Recommendations for resource assessment for collaborative forest management in Uganda

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Report to the EDF/Uganda Forest Department: Forest Resources Management and Conservation Programme

Consultancy SC/08/2002: Non-wood forest products, assessment methods and plan of action.

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Executive summary

A good start has been made with the CFM trials and the communities have shown strong commitment to CFM. The CFM resource assessments have produced a lot of worthwhile data information but most of it is qualitative. Quantitative data is needed as a sound basis for determining yields for NTFPs. A number of changes are required to the CFM resource assessment protocols to facilitate the collection of quantitative data most of which are fairly easy to implement. However, the exact form they should take will depend on the objectives for CFM which at the present time do not make specific recommendations for the precision required for quantitative data. The relationship between CFM resource assessment and the Forestry Department EI and ISSMI inventories needs to be established before the CFM protocols should be revised.

Even before recommended protocols are decided it is important to ensure that quantitative inventory and standards are introduced into Step 4 of the CFM Guidelines, accompanying manuals and training. These are currently under development and the small changes needed to raise these issues should be made. In due course separate documents and training may be required to address the implementation of CFM inventory.

Details of suggestions made in the report are given in the summary table below.

Summary table of recommendations

Issue	Observation	Recommendations	Pages
Quantitative data required	Protocols need to be quantitative	a minimum of 200 plots rather than transects are used	31
		Plants should be tallied into size or age classes	31
		Trials will need to be done for different resources to determine the best methods for undertaking ISSMI-style inventories for NTFPs	33
	Protocols need to respond to local circumstances	Perhaps the ideal is to have a flexible inventory protocol that the FD and communities can adapt to suit a particular forest	27
		best to take a Co-learning approach towards inventory	26
	The botanical names of resources is required	it is necessary to determine the botanical name for the plant	28
Maps of CFM areas are required	No accurate maps are prepared	more use of GPS and other surveying techniques when undertaking CFM assessments	29, 33
	Communities need to be able to undertake map preparation	use geo-referenced data manually on large sheets of graph paper	30
Analysis of CFM data	Only plot summaries are prepared	inventory data should be worked up into estimates of total stocking for an area of forest and the SE% of the estimates	31
	No precision standards	There is a need for the FD to decide on standards for CFM inventory	28
	Communities are unable to undertake analyses	that something along the lines of a Statform is prepared so communities can undertake some of the basic calculations themselves	32
Quotas	Principles	two principles should apply: the precautionary principles and adaptive management	26
		quota setting is not an exact science and needs to be approached with as much sensitivity as possible and drawn from both scientific and traditional knowledge	33
	Data good enough?	In order to determine whether a set of data is sufficient for quota setting a target sampling error will need to be agreed	32
		It is possible to use the RME rather than the mean as the estimate of the useable population density	27
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Issue	Observation	Recommendations	Pages
	Best harvesting practices?	There is a need to develop guidelines for best harvesting practice for a range of resource types. This can be done through experimentation using traditional practices as a guide	33
	Growth rates?	Establishing sustainable quotas also requires some knowledge of growth or replenishment rates	33
		obtain simpler assessments of the growth and harvesting response of resource species by tagging and measuring individual plants	33
Monitoring	Need to devise some monitoring systems for CFM	monitor the success or otherwise of CFM management itself	34
		monitoring is to determine the impact of harvesting on the species and forest	34
		level of change that you wish to detect has big implications for the design of the monitoring scheme	34
Guidelines and manuals	No proper positioning or mention of quantitative inventory	There is a need to include the various types of inventory in the CFM process especially the relationship between those undertaken by the FD and by the community particularly with regard to quality standards and who is going to finance them	37
		There is a need to co-ordinate the Guidelines with training and to ensure that the technical as well as participatory aspects of CFM are properly positioned and represented in both	37

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Acronyms

BFR	Budongo Forest Research
BNP	Bwindi National Park
CFM	collaborative forest management
CFMU	Collaborative forest management unit
d	Tree diameter at 1.3 m above the ground
DFO	District forest officer
EI	Exploratory inventory
FD	Forestry Department
FR	Forest Reserve
ISSMI	Integrated stock survey and management inventory
ITFC	Institute of Tropical Forest Conservation
MoU	Memorandum of Understanding
MUZ	Multiple-use zone
NP	National Park
NTFP	non-timber forest product
PSP	Permanent sample plot
RME	Reliable minimum estimate (mean – one tailed 95% confidence interval)
RVA	Rapid vulnerability assessment
SE%	Sampling error (95% confidence interval as a percentage of the mean)
SE20	Sampling error of 20% (target for EI)
UWA	Uganda Wildlife Authority

Acknowledgements

I wish to thank my fellow consultants, David Hafashimana and Jackson Mutebi for all the insights into Ugandan ethnobotany and collaborative forest management. I also would not have been able to report so much of past experience without long discussion and generous searching and copying of old reports by Dezi Irumba, Robert Bitahiro and Fiona Driciru. The DFOs, rangers and NTFP users also gave freely of their insights in the field. However, I accept full responsibility for the contents of this report.

1. Introduction

This reports focuses on recommendations for participatory, reliable and practical inventory of NTFPs to support the development of CFM Resource Assessment Guidelines. It is one of a pair required to fulfil the consultant's terms of reference on NTFP inventory to support the management of Uganda's high forest (see Annex 1).

Before the consultant could make any recommendations it was necessary to understand the objectives for any participatory inventory and to evaluate current practice. This background material was gathered through interviews with key members of the CFMU (Fiona Driciru and Dezi Irumba) and the FD field staff, available literature and field visits.

During the consultancy field visits were made to the following forests with discussions with the following people:

Budongo FR: Budongo Community Development Organisation, DFO, Haanga village (CFM village), FD field staff, basket weaver

Mabira FR: DFO, CID, herbalist

Mpanga FR: DFO

Sango Bay FR: DFO, CFM officer attached to district, Mujanjabura village CFM committee members, palm leaf harvester, herbalist

Kalinzu FR: DFO, herbalists

Echuya FR: DFO, FD field staff, Batwa bamboo harvesters

Bwindi Impenetrable NP: Institute for Tropical Forest Conservation, UWA field staff

Collaborative forest management is a general term which refers to the practice of inviting communities close to FRs to collaborate or have a part in management planning and responsibility for the forest. It can take many forms and is provided for in the recent Forest Policy (2001) and the National Forestry and Tree Planting Act (2003) and its accompanying CFM Regulations (2003) and CFM Guidelines (2003).

Management is viewed in these documents as a iterative process on three levels:

- Plans that define relatively broad objectives, agreed with all stakeholders, for management of entire regions or 'forest management areas'
- Site specific planning
- Agreements for the management of specific resources

CFM itself is taken to mean 'a mutually beneficial arrangement in which a local community or forest user group and a responsible body[1] share roles, responsibilities and benefits in a forest reserve or part of it'. The reserve remains the ultimate responsibility of the responsible body who should maintain it for the benefit of all Ugandans. The emphasis is very much on the involvement of local or forest adjacent communities and user groups with the intention of providing resources to support their livelihoods and to secure sustainable use of the forest.

The first step is the management plan and this must be in place before the CFM process can be implemented. The management plan is a legally binding document and the scope of CFM in a particular reserve is constrained by the provisions of the

[1] The responsible body being the FD and when it is inaugurated the National Forest Authority.

plan. This generally means that it is concerned with site specific planning and rules for use of NTFPs as timber management is the preserve of the FD.

Management itself is a cyclical process that ideally is based on reliable (biometric) data of stocking, replacement rates etc., harvesting rules, monitoring, plan evaluation and revision. Undertaking this process with local people ideally means involving them in all the planning processes including inventory to obtain the basic data required. Experience with participatory inventory indicates that it can be used to build a deeper understanding of the resource and the logic of management options both among the CFM community and FD and it is often the first real joint venture by the participants (Carter 1996). Consequently the CFM trials that were initiated in 1998 focussed on CFM infrastructure in the communities and had the people undertake participatory inventories. This report is an assessment of these inventories with regard to their efficacy in producing data suitable for management planning.

Conflicts resulting from the imposition of total bans on access to National Parks (UWA) in the early 1990's were addressed through the institution of Multiple-Use Zones (MUZ). In these zones, harvesting of certain resources is permitted by licensed users under strict management rules and quotas. The MUZ experience is long and contains elements of inventory and monitoring and there is much that the FD can learn from UWA. However, there is one distinct difference that needs to be borne in mind when comparing MUZ and CFM. MUZ use is regulated entirely by UWA and harvesting is intended to be non-commercial. CFM is intended to be self-regulated by the communities and provides for commercial use of resources.

This report makes recommendations for the further development of participatory resource assessment and inventory are made for consideration by the CFMU.

2. CFM resource assessment

Work on CFM commenced in 1998 and there are various methods for participatory resource assessment that were developed in the trial sites. Four of these sites were visited during the consultancy and the methods used in each are briefly outlined along with difficulties with these methods reported by CFM Unit staff.

Notes for the second training workshop for CFM held in 2000 (CFMU 2000b) gave the following explanation for CFM inventory:

What is CFM resource assessment?

> It is an exercise that is carried out in the forest using well designed methods in order to determine what resources in the forest, their status, quantities and distribution

Why is it important?

> For the following reasons:
>
> + gives us a baseline/starting point to know what resources are in the forest and their quantities
>
> + enables resource managers to make the right decisions
>
> + is a good base for the next CFM stages

What is the difference between forest assessment under CFM and under traditional management?

CFM resource assessment	Traditional forest assessment
Considers resource used by the community and FD	Looks at marketable products e.g. timber
Involves participation of local communities	Communities not involved
Considers peoples direct benefits	Peoples benefits may not be considered
Simpler and requires less expertise	Sophisticated and requires more expertise

During open discussion at this workshop, participants also recommended a number of rules/guidelines to be followed during a forest assessment:

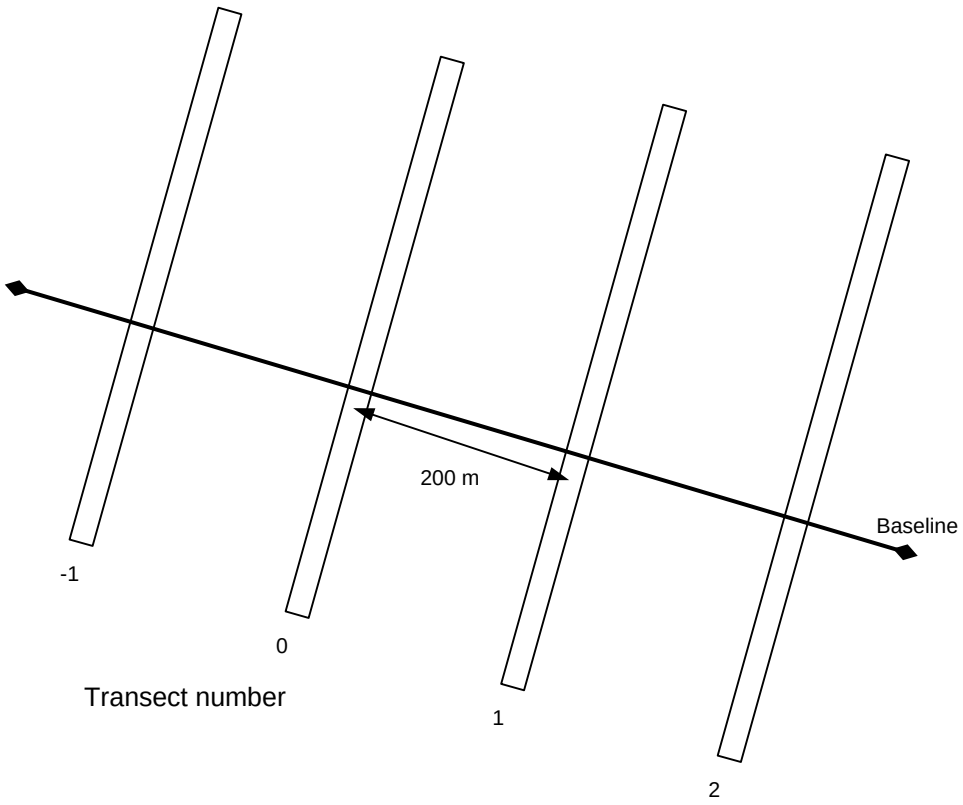
- data collection and analysis processes should be simple to understand and implement,
- the assessment should be related to people's needs,
- should be carried out with the local communities,
- simple technology easily understandable to the local community should be used,
- should be relatively cheap to carry out,
- not too time consuming,
- should be orderly and logical,
- should answer all the questions/objections available,
- should be open to criticism and also flexible to modification,
- information gathered should be available to the local community.

