69,130.25	72,015
1995	332.42	221.45	475	157,935.70	105,190
1996	298.34	205.74	475	113,668.50	97,731
1997	89.06	416.51	475	42,302.50	204,307
Total	**1503.89**	**2089.86**		**561,826.79**	**793,119**

The differences between the recorded and accounted for cedar volumes suggests that there is no unified system for record keeping. Cedar management records need updating so that correct information is made available.

Annual cedar log off-take and sales of Mulanje cedar from the study area has been low over the period covered by this study. This could partly be due to a 70% increase in the stumpage midway through the period. The increase could likely have made it difficult for pitsawyers to cover the costs of production in a market that may not have responded favourably to the increase in stumpage. An effort to switch to new and better markets appears not to have taken place.

On the other hand, FD expenses on labour has gone up by an yearly average of 31% over the last six years. Revenues from cedar on the other hand are a pittance. It appears that cedar sawing will remain non-viable for both the FD and pitsawyers under the prevailing sales and sawing arrangements.

2.0 DEFICIENCIES OF PRESENT MANAGEMENT AND HARVESTING OF CEDAR

The FD is for the same reasons/limitations as outlined earlier in this report not capable to manage, harvest and, most important, protect this unique tree.

Nothing is done in the way of planting. The little bit there is of natural regeneration is not tended/protected, with the result that a considerable amount of both regeneration and mature trees are killed every year by fire. The previous effective fire-break system coupled with early burning is now non existent. Sakai (FRIM Research Record No. 65) indicates that some regeneration may be choked by competing vegetation, especially the invasive Pinus patula and Himalayan raspberry (*Rubus* ellipticus).

The FD is unable to stop the pitsawyers from deliberately killing trees (only dead trees are allowed to be harvested) by girdling or lighting fires around the base of the tree. The same can be said for the theft/illegal cutting of cedar. The few people caught are either acquitted or fined a token amount.

It was interesting to note that cedar planks were still available during the 1987-91 moratorium on cedar cutting. In 1998 no cutting licences were issued for cedar. Just as a test, the consultant let it be known in Mulanje in May-June 1998 that he was in the market for a substantial amount of cedar. Three different offers were received for amounts between 20-80 cu.m.

When questioned about the moratorium the year before, the answers were that this was old stock from 1996-97. This is doubtful, as upon inspection of the planks a number of them were not properly dry. They were all without official FD stamps/hammer.

Going through the FD records over illegal activities is interesting reading. It is quite obvious that the few forest guards and patrolmen who try to stop illegal activities are risking their health/life in doing so. They will do it once, be threatened and quite understandably quietly drop the case. The assistance given by the FD to the few brave ones, who have got injured, is minimal.

The wastage of good cedar is partly due to low stumpage, non payment of stumpage and the fact that the pit sawyer is only obliged, according to the regulations, to pay for the log that is actually sawn.

Estimates of how much is cut illegally?

3.0 EXISTING AND POTENTIAL MARKETS FOR CEDAR TIMBER

3.1 Existing market

Cedar planks are presently mainly used in the local construction industry for internal panelling, door and window frames. Some timber is also exported.

There is a substantial boat building industry along Lake Malawi. The two boatyards contacted used together about 65cu.m/year, purchased at a price of MK7100/cu.m (US$153). The price does not include loading and transportation. Both yards reported they had little problem getting the cedar they needed.

There is a growing market for chests, jewellery boxes in various sizes, CD stands and other articles aimed primarily for the tourists. The young men/boys making these items can use cedar "off cuts", thereby creating a market for short cedar planks and consequently a better utilisation of the cedar tree.

3.2 Potential market

The consultant is of the opinion, that cedar sawn timber is sold far too cheaply. The price should be put out of range for general use in the construction industry.

As recent as February, 1998 the FD bought 260 pieces of 2 x 8, 2 x 10 and 2 x 12 for house building in the Dzalanyama Forest Reserve outside Lilongwe. The price to the project was about USD 200/cu.m. delivered in Lilongwe. Pine at the time sold for USD 140/cu.m.

During the course of this study the consultant has received a copy from the Timber Association of Malawi for an enquiry for air dried Mulanje cedar sent by a South African Company. The price offered is US$375 for "millrun" grade FOB Blantyre. An interesting aspect of this offer is that the company is willing to take lengths in multiples of 0.6m starting from 1.8m. For clear grade (no knots) the price offered is US$470/cu/m

Presently very little cedar is sawn less than 4m in length there is hardly any market for shorter lengths.

