THE IMPACT OF SUBSISTENCE USE OF FOREST PRODUCTS AND THE DYNAMICS OF HARVESTED WOODY SPECIES POPULATIONS IN A PROTECTED FOREST RESERVE IN WESTERN ZIMBABWE

By

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Declaration

I, John Mudekwe, the undersigned, hereby declare that the work contained in this dissertation is my own original work and that I have not previously in its entirety or in part submitted it at any university for a degree.

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ABSTRACT

Developing sustainable mechanisms for use-management of forest products by user communities has been suggested as a possible solution to the often-observed conflict between forest use and the conservation of protected forests. In Zimbabwe, the use of forest products in protected forests by local communities has a long history, but few studies have explored both the socio-economic and ecological aspects of this use.

This study was conducted in the *Baikiaea plurijuga* forests and woodlands in and around Fuller Forest in western Zimbabwe, protected since 1943. It explored the characteristics and dynamics of forest products use by communities surrounding this protected forest. Further, the demography and dynamics of commonly harvested woody species was examined in order to establish the present status of populations of these species. This examination, focusing on diameter class distributions, was aimed at informing whether species populations were expanding, stable or declining in view of their capacity to continue providing required goods and services.

Results indicated that all households, rich and poor, were harvesting at least some forest resources from the protected forest, with the most frequently harvested resources being firewood, wood for curios, thatch grass, wild fruits, timber for construction and fencing and those who owned livestock used the forest for livestock grazing. The extraction and use of 23 different products was recorded across the villages. The top five harvested forest products in terms of the mean proportion of households using them were fuelwood, building poles, thatch grass, wild fruits and broom grass. Forest products were harvested both for own consumption and for sale.

At present *Baikiaea plurijuga*, *Colophospermum mopane, Brachystegia spiciformis, Diplorhynchus condylocarpon, Commiphora mocambicensis* and *Bauhinia petersiana* out of 14 commonly harvested species appear to have relatively stable populations as indicated by their inverse J-shaped diameter class distribution profiles.

Preliminary indications from this baseline information point towards the successful integration of local use of forest products and conservation objectives noting that there is need for caution until further studies as recommended in this study are taken.

OPSOMMING

Die ontwikkeling van meganismes vir volhoubare bestuur vir gebruik van bosprodukte deur gebruikersgemeenskappe is al voorgetsel as ‘n moontlike oplossing tot die dikwels waarneembare konflik tussen gebruik en bewaring van beskermde bosse. In Zimbabwe, die gebruik van bosprodukte in beskermde bosse deur plaaslike gemeenskappe het ‘n lang geskiedenis, maar slegs ‘n paar studies het beide die sosio-ekonomiese en die ekologiese aspekte van sodanige gebruik verken.

Hierdie studie is gedoen in die Baikiaea plurijuga bosse en boomveld in en aangrensend aan Fuller Forest in westelike Zimbabwe, wat sedert 1943 beskerm is. Die studie het die eienskappe en dinamika van die gebruik van bosprodukte deur gemeenskappe rondom ‘n beskermde bos verken. Verder is die demografie en dinamika van dikwels gebruikte houtagtige soorte ondersoek om die huidige status van populasies van hierdie soorte te bepaal. Hierdie ondersoek het gefokus op deursneeklasverdelings met die doel om vas te stel of die soorte uitbreidend, stabiel of afnemend is in terme van hul kapasiteit om steeds die verlangde goedere en dienste te lewer.

Die resultate het getoon dat alle huishoudings, ryk en arm, oes ten minste sekere bosbronne van die beskermde bos, met vuurmaakhout, hout vir houtsneewerk, dekgras, wilde vrugte, hout vir konstruksie en heinings, en beweiding deur vee van mense wat wel vee besit, as die mees dikwels gebruikte bronne. Die oes en gebruik van 23 verskillende produkte is oor die verskillende klein dorpies (villages) aangeteken. Die top vyf ge-oeste bosprodukte in terme van gemiddelde proporsie van

huishoudings wat hulle gebruik, was vuurmaakhout, boupale, dekgras, wilde vrugte en besemgras. Bosprodukte is vir beide eie gebruik en verkoop ge-oes.

Van die 14 algemeen ge-oeste soorte toon *Baikiaea plurijuga*, *Colophospermum mopane, Brachystegia spiciformis, Diplorhynchus condylocarpon, Commiphora mocambicensis* en *Bauhinia petersiana* tans relatief stabiele populasies, volgens hulle omgekeerde J-vormige deursneeklasverdelings.

Voorlopige aanduidings vanuit hierdie basisinligting dui op ‘n suksesvolle integrasie van die plaaslike gebruik van bosprodukte en die bewaringsdoelwitte, met inagneming van die behoefte vir versigtigheid totdat verdere studies onderneem is soos in hierdie studie aanbeveel is.

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The views expressed here are those of the author and may not reflect the opinion of individuals and institutions mentioned above. The author takes responsibility for any errors and omissions.

ACRONYMS

BH	Bore hole
CAMPFIRE	Communal area management programme for indigenous resources
CIFOR	Centre for international forest research
CM	Centimetre
DBH	Diameter at breast height
DFID	Department for international development
DNPWLM	Department of national parks and wildlife management
FAO	Food and agriculture organisation
FC	Forestry commission
GPS	Global positioning system
ITTO	International timber trade organisation
KS	Kalahari Sands
MLGRUD	Ministry of local government, rural and urban development
NTFP	Non timber forest products
PRA	Participatory rural appraisal
SFM	Shared forest management
UNEP	United nations education programme
USD	United states dollar
VIDCO	Village development committee
WADCO	Ward development committee
ZWD	Zimbabwean dollar

1. CONFLICTS BETWEEN CONSERVATION AND RESOURCE USE

1.1 Introduction

Protection of forests through proclaimed reserves, and setting aside timber concessions, often alienate local people who formerly depended on those resources for their subsistence livelihoods. The current problem is how such protected forests can be managed to address the diverse needs for subsistence use by poor, rural people, extraction of commercial timber, ecotourism use and conservation of the forests? An opportunity exists to explore these dependent but conflicting issues using an example from a protected forest reserve in western Zimbabwe. Protected forest reserves in western Zimbabwe are characterised by state ownership, control and management. The forests were reserved for their importance as water catchment areas, stabilisation of the fragile Kalahari Sand ecosystem, biodiversity conservation, production and protection of merchantable timber species, and the protection of wildlife (Judge 1975). The current forest policy and legal framework in Zimbabwe has no direct concerns with rights of ownership, access and use of protected forests by forest adjacent communities (Mohamed Katerere 2000). The lack of a legal framework supporting local use of protected forests has resulted in the destruction of forests and the degradation of forest resources through poaching of forest products, causing of wildfires and overgrazing (Mutsiwegota and Mudekwe 1998; Matose and Clarke 1993).

Humans have historically depended on forests for a variety of plant and animal products (Posey 1982; Denevan 1992; Bradley and Dewees 1993; Burger 1993; Campbell *et al.* 1996; Clarke *et al.* 1996). Households tend to be involved in harvesting, collecting, processing, consuming, and selling forest products to complement outputs from agricultural activities (Arnold 1998). Large numbers of rural people generate a portion of their income from forest products (Arnold 1998). For some households the forest-based income generating activities can be a major income source

(Arnold 1998). Forests also provide a reserve of products upon which people can fall back for subsistence and income in times of hardships, for example crop failure or unemployment (Arnold 1998).