However, the CFM inventories that were done are not really adequate to answer these quite sophisticated questions. However, the points made that CFM resource assessment needs to be simpler and requiring less expertise than FD inventory needs to be critically assessed.

2.1 Basic CFM inventory design

All the CFM resource assessments to date have the same basic systematic design as shown in Figure 1 and described in (CFMU 2000a, CFMU 2000b, Irumba (2002). Parallel 20 m wide transects were laid out at 200 m intervals giving a 10% sampling intensity. The transects were laid out perpendicular to a pre-determined baseline arranged to be easily accessible (i.e. parallel and close to a road or track). The first transect was usually numbered 0 and put half way along the baseline. The transects were then numbered +1, +2 etc to the east of transect 0 and –1, -2 etc. to the west. The transects were located using distances and compass bearings to permit mapping of the information. General information such as topography, vegetation type, forest condition and dominant species were recorded at 100 m stations along the transects.

Figure 1: Basic layout of CFM resource assessments



The following information was collected on separate data collection forms for either side[2] of 100 m sections of transect:

[2] Designated ‘a’ and ‘b’ sheets for each transect section.

Evidence of resource use

Timber tree species abundance and distribution

Tree species diversity, abundance and distribution

Non-timber resource availability

Palm tree abundance and distribution

Resource use was recorded as *impact scores* ranging from 1 (least) to 5 (most) which took into account all the damage intentional or otherwise caused by harvesting. The species and numbers of plants damaged and the reason for harvesting and the time since harvesting were also recorded.

The tree assessments were tallied into 10 cm diameter classes from 20 cm d. This was done by estimating tree diameters by eye. The number of 7 foot logs that could be obtained from the timber species was also estimated and recorded. The presence of heart rot and other defects was also noted.

Poles, firewood and rattan canes were assessed in 100 m sections of transect using subjective scores ranging from 1 to 5 with 5 representing the densest populations and 1 the sparsest. No attempts were made to determine the approximate numbers of plants in each density class. Most trees were identified by the FD staff and other plants were recorded against the local names used by the community members participating in the assessment.

There was no assessment of animals as it was the intention to maintain the outright ban on hunting within the CFM portions of FRs. In essence making hunting non-negotiable.

It was acknowledged that such a design would be open to criticism and would not produce very accurate data. The intention was to use a design that would be easy for the community to implement.

Information obtained for Sango Bay indicates that the field teams were made up of 7-8 people of which 3-4 were FD staff (usually District staff) and the rest from the CFM villages. Recording on 100 m sections of transect meant that 3 x 1000 m transects could be covered in a day. Three bookers were used, one each for the trees, NTFPs and palms using specially designed field sheets. The FD staff did most of the tree identification using botanical names but the other species were recorded against vernacular names. It seems that at least the timber tree field form was considered difficult to understand and complete.

There are apparently few reports prepared from the CFM assessments. The consultant was only able to obtain a preliminary reports for Budongo (CFMU undated) and a draft report for Sango Bay (Irumba 2002). Since the resource assessments were undertaken in 2001 there has been something of an impasse in progress with the development of CFM. The reason for this was given as the absence of an enabling legal framework for CFM. This has now hopefully been resolved with the passing of the National Forestry and Tree Planting Act (2003). The communities visited during the consultancy have been remarkably patient and are still keen for the process to be picked up so they can access the forest.

The consultant was only made aware of one set of draft CFM harvesting rules for Sango Bay. These concerned themselves mainly with the penalties for unlicensed or poor harvesting and sought to regulate harvesting through limiting the amount of time that an individual licensee can harvest the resource.

2.2 Budongo

CFM resource assessment was undertaken in Compartment W38 by the Haanga CFM community. Reports from the District FD staff who facilitated the inventory suggest that several iterations were made to accommodate concerns on the part of FD HQ of the quality of the results and its appropriateness for timber harvesting.

The first assessment was done using the tracks and paths in the forest as transects and enumerating trees and NTFPs 10 m either side of the track or path. Distances and bearings were taken along the tracks so they could later be mapped.

It was then decided that the tracks and paths did not adequately cover the area and straight transects were laid out to cover areas without paths.

However, the data from transect survey is not sufficient for timber management which was the intention in this compartment so the FD undertook ISSMI in five blocks (5 km²) of W38. A CFM assessment was conducted along the ISSMI block lines.

The various assessments in Budongo have generated at least three sets of data that could be used to evaluate the strengths and weakness of assessment along paths, on transects and in the formal pattern of ISSMI block lines. Unfortunately it was not possible to locate the different assessments so this was not possible[3].

The CFMU Budongo file revealed summary tree data for 12 transects (19.8 km) in the Haanga CFM area. The transect lengths varied as they were not extended into non-forest land. The average transect length was 1.65 km with a total length of 19.8 km. These data are summarised in Table 1.

The sampling errors (SE%) for all trees greater than 20 cm d and for each size class were calculated. In the accompanying EI report a target sampling error of 20% (SE20) was adopted as being appropriate for development of management plans. The overall SE% for all trees counted in the CFM assessment is 72% which is several times higher than the target figure. From the variance of the sample data it is possible to estimate the number of plots that would be required to achieve SE20. For these data this is estimated that 158 transects would be required for the error of the estimated mean number of trees per ha to be within 20%.

There is an interesting conundrum in Table 1. The errors for the total numbers of smaller sized trees is much lower than those for the individual species or all trees. This is because the smaller sized trees have smaller variances i.e. they are more evenly distributed within the forest. This suggests that an assessment of poles might require far fewer plots than larger trees or any species on its own.

Some of the species in Table 1 are very rare and even a search of 39.4 ha of forest at a sampling intensity of 10% was only able to locate a few trees. Conventional sampling does not work well for rare species and it is not going to be possible to obtain accurate results except from a census of all individuals as is the case with ISSMI.

Another anomaly in Table 1 is the rather even spread of trees between the size classes. This is very odd the norm for mixed aged forests is for large trees to be greatly outnumbered by small ones. It is just about conceivable that such a distribution may occur but it this observation does rather suggest that the protocols for counting trees in the transects need to be examined for possible biases.

[3] It would in any case be problematic with subjective scores rather than actual counts for the NTFPs although it would be possible for the tree data.

Table 1: Numbers of trees counted during Budongo CFM inventory

Species	20-30	30-40	40-50	50-60	60+	Total	Stems ha^{-1}	Total SE%
Albizia zygia	3		1			4	0.101	200
Alstonia boonei	13	22	28	19	22	104	2.625	56
Blighia unijugata	17	3		6	1	36	0.909	114
Bosquea phoberus	1	1	1	1		4	0.101	144
Celtis spp	180	152	41	14	11	398	10.050	65
Chrysophyllum albidum	20	15	5	2	5	47	1.187	69
Chrysophyllum purpulchrum	20	25	7	6	8	66	1.667	87
Cola gigantea	5	1	5	2		13	0.328	136
Cordia millenii	1	4	1	1		7	0.177	111
Cynometra alexandrii	160	311	205	198	388	1262	31.868	89
Dombeya kirkii	1	1				2	0.050	200
Erythrophleum suaveolens.		2			3	5	0.126	135
Ficus spp					1	1	0.025	200
Funtumia spp	44	9	1		1	55	1.388	78
Holoptelea grandis	34	22	11	26	11	104	2.626	81
Khaya anthotheca	7	3	1	1		12	0.303	99
Klainedoxa gabonensis				2	3	5	0.126	101
Lovoa trichilioides	1					1	0.025	200
Maesopsis eminii	5	5		1	4	18	0.454	99
Mildbraediodendron excelsum		1			1	2	0.050	166
Milicia excelsa	1		3	14	7	44	1.111	138
Morus lactea	5					5	0.126	200
Mumora erysou ?	1					1	0.025	200
Pterygota mildbraedii					2	2	0.050	200
Ricinodendron heudelotii	3					3	0.075	200
Scrabulus gabonensis ?		3			1	4	0.101	200
Schrebera aborea		1				1	0.025	200
All species	522	581	310	293	469	2206	55.707	72

Stems ha^{-1}	13.182	14.672	7.828	7.399	11.843
SE%	44	78	68	97	97

? indicates a name quoted from the source that does not appear in the FD biodiversity database and is therefore suspect.

2.3 Mpanga

The training for the Mpanga CFM took place at the same time as that for Budongo (CFMU 2000a) and therefore uses much the same methodology. However, here the data was collected along trails and not along cut transects. The main resource of interest to the local communities in Mpanga are large sized trees of the species preferred for drum making. The preferred species for drums in this area is *Polyscias fulva* but this has disappeared from all but a few reserves in Mpigi district (Lwakuba 1997). Table 2 gives a summary of the CFM assessment data for two species of drum trees present in Mpanga. The file these data were taken from did not indicate whether they refer to the mean stocking or the totals counted in the assessment though the size of the figures suggest that they are the latter. There were many more transects in Mpanga than Budongo and the high numbers and proportion of plots containing *Bosqueia* suggests that the sampling errors are likely to be small but generally one would expect the situation here to be much the same as in Budongo.

Table 2: Number of stems and drum frames for selected species in Mpanga

Species	Product	Diameter class (cm)			Total	No. of transects	% of transects
		5-10	10-20	20-30			
Bosqueia	Stems	162	251	112	573	52	96
	Drum frames	985	2435	1310	5587		
Ficus mucuso	Stems	14	19	7	48	21	39
	Drum frames	87	111	81	431		

The Mpanga file (1998-present) also contained summary data for poles in the form indicated in Table 3. The figures presented are the average of the subjective abundance scores for the transects. The transect score for each species is the average of scores for the 100 m sections of transects (or 'plots'). The average score for a species is the average of the transect scores. The % of plots gives the number of 100 m transect sections which contained the species. The % plots gives useful information for the species and demonstrates the near ubiquity of small sized trees of the three species. The average scores for the species likewise gives an indication of the relative abundance of the species, the low scores for the three species together with the % plots suggests that they are sparsely but evenly spread across the forest. Unfortunately, the raw data was not in electronic form so it was not possible to calculate the errors for these means.

Table 3: Summary data for poles in the Mpanga CFM inventory

Species	Transects			Average score	No of plots	% of plots
	1	2	3			
Celtis	2.0	1.3	1.7	1.7	44	83
Teclea	1.8	2.0	1.3	1.8	43	81
Bosqueia	4.0	2.0	1.0	2.2	46	88
Etc						

The correctly way to calculate statistics for transect data is to use the sums of the transects, however, in Table 3 the averages for the transects is presented. It is difficult to know how to interpreter differences between the average of subjective scores for transects which are up to a couple of kilometres long and only 200 m apart. A more meaningful way of representing differences in density across the area would be to represent density as different coloured or sized symbols on maps. Mapping the CFM assessment data should not be difficult if there are GPS readings or tie line information to locate the transects.

2.4 Sango Bay

The CFM inventory in Sango Bay is the best documented although the report prepared by Dezi Irumba is still in draft form despite being largely prepared in 2002. Detailed explanations of the protocols used in the assessment were obtained during a field visit and discussion over the field sheets with Dezi in Kyotera.

The overall objective of the Sango Bay resource assessment was 'to collect data that would be used as a basis for negotiations between FD, local community and other stakeholders that would culminate into an agreement and a management plan to be implemented under the CFM arrangement'. Draft management rules have been prepared but the management plan was in abeyance pending the legalisation of CFM.

The specific objectives given for the assessment are quite detailed and are presented in Table 4. The boundary objectives b) were dealt with by participatory mapping as were fishing grounds, pasture and water (products vii) and viii) under a)). The other plant resources were assessed using the standard CFM style transects. Each of the five patches of forest were assessed and reported independently. All the data obtained from the assessment were summarised by hand as averages and the percentage of plots in which each species occurred. Samples of the results tables and figures prepared for the Sango Bay report are given in Annex 2.

Table 4: Specific objectives for the Sango Bay forest assessment

Questions to be answered during forest assessment in Sango-Bay forest reserve	
a) Composition of the forest resources *i) Palm leaf trees* *ii) Timber trees* *iii) Fuelwood* *iv) Medicinal plants* *v) Poles and posts* *vi) Craft materials* *vii) Fishing grounds /ponds* *viii) Pastures and water* • How much of the above components are available? • Where are they located? • How are they distributed? • What are the timber tree species in this forest? • What the timber size classes are available? • Are there mother trees for the timber species? • What is the level of illegal activities? • What is the extent of the pastureland? • Who uses them and how?	b) Reserve boundaries • Where are the village management boundaries? • How much of the area are they going to manage?