The cedar timber should be used in prestigious buildings as panelling, carved single and double doors, window framing and sills. The quantity available is not large enough to interest serious importers in the US and Europe, but the South African market should definitely be looked into.

One market that should be developed with the assistance of an NGO is that for chests and artifacts. The consultant having been interested in this market for some time, exported about hundred items to Norway last spring. All were bought from the carvers around Likhubula Forestry Station. The exercise proved one has to be very careful about buying large items such as chests. It turned out that many of the chests were made of not properly dried material with the result that the lid or sides cracked after arrival in Norway. The same happened to many of the glue seams, due to the poor quality glue used. There was a ready market in Norway, as all items, of sufficient quality, sold quickly at prices that made the exercise worthwhile.

The consultant firmly believes that this market has a good potential. However it needs a NGO or a private company in place. Another possibility is for the carvers to start a co-operative with training, marketing and management support from another organisation. The carvers need better tools and good quality glue. Many of them also need some training. One organisation should purchase all the sawn timber required to make sure stumpage has been paid and that the timber is properly dried.

Presently the sawn cedar timber is almost all in 18 feet (5.50m) lengths. There is obviously also a market for shorter lengths. This should be developed in order to increase the recovery factor and reduce waste when sawing cedar.

4.0 RECOMMENDATIONS FOR IMPROVED MANAGEMENT AND UTILISATION OF CEDAR

For part of this chapter the consultant has solicited the views of Mr David Cornelius.

If the production/management of the cedar is left to the present land manager it is a good possibility that Malawi will lose the Mulanje cedar. This will be rather embarrassing for the country, as the tree has been designated as Malawi's National Tree. Malawi, heading up the SADC forestry office, will also lose considerable international credibility if such a thing should happen.

4.1 Management

The natural way of regenerating cedar has been through wild fires. Deliberate efforts to restock cedar by other means or as a supplement to natural regeneration need to be encouraged. These could be raising seedling and planting out in cedar harvesting areas. Edwards, 1982 indicates that there is considerable difference in site quality between different cedar growing areas on the mountain. For example, Thuchila is far better than Lichenya, mainly due to the fact the latter has almost double the precipitation (3850mm) of what Thuchila is getting (2000mm). The luxurious undergrowth , due to the rain, found at Lichenya makes it far more difficult and costly to carry on regeneration work. Natural regeneration on such sites can almost be ruled out.

Pitsawyers should have a stake in regeneration of cedar. One way of achieving this would be by giving out multi-year sawing licenses to pitsawyers. This should enable sawyers to carry out planting of cedar during rainy season and put out fires in their charges during the dry season. Higher volumes of cedar would also be taken out with better prospects for revenue collection. Incentives for pitsawyers under this arrangement could be worked out.

Lawrence-1994 with others, did a very comprehensive inventory of the cedar. His survey indicated a total volume of about 110,000 cu.m. It is safe to assume that the proportion of dead trees has increased during the last six years. It is estimated that legal/illegal cutting and firekilling of smaller non-merchantable trees has reduced the present total volume of cedar to about 95,000 cu.m. including about 35,000 cu. m of dead trees.

Table 3: Summary of the tree volume, (as a % of the total tree volume), in each Damage Class of Mulanje cedar on Mulanje mountain, (rounded to nearest whole number).

	Damage Class				
Area	1	2	3	4	(Dead)
Mulanje Mountain	13%	23%	21%	43%	(30%)
Chambe	7%	30%	29%	34%	(32%)
Lichenya	23%	29%	32%	16%	(14%)
Thuchila	4%	16%	23%	57%	(38%)
Chinzama	33%	22%	15%	30%	(6%)
Sombani	8%	20%	21%	51%	(35%)
Madzeka	35%	37%	10%	18%	(13%)

Due to fires and aphid attacks the health situation for this remaining volume is rather poor.

Lawrence categorized the trees in damage classes as follows:

Class 1- 0-10% of needles brown
Class 2- 11-25% of needles brown
Class 3- 26-60% of needles brown
Class 4 – 60-100% of needles brown

The volume distribution turned out as follows:-
Class 1 14,000 cu.m
Class 2 25,000 cu.m
Class 3 22,000 cu.m
Class 4 46,000 cu.m

(In Class 4, 32,000 cu.m was dead)

Of the total number of stems (170,000), over 60% have an dbh of 10-30 cm, indicating that the number of big merchantable trees are fast disappearing

Certain specific areas should be considered and agreed upon as cedar conservation areas for the total protection of all remaining cedars both alive and dead with no felling/cutting being permitted within these areas.