The demand for non-timber forest products for subsistence and the encroachment into forests for agriculture and settlement purposes have increased the rate of forest loss and forest degradation in many places around the world (Rai and Uhl 2004). This has partly undermined the original conservation values of protected forests such as protection of commercial timber species, conservation of biodiversity and the protection of soil and water (Judge 1975). Following the influential study on the potential high social and economic value of forests to local indigenous communities (Peters *et al.* 1989; see Sheil and Wunder 2002 for a critique) the harvesting of forest products by local communities was widely proposed as a strategy to stem the rate of deforestation and forest degradation while enhancing local livelihoods (Nepstad and Schwartzman 1992). This 'good harvesting' approach has spawned much research on the role of non-timber forest products in forest conservation (Peters 1996) and livelihoods (Godoy *et al.* 1995). There are few studies in Zimbabwe (Vermeuelen 1993; Forestry Commission 1994a; Cunliffe 2000) that have explored the contribution of forests, particularly the protected forests, to the welfare of rural communities living adjacent to these forests. Studies that have been conducted in various types of forests and woodlands in communal areas around Zimbabwe and in other southern African countries have shown that most rural households are harvesting a wide range of products from the forests and woodland resource base for household consumption and for sale (see for example Clarke *et al*. 1996 for Zimbabwean examples; Cunningham 1990 and Shackleton 1993a for South African examples). In his study, Cavendish (1996) showed that poorer and more vulnerable households tend to be more dependent on the natural resource base and use a greater diversity of these natural resources compared to richer households with access

to alternative livelihood resources. Other studies showing the importance of forest products to rural livelihoods include those of Arnold *et al*. (1994), Clarke *et al*. (1996) and Shackleton and Shackleton (2000, 2003). Factors such as population growth, land shortage, environmental calamities, and loss of employment enhance the importance of forests in meeting household needs. Where farming is marginal and where the high probability of crop failure has an influence on the survival of rural households, survival through forest products exploitation becomes an important factor (Clarke *et al*. 1996).

Studies by Kumar (2002) and Padoch (1992) on the harvesting, use and commercialisation of subsistence forest products suggest that an emphasis on these products as a major source of livelihoods for the poor rural communities might be flawed because access to these products is often socially inequitable and that markets for non-timber forest products are frequently unstable, situations that make achieving sustainable livelihoods difficult. Further, in tropical and sub-tropical forests most non-timber forest products occur at low densities (LaFrankie 1994; Peters 1994), complicating the thrust on harvesting non-timber forest products to enhance local livelihoods. In practice, emphasis on harvesting and utilisation of forest products by local communities might be problematic in view of achieving sustainable forest management if issues such as access to forest products, market availability and improvements of the stocking of the resource base are not addressed.

In the process of contributing to rural livelihoods, forests are not only experiencing intensified pressures arising from harvesting for subsistence consumption; they are also experiencing increased pressure from harvesting for commercial purposes (Shackleton 1996; Rai and Uhl 2004). The harvesting of forest products has implications for the ecology of the resources being exploited (Peters 1994, 1996). For example, Peters (1996) and Momberg *et al.* (2000) have

reported that the lack of security of tenure on forest resources, as commonly encountered in state-controlled forests, often results in adverse ecological impacts such as damage during harvesting, suppressed regeneration due to over-grazing and anthropogenic fires and over-harvesting of the best genotypes of plant and animal species. Therefore, there is often conflict between usage of forest resources and the need to conserve them. Ecological effects of harvesting non-timber forest products have been shown to be higher than expected (Padoch 1992). There is growing evidence that in practice the harvesting of non-timber forest products does not often follow the concept of 'good harvesting' (Rai and Uhl 2004). An impoverished resource base, therefore, might not be able to pull out poor rural communities from the vicious poverty cycle. Therefore, sustained-use management of the forests requires that the essential ecological processes of disturbance and recovery are understood so that there is balanced availability and optimal utilisation of the forest products (Geldenhuys 2004).

In most countries of Sub-Saharan Africa forest related policy and legal frameworks are remnants of the colonial period placing emphasis on policing forests and managing forests for the production of commercial timbers (Judge 1975; Katerere *et al.* 1993; Malaya 1996). Under these legal frameworks the local communities and their dependence on forests have been ignored (Banerjee 2000; Wily 2000). Due to the inappropriate legal frameworks there are problems of ensuring that forests maintain their capacity to provide various social and economic products as well as preserve their biological diversity for future generations. There might be conflict of interests and objectives between social needs and values of local communities and the national economic and service values placed on the forests. The problem becomes in deciding which values to promote i.e. local values or national values or a compromise between the two.

Linking forest conservation and improved livelihoods can be placed within the overall sustainable development and sustainable forest management paradigms, which have been evolving over the last few decades (Rai and Uhl 2004). Internationally, subsistence use of forest products has given rise to a thesis that sustainable forest management for non-timber forest products should be socially, economically and environmentally sound, encouraging the idea that utilisation and conservation may be pursued jointly (Falconer and Arnold 1989; Balick and Mendlesohn 1992). In practice there might be several factors that militate against this thesis. These may include policy and legal frameworks that are not supportive of local use of forests, diminishing or degrading forest products that are not capable of enhancing local peoples' livelihoods and conflicts between use and service values of forests.

The controlled harvesting and use of plant and animal products in protected forests by local people has been suggested as a possible solution to the observed conflict between forest use and conservation. Few studies have explored both the social and ecological aspects of forest products harvesting (see for example, Timmermans 2000 and Rai and Uhl 2004). In order to fill this gap in Zimbabwe, there was a need to undertake such a study in a protected forest reserve where village communities were observed to be heavily dependent on the state-controlled forest for their resource needs. This presented a suitable case to examine the dynamics of forest resource use and the ecological impacts of harvesting the forest products. Understanding this scenario would assist in the development and implementation of an integrated management system for the protected forest and the model could be up-scaled in other protected forests if found successful.

Literature of new management systems that integrate use and forest conservation is scarce but see for example Ford Foundation (1998), Wily (2000), Rai and Uhl (2004) and Geldenhuys

(2005) for people focused forest management approaches and recommendations and guidelines for implementing improved use-management practices in the management of indigenous forests.

1.2 Problem context

Two main problems are apparent in the context of the management of the protected forest reserves in Zimbabwe. These are the socio-economic and ecological problems as perceived by forest adjacent communities and by the Forestry Commission respectively.

1.2.1 The socio-economic problem

Rural people throughout the world make extensive use of biological resources for both home consumption and income generation (Cunningham 2001; Koziell and Saunders 2001). Tree and forest resources have been important for indigenous peoples for millennia (von Maltitz and Shackleton 2004). Poor rural and urban people rely on a variety of forest products for construction, food, craft, medicine and energy (von Maltitz and Shackleton 2004.)

In Zimbabwe, like elsewhere in Africa and the world, the processes of demarcating and gazetting state forests alienated the indigenous peoples who had lived in the protected forests and subsisted on the forest products (Mohammed Katerere 2000; Wily 2000; Banarjee 2000). The indigenous peoples' rights to customary use of the protected forests and forest resources were abolished through the application of the forest legislation. Use was only possible through permits or licences as a means of controlling use activities in order to achieve set forest conservation and management objectives. Presently local communities living around protected forests are contesting ownership and control of the forests and the forest products (Matose and Clarke

1993). The main area of contention is denied access to subsistence forest products that are important for their livelihoods. Further, the communities detest the permit and licensing system of getting access to forest resources as they perceive that the permits limit them on choices of what they prefer to harvest, the number of people allowed in the forests at any one time, the areas from where to harvest products and the type of transport allowed into the forests. However, these perceptions might be misguided, as even under the pre-colonial traditional forest management systems control of use of natural resources was necessary to avoid over-exploitation and mismanagement.