2.4.1 Timber trees

For the timber species the summaries were done in 10 cm size classes as the number of trees and logs counted in the transects and as bar charts by species. The average abundance score was also tabulated for each transect and species. See Annex 2 for example tables. These tables are useful for indicating the distribution and relative abundance of the trees but are not formal stocking figures which are usually expressed as numbers per ha or as an estimate of the total number of trees for the forest block.

The data was also used to determine the total amount of mature timber above 50 cm d which could potentially be harvested. This assessment was restricted to only the commonest species in each block and calculated for the five blocks together as it was considered that harvesting in each forest patch as single entity is not sustainable because of the limited abundance in addition to the poor population structure. The yield control system used to determine how much of the mature standing stock can be removed is not given in the report but is presumably according to the FD timber allocation rules. The FD would also presumable insist on ISSMI before allocating timber trees rather than basing it on a 10% sample. However, the results should be a good indication of the amounts available.

Species richness and diversity were also calculated for all tree data for each forest block. This revealed very little difference in species composition between the blocks which is perhaps not surprising given their proximity and roughly similar histories. Although it is useful to know the forests are similar it is not clear how these data

would otherwise be used by the community to determine management options for the forest blocks.

2.4.2 Palms

The significance of *Phoenix reclinata* in the Sango Bay area (~90% of women and girls use it for mats) meant that a more detailed assessment of its abundance was required. A new recording sheet was devised and individuals and palm clusters were counted. The clusters were also scored according to the number of stems in the cluster in the following manner:

Score	Numbers
1	2-5
2	6-8
3	9-10
4	11-13
5	13+

The resulting palm data were summarised as the total number of clusters, mean score per cluster and the number of plots containing palms per transect and represented as graphs as shown in Figure A2.2 in Annex 2.

2.4.3 Other NTFPs

Dezi's report makes it clear that there are few commercial NTFPs collected from the Sango Bay area. The procedure with other NTFPs was to have the community members identify useful plants as they moved along the transects. The species were recorded against local names and from that point onwards the species was included in the inventory. In this manner 64 names were recorded in Kaiso and 83 in Malabigambo. None of the plants in Kaiso were given botanical names and only 23 of those in Malabigambo were botanically named. Many of these plants are used non-commercial as medicines and for casual use. Again, these data are presented as tables of the average abundance score for each transect. The average abundance score, number and percentage of plots are also given as summaries for each species for the inventory block.

As part of the field trip, the CFM committee had collected fresh specimens of 55 useful plants from the forest for David Hafashimana to identify. David was able to put botanical names to 50 of these but identification of the few remaining was confounded by the immaturity of the specimens, lack of form and habitat notes and the lack of flowers (Hafashimana 2003).

2.4.4 Conflicts in resource use

Many NTFPs are a source of several products e.g. a tree may have edible fruit, medicinal bark, be a strong pole when immature and valuable timber when mature. The Sango Bay report (Irumba 2002) attempts to analyse conflicts in demand for a species by using the Soerensen Similarity Index. This index is calculated as:

$$S = \frac{2c}{a+b}100$$

where: S is the Soerensen Similarity Index

a, b are the number of species into two samples

c is the number of species common to a and b.

The Index was calculated for timber and non-timber species for each forest patch to identify the areas where there was the most overlap in uses. Therefore areas with high index values are those where there is likely to be the most conflict between different user groups for access to resources. This may be useful but only between 3 and 5 species had timber and NTFP use in Sango Bay and most of these are well known.

2.4.5 Feedback and management rules

There has been considerable feedback of the CFM assessment results to the community and this has been used as the basis for setting NTFP harvesting rules. Much of the feedback was in the form of sketch maps illustrating where specific resources are located. Data in the form of abundance scores and numbers of palms was also presented. It seems that the maps and knowledge resulting from visiting little known parts of the forest along the transects has significantly increased awareness of species vulnerability to harvesting. In particular the community has agreed to ban the cutting for timber of preferred medicinal species (*Mitragyna*[4], *Podocarpus* and *Maesopsis*) because they are becoming rare and their use as medicine is a higher priority than timber. Since replacement timber species are required two abundant species (*Manilkara* and *Baikiaea*) were tested for use as timber and found to be acceptable and are to be targeted for timber cutting.

The committee has drafted a set of management rules which mainly provide for control of licensing by the committee, days for domestic use and penalties for unlicensed harvesting. Commercial collection is permitted and regulated through the use of licenses for restricted periods i.e. a licence to collect palm fronds for a month. It is unclear how the type of data collected from the transects would assist in determining the level of sustained yield of the product nor the length of time that would be required to harvest this level and no more. The committee suggested that the licenses would be controlled through joint patrols with the FD. It seems that their intention is to monitor use at preferred sites and to close it if it appears that the population is being compromised (declining) with detailed monitoring to be done by the FD. However, the committee was confident that it would be able to undertake future assessment using the same protocol as before and were keen to be trained to undertake more of the inventory and data analysis. They also had quite sophisticated questions about the ecology of the common fish to support the advice they were receiving about fisheries management.

2.5 Echuya

CFM process was initiated in three areas around the reserve by local FD staff with assistance from the CFM Unit in 2002 (CFMU 2000b refers to Echuya but the field work took place in 2002). Several social surveys have been undertaken along with some resource assessment. However, only summaries of the social surveys have made it into the draft management plan for the reserve and the data has not been collated from field notebooks and analysed.

The main species of interest in Echuya is bamboo. Rather than simply enumerate bamboo in the same way as other NTFPs in the CFM assessments, the bamboo assessment closely followed the protocols used by Robert Bitahiro of ITFC who did his MSc project on bamboo in Bwindi and Mgahinga NPs (Bitahiro 1999). These protocols are based around a 10x10 m square plot spaced at 100 m intervals on

[4] This species is abundant but the community are concerned about the mode of harvesting as they found trees that had been ring barked.

alternate sides of transects spaced 100 m apart. In effect a systematic sample on a 100 x 100 m grid giving a 10% sampling intensity. Bitahiro also stratified the forest into three strata according to the dominance of bamboo.

The details of the CFM assessment undertaken in a part of Echuya is taken from the field notebook of Kasimbazi Lemmy dated 2002 – though the inventory took place in 2001. The notebooks reveals that the CFM assessment took place in a series of stages, of which quantitative assessment of resources is only a part. The basic exercises undertaken were:

- Obtain list of forest uses from community –Rwaburindi & Rwamamahomo villages gave a list of 22 plants (local names) and their uses
- Different interest groups (gender, age groups etc.) ranked the uses to identify the most important ones for a particular community
- Specialist user groups were characterised in terms of who harvests, the plant part utilised, the quantities required and preferred sites and species
- A sketch map of village lands was prepared to illustrate the location of farm areas etc. (in these examples these maps were very rudimentary)
- Participatory inventory for bamboo using advice from ITFC. In each plot the number of bamboo stems was tallied by age class. Where there was no bamboo other useful species were recorded as being present (not counted) using local names.

Perhaps because of the restricted size of village lands within the reserve, relatively few plots were done in each village:

Village	Plots
Rwaburindi	5
Rwamamahomo	5
Kashambya	7
Kagano	16
Rushayu	3
Mushangye	2

This design is basically a conventional systematic plot sample and the data lend themselves to statistical analysis. A discussion of these data has been presented in Section 4.1.1. of the accompanying NTFP inventory for EI report. A summary of these analyses is presented in Table A2.1. From this analysis it would require around 30 plots to achieve the SE20 target for EI. This is many more than was done in the various villages but is not an impractical number for participatory inventory.

Since the data has not been transcribed from the field notebooks it seems unlikely that there has been any feedback to the communities of the data from the assessment nor has it been used in the draft management plan. In fact the relationship between the FD management plan and the CFM plans is not yet clear so it is not apparent who the most appropriate ‘client’ for these data would be.

Table 5: Inventory data for CFM bamboo plots in Echuya

Statistic	Culms per 100 m² plot						
	Shoots	Young	Mature	Old	Dead	Diseased	Total
Average	32.43	75.71	63.14	100.57	13.86	1.86	287.54
Var	696.95	2048.90	1491.14	4234.28	61.14	1.81	26848.69
N	7	7	7	7	7	7	7
Std Error	10.78	18.48	15.76	26.56	3.19	0.55	66.89
SE%	66.47	48.81	49.93	52.83	46.07	59.14	46.52
CV%	81.41	59.78	61.15	64.70	56.43	72.43	56.98
N for 20%	66	36	37	42	32	52	31

3. NTFP resource assessment in Bwindi

The wholesale gazettement of former Forest Reserves into National Parks had a considerable impact on the local communities. In Bwindi and Mgahinga this was particularly acute as UWA, supported by international conservation interests closed the parks and evicted indigenous forest dwelling people. In response a concerted effort was made to negotiate access to forest resources. This was facilitated by CARE under their Development through Conservation programme and included the determination of the resources which could be accessed, harvesting quotas and control systems. This process has been particularly well documented (Cunningham 1996, Wild & Mutebi 1996) and reviewed (Blomley undated, Davey *et al* 2001). The resource assessment protocols used at each stage of the process are outlined below. There is much to be learnt from UWA experience but there are some important differences between UWA and FD approaches to local involvement in forest management. The UWA multiple use zone management strategy has the following features:

- the principle objective is to protect the integrity of the park – not to maximise the production of even permitted products from the forest,
- the programme was designed as a 'high value, low impact' strategy where limited amounts of useful products are harvested by a small number of people (350 for Bwindi and Mgahinga),
- access is intended to cater for personal or village level consumptive use – commercial harvesting is not permitted,
- access is free of charge to ID card-carrying individuals for specific amounts of named products,
- all management decisions i.e. species, quotas etc. are made by UWA and they often restrict access to resources of any significant value.

3.1 Rapid vulnerability assessment

This was the first step in the process and is a rapid method for determining which resources are threatened by exploitation. It was developed by Cunningham and formalised for Bwindi by Wild & Mutebi (1996). Rapid vulnerability assessment (RVA) was developed as a protocol for collecting available knowledge, indigenous as well as scientific, about a resource species and does not itself generate any new data. The method requires the integration of local knowledge (gathered using PRA and similar techniques) and scientific information (from literature and herbaria) and depends on being able to match local and scientific names to form the link between the two bodies of information. The collated information is used to identify species, resources or sites that may be vulnerable to over-exploitation. The assessment of sustainability commences with the completion of a set of standardised field sheets for each species, which is then used to collect the following information about a species:

life form,
habitat specificity,
abundance and distribution,
growth rate,
response to harvesting,
parts used,
pattern of selection and use,
demand,

seasonal harvesting,
traditional conservation practices,
commercialisation and substitutes.

A standard summary sheet is prepared and the information evaluated according to a set of criteria of sustainability (see Table 6 for example criteria) drawn from ecology, socio-economics and economics. On the basis of the assessment, each species is assigned to one of eight management categories; Mentioned, Demanded, Outside forest, Utilisation, Non-utilisation, Monitoring (minimal, moderate or maximal), Research or Substitution. Appropriate management actions are recommended for each category.

Table 6: Criteria used in Rapid Vulnerability Assessment

Criteria	Potential for sustainable use	
	Low	High
Ecology	Low abundance	High abundance
	Slow growth	Fast growth
	Slow reproduction	Fast reproduction
	Sexual reproduction only	Vegetative reproduction
	Habitat-specific	Habitat non-specific
	High habitat diversity	Low habitat diversity
	High life form diversity	Low life form diversity
Life form	Use of grasses an forbs is likely to be more sustainable than trees	
Parts used	The use of leaves/fruit/stem is more sustainable than of the roots (if damaging) or the whole plant	
Method of harvesting	Potential for sustainable harvesting is higher if size/age classes are not selected	

Table taken from Watts *et al.* 1996

In Bwindi RVA was used to select species which could be used with the least chance of over-use and was effective in providing park management with information on which to decide which species could be used. The system appears to have been difficult for people new to this type of assessment because of the many and various techniques which were used to collate the information.

3.2 Memoranda of Understanding

BNP decided on the species and number of users that could be permitted in each MUZ area based on the results of the RVA. These restrictions were presented in a workshop setting and after discussion were accepted and harvesters were nominated by the communities.