Such areas would be properly described and marked with some form of beacons on the ground.

Notice boards should be placed on pathways advising visitors when entering a Cedar Conservation Area.

Top priority for fire protection must be given to all conservation areas.

Some suggested cedar conservation areas are indicated on Map No.3. out of pla

The consultant recommends that the protection, management and utilization of this unique resource is handed over to a NGO such as the Wildlife Society of Malawi A long-term (25 years) lease agreement should be set up together with a revolving 5 years cedar management plan specifying the protection, tending and utilization of the cedar. The society operates an agreement to implement, on behalf of the FD and the donor, a pilot indigenous forest resources management project in Mwanza District.

4.2 Exploitation – Reduction of Waste

The reported amount harvested the last six years is 1500 cu.m equal to an average of 250cu.m/year. It is doubtful that the combined volume of legal and illegal harvesting exceeds 1000cu.m/year. Making allowances for proposed protection of certain areas, inaccessibility and extensive rot in some trees, there still appears to be enough volume from dead trees to meet the present demand for cedar planks.

Three possible means of exploitation should be considered as follows:-

Method one

Licenses should be issued to cut and saw in named areas/plot numbers as marked on a map.

All trees should be defined into numbered lots with each tree in the lot being numbered and the total number of trees in the lot being stated on the license issued.

After felling by the licensee, trees will be converted into logs and graded according to diameter/length/quality.

There might be three categories of logs for grading and pricing purposes.

Grade one logs - Butt logs 5 meters and over in length, mid diameter over 50cm, straight and having no visible faults.

Grade two logs – all other logs 3.5 meters and over, 30cm-50cm mid diameter, which may have branch whorls and visible faults (e.g. fire damage or some butt rot showing) but which would produce timbers if sawn.

Grade three logs – All other material of lengths less than 3.5 meters and of any diameter, which would provide utilizable timbers.

There should be a pricing structure worked out which would encourage the licensee to have his sawyers convert as much of the tree as possible to reduce the present wastage.

Suggested Pricing

Grade one logs	K5000.00 cu.m
Grade two logs	K2500.00 cu.m
Grade three logs	K1000.00 cu m

The present stumpage of MK1000/cu.m appears to be far two low. Cedar should be priced realistically compared to plantation grown softwoods. Increasing the price will encourage more thought and care as to how the logs are converted and how the resulting timber is used. However increasing the price (value) of the cedar will also increase the temptation for theft and/or corruption. The same can be said about the above suggested method of paying for the cedar based on log quality. The temptation to downgrade a log, in return for some favours, will be considerable for the persons scaling and grading the logs.

Method two

Each year areas for exploitation are decided and the work of felling all trees and conversion to logs is contracted out to a company/persons who are able to provide experienced chainsaw operators. Apart from being efficient the use of a chainsaw also save valuable timber in the cases where the operators are using an axe for felling and/or crosscutting instead of a crosscut saw.

All logs are graded, volumes measured, numbered and the values calculated.

A list of all logs available by grades/volumes/numbers for sawing is then published and offered to sawyers who may then go and inspect the logs on offer.

Payment based on the rates set out in method one above, would be made for the numbered logs selected and sawing would commence after official receipts are issued.

Any logs not bought by sawyers would remain on site until all bought logs have been sawn after which the management agent would engage pitsawyers to convert unsold logs into planks.

Method three

It can be seen from what has been written earlier that there is a market for short lengths of cedar planks. This makes it economically feasible to utilize far more of the tree than what is presently done.

It is suggested that instead of selling logs the management agent should sell the entire tree at a price of MK3000/cu.m based on the standing volume to a 20cm

top. It is then up to the sawyer to utilize the tree to the fullest extent. (In the Viply plantation pine is sold on a compartment basis based on standing tree volume). Standing volume tables have been calculated for Mulanje cedar for trees up to 130cm diameter breast height. (Lawrence etc. 1994). If necessary these tables can be refined by carefully measuring a number of trees after felling.

This method will guaranteed reduce the waste. There will be less opportunities for corruption and supervision will be simplified.