The result of restricted access to protected forests has been increased cases of encroachment for settlements and agriculture and poaching of timber and non-timber products. While that might be so, these use practices deny the local people future dependence on use of the forest resources. The communities do not see sustainable use as a means to ensure future access to the important resources, as they want to maximise benefits in the short term in contrast to the long-term conservation objectives of the state. What the communities fail to realise is that the application of the forest legislation is to ensure there is reasonable restrictions on the public's access to the forests so that management activities are not interrupted and the conservation efforts are not compromised by unsustainable subsistence use.

Meanwhile increased use of force by the Forestry Commission in an attempt to control use and protect the forests is being met with increased resistance. Relationships and attitudes on both sides have become polarised (Matose and Clarke 1993). There is need to reconcile the differences so that the forests continue to meet the subsistence needs of the local communities and the national objectives of setting aside proclaimed forests. This is important because forests become sources of subsistence during difficult times such as years of crop failure or periods of

unemployment (Arnold 1998; Shackleton and Shackleton 2004). The current illegal and uncontrolled use practices of Zimbabwe's protected forests are unsustainable as they destroy and degrade the resources base on which local livelihoods and the national forest-based economy are based. An integrated management approach is required in order to ensure future availability of the forest resources and an improved forest-based standard of living for the local communities.

1.2.2 The ecological problem

The harvesting of forest products for direct household provisioning and for commercial purposes might have implications for the ecology of the resources being exploited (Padoch 1992; Peters 1994, 1996; Momberg *et al.* 2000; Geldenhuys 2004). The delicate ecological balance maintained in protected forests can easily be disrupted by human intervention. Forest use practices may seem benign but in the longer term can impact severely on the structure and dynamics of the forest ecosystem (Peters 1996; Cunliffe 2000).

Selective harvesting practiced on woody communities may have positive or negative effects on the forests. On the positive side gaps created in the canopy will improve light levels and soil temperatures on the forest floor. The improved light and temperature conditions encourage increased growth of suppressed seedlings and saplings into the canopy layer. New species may also colonise the gaps. This improves stand structure and species composition. On the negative side the improved forest floor conditions encourage the growth and development of grasses, shrubs and herbaceous plants that compete with regeneration of the canopy trees (Peters 1996). This competition may result in the complete failure of canopy tree species to establish in the forests, a situation that may gradually affect the species composition of forest stands and the availability of favoured canopy species (Calvert 1993). Further, the grasses and shrub thickets

increases the forest fire hazard where occurrence of fire would damage or kill fire intolerant plant species. However, fire within a regime to which the species are adapted may also facilitate their establishment (Geldenhuys 1977).

Although the vegetation in the protected forests has evolved under regimes of periodic and regular natural and anthropogenic fires (Calvert 1974, 1993), a single severe fire can destroy hundreds of years of accumulated growth. There is evidence suggesting that fire hampers the regeneration and development of fire sensitive woody species (Calvert 1974; Geldenhuys 1977). Frequent late dry season fires can result in wooded vegetation areas being converted to grasslands (Calvert 1986a). Some plant species are more resistant to fire than others, and particular fire regimes will favour certain species at the expense of others thus resulting in changes to species composition and forest stand structure (Trapnell 1959; Calvert 1993). In his studies in the Kalahari Sand forests, Geldenhuys (1977, 1991) found that there is management conflict between *Baikiaea plurijuga* proliferation with the exclusion of fire, and *Pterocarpus angolensis* proliferation with fire. The Forestry Commission perceives that the main source of fire in protected forest is forest adjacent communities (Forestry Commission 1994a; Cunliffe 2000).

The intensive selection of preferred tree sizes may also lead to changes in the stem diameter distribution of forest stands (Shackleton 1993b; Peters 1996). In a study in the eastern Lowveld of South Africa, Shackleton (1993b) found that woody species experiencing intensive size preferences exhibited reduced numbers of size classes available and reduced individuals in particular size classes.

The Forestry Commission strongly perceives that the subsistence harvesting of the woody component in the protected forests has impacted on the population structure and composition of the species being harvested and that the populations have become unstable and cannot maintain themselves (Forestry Commission 1992). There is need to investigate whether use and management practices in protected forests have impacted on the population structures of species being harvested. Such information would be useful for planning harvesting yields and implementing silvicultural practices that enhance productivity of the plant resources.

These social and ecological problems necessitated the need for the present study to explore both the social and ecological aspects of forest products harvesting and use in order to develop integrated and sustainable use-management approaches for the protected forests in Zimbabwe.

1.3 The goal of this study

It is the intention of this study to provide a model for integrating social and ecological aspects in the management of protected forests in Zimbabwe and in the region. Results from this study could provide many potential opportunities to influence the use-management of protected forests and woodlands. The guiding philosophy under which this study was undertaken was that sustainable forest management should be both socially and ecologically sound and that forest use and conservation may be pursued jointly.

1.4 Objectives and key research questions

The main objective of this study is to develop sustainable forest resource use and forest management approaches that would benefit local people and the forest environment. The study is

guided by two specific objectives directed at exploring the basis for sustainable management of protected forests.

Forest resource use

1. To determine the overall use patterns of forest products by rural communities living around a protected forest reserve.

Key questions:

(i) What is the dimension of forest products utilisation in the protected forest i.e. types of products extracted and used, purposes of harvesting, when are products harvested/collected, who are involved in harvesting/collecting, where are the products collected from in the forest?

(ii) What are the perceptions concerning the historical trend in the management of the protected forest reserve and the availability of the forest products?

(iii) What kinds of households are most dependent on the forest products?

(iv) What are the local perceptions on the impacts of forest products use and how realistic are they?

Forest resource base

2. To assess the present status of populations of the commonly targeted woody species within the protected forest reserve.

Key questions:

(i) Are populations of the commonly targeted woody species stable?

(ii) How has use impacted on the population structure of the commonly harvested woody species?

Sustainable forest management

3. To develop a strategic framework for the integrated and sustainable management of the forest.

Key question:

(i) How could results from the socio-economic and ecological studies be integrated to improve the sustainable management of the forests for their products and services for the well-being of all relevant stakeholders?

Hypotheses:

(i) Forest neighbours are not depended on forest products in protected forests for subsistence.

(ii) Subsistence use has no effect on populations of woody species being harvested.

2. PROTECTED FORESTS OF WESTERN ZIMBABWE AND THEIR MANAGEMENT HISTORY

2.1 Forests of western Zimbabwe

The *Baikiaea plurijuga* forests and woodlands in western Zimbabwe cover about 2 million hectares or 5% of the land surface of Zimbabwe (Judge 1986; Figure 1). The Forestry Commission has jurisdiction (management control) over about 40% (874 400 ha) of this area (Table 1). The rest is controlled on land managed by the Parks and Wildlife Authority (568 000 ha), on communal land in six rural districts in western Zimbabwe (638 000 ha), and on large and small-scale commercial farms (344 000 ha). The Forestry Commission land covers 508 600 ha that is productive forests in terms of commercial timber production and the balance is unproductive forest (Judge 1986).

The *Baikiaea plurijuga* forests and woodlands are primarily found on Kalahari Sand with the main occurrence located on ridges or plateaux between rivers flowing north-westwards to the Zambezi River. They have declined greatly in extent and condition during the past century, almost entirely as a result of disturbance by man (Piearce 1986; Wood 1986). In the communal areas and to some extent on commercial farms, *Baikiaea plurijuga* forests and woodlands exist in theory only, much having been cleared for agricultural purposes (Judge 1975; Wood 1986).