Once the species which were going to be permitted for harvesting had been decided the next step was to define potential MUZ on the ground. This was done by constructing 'ground maps' (PRA style maps using sticks, leaves etc.) and then having a nominated forest survey team examine the resources and modify boundaries if necessary. It was not possible to cover more than a small area of forest so attention was focussed on areas containing vulnerable species as identified by the RVA. The abundance of the resources was done subjectively into classes such as dominant, abundant, frequent, occasional and rare. These user abundance scores were compared with knowledge of the BNP team and the local rangers. All estimates compared favourably though users consistently estimated abundance at one score higher than BNP.

All of these agreements were codified into Memoranda of Understanding (MoUs) with each Forest Society formed within each community. These set out the intent of the Forest Society and its objectives, the names of office holders, nominated resource users, the species and quantities to be harvested, boundaries of MUZs and sections

related to other issues with the Park such as crop raiding. These agreements are not legally binding but at least provide a record of agreements. The quantities of resource that were permitted are small and based on personal and village needs and applying the precautionary principle where a small percentage of the available resource …… is allocated for harvesting?. The harvesting methods to be used are based on recognised best practice from the users accumulated knowledge. Restrictions were also placed on the number of days and frequency of permitted gathering dependant on the type and quantity of resource being harvested. An example of the harvesting quotas for basketry plants used by men is given in Table 7 as a selection of species from Table 7 in Wild and Mutebi (1996).

Table 7: Example quotas for basketry plants in Bwindi MUZ

Species	Life form	Part used	No of users			Total users	Annual permitted harvest
			MPU	RUT	NTE		
Smilax anceps	Liane	Stolon	18	9	12	39	180 hls
Dracaena laxissima	Liane	Stem	18	5	9	32	82 hls
Monanthotaxis littoralis	Liane	Stem	17	4		21	400 sticks
Alchornea hirtella	Shrub	Stem		2		2	8 hls
Endengematar [local name]	Liane	Stem			7	7	26 hls
Engondero [local name]	Liane	Stem			5	5	20 hls

MPU=Mpungu, RUT=Rutugunda, NTE=Nteko Parishes: hfs=handfuls, hls=headloads

Harvesting began once the MoUs had been signed.

In the spirit of adaptive management the MoUs established monitoring for the permitted resource species. Five types of monitoring were identified: illegal activities, utilised species, secondary ecological impacts, user presence in the forest and community attitudes. These monitoring programmes have been applied at some time using a variety of protocols. An overall evaluation of the MoUs is given in Davey *et al.* (2001) and Blomley (undated).

Monitoring is a critical component of any management system and particularly of the type of adaptive management recommended for CFM. Efficient monitoring protocols are particularly difficult to devise so the methods used by BNP and ITFC are outlined below along with more general monitoring schemes implemented by UWA in all NPs.

Monitoring is intended to inform managers of the effectiveness or otherwise of management prescriptions which in turn should lead to revision of the prescriptions. Both UWA and ITFC staff are aware of the need for revisions to the MoUs in the light of changes in circumstances and knowledge since they were drawn up. However, they are unsure how this should be done or achieved. It seems that the main changes over the years have been decreasing dependency on the forest and consequently several species are no longer being harvested or at least the full quota is not being taken. Many registered harvesters are also no longer collecting though it seems that at least some have taken to trading medicinal species collected under their permits.

3.3 Monitoring illegal activities

The intention was to monitor the level of illegal activities as a measure of the effectiveness of the MUZ programme. The rangers keep records of illegal activities, their location and type, the duration of patrols and level of assistance from communities. The Forest Societies also keep records of illegal activities they observe. Initial indications were that the MoUs were successful in encouraging resource users to report illegal activities (Wild and Mutebi 1996). However, the UWA

staff at Bwindi met during the consultancy had a different perspective. They reported that illegal activities continued even in the MUZ after the ten years of MoUs. It even seems that the level of illegal activities is higher in the MUZ than elsewhere though the communities defend this by saying this is because more is detected with their assistance than elsewhere and that illegality is being perpetrated by outsiders. Furthermore, changes in socio-political conditions mean that the socio-economic incentives no longer match up to the cost of the concomitant responsibilities.

On balance the UWA staff wonder if the programme has really improved the situation though this was considered to be the case by Davey *et al.* (2001).

3.4 Monitoring harvesting impact of key utilised species

During the initial harvests the users were accompanied to collection sites by project staff and the quantities harvested were weighed and measured. This was considered policing of use rather than the species by the users and the recording of harvests was eventually taken over by the users. However, the present UWA staff report that it has been difficult to maintain offtake recording because this is something foreign to the local people who hardly record important events let alone day-to-day activities. Discussion with ITFC staff suggested that they are considering alternative means of recording harvests.

In addition to the offtake records the intention was also to monitor the species at three levels of intensity depending on the species vulnerability along the lines given in Table 8.

Table 8: Resource monitoring for permitted species in Bwindi MUZ

Resource vulnerability	Monitoring intensity	Data collected
Low	Minimal	Offtake records User reports
Moderate	Moderate	Offtake records Harvests measured in PSPs in MUZ by UWA and ITFC
High	Intense	Offtake records Greater number of PSPs with some located outside the MUZ

It seems that it has taken some time to implement the PSP based monitoring. Since 2001 the Ecological Monitoring Programme of ITFC has been monitoring *Loeseneriella apocynoides* (a climber used to make baskets), *Rytigynia spp* and *Ocotea usambarensis* (trees from which bark is harvested for medicinal use) which are three of the most vulnerable species (Bitariho *et al.* 2001). Data on each of these species is collected from by ITFC staff from PSPs using protocols very similar to conventional forestry PSPs. The intention is to collect data on the yield potential, harvest impacts and regeneration characteristics of the plants as a basis for establishing sustainable harvesting levels. The study therefore sought to compare the size structure, yield and regeneration potential of harvested and un-harvested populations and to assess the direct impacts of harvesting on the health of individual plants.

The PSP plots are laid out in a stratified random (sic it is actually systematic) sampling design. There are three strata, MUZ areas being actively harvested and two unharvested controls, one close to MUZ areas and one more distant. Plot size varies with species and are permanently marked with concrete blocks with embedded metal spikes. Plants for yield measurements are numbered, flagged and marked with paint.

- *Rytigynia* (shrub) - plots are 20x20 m and placed 15 m apart on alternate sides of a line transect with 100 m between transects. In each plot the number of stems and d are recorded along the number of seedling (< 1.3 m tall) in 0-40, 40-80, 80-120 and 120-130 height classes. De-barking was assessed using a seven point scale after Cunningham (2001), phenology and plant health are also recorded. A minimum of three plants from each size class per transect were selected and on each bark thickness is measured at four locations around the stem at 1.3 m to obtain the mean bark thickness.
- *Ocotea* (tree) – these are recorded in permanently marked belt transects running from the forest edge and spaced 100 m apart. The trees are recorded in the same manner as *Rytigynia*.
- *Loeseneriella* (liane) – uses the same plot layout and sampling protocols as for *Rytigynia*. However, since this a liane the diameters are measured at the base of the stem with vernier callipers.

The plots are measured at annual intervals and the data entered onto the ITFC computers. To date very little analysis of the repeat assessments has been done though it has become apparent that no growth in diameter has been recorded on the trees. The method for determining bark yield for *Ocotea* and *Rytigynia* will only give estimates of bark growth with tree diameter. However, this relationship can be determined by measuring bark thickness across the size range of the species. An alternative method for determining sustainable bark yields is to assess the rate of bark recovery from harvesting wounds. Protocols to do just this are the subject of a study funded by the UK DFID in southern Africa (RSA, Malawi and Zambia) and should be available in a couple of years.

Although the MUZs are community based these PSP plots are maintained and measured by ITFC without assistance from the Forest Societies. However, it seems that BNP have UNESCO funding to establish community monitoring along the lines of that done by ITFC. It is suggested that before this is done that further advice is sought on suitable protocols for the species to be monitored.

3.5 Ecosystem monitoring

Given the presence of ITFC there are a number of academic-style studies being conducted in Bwindi. Many of these are concerned with Gorilla sociology and conservation but there are also studies on the general ecology of the forest. For example the field work for an extensive study of boundary effects has recently been completed and will be reported in the near future. This study looked in detail at the impact of legal and illegal harvesting up to 1 km in from the boundary. There is no regular study of the impact of harvesting on the functioning of the forest itself, although this was prescribed in the initial ideas for MUZ it is difficult to implement.

3.6 User presence monitoring

This is the simple recording of the presence of users in the forest during harvesting events. The data was to be compared to the presence of tourists and rangers, presumably to indicate which has the greatest presence in the forest and therefore may constitute a disturbance to wildlife. Since Wild and Mutebi (1996) there has been little mention of this form of impact monitoring.

3.7 Monitoring community attitudes

Since the principal objective of community based initiatives is the resolution of conflict between the Parks and local people it is important to monitor whether the programmes being implemented are indeed reducing conflict. CARE and the Mgahinga and Bwindi Conservation Trust have instigated conflict monitoring using local perceptions and attitudes (positive and negative) as indicators. These assessments are done by randomly selecting individuals and posing a series of questions which sought to reveal the extent, trends and causes of conflict, as well as local perceptions of conservation costs and benefits. The first survey was in 1997 and are planned at two yearly intervals. The 1999 survey revealed a positive change over the two-year period though the continuing negative attitude among poorer women indicates that there are still equity issues to be addressed. The survey includes relatively few people (144 in 1997 and 122 in 1999 from 24 parishes) and there are concerns that this is not enough for rigorous statistical analysis. It seems that a broader inter-agency assessment of changes in attitude (and any associated behavioural changes) amongst park edge communities using a wider range of quantitative and qualitative techniques is underway. (Blomley undated)

3.8 Recent refinements

After the initial establishment of MUZs at BNP a second set of areas were also made available for harvesting of weaving materials and medicines. This work was led by ITFC (1999) and in some senses streamlined the previous procedures. The reported steps in this process area used a combination of community surveys and standard biological inventory techniques and covered the following activities:

- PRA with specialist user groups in the communities to establish the plants they would like to harvest
- Resource mapping to identify the boundary of the proposed MUZ – this was done in the field using a GPS
- Focussed search for the plants requested by communities – specimens (of sterile and when available fertile material) were made for botanical identification. Subjective assessment of the density of species was also made.
- Inventory using five randomly located 10 m wide transects of varying length. Within the transects, all requested trees > 10 cm d were counted. Herbs were counted in 1x1 m, vines and small shrubs in 5x5 m and lianes and large shrubs in 10x10 m nested sub-plots. In each plot, aspects, altitude and canopy cover were recorded. Users with the inventory team identified the plants that were suitable for harvesting. The RME for each species was calculated. Figures extrapolated to give estimated minimum stocking in the MUZ.
- The amount of plant material in a headload or handful (whichever was most appropriate) was determined from interviews with users. This was used to express the quantities of resource in terms of units which can be easily understood by users.
- Used a threshold of 0.1 stems per plot (RME) as the cut off for sustainable harvesting. Only plants with densities higher than the threshold were permitted for harvesting (only 9 in this instance from a list of 26 which were inventoried).

- Interviews with users were used to determine the quantities of resource being requested by working backwards from numbers of headloads or handfuls. It is not clear from the report how the harvest quotas were arrived at but they are all very low and only a small percentage (<3%) of the total amount present.

This seems a workable system which builds on the best of both participatory and scientific approaches. However, the emphasis is still firmly on BNP control of the process and the inventories only use users as informants. Although the use of RME is laudable more explanation is required of the ideas or rules used to determine the threshold for admitting a species and the harvesting quotas. More though also needs to be given to monitoring harvesting impacts other than the use of size class curves.

3.9 MIST

MIST is a ranger-based monitoring system which is in the process of being operationalised across the NPs. The system is based on ranger reports of animal signs, human incursion, illegal hunting and the like. The rangers make their reports on paper forms using a GPS to record the exact location of the signs. The GPS readings are then downloaded onto a computer and the accompanying information typed in on the computer. The records can then be displayed as maps using a specially designed GIS application. Over time the records build up into a detailed picture of activities within the Parks and can also provide useful data on animal movements and numbers. The training for implementation of MIST in all NPs took place early this year and it was not possible to view any data for Bwindi.

4. Recommendations for CFM inventory

There is a considerable amount of experience with community involvement in forest management. Much of the UWA and later FD experience has necessarily focussed on the social dimensions such as building consensus within the community, changing attitudes toward forest authorities and the development of community-based forest management institutions. None of these things are easy but it appears that there is now sufficient experience that they can be achieved by the CFM staff. Unfortunately, success here has been at the expense of a scientifically based approach to the determination of forest management prescriptions and specifically NTFP yields.