4.3. Processing

Due to the inaccessible location of the remaining cedars the only way to "process" the log is by continued pitsawing. However payment by the tree and increased value will make it profitable for the sawyer to utilize the tree much better than presently. Other end uses and markets for Mulanje cedar should be developed. Linkages with business promotion and the tourist market should be actively explored.

LIST OF ANNEXES

ANNEX I: TERMS OF REFERENCE

Forest productivity consultant

The consultant will carry out the following activities:

Exotic Plantations.

1. Prepare a comprehensive inventory of the plantations inside the Mulanje Mountain Forest Reserve. This will include information on locations, areas covered, species, age and condition of stands, etc. Appropriate data should also be mapped, in a form which is readily transferable to a GIS computerised mapping programme.

2. Collect, collate and analyse data regarding the productivity of the plantations. The study will cover the period 1992-present, and will encompass all types of production for which data are available (timber, fuelwood, charcoal, etc).

3. Describe and evaluate methods and systems used in harvesting, processing and marketing wood products.

4. Assess productivity in terms of volume, gross and net revenue.

5. Investigate existing and potential markets for plantation products

6. Identify those products for which an increase in productivity is economically justifiable.

7. Make detailed recommendations as to how productivity can be improved in the case of economically viable products

Mulanje Cedar (Widdringtonia cupressoides)

1. Examine the system used by the Forest Department for harvesting and marketing Cedar.

2. Investigate and evaluate deficiencies with regard to the present situation- wastage of timber, illegal felling, inadequate security, etc.

3. From Forest Department records, determine annual production figures for Cedar over the past five seasons and calculate annual income versus expenditure.

4. Investigate existing and potential markets for Cedar timber.

5. Recommend ways in which the exploitation of Cedar can be improved in order to maximise profitability, and control wastage and theft

ANNEX II: PLANTATION FIRE INCIDENCES-MULANJE MOUNTAIN FOREST RESERVE

Station	Date	Compt	Pyear	Species	Fire Affected Area (ha)	Area Damaged (ha)	Remarks
Likhubula	03/09/92		89	E.gra	1.5	1.5	Complete damage
	03/09/92		86	P.ooc	1.1	0.3	Butt scorch
	01/04/94		88	P.ooc	0.5	0.1	Butt scorch
	12/11/94		86	P.ooc	2.7	0.7	Butt scorch
	20/11/94		86	P.ooc	0.5	0.1	Butt scorch
	12/10/95	1c	86	P.ooc	1.5	1.5	Complete damage
	12/10/95	4a	89	P.ooc	1.0	1.0	Complete damage
	25/10/95	4d-j	86	P.ooc	11.5	2.9	Butt scorch
	18/08/96	3c, 4bdg	95	E.camal	2.3	2.3	Complete damage
	15/09/96	2b	86	P.ooc	1.3	0.3	Butt scorch
	15/09/96	2e	86	P.ooc	2.3	0.6	Butt scorch
	10/11/96	2f	86	P.ooc	2.0	0.5	Butt scorch
	30/09/97	2d	89	P.ooc	1.8	0.5	Butt scorch
	15/10/98	2c	94	P.ooc	1.9	1.9	Complete damage
						14.0	
EOS	05/06/92		83	P.kes	0.5	0.1	Butt scorch
	31/07/92		85	P.kes	2.7	2.7	Complete damage
	02/09/92		83	P.kes	3.6	1.8	Heavy damage
	22/09/92		87	P.kes	1.2	0.3	Butt scorch
	22/09/92		92	P.kes	8.3	8.3	Complete damage
	23/09/92		83	P.kes	20.0	20.0	Complete damage
						33.2	
Fort Lister	14/07/92		86	P.pse	0.8	0.8	Complete damage
	12/08/92		86	P.kes	4.0	4.0	Complete damage
	12/09/93		80	P.pse	8.6	2.2	Butt scorch
	16/09/93			P.kes	6.3	6.3	Complete damage
	22/09/93		82	P.pse	1.0	1.0	Complete damage
	15/09/94			P.pat/pse	45.5	45.5	Complete damage
	15/11/94		90	P.pse	16.5	16.5	Complete damage
	27/08/95	11a,b	93	P.pse	18.0	18.0	Complete damage
						94.3	
MCGP	19/10/92			E.gra	1.6	0.8	Partly damaged
	20/10/93		91	E.gra	1.0	0.6	Partly damaged
	27/06/94		91	E.gra	5.0	2.5	Partly damaged
	08/08/94		92	E.gra	11.0	5.5	Partly damaged
	29/10/94		90	P.ooc	48.1	24.0	Partly damaged
	22/09/95		88	E.gra	0.6	0.3	Partly damaged
	06/10/95	7b,c,d,j	88	E.gra	8.0	6.3	Partly damaged
	09/10/95		91	E.gra	205.0	102.5	Partly damaged
	28/10/95	17a	89	E.gra	38.0	19.0	Partly damaged
	28/10/95	19a	89	K.anthot	0.3	0.3	Partly damaged
	28/10/95	20a,d	89	E.gra	80.0	40.0	Partly damaged
						201.8	