By harvesting plants for direct household provisioning and for commercialisation, or clearing forest to allow settlements, cultivation and ranching, man has directly altered the vegetation of the *Baikiaea plurijuga* forests and woodlands (Wood 1986). What remains is still of

Table 1. **Protected forest reserves in western Zimbabwe controlled by the Forestry Commission**

Province	District	Forest land	Area (Ha)	Productive (Ha)	Non-productive (Ha)
Matabeleland North/western Zimbabwe	**Binga**	Kavira	28 200	8 600	19 600
		Sijarira	25 600	-	25 600
		Mzolo	67 000	35 000	32 000
	Bubi	Bembesi	55 100	39 240	15 860
		Molo	2 900	2 580	320
	Lupane	Gwaai	144 300	105 020	39 280
		Lake Alice	39 000	24 360	14 640
		Ngamo	102 900	56 210	46 690
	Nkayi	Gwampa	47 000	35 490	11 510
	Umguza	Chesa	14 248	6 780	7 468
		Inseze	35 200	24 550	10 650
		Inseze Extension	8 400	6 010	2 390
		Umgusa	32 200	28 500	3 700
		Umzibani	2 471	2 260	211
	Hwange	Fuller	24 700	16 470	8 230
		Kazuma	24 000	15 420	8 580
		Panda Masuie	33 500	29 300	4 200
		Sikumi	55 700	24 750	30 950
Midlands	**Gokwe**	Mafungabusi	105 000	48 000	57 000
	Totals		**847 419**	**508 640**	**338 779**

(Source: Forestry Commission 1992)

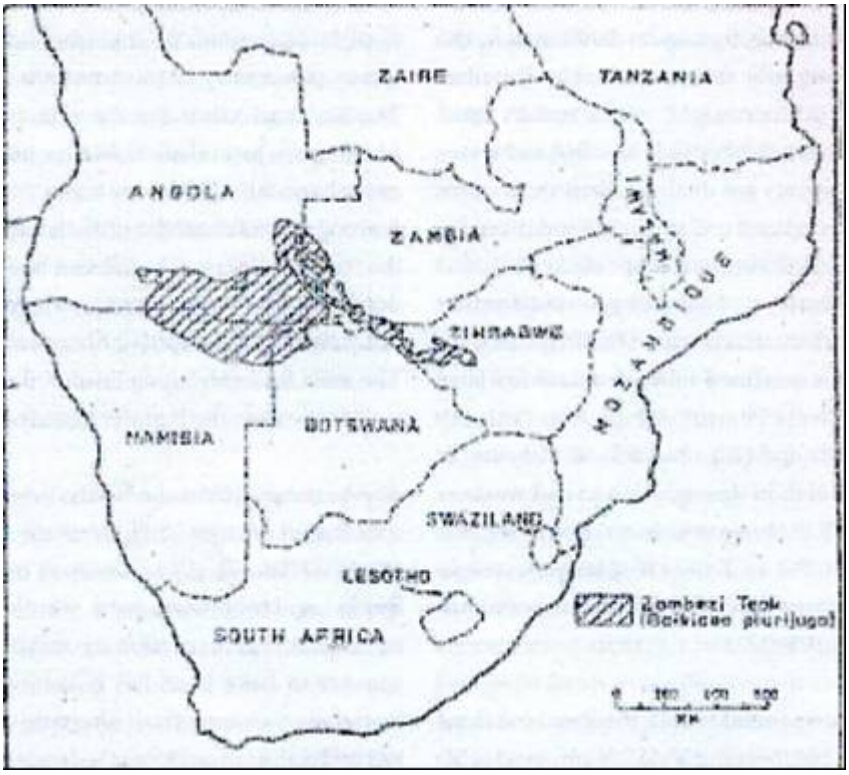


Figure 1. ***Baikiaea plurijuga* forests in central southern Africa and western Zimbabwe**
(Source: Huckabay 1986)

considerable importance economically, ecologically and socially. However, the virtual degradation of these forests is imminent if extensive commercial and subsistence exploitation and devastating fires continue unchecked.

In Zimbabwe the state owns all the protected forests and the resources therein. The state can grant leases and permits for use, occupancy and management of these forests to individuals or private enterprises according to the provisions of the Forest Act (Mohammed Katerere 2000). The Zimbabwe Forestry Commission in the Ministry of Environment and Tourism manages the protected forest reserves. The management includes protection, development and promotion of sustainable use of forest and wildlife resources. The first forests to be proclaimed and gazetted under the Land Apportionment Act of 1930 were Gwaai and Ngamo Forest. Many other forests were gazetted under repeated amendments to the Act up until 1969 when the Land Tenure Act repealed the land Apportionment Act. The new Land Tenure Act described the official gazetted forest estate amounting to a total of about 847 400 hectares (Judge 1975).

2.2 Developments in forest management in western Zimbabwe

2.2.1 Management of the Baikiaea forests: historical overview

Due to the economic and ecological importance of *Baikiaea* forests to the nation in particular and the local people in general, there was an early development of interest in conservation and management of the forests in the early 1900s, particularly with respect to the gazetting and protection of forest reserves. Commercial timber exploitation was taking place in these forests by 1904, the first forest officer was employed in 1925, fire management activities were instituted in 1930 while schemes to deal with previous occupiers of the forests took place around the 1960s.

Wildlife management and the development of related tourism activities began in selected forests in the late 1950s (Judge 1975).

2.2.2 Management objectives for protected forests

The Forest Department was established in the then Southern Rhodesia in 1920 under the Ministry of Agriculture but it was not until 1925 that a forest officer was posted to manage the *Baikiaea* forests in western Zimbabwe. The officer was actually based at Fuller railway siding 8 km away from the present location of Fuller Forest offices. The immediate terms of reference for the forest officer were to develop plans for the control of timber concession activities, fire protection and to develop a Working Plan for the protected forests estate in western Zimbabwe (Judge 1975, 1986).

Four main management objectives were set out in order to achieve sustainable management of the *Baikiaea* forest in western Zimbabwe: (i) to produce exploitable timber of the main commercial species on a sustained yield basis; (ii) to increase productivity through multiple land-use practices including utilisation of minor forest products; (iii) to increase the soil and water conservation value of the forests; and (iv) to develop the amenity value of the forests. Over the last few decades, the role of the protected indigenous forest reserves towards the conservation of biodiversity and towards their contribution to rural livelihoods has been increasingly highlighted (Matose and Clarke 1993; Forestry Commission 1994a; Mutsiwegota and Mudekwe 1998; Cunliffe 2000). These objectives have not changed much since their initial adoption despite the global initiatives in new forest management systems. In practice these objectives focused on timber and wildlife production and enhancing the ecological services of the forests. The multiple land use practices implied in these objectives were never developed fully. The problem then, as

now, was how to put these ideals into practice given the then inherent focus on protectionist management approach to the forests and the lack of skilled field staff to implement the ideals. Judge (1986) recognised that wildlife and timber production, livestock grazing, tenant agriculture and livestock production in suitable areas, use of minor forest products all have roles to play in the development of *Baikiaea* forests. He further commented, "When one examines the economics and ecological services, particularly the return per unit generated by each of the multiples, it is clear that to adopt any policy other than multiple land use would be foolish". However, forest management in protected forests has remained focused on production of timber and wildlife, fire protection and protection from unauthorised local use.