This section make suggestions for ways in which the shortcomings of the existing CFM inventories could be overcome. In complex forests in which little is known of the species ecology or ecosystem processes it has been suggested that **two principles should apply: the precautionary principles and adaptive management**. Both of these seek to base management prescriptions on the best information available with a healthy margin for error. Adaptive management goes further and requires that the forest is carefully monitored, specifically for the impacts of interventions and that prescriptions are changed in the light of any new information. All management should be a cyclical process with inbuilt review. These requirements mean that baseline data are required such as that provided for by well designed inventory and sometimes PSP observations. In the context of CFM all of this needs to be achieved with the active participation of the communities. This is a big undertaking and will not be achieved quickly. However, ensuring that all inventories contribute the best data possible is a good start.

4.1 Level of community participation

In BNP although the communities are involved in MUZ management they have deliberately been excluded from much of the decision making. This is because the Park authorities have as their principle objective the protection of the forest and only permit access for non-commercial use as a necessary trade off to gain the good will of the communities who live next to the forest. Consequently the species, quotas and areas given to the communities are decided by BNP. This represents something between the Consultation and Collaboration levels of participation as indicated in Table 9 (taken from Carter 1996).

The level of involvement of local communities in the CFM inventory is causing concern to CFMU staff. The communities role in the inventories so far has been as volunteer labour and as expert informants (naming useful plants). The design, technical work (using compasses etc.) and booking is done by local FD staff. Although the overall management process is intended to be at the Collaboration level the inventories themselves are no better than Co-operation. However, the communities themselves would prefer to have more involvement and would probably in many cases after appropriate training be capable of undertaking inventory without assistance from the FD. If the community are to have a greater role in inventory many would argue that this will mean that the protocols should be pre-determined, simple and taught to the communities on the grounds that they will not have the education necessary to understand sophisticated statistically based protocols. However, it is nearly always a mistake to underestimate and certainly pre-judge what a community is capable of. It is perhaps not simplicity that is important but intuitiveness – if something makes *sense* it is easier to follow even if complex.

In the present situation where the FD do not have a reliable method it might be **best to take a Co-learning approach towards inventory** at least for the next iteration of

participatory inventory. As shown in the box, this sort of approach has been welcomed by at least one community who then went on to develop their own inventory method.

Table 9: Levels of participation in forest management

Mode of local people's participation	Type of participation	Empowerment for decision making		Role of local people in research and action	Uganda
		FD/UWA	People		
Co-option	Tokenism – representatives are chosen but have no real input of power	**********		Subjects	
Co-operation	Tasks are assigned, with incentives; outsiders decide agenda and direst the process.	*********		Employees/ subordinates	
Consultation	Opinions asked; outsiders analyse information and decide on a course of action.	*******		Clients	MUZ
Collaboration	Local people work together with outsiders to determine priorities; outsiders have responsibility for directing the process.	*****	***	Collaborators	CFM
Co-learning	Local people and outsiders share their knowledge to create new understanding and work together to form action plans; outsiders facilitate	***	******	Partners	
Collective action	Local people set and implement their own agenda; outsiders absent		*********	Directors	Communal forests

Quintana Roo, Mexico

In the Quintana Roo community forests in Mexico communities have developed their own inventory protocols. These were developed from a standard forestry design they were taught, their own experience and was driven by the need to have good quality data on which to select trees for felling as timber. The design they came up with is judged to be as good as or better than those used by many Forestry Departments. The Quintana Roo inventory teams now sell their services to other community forestry groups.

(Lawrence and Román 1996)

The situation in the communal forests being developed by the Forest Secretariat is similar to that in Quintana Roo where the communities own the forests and it is therefore the choice of inventory and indeed management system is their prerogative. However, for CFM within the forest reserves it is the responsibility of the FD to ensure that management reaches a certain standard. This may well mean that the scope for co-design of an inventory for a forest may be limited to conform with FD standards. However, this does not mean that community knowledge can't be used, perhaps for stratification. **Perhaps the ideal is to have a flexible inventory protocol that the FD and communities can adapt to suit a particular forest**. This could be developed in a co-learning approach in trials and then implemented as an FD led process thereafter. Potentially, like in Quintana Roo this may put the co-learning communities at an advantage and they could then be used as trainers or perhaps contract teams elsewhere, this being a recompense for the extra commitment required to develop the inventory system. After suitable training the communities can then undertake inventory and subsequent monitoring with FD checks and perhaps assistance with analysis and interpretation. The more that communities can do themselves, the less demand there will be for FD staff and resources which may be desirable.

There is a need for the FD to decide on standards for CFM inventory. This could take the form of target SE for stocking estimates of species that are to be licensed etc.

4.2 Botanical naming of resource species

In order to generate the broadest body of knowledge on the forest and NTFP species is it necessary to combine all available information. Local knowledge can be extremely detailed and useful for management while scientific knowledge can provide information on related species, chemical composition and larger scale processes. RVA as explained in Section 5.2 attempts to bring these bodies of knowledge together. However, this cannot happen unless the names of the plant in both systems are known which is the case for many of the resources in the CFM inventories.

In the BNP participatory surveys 44% of the 16 species used as basketry by men (Wild and Mutebi 1996) were not identified beyond a local name. This is somewhat surprising given that this project had substantial ethnobotanical support. The lack of names may therefore represent difficulties with specimen collection or a lack of suitable reference material. Since this time ITFC have been able to employ and train an herbarium curator and have a comprehensive field herbarium. Presumably they now have the capacity to identify more plants in the field.

The situation in the CFM inventories is more difficult in that the FD is only able to identify trees, does not have a botanist and certainly no-one trained in ethnobotany. There has therefore been an almost total reliance on local names. In the Kaiso inventory none of the 65 'other' NTFPs and in Malabigambo only 28% of the 83 names were assigned a botanical name.

Unfortunately, local names are notoriously fickle and the same name can be used for different species in neighbouring villages, to refer to a group of perhaps unrelated species or be known only to a few specialist users (e.g. herbalists) and the different parts and uses of the same plant can even have quite different names (Hafashimana 2003). Even if a local name with wide currency can be identified it is still not possible to link the body of knowledge about the plant to scientific knowledge. Collaboration means sharing and this should also extend to knowledge of the taxonomy, ecology, phytochemistry and uses of resource plants. For this **it is necessary to determine the botanical name for the plant**.

Ethnobotany is the study of local uses for plants and part of this is the rigorous identification of the plants in question. Many enthobotanical texts provide useful information on how plants can be named. The first step is to collect a representative portion of the plant and preserve it by pressing until such time as it can be identified by a competent botanist or by comparison with a flora entry or reference specimen. There are a number of textbooks which deal with this e.g. Martin (1994), Cunningham (2001), HMSO (1996) and Stockdale and Corbett (1998). Hafashimana (2003) has also provided recommendations for the collection of specimens for identification. His recommendations have been put into the form of a specimen collection sheet in Annex 3 and some guidance notes in Annex 4.

Besides being able to identify the botanical name for an NTFP it is also necessary to know something of the variation in local names in order to use the one with the widest currency. A method for sampling the variation in local names was developed in a DFID funded project on Mount Cameroon. Draft protocols from this study can be found on the ETFRN website as a contribution to the e-conference on participatory biodiversity assessment (www.etfrn.org/workshop/biodiversity).

For the CFM inventories it is recommended that the following process may help to resolve some of the naming issues.

1. In a group situation have people identify the resources of most interest to them using local names
2. Have those who give the names describe the plant and determine if anyone else recognises the plant. Record both the description and any alternative names other people may have for the plant. (Asking people to describe the plant as they would to a child they were sending to fetch it can work well in this situation.)
3. Take a group of local people along with a FD tree spotter on a walk into the forest. Have local people point out plants they have previously named. The tree spotter should be able to identify the botanical name in the field. Otherwise demonstrate the collection of botanical voucher specimens. Complete a recording sheet in the field and attach to the specimen. Back in the village the vouchers can be pressed and dried.
4. At a suitable opportunity (either have botanist visit or send vouchers to Kampala) the botanical names for the plants should be determined and added to the species lists.
5. At some stage ask a number of people whether they know the plant and to give the name they usually use for it. It should become apparent which names are most commonly used and understood.

Experience on Mount Cameroon suggests that local people are often extremely interested to learn of new plants and their uses and that some plants are known to only a few people in the community. The voucher specimens and descriptions can be used to stimulate interest in local plants and uses and could be developed into a booklet for preserving and transmitting this knowledge to children and other communities. Such and undertaking is not necessary for CFM but the correct identification of the resource species is.

4.3 Rapid vulnerability assessment

RVA is a useful technique for collating data and making a first assessment of NTFP status. It depends on being able to name the plants properly and should be done once this has been established. Training in the use of RVA is included in CFM training and is being dealt with by Tom Blomley from CARE-Uganda.

4.4 Mapping

Sketch maps are easy to produce and are interactive and are used as an essential component of PRA. The CFM process includes participatory sketch mapping of village lands (as in Echuya) and sometimes the mapping of forest trails (as in Budongo and Sango Bay). This together with the plot data along the transects is a very useful basis for discussing management zoning and access issues with the community as demonstrated in Sango Bay by Dezi Irumba. Although sketch maps are perfectly adequate for many purposes there are advantages to **more use of GPS and other surveying techniques when undertaking CFM assessments**. The production of geo-referenced data will permit the production of accurate maps. These can be integrated with the other GIS based data of topography, drainage, forest boundaries, remote sensing images etc. would greatly increase the information available to the management planners both from the FD and community.

In order to provide detailed and useful data for management planning any mapping undertaken should be accurate and detailed. At present GPS locations have not been recorded in most CFM sites. This is unfortunate and **GPS units should be**

made available and used in all CFM in-forest activities. In particular accurate maps of boundaries, trails, rivers and landmarks can help to break the area up into easily recognisable management units. The only difficulty with advocating the use of GIS is that this is hardly something that the villagers can do for themselves. However, the Biomass Unit at FD headquarters in Kampala has a competent GIS unit. The implications of using a Kampala based unit for mapping CFM areas needs to be carefully considered. There would need to be additional staff with special responsibility for CFM mapping as well as an efficient system for getting the data to Kampala and the maps back to the villages. The disadvantage of having part of the process remote from the communities and District would also need to be evaluated. If it seems inappropriate to use GIS it would still be possible to **use geo-referenced data manually on large sheets of graph paper** to prepare accurate maps in the village.

Even if use of GIS is not practical, copies of any available topographic and administrative maps for the area should be given to the communities for use as base maps. The easiest way to generate this would probably be to make printouts of the GIS database for the reserve held in Kampala, otherwise photocopies of topographic maps would have to suffice. In additional, any satellite imagery can be used with communities to shown internal features of the forest (swamps, grasslands) and also the context of the forest (it's the only one for miles). If these are available printouts should be made for use by the communities.

Obviously the easiest way to generate maps from GPS readings is to use a computer-based GIS. It may be possible to take the data to Kampala for the Biomass Study to enter into ArcInfo GIS though this may well be expensive.

4.5 Quantitative inventory

The CFMU staff have become aware that the abundance scores have been rather more subjective that was intended. The protocol requires that the FD staff take care to ask people whether the density in a 100 m section is more or less than a score given earlier. However, there are still marked discrepancies in the scores given by different members of the community inventory team. There are also differences from day to day and from forest to forest. Even if the scores were given in a consistent manner without calibrating them with actual counts it is not possible to determine the actual amount available at a location. Score 5 (the highest density in 100 x 20 m patch of forest) for one species may be very much less than score 5 for another. It is therefore difficult to compare even the relative abundance of species as score 5 for a rare species might be equal to score 2 for a common one.

Collecting subjective data makes for a qualitative assessment which cannot be used to determine actual stocking levels nor is it appropriate for determination of harvesting levels. Locating and cutting transects is the hardest and most time consuming part of an inventory. It doesn't make sense to go to all this trouble and to then collect qualitative data.

What is required for the application of objective management rules and as a baseline for monitoring is good quality quantitative data. This means data that can provide reliable estimates of stocking with a calculable error. Both of the participatory inventory methods in use produce qualitative data and **modifications are required if the CFMU facilitated participatory inventories are to produce quantitative data**.

The main change that would be needed to generate quantitative data is that the number of plants be counted rather than estimated. Since the transects are too large for full counts to be made it is necessary to institute the use of smaller plots for

counts. The simplest solution would be to place small plots (10 x 10 m squares) at regular intervals (200 m) along the transects to give a systematic grid design.