Key: ? to symbols.

ANNEX II: PLANTATION FIRE INCIDENCES-MULANJE MOUNTAIN FOREST RESERVE

Station	Date	Compt	Pyear	Species	Fire Affected Area (ha)	Area Damaged (ha)	Remarks
Chambe	10/09/95			P.pat	96.1	96.1	Complete damage
	10/11/96			P.pat	161.0	161.0	Complete damage
	26/09/98			P.pat	10.1	10.1	Complete damage
						267.2	

ANNEX III: SUMMARY OF RESULTS FROM THE PLANTATION PRODUCTIVITY STUDY 1999
MULANJE MOUNTAIN

MAI = ? mean annual increment ?

MAIs WEIGTHED BY AREA

Spp	Area	Pyr	Age	Domht	Mnht	Dbh	Ba	Sph	Vol/ha	Tot Vol	mai	Weigthed mai
	Area				Mean ht x Basal Area x .45 x Vol/ha							
E.gra	3.2	88	11	33.0	38.4	27	21	375	366	1,172	33	5
E.gra	30.4	88	11	35.7	27.1	24	35	200	421	12,790	38	54
E.gra	5.8	88	11	39.6	32.5	24	43	950	622	3,605	57	15
E. gra	9.6	88	11	28.4	24.7	24	25	563	273	2,625	25	11
E. gra	1.1	88	11	33.9	28.2	25	26	525	332	366	30	2
E. gra	1.2	88	11	29.0	25.3	23	8	200	90	108	8	0
E.gra	5.8	88	11	39.6	32.5	24	43	950	622	3,605	57	15
E. gra	9.6	88	11	28.4	24.7	24	25	563	273	2,625	25	11
E. gra	1.1	88	11	33.9	28.2	25	26	525	332	366	30	2
E. gra	1.2	88	11	29.0	25.3	23	8	200	90	108	8	0
E. gra	3.4	88	11	21.0	19.4	11	4	425	34	116	3	0
E. gra	1.9	88	11	13.2	11.7	13	1	100	7	13	1	0
E. gra	4.8	88	11	19.5	23.4	19	20	750	213	1,021	19	4
E.gra	15.2	88	11	15.9	16.2	12	6	500	43	654	4	3
E.gra	3.6	88	11	20.6	18.7	18	8	317	68	245	6	1
E.gra	6.1	88	11	12.1	10.6	8	3	625	15	90	1	0
E.gra	2.8	88	11	33.4	20.1	16	20	950	176	494	16	2
E.gra	11.6	88	11	22.0	19.3	21	19	550	162	1,884	15	8
E.gra	0.9	88	11	36.0	29.5	24	15	350	202	182	18	1
E.gra	0.7	88	11	30.8	29.6	28	11	175	141	99	13	0
E.gra	1.6	88	11	36.8	30.2	24	19	425	255	409	23	2
E.gra	27.4	88	11	34.6	27.3	21	17	525	214	5,857	19	25
E.gra	0.7	88	11	26.9	20.9	23	9	225	87	61	8	0
E.gra	0.9	88	11	21.5	16.3	20	11	350	78	70	7	0
E.gra	21.6	88	11	30.1	27.6	26	12	225	145	3,139	13	13
E.gra	7.1	88	11	13.1	12.0	12	7	600	38	268	3	1
E.gra	1.2	88	11	43.3	34.2	26	52	1000	793	951	72	4
E.gra	1.4	88	11	40.1	36.1	26	52	975	848	1,187	77	5
E.gra	2.9	88	11	41.3	31.9	27	43	775	614	1,782	56	8
E.gra	2.4	88	11	37.7	31.2	23	39	925	541	1,297	49	5
E.gra	0.2	88	11	36.7	34.2	24	42	925	651	130	59	1
E.gra	14.0	88	11	38.6	33.1	25	46	950	681	9,530	62	40
E.gra	1.7	88	11	37.1	38.4	30	42	600	726	1,234	66	5
E.gra	11.2	88	11	14.3	16.6	18	24	950	180	2,016	16	9
E.gra	19.4	88	11	31.8	27.4	21	40	1142	498	9,664	45	41
E.gra	128.2	89	10	37.6	33.6	24	38	821	579	74,240	58	346
E.gra	71.2	89	10	29.5	25.6	23	25	625	291	20,752	29	97
E.gra	77.9	89	10	23.3	20.0	16	13	620	114	8,904	11	41
E.gra	54.1	89	10	27.0	25.5	21	26	763	294	15,892	29	74
E.gra	69.4	89	10	21.8	18.9	16	9	481	80	5,548	8	26
E.gra	90.1	89	10	13.8	14.2	12	6	575	40	3,570	4	17
E.gra	10.9	90	9	29.9	24.5	20	25	795	278	3,028	31	16
E.gra	50.4	90	9	26.9	22.4	23	31	775	310	15,647	34	81
E.gra	26.0	90	9	22.8	21.3	20	29	900	280	7,277	31	38
E.gra	45.8	90	9	22.1	20.6	23	38	913	352	16,134	39	83
E.gra	75.2	90	9	32.5	26.3	23	34	825	398	29,904	44	155
E.gra	34.2	90	9	34.3	26.5	22	32	845	385	13,173	43	68
E.gra	18.5	90	9	28.5	27.0	24	26	567	311	5,754	35	30