2.2.3 Timber concessions

Timber exploitation by private concessions was first recorded in *Baikiaea* forests in 1904. Harvesting was, and still is, selective and concentrated on three commercial species, *Baikiaea plurijuga* (Zambezi teak), *Pterocarpus angolensis* (blood wood/mukwa/kiaat), and *Guibourtia coleosperma* (mchibi) for railway sleepers, furniture and flooring (Calvert 1974; Judge 1975). Various timber concessionaires have operated in the forest reserves, mainly taking these three species. The timber concessions are contractual agreements: i) with the Forestry Commission, if operating in protected forests; ii) with the private commercial farmer, with supervision from the Forestry Commission, if the operation is on a private commercial farm; and iii) with the Rural District Council, with supervision from the Forestry Commission, if the operation is in a communal and resettlement area. The timber concession system in Zimbabwe has a long history with experience of operating procedures such as resource inventory, determining and prescribing allowable harvesting limits, preparation of harvesting plans, and policing and monitoring. A

legal framework of licensing for periods not exceeding ten years regulates the concession system (Mudekwe and Mushaka 2004).

In terms of sustainable forest management, the maximum allowable concession period of ten years does not create incentives towards the proper management and development of the concession areas (Mudekwe and Mushaka 2004). As yet there is no integrated use-management of the concession areas in the region (Geldenhuys 2005). In Zimbabwe, there is no synergy between the concessionaires, the Forestry Commission and rural forest resource users with respect to the use of forest resources in concession areas particularly for wood left after log processing.

Timber concessions have been implicated for the over-harvesting of commercial species in protected areas and other land categories where commercial timbers are found. The loggers' activities have been cited as being the source of wild fires, through creating fire hazard out of waste wood left in concession areas. In addition, their activities have been reported to cause damage to residual standing stock and reduce the quality of residual stock through selection of best genotypes (Calvert 1986b; Judge 1986; Mubita 1986). These factors have implications for the development of the timber and non-timber resources base that is important for rural livelihoods and the ecological functioning of the *Baikiaea* ecosystem.

2.2.4 African tenants in protected forests

Prior to gazetting, the Kalahari Sand forests were occupied by subsistence farmers who kept livestock and cultivated crops in the river valley areas. When the forests were gazetted, most of the subsistence farmers were evicted while selected ones were allowed to remain as forest

tenants (Calvert 1974; Judge 1975). The activities of the forest tenants were seen to be beneficial rather than detrimental to forest management, allowing for multiple uses, and reducing fire hazards through livestock grazing. The philosophy of the forest tenant system was based on observations that within the forest areas there is a considerable area of land that although it is integral with the forests, is more suited to agricultural use than forestry. Such land is primarily found along the valley areas where the soils are richer. Grazing for the forest tenants is also available in the bulk of the forestry land situated on the Kalahari Sand ridges between the river valleys.

The main objectives of the African tenant system were: (i) to optimise utilisation of the forestry land for the benefit of local people and the forest environment; (ii) to develop approaches that balance agricultural production with forestry and wildlife production; and (iii) to apply management of the tenant community so as to play its role in forest protection and contributing to the economy of the region through crop and livestock production and small forest based enterprises. The system operated under a legal framework of permits issued to households in terms of the Land Use Regulations of the Forest Act (Judge 1975; Mohamed Katerere 2000). Although the tenant system was envisaged and developed well ahead of the present day community forestry initiatives, socially it aimed at satisfying the cultural and livelihood needs of the local people. The system was abandoned in the early 1980s partly due to factors that generally affected the progress of community forestry initiatives e.g. poor mechanisms and institutions to manage and control activities of the system, top-down approach in managing the system and failure to develop sustainable mechanisms to control population growth and influx of outsiders. Currently all households resident in protected forests are considered illegal settlers despite the legal framework under which the tenant system was established. The African tenant system has been partly implicated in some quarters for the conflict between the Forestry

Commission and local communities with respect to access and use of forest resources (Matose and Clarke 1993; Baker and Mudekwe 2000).

2.2.5 Wildlife management

After the establishment of the Forestry Department in 1946 (Judge 1975), wildlife production and protection within the protected forests became one of the major forestry activities. Early management activities included anti-poaching operations and the reduction of predators e.g. hyenas, jackals, leopards and lions (Judge 1975). Currently wildlife management activities include intensive anti-poaching, the provision of water, population census, determination of hunting quotas, the development of ecotourism infrastructure and conducting safari operations (Forestry Commission 1998a). The Forestry Commission perceives that wildlife and timber poaching activities are the major causes of forest destruction and degradation. Whether this is true or false is yet to be established through empirical studies. Wildlife utilisation is a major source of revenue generation for the Forestry Commission and the state. It still remains to be seen how local use of this resource and its value to the Forestry Commission and the state can be formerly complimented by local use on a sustained basis.

2.2.6 Fire and Forest Protection

Fire is one of the commonest disturbance processes in the *Baikiaea plurijuga* forest together with grazing and/or browsing and harvesting of the woody forest component (Calvert 1986). Similar disturbance processes are suggested by Geldenhuys (2005) for the Miombo woodlands. The destructive and non-selective nature of fire require that suitable fire management programmes are employed to enhance the productivity of forest stands so that timber and non-timber forest products are supplied on a sustainable basis. To achieve sustainable use-management of forests

that could benefit local people and the forest environment, it is generally important to take note that (Geldenhuys 2005): (i) fire can be considered a natural feature and an integral part of forest vegetation dynamics, hence complete fire protection may not be desirable nor attainable over the long-term under some situations; (ii) fire can be used to manipulate woody vegetation, favour regeneration and growth of favoured species; and (iii) fire tolerant and intolerant woody species may require different and specific fire management treatments.

The first fire protection plan for the protected forests was developed for Fuller Forest and Umgusa Forests in 1925. Fire protection efforts were concentrated in logged over areas as they presented the highest fire hazard areas (Judge 1975). The fire prevention plan primarily aimed at protecting young regrowth in the logged over areas. As more resources became available fireguards and fire lines were opened up (Judge 1975). The early fire prevention plan primarily involved controlled early dry season burning operations. Early dry season burning was intended to reduce the fuel load and hence reduce the risk of more severe and damaging fires later in the dry season. During the late 1960s concerns were expressed that the early burning operations were difficult to time in order to obtain the desired burn and that the operations damaged the young regeneration. Early burning was subsequently abandoned in 1970 (Calvert 1974; Judge 1975). Despite these protection measures fires are still an annual occurrence in the forests. Although well recognised by the Forestry Commission, the fire management aspects are not being implemented due to lack of finances, and skilled and experienced forestry practitioners. The current main activity is the prevention of the spread of fires when they occur.

Another forest protection activity carried out by the Forestry Commission involves anti-poaching patrols aimed at discouraging illegal use of forest products by communities living around the

protected forest reserves. The Forestry Commission employs 60 armed forest guards to protect about 800 000 ha of protected state forests i.e. about 13 300 ha per forest guard.

Despite these protection measures the forests continue to be destroyed and degraded through anthropogenic fire and illegal forest use practices (Calvert and Timberlake 1993; Cunliffe 2000).

2.2.7 Forest policy and legislation

An understanding of the past and present land tenure policies is a vital part of any assessment of forest and woodland management options. Land is the key issue in the debate over the future of Zimbabwe's rural resources (Katerere *et al*. 1993), and the dynamics of forest and woodland management in Zimbabwe can only be discussed meaningfully in the context of land use policies (Bradley and McNamara 1993). Policies and legislation have a direct impact on peoples' behaviour either through punitive measures or through positive incentives. Therefore, to understand the current use-management of the protected forests, it is essential to consider the policy and legislative context in which the forests exist.

The original forest policy statement for Zimbabwe called for "the demarcation and reservation of natural forest reserves, the provision of funds for the protection of the forests and for the close supervision of timber exploitation" (Judge 1975; Katerere *et al.* 1993). The focus then, as now, was to exploit and earn revenue from the valuable timber. Under this policy and subsequent forest laws enacted in 1929 and amended in 1948 and 1953 and revised in 1982, community rights in protected forests were reduced to privileges, and free access was replaced with restricted access rights (Mohamed Katerere 2000).