Size (or preferably age) structure of the plants is important to assess the health of the exploited populations. This is important for management as it would not be advisable to harvest a species if all that is available are elderly plants. It is therefore suggested **that plants are tallied into size or age classes**. It is difficult to advise quite how this should be done as the procedures would be different for each life form e.g. height is a useful measure for palms but wouldn't work for *Marantachloa* where extent or density of stems would be a better measure. Identifying the size or stage at which the plant is exploited would also more accurately estimate the quantity of a resource available for exploitation and would need to be done with users.

4.6 Number of plots required

It is considered by the CFMU that the assessments are too time consuming. This is probably true given the subjectivity of the data collected and the qualitative nature of the assessment. Qualitative assessments could be done in much less time and certainly there should not be a need for the type of repeat assessments done in Budongo. However, the consultant was impressed at the willingness of the communities to undertake extensive field work for little immediate reward (food was not even provided).

The amount of time that should be spent on an inventory depends upon the quality of the data required, the costs of doing the inventory (which can be stated in terms of time) and the size of the area. If we take achievement of SE20 as an indicator of quality for inventory data then Anenx 5 can be used to estimate the number of plots required for any particular species if we can estimate its approximate density. Furthermore it is apparent that for rare species that it is probably better to do a census than sampling as the number of plots required would be very high. If we take it that 200 plots would suffice for most resources then this is the number of observations that would be needed for the CFM inventory. However, transects are rather large so it is recommended that **a minimum of 200 plots rather than transects are used** in CFM inventory. Given the number of plots required issue is then how to distribute them in the forest. Stratification works well and could be done using local knowledge to determine the strata boundaries. The size of the forest is the last consideration, if it is large it is obviously going to take more time to complete the inventory.

Annex 5 is for tree species and there is a need to complement it with comparable data for other NTFPs.

4.7 Data analysis and presentation

There is very little in the way of data analysis for the CFM data. Mostly the trees are summed by size class and the averages of the abundance scores calculated. These figures are presented in the form of tables and bar charts. In Sango Bay the results were also presented in the form of sketch maps. Although these figures and presentations are indicative of the quantity of resources present there is more that could and should be done. It is recommended that the **inventory data should be worked up into estimates of total stocking for an area of forest and the SE% of the estimates**. The easiest way to do such calculations is using a computer but these are not accessible to the communities. Many District Offices have computers and these could be used for data entry and analysis but it is probably best to make it possible for the calculations to be done by hand or with a simple calculator. The Statforms (Dawkins 1975) and Statnotes (Wright, Oxford Forestry Institute student

notes) were prepared to facilitate the hand calculation of errors (and other statistical tests). It is recommended **that something along the lines of a Statform[5] is prepared so communities can undertake some of the basic calculations themselves**.

However data is collected it is important that it is analysed in a sensible manner. In many cases this may mean that the DFO makes a computer available and undertakes computer-based analysis on behalf of the CFM group. Other groups (such as the one in Sango Bay) may prefer to undertake the analysis themselves using statforms as described in Section 4.7 above. However it is done, the following basic data required are:

- stocking density (stems per ha) with error
- Area being managed for species
- Estimate of total number of harvestable stems with error
- Percentage of the area which contains the species

Although foresters and the community members involved with the inventory may be able to understand such figures it seems likely that they will be incomprehensible to the majority of the communities. Therefore a means of making the critical information accessible to people is necessary.

Ideas such as mapping with symbols in proportion to abundance etc. need to be tried and some suggestions made for use in subsequent CFM which can be modified to fit particular circumstance. In Malawi it was discovered that people could most readily understand that larger circles on a map signified a greater number of trees (Anton undated). Similar work is required in Uganda to design how the data should be presented to the communities. Of course they will also need to be trained in the preparation of the presentations as well as data analysis.

4.8 Regulation of harvesting

At present most of the draft management rules for CFM (e.g. Sango Bay) prescribe licensing by time periods as is the norm for FD licensed NTFP collection. Thus a permit is given to collect palm leaves for a month rather than the number of stems that can be taken. The BNP MoUs do both and specify a specific time period for harvesting and also the quantities than can be taken (see Table 7).

Regulation by time would probably suffice for very common species but more care is needed for rarer and certainly for threatened species. It is suggested that the CFM yields are done as quotas. The quota level should be set by applying the precautionary principle to the data obtained from inventory. Quota setting by the FD for timber trees is done through a 100% census of small blocks of forest in ISSMI. This is hardly going to be possible for smaller, commoner plants and some form of sampling, ideally one that can be used to map patches of highest density will be required. The data need to be quantitative so plots and counts are needed. The sampling design and intensity will need to be varied for different life forms if not species. For example, there is little point laying out plots in terra firme forest if the resource is known to inhabit swamps.

In order to determine whether a set of data is sufficient for quota setting a target sampling error will need to be agreed. This should be at a higher level than

[5] These are tables into which the data is entered. The specified calculations are done and entered into boxes in the table. In this manner the user is lead through the complex calculations required to derive the sampling error.

for EI though it is suggested this should not be more than 10% (if EI achieves this for the CFM block then no further inventory may be needed). **Trials will need to be done for different resources to determine the best methods for undertaking ISSMI-style inventories for NTFPs**.

Having recommended that a target sampling error is required for data to be used to determine a harvesting quota, consideration of Annex 5 suggests that this may be logistically difficult to achieve for all species. A different approach would be to adopt the use of the reliable minimum estimate (RME) as an expression of the precautionary principle. The RME is the mean minus the one-tailed confidence interval at a selected probablity level. This is often taken as 95% meaning that 95% of repeat inventories would be expected to produce estimates of the mean higher than the RME. It is a mechanism to try and minimise the risk of assuming there are more trees that are really there (which would be the case 50% of the time using the mean). The RME is calculated as shown in Annex 6. Rather than trying to achieve a set target SE% for all species it may be more practical to undertake an inventory of a fixed sampling intensity and then to **use the RME rather than the mean as the estimate of the useable population density**. This would work fine for species where the SE% was relatively low but for rarer species with large SE% the RME could well end up negative. Medicinal species in particular are often rare and could present a problem with this approach though harvesting may not be a problem if the plants are not excessively damaged. This suggests that it may be possible to prepare a decision-tree to guide quota setting which would run through a set of issues similar to those in RVA such as the harvesting response of the the species, its relative rarity etc..

Establishing sustainable quotas also requires some knowledge of growth or replenishment rates. For most Ugandan plants this is not known and needs to be determined. Setting up conventional PSPs usually entails complex protocols and even more complex analysis (Alder and Synnott 1992, Alder 1995). Such monitoring is hardly appropriate for use by communities in CFM. However, it is possible to obtain simpler assessments of the growth and harvesting response of resource species by tagging and measuring individual plants. Participatory techniques for assessing yield were used by Cunningham and Liebenberg (1998) for bark and palms in RSA. Similar techniques should be developed for use with important Ugandan NTFP resources.

Many traditional harvesting practices have been developed over a long dependency on the resource and often inflict recoverable damage on the plants. However, this is not always the case and destructive practices are developing for some valuable species as a result of the threat of illegal harvesting (if someone else is going to steal the resource you may as well take everything you can now). **There is a need to develop guidelines for best harvesting practice for a range of resource types. This can be done through experimentation using traditional practices as a guide**. For some products it may be possible to substitute, e.g. using leaves rather than bark of medicinal tree species. This would require experimentation on the part of users which is harder to achieve but the NCRL is undertaking such research on medicinal plants. It may be possible to advise NCRL and the like of the species under most threat and request that these are targeted for research on substitution.

However, it should be borne in mind that **quota setting is not an exact science and needs to be approached with as much sensitivity as possible and drawn from both scientific and traditional knowledge**.

4.9 Monitoring

There is a lot of monitoring that is required (see Section 3 for the types of monitoring for BNP). The ideal would be to implement two basic types of monitoring system for CFM. The first would **monitor the success or otherwise of CFM management itself**. This could involve tracking offtakes, illegal activities, number of people in the forest, revenues etc.. Since BNP have a lot of experience at this type of monitoring it would be a good idea to seek their advice on how this can be implemented.

The second type of **monitoring is to determine the impact of harvesting on the species and forest**. The first of these is tackled at least for mature plants by the growth and yield assessments advocated in Section 5.5. However, even for these there is need for monitoring of regeneration as well as for the health of the ecosystem. Seeking to monitor ecosystem, societal or species responses to an intervention would require measuring everything. This is hardly possible so indicators are often used as a proxy for the health or otherwise of the whole system. Care needs to be taken with proxies that changes in their levels are in fact correlated in a predictable manner with changes in the ecosystem. Indicators are often selected and used in collaborative management as the intimate knowledge of the users can often identify effective indicators. The possibility of doing something like this to monitor health of species and the forest within CFM should be explored.

Even with indicators the **level of change that you wish to detect has big implications for the design of the monitoring scheme**. The smaller the detection level the more effort has to go into each enumeration and the more costly are the exercises. For example, if we want to detect a 10% change in stocking then we will need to estimate stocking at least 5% precision in each period. We have already seen that larger numbers of plots are needed to obtain more precise estimates hence the expense of sensitive monitoring schemes.

4.10 Animal resources

None of the CFM assessments take any note of animals within the forest. This is because the CFMU (along with the rest of the FD) considers that animals are not part of its responsibility and does not permit hunting within the forest. However, there are protected animals (e.g. chimpanzee) within many reserves and it seems likely that it would be worth monitoring their number to gauge the success or otherwise of hunting restrictions instituted by CFM. However, a more important issue is the degree of interest in hunting exhibited by some communities. There are reported instances of communities refusing to consider CFM agreements if that meant restrictions on hunting. In other countries there are examples of hunting agreements with local communities along the lines of those considered for plants under CFM. There needs to be some negotiations with UWA to consider if such agreements are possible in Uganda. If so then the communities would need to undertake animal surveys as well as inventory for plants.

5. Discussion

Any CFM assessment has to fit within the context of guidelines for CFM and the procedures used by the FD in forest management. There are a number of issues that need to be resolved before it will be apparent where and how CFM inventory fits into wider management systems. It is not possible to provide unambiguous advice on the best way to handle these issues as this depends on decisions that can only be made by the FD. In this section some of the issues are explored and possible responses are briefly described.

5.1 CFM, EI and ISSMI

At the present time the relationship between EI, CFM and ISSMI is unclear. EI provides low intensity data at the reserve level, while ISSMI provides a full census at the sub-compartment scale immediately prior to logging. CFM inventory sits in the middle and it is not clear if it is intended to provide data for strategic or detailed planning. If it is the former then the intensity is probably much too high, if the latter, at least for timber it will be too low. In the trials no forestry data was made available to the communities principally because the EI took place after the CFM process commenced and there are no formal reports of EI available.

There are a number of options. It is not going to be possible to choose between these at the present time until the FD has developed a clear understanding of what decisions the CFM data is intended to inform. There are two basic scenarios which relate to who should undertake EI and the relationship between the partners in developing the basic data needed for forest management. There is little to choose between these alternatives they are simply different ways of doing things. The final decision is therefore likely to be made for economic or capacity building/ CFM development reasons as any others.

5.1.1 Communities undertake EI

One option is to undertake standard EI with community participation. At present villagers are recruited onto the EI team to act as labourers and sometimes as guides. This could be expanded so that communities wishing to engage in CFM would undertake the inventories, either as labourers or, after appropriate training by forming their own teams. Since the data is to benefit the communities as much as the FD they should be willing to undertake the work at community expense (as is the case for the present CFM resource assessments). This would significantly reduce the cost of EI. In this scenario the EI would be done to the stanard protocols but could also include specific resources of particular interest to the community. One problem with this approach is that the present EI stratification into large blocks may not fit particularly well into CFM areas. A further difficulty is that it would take a lot of co-ordination to ensure that the whole reserve would be covered by CFM/FD teams at the same time to minimise FD logistics and also to generate a coherent picture of the reserve at one point in time. This may not be such a problem if all the stakeholders in a reserve are notified and included in management planning from the beginning. Such an approach is recommended given the experience in Bwindi where the great majority of the available multiple-use zone were allocated to only a few communities. With hindsight this is obviously unequitable and should be avoided by the FD.

The data derived from the EI could then be used to generate the management plans required by the CFM agreement. If the SE% from EI is acceptable for specific resources then these data can also be used to derive quotas. If the SE% are rather

high then further inventory, perhaps even the 100% census of ISSMI may be required.