Area Vol/ha = Tot Vol

Total Vol / Weighted Mai ≈ 240 - but a lot of variation there.

ANNEX III: SUMMARY OF RESULTS FROM THE PLANTATION PRODUCTIVITY STUDY 1999
MULANJE MOUNTAIN

E.gra	48.6	90	9	35.6	26.5	24	35	974	414	20,111	46	104
E.gra		91	8	31.1	26.2	22	37	981	430	0	54	0
E.gra		91	8	33.9	28.5	23	41	950	519	0	65	0
E.gra	40.0	90	9	15.3	14.4	18	25	942	163	6,532	18	34
E.gra		91	8	23.9	19.9	18	31	1220	277	0	35	0
E.gra		91	8	22.1	17.9	18	23	875	184	0	23	0
E.gra		90	9	30.2	21.6	21	27	742	258	0	29	0
	1074.2		567								1651	1503
	21.5		10.3								30	30

area ? ↓

Spp	Area	Pyr	Age	Domht	Mnht	Dbh	Ba	Sph	Vol/ha	Tot Vol	mai	Weigthed mai
P.pat	28.3	53	46	25.1	24.5	29	56	825	619	17,516	13	43
P.pat	2.0	50	49	26.9	22.6	27	40	713	404	807	8	2
P.pat	4.8	86	13	20.4	20.4	23	47	1110	431	2,084	33	18
P.pat	6.4	85	14	18.3	15.8	21	38	1117	270	1,729	19	14
P.pat	11.1	55	44	35.2	24.1	31	44	600	474	5,270	11	13
P.pat	7.6	88	11	17.4	14.4	19	17	650	113	852	10	9
P.pat		86	13	9.7	11.0	15	10	556	51	0	4	0
P.pat	9.2	89	10	10.9	7.4	9	5	725	16	147	2	2
P.pat	6.1	86	13	20.7	18.5	24	38	850	320	1,950	25	17
P.pat	8.5	80	19	15.9	16.4	21	3	100	24	207	1	1
P.pat	1.1	80	19	21.2	19.9	25	34	700	304	335	16	2
P.pat	2.3	80	19	13.8	11.2	19	16	575	83	190	4	1
P.pat	15.0	79	20	18.4	16.5	24	32	725	238	3,564	12	20
P.pat	13.6	79	20	20.5	20.4	26	18	338	169	2,297	8	13
P.pat	23.2	87	12	14.8	12.6	20	13	438	75	1,750	6	16
P.pat	1.8	88	11	33.9	28.4	23	20	475	258	465	23	5
P. pat		84	15	18.5	19.3	22	22	575	190	0	13	0
P. pat	1.7	88	11	37.1	38.4	29.9	42	600	726	1,234	66	13
	142.7		359								276	188
	8.9		19.9								15	12

area ?