The Forest Act gave the Forestry Commission absolute rights over demarcated forests where no one is entitled to any rights in any demarcated forest or to any forest produce, other than may be given by the Forestry Commission in terms of the Forest Act. However, in terms of Section 66 of the Forest Act, the Forestry Commission has powers to make by-laws that may provide for use of demarcated forests for purposes considered reasonable.

In the context of this study the management approach to the protected forests is still protectionist and focusing on production of commercial timbers and the wildlife resources. Use of forest resources by communities adjacent to the protected forest is illegal. It is also generally perceived that poaching and encroachment has destroyed and degraded the forest resource base.

3. STUDY AREA

Fuller Forest is part of the protected forest estate in western Zimbabwe. All the protected forests face more or less the same socio-economic and ecological problems though some problems are more specific to a particular forest. The choice of Fuller was based on the philosophy that the recommended sustainable use-management model could be duplicated with modification to the other protected forests in western Zimbabwe and protected forests in the region.

3.1. Location

Fuller Forest Reserve lies between $18^0$08'31" South and $25^0$56'16" East (Figure 2). The forest reserve covers approximately 23 300 ha. It falls within the jurisdiction of the Hwange Rural District Council and is administered by the Forestry Commission on behalf of the state. The forest borders with Hwange Communal Area in the north and commercial game ranches in the south. The Bulawayo to Victoria Falls road and the Bulawayo to Victoria Falls railway line run along the northern and southern boundaries of the forest respectively. The Victoria Falls International Airport is located in the north western portion of the forest reserve. The world-renowned resort town of Victoria Falls is 25 km to the north and Hwange National Park 120 km to the south of Fuller Forest.

3.2 Climate

The dominant climatic characteristic in and around Fuller Forest is a short and erratic rainfall season from mid-November to mid-March. The dry season ranges from April/May to October/November. The annual average rainfall for the forest is about 550 mm (Forestry Commission 1992). The long-term (45 years) annual average rainfall for Victoria Falls, 25 km

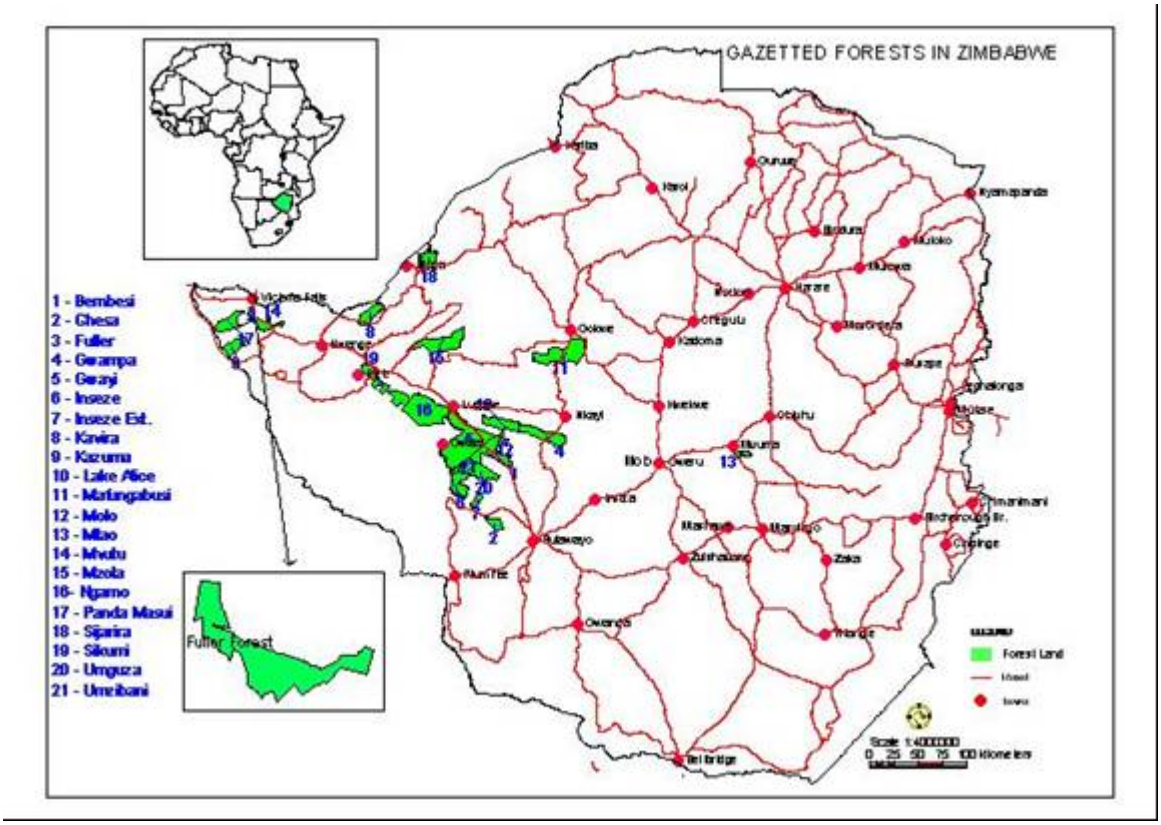


Figure 2. **Protected forest reserves and the location of Fuller**
(Source: Forestry Commission 2006)

from Fuller Forest is about 600 mm (Anderson *et al*. 1993). There is considerable year-to-year variation, such that in some low rainfall years the annual average rainfall falls to 400 mm and in high rainfall years goes above 800 mm (PlanAfric 2000). The low and erratic rainfall phenomenon comprises a major constraint to dry land crop production in the region. Mean annual temperature in the study area is approximately 21.5^{0}C. Mean monthly temperatures in the hot and cold months are about 30^{0}C and 17^{0}C respectively (Nyamapfene 1991).

3.3 Soils

The Kalahari Sands cover the bulk of Fuller Forest and the surrounding area. The sands comprise deep unconsolidated Tertiary Sands of Aeolian origin (Nyamapfene 1991). The Kalahari Sands are strongly uniform physically and chemically. The soils comprise well drained and deep, medium grained sands (Anderson *et al*. 1993). The extremely low occurrence of silt and clay

particles (< 10%) is due to the absence of any weatherable minerals (Lockett 1979). The sands are inherently of extreme low fertility (Nyamapfene 1991). The high permeability and low fertility severely limits the potential of these soils for crop production.

3.4 Vegetation and wildlife

The Kalahari Sands ridge in Fuller Forest supports a predominantly *Baikiaea plurijuga* forest type (Figure 2). The vegetation shows a distinct catenary pattern with *Baikiaea* on the ridge and *Burkea*, *Terminalia*, *Combretum mixed scrub* and occasionally *Colophospermum mopane* in seasonally water logged depressions. *Baikiaea* is an African genus, with five other species confined to the tropical lowland rain forests of west-central Africa, the Guinea-Congolian floral region (Huckabay 1986). The *Baikiaea plurijuga* forest formation in its present range in central southern Africa (Figure 3) is believed to be at its environmental and climatic limits (Brummitt 1986; Huckabay 1986). It is uniquely restricted to Kalahari Sands, under an annual rainfall regime ranging from about 1000 mm in southeast Angola to about 500 mm in northwest Zimbabwe (Huckabay 1986; Wood 1986). The vegetation of the Kalahari Sands has been described by Fanshawe and Savory (1964), Huckabay (1986), Wood (1986) and Childes and Walker (1987).