5.1.2 FD undertakes EI

Making the communities undertake EI as a test of commitment before drawing up the CFM agreement may be desirable but it does mean that the more strategic elements of management planning including the assignment of CFM zones within a reserve may not be adequately resourced. A different approach would have the FD undertaking EI in a systematic manner for all reserves using (paid) labour from the CFM communities were appropriate. The data would then be available in a timely manner for strategic decision making by the FD and also presented to the communities as the basis for any CFM agreements that may be forthcoming. The advantage of this approach is that CFM can proceed faster and the communities efforts can be directed at more intensive inventories and the establishment of monitoring.

5.2 National CFM guidelines

The CFM Guidelines (Forest Department 2003) lays out a vision for CFM that includes 'ensure the sustainable supply of forest produce and services by maintaining sufficient forest area under efficient, effective and economical management'. As argued above this requires quantitative data and the merging of both scientific and local sources of knowledge. The Guidelines envisage two levels to CFM, the long-term *agreement* which provides the long term conditions under which the community will be allowed access to the forest and a *plan* which provides the operational details and which should be revised from time to time. The type of information required to prepare the agreement is strategic in nature and could be derived from a low intensity survey either done by the community or be derived from EI. The detailed data required for the plans could come from either a higher intensity inventory or a complete census (ISSMI-style approach). In both cases, the need for monitoring as well as the defensibility of decisions are served by quantitative data.

The Guidelines have a lot to say about the steps in the negotiation process which is right and proper. The more technical side of forest management is provided for in the following:

Step 4: Situation analysis – This includes mapping of resource use, stakeholder and conflict identification. There is no mention of how the maps are to be generated and it is presumed that this is most likely to be in-village, participatory sketch mapping. Thought needs to be given to whether this is the appropriate stage to introduce field mapping using GPS for important features. Since this information is to be used in the agreements which are provided for in law then it is probably advisable to make these maps as accurate as possible. This step also includes the use of RVA to analyse values and threats according to importance. This is an appropriate place to introduce RVA but doing this well requires some attention to enthnobotany which should ideally be done during this step. Of the six objectives given for Step 4 the Guidelines only one refers to physical properties of the forest and this is 'to understand in sufficient detail the resource pattern limitations and values local people attach to the resources'. This is hardly a basis for quantiative assessment of the resource population and needs to be revised.

Step 5: Negotiating and drafting a CFM plan – This appears to depend on the information collected using Step 4 and that the identification at compartment level (whether this is FD compartments or sub-divisions of the CFM area is not clear) of a prioritised list of products and species, the availability and demand for the product.

This is to be done by the Applicant and Responsible Body facilitated by the Planning Team. Presumably the intention is to use the standard CFM assessments as described in Section 2. This is probably the place to put a more detailed exposition of the role of inventory in the management process and to provide sufficient advice, support and training to ensure that this is of a standard acceptable to the Responsible Body.

There is a need to include the various types of inventory in the CFM process especially the relationship between those undertaken by the FD and by the community particularly with regard to quality standards and who is going to finance them. The analysis and use of the data to derive yields or quotas also needs to be included in the CFM process also needs to be included into Step 7: Negotiating an drafting a CFM agreement and plan. Likewise some consideration should be given to the statistical aspects of monitoring in the plan and Step 9: Implementation. The suggested contents for the management plan should also include Appendices which list the names (local and botanical) for resource species, and the summaries of the data obtained from the various inventories.

5.3 Training workshops

Various workshop have been held for training in participatory resource assessment and CFM processes. The process of developing the contents of these workshops and the workshops themselves is being supported by FAO and Integrated conservation and development training programme (CARE/WWF/GEF-UNDP/MSTCDC). This process seems very thorough and includes contributions from many people from both inside and outside Uganda. It is gratifying to see that an exposition of RVA is included in the workshop. However, following the CFM Guidelines the training workshops do not include much exposition of technical aspects of forest management or the need for quantitative inventory. Indeed Community-based resource assessment is allocated just 4 hours. However, doing more than this at general training for CFM may not be appropriate. There is much that is new in CFM for the forestry field staff and it is important that they understand the concepts behind CFM and develop the skills to act as efficient participatory facilitators. However, there is a need to include inventory in the CFM manual from which it is currently lacking and to provide for training in this work, perhaps at a different occasion. The participatory inventory, besides providing useful data can also be used as an opportunity for confidence building and to demonstrate commitment to the CFM process.

As it appears the training and manual provides for data suitable for use in strategic planning as might be envisaged for the CFM agreements mentioned in Section 5.2 but such agreements are not mentioned here. **There is a need to co-ordinate the Guidelines with training and to ensure that the technical as well as participatory aspects of CFM are properly positioned and represented in both**.

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Annex 1 – Terms of reference

REF. NO.	SC/08/2002
TITLE:	Non-Wood Forest Products, Assessment Methods and Plan of Action
DURATION:	Maximum 26 professional days.
TIMING:	May – June 2003.
LOCATION:	Based in Kampala, but with significant field work in rural areas
BACKGROUND:	The Forest Resources Management and Conservation Programme is actively involved with the conservation of key forest reserves in Uganda, particularly those with high biodiversity values. Many of Uganda's Natural High Forests (NHF) are a rich supply of timber and also numerous non-timber products such as rattan, medicinal plants and bamboo. Most of these areas, however are seriously threatened by ever increasing demand placed on them from surrounding communities. If such reserves are to stand any chance of survival, it is imperative to involve those stakeholders who have traditionally harvested various products and to provide them with information on sustainable harvesting methods and through participatory inventory and/or assessment methods.
OBJECTIVES:	To recommend participatory, reliable and practical methods of assessing selected NWFP in Uganda's NHF. To integrate NWFP assessment methods into standard Exploratory Inventory and/or Integrated Stock Survey and Management Inventory methods, and into the ongoing development of CFM Resource Assessment Guidelines.
SPECIFIC TASKS:	To carry out a general review of the various NWFPs within Uganda's key NHFs. Focusing on 1 or 2 Forest Reserves (to be selected in conjunction with FRMCP staff) to recommend and test / demonstrate methods of assessment of the most important NWFPs. To identify important NWFPs in (5) key focus Forest Reserves (and combined with the results of task 1, to identify national priority NWFP species for inclusion in general forest surveys. To document recommended methodologies for field survey and data analysis, ideally through integrating method into standard EI, ISSMI and CFM Participatory Resource Assessment methodologies. To assist the Technical Services Section of the EC-Forestry Programme to prepare a plan for inventory work within the selected FRs. To train key staff on survey and analysis methods.

Annex 2 – Sample results from the Sango Bay

Figure A2.1: Abundance of timber trees in Lugezi

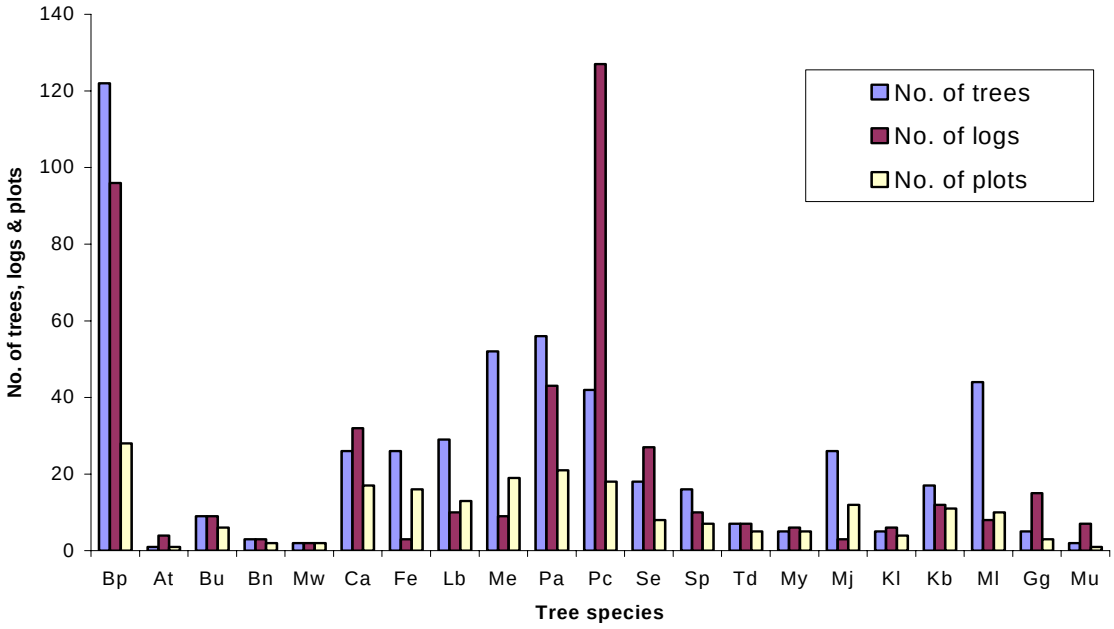


Table A2.1: Table of abundance and distribution of timber tree species in Kansolo

Species			Diameter classes					Numbers of		No. of plots	% plots
Bot. Name	Local name	Code	20-30	30-40	40-50	50-60	60+	Trees	Logs		
Albizia gummifera	Nongo	Alg	5	2	0	1,**7**	0	8	7	3	12.6
Antiaris toxicaria	Kirundu	At	1	0	0	0	0	1	0	1	6.3
Beilschmiedia ugandensis	Mwasa	Pf	10	5	0	0	0	15	0	5	31.3
Boscia phoberus	Mugwi	Bp	3	1	1,**4**	1,**7**	0	6	11	3	18.8
Canarium schweinfurthii	Muwafu	Cs	0	2	2,**9**	0	0	4	9	3	18.8
Chrysophyllum albidum	Mukalate	Muk	1	10	3,**10**	0	0	14	10	6	37.5
Entandrophragma cylindricum	Muyovu	Ecy	0	0	2	0	0	2	0	1	6.3
Funtumia elastica	Nkago	Fe	3	3	0	1,**7**	0	5	7	4	25
Lovoa brownii	Nkoba	Lb	5	3	0	0	0	8	0	4	25
Maesopsis eminii	Musizi	Me	13	8	1,**4**	0	0	22	4	6	37.5
Piptadeniastrum africana	Mpewere	Pa	8	4	3,**8**	2,**8**	0	17	16	5	31.3
Pseudospondias microcarpa	Muziru	Pm	17	4	3,**8**	2,**8**	0	17	16	5	31.3
Pycnanthus angolensis	Munaaba	Pc	2	3	3,**9**	4,**23**	0	12	22	3	18.8
Sapium elipticum	Musasa	Se	0	3	0	0	0	3	0	1	6.3
Spondianthus preussii	Mimbiri	Sp	0	0	1,**3**	0	0	1	3	1	6.25
	Mukejje	Mj	2	7	0	0	0	9	0	2	12.6
	Muteganjobe	Mb	0	2	0	0	0	2	0	1	6.3
	Muyanja	Mja	0	0	1,**3**	0	0	1	3	1	6.3
	Ensagulanyi	Eg	0	2	1,**4**	0	0	3	4	1	6.3
	Mubondo	Md	0	1	0	0	1,**1**	2	1	1	6.3

Non-bold figures are the number of trees and the bold numbers of logs.