Spp	Area	Pyr	Age	Domht	Mnht	Dbh	Ba	Sph	Vol/ha	Tot Vol	mai	Weigthed mai
P.kes	5.5	89	10	14.8	12.9	16	17	825	101	556	10	4
P.kes	28.4	84	15	15.7	15.7	19	19	675	137	3,893	9	19
P.kes	12.0	84	15	18.3	16.3	18	22	863	161	1,934	11	10
P.kes	29.1	85	14	20.0	15.1	21	14	425	98	2,847	7	15
P.kes	2.2	85	14	17.3	16.6	23	29	675	213	468	15	2
P.kes	2.8	78	21	19.3	18.8	25	45	925	384	1,075	18	4
P.kes	14.2	86	13	20.9	20.4	23	34	800	310	4,418	24	25
P.kes		84	15	19.9	20.7	22	27	735	255	0	17	0
P.kes		85	14	20.5	17.4	20	21	632	162	0	12	0
P.kes		87	12	19.0	22.7	21	28	845	286	0	24	0
P.kes		82	17	22.3	21.5	24	28	717	271	0	16	0
P.kes		88	11	12.7	11.6	16	31	775	164	0	15	0
	94.3		171								178	80
	13.5		13.2								14	11

ANNEX III: SUMMARY OF RESULTS FROM THE PLANTATION PRODUCTIVITY STUDY 1999 MULANJE MOUNTAIN

Spp	Area	Pyr	Age	Domht	Mnht	Dbh	Ba	Sph	Vol/ha	Tot Vol	mai	Weigthed mai
P.ooc	2.3	86	13	19.3	17.3	20	23	721	181	414	14	4
P.ooc	4.4	88	11	15.3	15.2	18	15	592	101	443	9	4
P.ooc	1.7	89	10	13.0	9.5	15	12	700	51	85	5	1
P.ooc	2.3	95	4	8.4	7.0	7	2	700	7	17	2	0
P.ooc		88	11	36.8	36.8	27	41	738	681	0	62	0
P.ooc		88	11	20.4	18.3	24	21	450	171	0	16	0
P.ooc	36.8	88	11	20.4	18.7	21	20	550	165	6,070	15	61
P.ooc	0.3	88	11	19.0	19.1	23	12	275	100	30	9	0
P.ooc	0.6	88	11	20.2	20.3	17	9	350	78	47	7	0
P.ooc	1.2	88	11	18.2	15.8	11	4	408	27	32	2	0
P.ooc	8.7	88	11	23.8	15.5	24	14	325	98	856	9	9
P.ooc	1.1	88	11	25.9	23.7	22	11	275	112	123	10	1
P.ooc	3.1	88	11	25.2	23.4	23	29	725	302	937	27	9
P.ooc	2.3	88	11	23.1	21.2	20	24	775	230	529	21	5
P.ooc	53.3	88	11	20.0	18.6	22	31	844	257	13,696	23	137
P.ooc		85	14	26.2	24.4	23	43	1025	467	0	33	0
P.ooc		86	13	19.3	16.9	22	33	775	249	0	19	0
	118.1		186								284	233
	9.1		10.9								17	18

are these grouped by species or area?