3.5 Social - economic aspects of surrounding communities

Fuller Forest and the surrounding area have a long history of settlements. The last Stone Age inhabitants of the area around Fuller Forest were the Khoisan Bushmen (PlanAfric 2000). The Khoisan Bushmen were gradually displaced by the Iron Age people who arrived in the area some

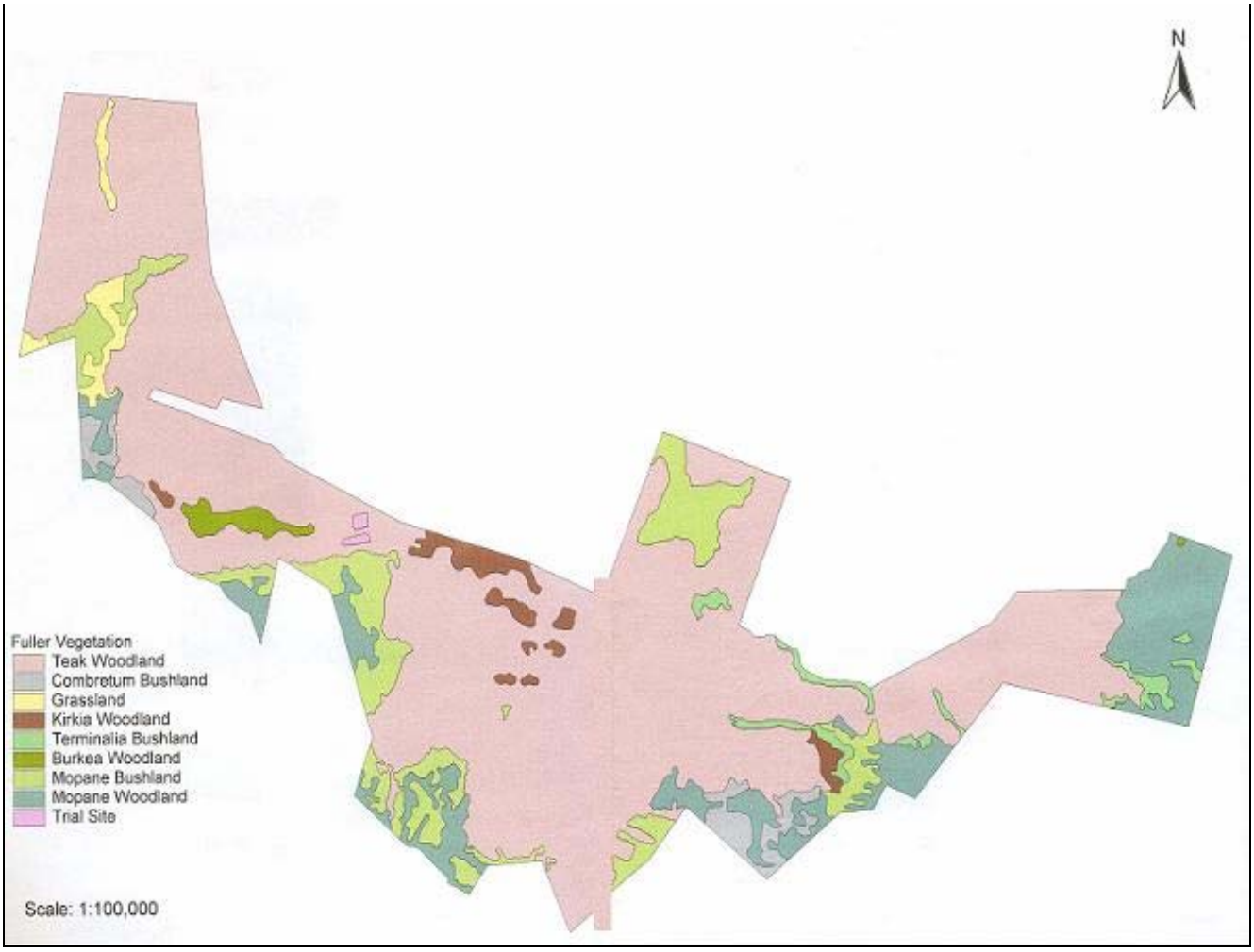


Figure 3. **Vegetation Types in Fuller Forest**
(Source: Forestry Commission 1998b)

2 000 years ago. Whilst the Stone Age people had been hunter-gatherers, the Iron Age cultures were based upon subsistence shifting agriculture and livestock production (PlanAfric 2000).

Two hundred years ago the Tonga and Lozi people moved south across the Zambezi River from Zambia and settled in the Matetsi, Victoria Falls and Hwange rural administrative areas. These areas fall in Hwange District in which Fuller Forest is located. Matetsi and Victoria Falls areas are 15 and 25 kilometres away from Fuller Forest respectively. Later the area around Fuller Forest came to be dominated by the Nambya people who are linguistically related to the Karanga people and trace their origins back to the Great Zimbabwe tradition (PlanAfric 2000). The final

movement of Iron Age people in the area occurred in the mid-19th century with the arrival of the Ndebele people from Kezi and Matobo Districts and Shona people from Masvingo District. The Nambya, Ndebele, Shona and Tonga ethnic groups currently inhabit the communal area surrounding Fuller Forest (PlanAfric 2000).

Out of twenty political wards in Hwange Communal Area, three wards (Chidobe, Kachechete and Chikandakubi) have common boundaries with Fuller Forest (Figure 4). There are 18 villages in these three wards with 12 villages sharing common boundaries with Fuller Forest. The 12 villages adjacent to Fuller Forest have 1931 households at an average of 100 households per village and a total human population of about 12 000.

The local institutions are made up of the traditional leadership of the Chief, four Headmen and eighteen Kraal Heads and the political leadership of three ward Councillors and eighteen village development committee Chairpersons. These institutions have the role of controlling the use of natural resources in the communal area, albeit with some over-lapping and conflicting responsibilities.

The basic form of agriculture in the communal area is crop and livestock production. Agriculture is limited by low and erratic rainfall and infertile Kalahari Sand soils. There are limited commercial activities in the communal area. Formal and contract employment can be obtained in the tourism and hospitality industry in Victoria Falls, in commercial farms operating eco-tourism activities and practicing livestock ranching and from the timber concession in Fuller Forest. Households are increasingly taking part in the wood curio industry where individuals are engaged in carving and/or selling the artefacts (Mufandaedza 2003).