Table A2.2: Average relative abundance scores of selected species in the five forest patches

Species	Forest patches				
	Lugezi	Mibalama	Kigona	Kansolo	Kansolo/ Kigona
Piptadeniastrum africana	0.78	0.25	1.25	0.45	1.1
Pseudospondias microcarpa	2.38	1.5	1.53	1.2	0.46
Boscia [phoberus?] – species not in Ugandan biodiversity database]	1.36	0.67	0.91	0.52	0.37
Pycnanthus angolensis	0.67	1	1.85	0.95	0.66
Maesopsis eminii	0.76	0.67	1.61	1.28	0.05
Beilschmiedia ugandensis	0.20	0	1.06	0.9	0.05
Entandrophragma cylindricum	0.07	0.08	0.68	0.32	1.01
Polyscias fulva	0.11	0.08	0	0.05	1.03
Harungana madagascariensis	0.55	0.25	0.41	0.67	0.81
Manilkara obovata	0.06	0.25	0	0	0

Figure A2.2: Distribution and abundance of Phoenix reclinata in Kansolo/Kigona

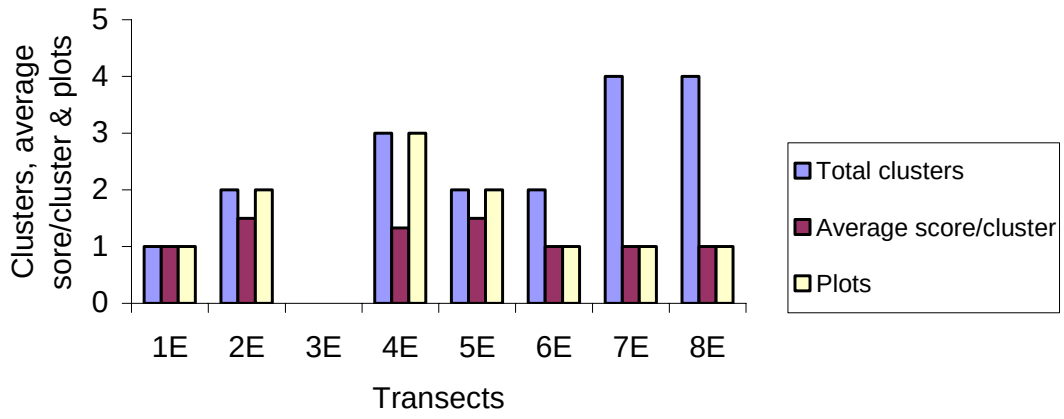


Table A2.3: Tree species diversity, relative abundance and distribution in Lugezi/Kigona

Species			Transect number										Average score	Number of plots	% Plots
Bot. Name	Local Name	Code	1E	2E	3E	4E	5E	6E	7E	8E	9E	10E			
Antiaris toxicaria	Kirundu	At	0.33	0.6									0.09	4	7
Beilschmiedia ugandensis	Mwasa	Bu			0.5	0.25	0	1				0.33	0.2	8	14
Blighia unijugata	Mukuzanyana	Bn	1	0.8						0.33			0.21	8	14
Bosquiea phoberus	Mugwi	Bp	2.33	3.4	1.67	2.13	0.57	0	0.25	1	1.67	0.67	1.36	33	61
Canarium schweinfurthii	Muwafu	Cs	0.3	0.8	0.5	0	0.28				0.33	0	0.22	11	20
Cordia Africana	Nkalati	Ca	1.33	0.8	0	0.25	0	0.33	0	0.33	0.67	0.33	0.4	12	22
Entandrophragma cylindricum	Muyovu	Ec	0.33	0.4									0.07	3	5
Ficus exasperata	Mwawu	Fx		0.8	0.15		0.28				0.33		0.15	11	10
Ficus natalensis	Mutuba	Fn			0.17								0.01	1	1
Funtumia elastica	Nkago	Fe	1	1.4	0.67	0.5	0.42				0.67	0.33	0.39	22	40
Harungana madagascariensis	Mukabira	Hm	0.33	1	0	0.87	0.42	0.33	1	1	1		0.55	15	27
Maesopsis eminii	Musizi	Me	0.33	1.2	0.8		0.85	1.33	0.5	1.67	0.67	0.33	0.76	25	46
Manilkara obovata	Nkunya	Mo								0.33	0	0.33	0.06	2	3
Markhamia lutea	Musambya	Mt	0	0.4									0.04	2	3
Piptadeniastrum africana	Mpewere	Pa	2	2	0.83	0.75	1		0.25	0.33			0.78	16	29
Polyscias fulva	Setala	Pf	0.33	0.2	0	0.25		0.33					0.11	4	7
Pseudospondias microcarpa	Muziru	Pm	3	3.8	3.5	2.5	2.42	0.66	0.5	3.33	4	1.33	2.38	33	61
Pycnanthus angolensis	Munaaba	Pc	0.67		1	2	0.87	0.33	0.5	1	1	0.33	0.74	23	42
Sapium elipticum	Musasa	Se	0.33	0.6	1.3	1.13	1.57	0.33	0.25	1.33		0.67	0.75	25	46
Scolopia sp.	Nkanaga	Sc	0.67		0.17				1	0.67	0.33		0.28	7	12
Spondianthus preussii	Mimbiri	Sp	0.33		0.33	0.88	1	0.67			0.67	0.33	0.42	16	29
Teclea nobilis	Enzo	Tn	2.67	2.6	0.67	0.37	0.57	0.33	0.75	0.67	1		0.96	23	42

Species			Transect number										Average score	Number of plots	% Plots
Bot. Name	Local Name	Code	1E	2E	3E	4E	5E	6E	7E	8E	9E	10E			
Trichilia dregeana	Ssekoba	Td			0.33		1				0.33		0.17	4	7
Vernonia amygdalina	Mululuza	Va		0.2									0.02	1	1
	Mweya	My	1.33	1	0.33								0.26	9	16
	Mukejje	Mj	0.33	1.4	1.5	1.25	1		0.25	2	0.67	0.67	0.91	26	48
	Kafunkula	Kl	1.33	1.2	0.5	0.25				0.33		0.33	0.39	15	27
	Kabandagala	Kb		0.8	0.67	0.87	1.28	0.33		0.33			0.31	18	33
	Mutangalala	Ml	1		2.3	2.25	0.42			2.67		0.33	0.89	22	40
	Nyamwezi	Ny		0.6									0.06	3	5
	Entankwa	En		0.2					0.25				0.05	2	3
	Mutwalabafu	Mf		0.2			0.28						0.05	3	5
	Ekajjolyenjovu	Ek		0.6									0.06	3	5
	Tokenkulukulu	To	1.33			0.63	1				0.33		0.32	11	20
	Mukalate	Mk		0.6	0.5	0.25							0.13	6	11
	Mutanjobe	Mb	0.67	0.8	0.17				0.75				0.23	8	14
	Nserere	Ns		0.4									0.04	2	3
	Katazimiti	Kz		0.2			1						0.12	2	3
	Nalijwalimu	NW	0.67	1			0.28				0.33		0.22	7	12
	Musekera	Ms			0.67	1.5				4	3.67	2.33	1.11	18	33
	Mutengo	Mg			0.17								0.02	1	1
	Murungu	Mr			0.17	0.38						0.35	0.09	4	7
	Nsali	Na	1.33		1	0.17	0.5						0.3	8	14
	Mubondo	Md				0.5						0.33	0.08	4	7
	Omugege	Og				0.12							0.01	1	1
	Ensagulanyi	Eg				0.12							0.01	1	1
	E nzibaziba	Eb				0.37	0.85		1.75	2	1.67	2	0.86	11	20
	Katinsanvu	Ks	0.33				0.42					0.67	0.14	4	7
	Nselele	Nl	0.67										0.07	4	7
	Omubalira	Ob	0.33		0.17						0.33		0.08	3	5
	wild coffee	Km	0.33	0.8	0.5						0.33		0.19	8	14
	Mutubatuba	Mbb		0.2	0.17			0.33					0.07	4	7

Species			Transect number										Average score	Number of plots	% Plots
Bot. Name	Local Name	Code	1E	2E	3E	4E	5E	6E	7E	8E	9E	10E			
	Emmo	Emm		0.4	0.67								0.1	5	9
	Munabumba	Mmb		0.6									0.06	3	5

Annex 3 – Plant specimen description form

Date		Collector		Specimen	
Forest		Cmpt		Village	
GPS east		GPS north		Altitude	

Physical features	
Vegetation type	
Plant type	
Approx. size	
Leaves	
Bark	
Slash	
Flowers	
Fruit	
Comments	
Local description	

NOTES:
Plant type – herb, shrub, tree, climber, palm etc.
Bark - texture; thickness; presence of thorns, spines, prickles, conical bosses, mottled lesions, prominent lenticels etc.
Slash - texture; patterns; exudate presence and type, smell; colour change on exposure to air or water, etc.
Flowers - colour, size, arrangement etc.
Fruits - type of fruits, size, placement, nature of the seeds etc.

Annex 4 – Guidelines for specimen collection

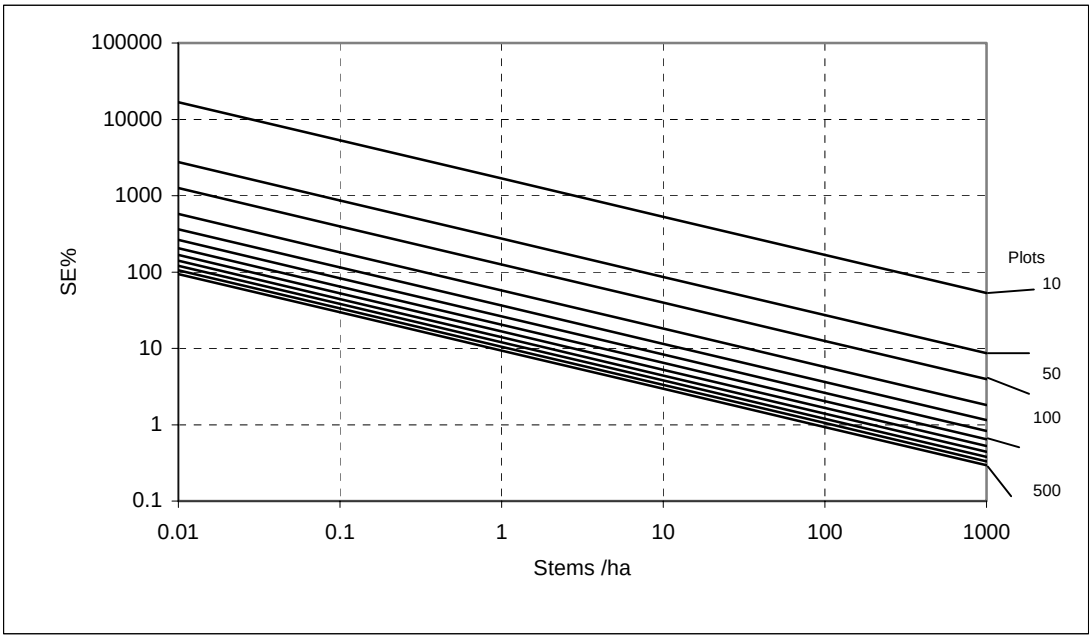
Golden Rule: Always describe the plant on site, rather than trying to rely on your memory at the end of the day. After a long busy day with hundreds of specimens, it is not easy to remember what you saw where earlier in the day.

A specimen should be representative so as to portray as much of the distinguishing characteristics of the plant as possible. Try to select normal plants.

1. For most plants, the specimen collected should be a branch cut in such a way that the leaf arrangement (alternate or opposite) is preserved and can be displayed. Normally the end of the branch is included to show any presence or absence of buds or stipules which may only be apparent at the branch tips.
2. To avoid discrepancies in leaf size and shape between juvenile specimens and older ones, attempts should be made to collect mature material, preferably with flowers and or fruits. Collection of seedlings as the only specimen should be avoided whenever possible.
3. In species that have separate male and female flowers growing on the same plant, both types should be collected.
4. In species where male and female flowers are on separate plants, attempts should be made to collect both sexes.
5. In plants where there is significant variation between the young versus old leaves (i.e. leaf shape, colour etc. changes as the plant ages) attempts should also be made to collect samples of each type of leaf.
6. For large leaved plants such as palms, which cannot fit on a herbarium sheet, pieces of the leaf usually representing the tip, middle part and base should be collected. A draft drawing of the entire leaf or photograph, descriptions and measurements should accompany the specimen. Where compound leaves are too big to fit on a herbarium sheet, the leaflets can be trimmed to leave the shortest and longest leaflet on the main stem which can be folded in such a way that its true length can be measured.
7. Avoid the temptation of collecting only the small leaves, which are more convenient to press, as they are not representative of the plant.
8. For very small plants, collect as many as need to fill the pressing sheets, but avoiding depletion of the source.
9. Plants collected for preservation should be tightly tied and pressed before drying to avoid shrinkage.
10. Drying succulent plants in a press can be very difficult. To ease this problem, immerse the specimen in hot water for a few minutes until it is dead before pressing and drying.
11. Flowers and fruit that grow on the main trunk or mature branches (e.g. Ficus) should be carefully detached from the stem with a precise description of the mode of attachment, or a photograph can be taken of the natural position.
12. For plants with bulbs or corms, dig up the underground structure, slice (longitudinally) part of the bulb or corm for pressing, or take a photograph or sketch drawing of it. Before pressing, the bulbs or corms may need to be first killed as described above for succulent plants.

13. Delicate structures (such as very soft flowers) that will get damaged beyond recognition after drying should be preserved in a (plastic) bottle full of liquid preservative such as alcohol.

Annex 5 – Variation of SE% with stem density and number of plots



Annex 6 – Derivation of the RME

Having obtained a set of data from n sample plots the calculations to determine the RME are given below.

n	number of plots
$\bar{x} = \frac{\sum x}{n}$	mean
$se = \sqrt{\frac{s_x^2}{n-1}}$	standard error of the mean
$n-1$	degrees of freedom
$t_{\alpha(1)}$	one tailed t value at α = 0.05 (to give the 95% level)
$\bar{x} - (set_{\alpha(1)})$	RME for the sample