ANNEX IV: PINE AND MULANJE CEDAR SAWLOG SALES 1992-1998

YEAR	TYPE OF PRODUCE	OFFICIAL RECEIPT	VOLUME (m^3)	UNIT COST (K/m^3)	AMOUNT (K)	
1992	Charcoal - Pine	244959 - 5100	3.5 tonnes	184		628
	Sawlogs - Pine	533850 - 4000	176.00	100	17,600	
		535250 - 4000	721.78	100	72,178	
		616850 - 7000	406.17	100	40,617	
			1,303.95			130,395
	Sawlogs - Cedar	616850 - 7000	105.36	280		36,431
	Total					**167,454**
1993	Charcoal - Pine	244950 - 5100	13.7 tonnes	184		6,744
	Sawlogs - Pine	616850 - 7000	237.53	100		23,753
	Sawlogs - Cedar	616850 - 7000	56.92	280	15,938	
		620200 - 0350	240.58	280	67,363	
		619600 - 9750	190.22	280	53,263	
		619150 - 9300	167.50	280	46,901	
		620950 - 1100	335.64	280	93,980	
			990.87			277,445
	Total					**307,942**
1994	Sawlogs - Pine	457200 - 7350	20.00	100	1,991	
		674250 - 4400	11.83	100	1,146	
		025050 - 5200	298.90	100	29,890	
		621250 - 1400	209.50	100	20,950	
		025500 - 5650	269.50	100	26,950	
		621000 - 1150	79.50	100	7,950	
		621850 - 2000	338.10	100	33,810	
		026550 - 6700	310.29	100	31,029	
		027750 - 7900	343.02	100	34,302	
			1,880.64			188,018
	Sawlogs - Cedar	025050 - 5200	26.84	475	12,748	
		621850 - 2000	4.41	475	2,894	
		025500 - 5650	54.50	475	25,887	
		026550 - 6700	64.18	475	30,486	
			149.93			72,015
	Total					**260,033**
1995	Sawlogs - Pine	028650 - 8800	265.36	100	26,536	
		135600 - 5750	880.65	100	88,065	
		675000 - 5150	26.12	100	2,612	
		135000 - 5150	308.21	100	30,821	
			1,480.34			148,034
	Sawlogs - Cedar	135600 - 5750	125.68	475	59,698	
		131000 - 1150	19.20	475	9,120	
		135000 - 5150	76.57	475	36,372	
			221.45			105,190
	Total					**253,224**

YEAR	TYPE OF PRODUCE	OFFICIAL RECEIPT	VOLUME (m^3)	UNIT COST (K/m^3)	AMOUNT (K)	
1996	Sawlogs - Pine	661400 - 1550	35.84	100	3,584	
		937950 - 8100	596.46	100	59,645	
		940000 - 0150	875.19	100	87,519	
			1,507.49			150,748
	Sawlogs - Cedar	421000 - 1150	33.61	475	15,966	
		940100 - 0250	54.17	475	25,731	
		940000 - 0150	117.96	475	56,034	
			205.74			97,731
	Total					**248,479**
1997	Sawlogs - Pine	265950 - 6100	226.09	100	22,609	
		022500 - 2650	260.33	100	26,033	
		572250 - 2400	839.64	100	83,964	
			1,326.05			132,606
	Sawlogs - Cedar	265950 - 6100	84.71	475	40,237	
		022500 - 2650	177.32	475	89,742	
		572250 - 2400	70.57	475	33,521	
		266000 - 16150	10.75	475	6,056	
		022000 - 2150	73.16	475	34,751	
			416.51			204,307
	Eucalyptus	572250 - 2150	10.81	45		486
	Total					**337,399**
1998	Sawlogs - Pine	572250 - 2400	278.81	100	27,881	
		693300 - 3450	1,014.99	100	101,498	
		175500 - 5650	148.36	100	14,836	
			1,442.16			144,215
	Total					**144,215**
	Total Revenue for 7 Years					**1,718,746**

ANNEX V

VOLUME DISTRIBUTION (M3) BY FOREST SPECIES, AREA (HA) AND AGE CLASS (YRS)

AGE CLASS

		0 – 5		6 – 10		11 – 15		16 – 20		21 – 25		26 - 30	
		Area	Volume	Area	Volume	Area	Volume	Area	Volume	Area	Volume	Area	Volume
Forest	Species												
Eastern Outer Slopes	E. grandis	-	-	1	137	0	0	55	9,456	87	14,802		
	P. kesiya	-	-	102	20,490	534	141,002	-	-	-	-	-	
	P. pseudostrubus	-	-	-	-	-	-	-	-	-	-	-	
Sub total		-	-	103	20,627	534	141,002	55	9,456	87	14,802		
Mulanje Central Govt. Plantation MCGP	E. grandis	-	-	2,108	634,633	408	141,940	-	-	-	-		
	P. kesiya	-	-										
	P. pseudostrubus	-	-										
	P. patula	-	-										
Sub total		-	-	2,108	634,633	408							
Fort Lister	E. grandis	-	-	-	-	-	-	-	-	-	-	16	1029
	P. kesiya	-	-	41	8,144	41	7,462	-	-	-	-	-	
	P. pseudostrubus	-	-	-	-	117	35,279	118	26,987	85	33,219		
Sub total				41	8,144	158	42,741	188	26,987	85	33,219	16	1029
Overall total				2,252	663,404	1,100	325,683	173	36,443	172	48,021	16	1029

ANNEX VI.

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