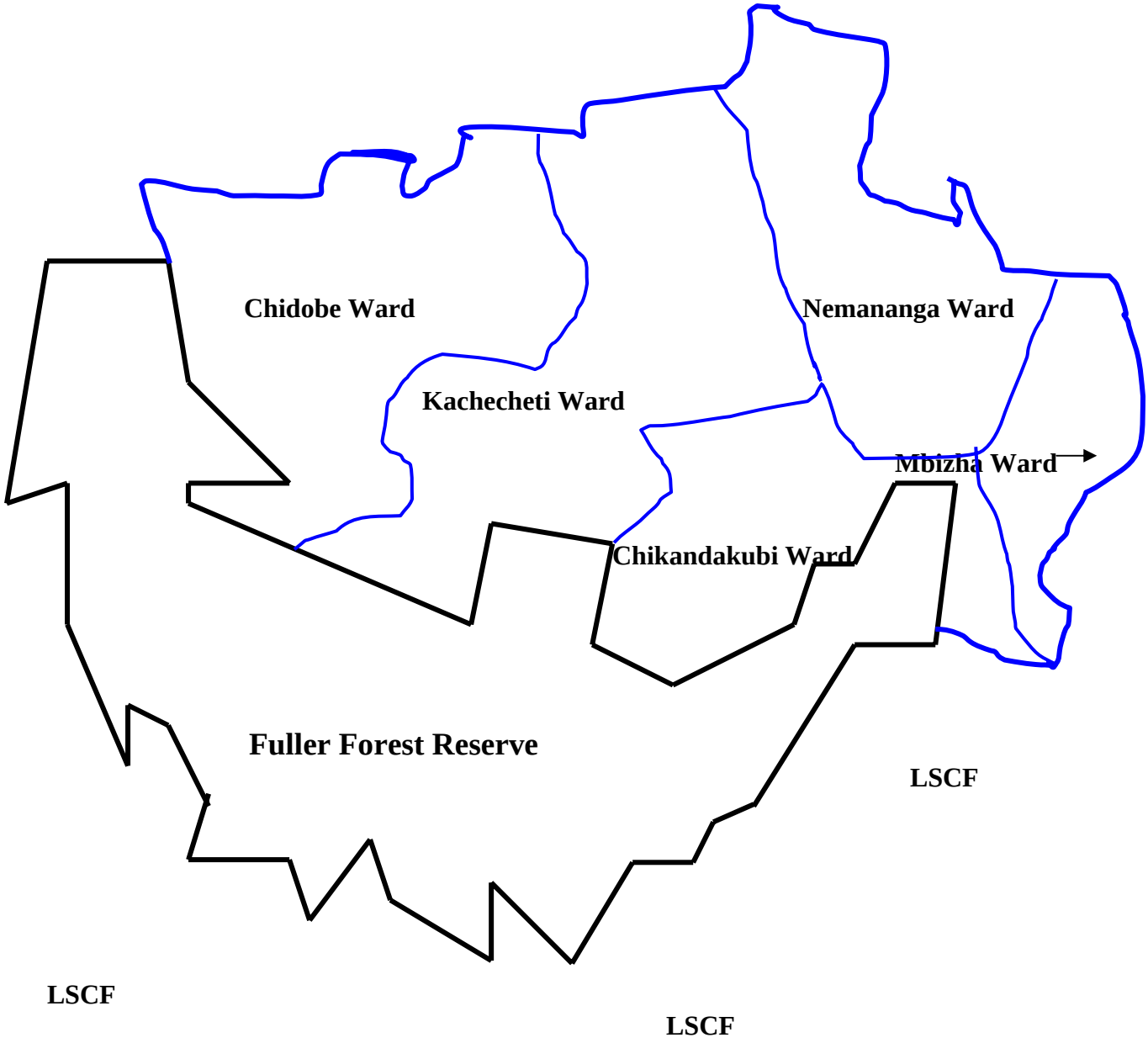


Figure 4. **Fuller Forest and adjacent wards.**
LSCF = Large Scale Commercial Farms (*Source PlanAfric 2000)*

Two private game ranching wards in the north west of Fuller were designated and proclaimed resettlement areas in 2000. There are two villages in this resettlement area and the villages fall under Chidobe Ward. At the time of the study selected households were still being allocated specific sites for settlement and agricultural purposes. It is not expected that these households will exert pressure on Fuller Forest for the extraction of forest products as the resettlement area is

still endowed with natural resources commonly targeted by rural people. The south of Fuller borders with state land that is divided into holdings that have been leased to private game and cattle ranchers. Ranch owners and their employees do not normally depend on Fuller Forest for the provision of forest products as they use forest products from within the ranches. However, due to its mobility and migration patterns, wildlife is and may be shared between the forest and the ranches. It was imperative therefore that this study focused on the communal areas with respect to the use of forest products by the forest adjacent communities.

Chief Mvutu is the traditional leader closest to Fuller Forest. He is the main interface with the forester at Fuller Forest with respect to issues related to use of the forest by surrounding rural communities. Chief Mvutu has regularly brokered discussions and consultations dealing with relations between Fuller Forest managers and communities surrounding Fuller Forest. Table 2 below gives a summary of the profiles of the wards adjacent to Fuller Forest.

Table 2. **Socio-economic profiles of the wards containing the five sample villages** (Source: Central Statistical Office 1998; PlanAfric, 2000)

Attribute	**Chidobe**	**Kachecheti**	**Chikandakubi**	**Total**
Number of villages	6	6	6	18
Number of households	669	667	595	1931
Average number of people per household	6.1	6.0	5.9	6.0
Number of people	4 108	4 002	3 511	11 620
Average number of formal jobs per household	0.5	1.2	1.6	1.1
% of households without any formal jobs	32	26	22	26.8
Livestock units (cattle)	5 926	3 839	2 822	12 587
% of households without any livestock (Cattle)	21	33	30	27.9
Grazing area (ha)	6 740	9 360	7 860	23 960
Arable land (ha)	1 842	1 699	2 554	6 095
Electricity services	1 school serviced	Nil	Nil	
Access to fields	All*	All*	All*	
Dominant housing style	Mixed pole and dagga and bricks walls, with asbestos or zinc roofs	Pole and dagga, or bricks, with thatched roofs	Mixed pole and dagga and bricks, with asbestos or zinc roofs	
Number of schools per ward	3	3	2	8

* The sizes of fields are variable per household and range from about 0.5 ha to 3 ha.

3.6 Forest management in the study area

Forest management in Fuller Forest is not different from the rest of the other protected forests as described above. Fuller Forest was gazetted as a protected indigenous forest reserve in 1943. The forest was gazetted for the main purposes of commercial production and protection of the main timber species of *Baikiaea plurijuga*, *Pterocarpus angolensis* and *Guibourtia coleosperma*, and the protection of the fragile Kalahari Sands (Judge 1975).

Commercial timber harvesting by concession commenced in 1919 and lasted until 1940 under the first cutting cycle and was scheduled for subsequent exploitation in 1979 under the second cutting cycle (Judge 1975). However, the forest was designated a wildlife production and safari hunting area during the mid-1970s and as a result timber harvesting was suspended until 2000. Early wildlife management activities involved anti-poaching operations and the reduction of some predators. Currently the main management activities include anti-poaching, provision of water, population census, determination of quotas and the development of tourism facilities. Currently Fuller Forest has two forms of wildlife utilisation activities run by Ngamo Safaris, a wildlife division of the Forestry Commission i.e. safari-hunting and non-consumptive safaris.

Fuller Forest has been the subject of a massive increase in timber poaching by the local woodcarvers (Sparrow 2000). Due to increased cases of poaching of the commercial timber species for woodcarving, the Forestry Commission took a strategic management decision in 2000 to log all harvestable timber in response to this illegal activity. The Forestry Commission granted a timber concession to a private concessionaire in 2001 (Forestry Commission 2000a). The concession has an annual off-take of 3 600 m^3 under bark (u.b.) inclusive of *Baikiaea plurijuga*, *Pterocarpus angolensis*, *Guibourtia coleosperma* and *Afzelia quanzensis* combined.

Fire protection measures were first implemented in Fuller Forest in 1925. The measures concentrated in areas that had been logged over by concessionaires. The annual fire protection plan was aimed at protecting young regrowth of the commercial timber species (Judge 1975). The first early burning operation in protected forests was also carried out in Fuller Forest in 1932 (Judge 1975). Current fire protection activities are concentrated on fire suppression to limit the impact of the wild fires. This is achieved through an established system of rapid detection and response of which key components include fire guards and fire lines, fire towers, radio communications, a network of access roads, vehicles, fire crews, equipment and tools. Uncontrolled fires are not tolerated in the forest. Despite these efforts, the rate of annual fires has increased in the past few decades (Judge 1975; Forestry Commission 1994a; Sparrow 2000). The main sources of fire in the forest are poachers, arsonists, steam locomotives used by tourists and herd boys. These sources contribute about 45% of all annual fires in Fuller Forest (Forestry Commission 1992). Other sources of fire include outbreaks from own burning operations and local farmers preparing agricultural land.

A Management Plan for the forest was developed and produced in 1994. The purpose of the management plan is to guide management operations in the forest. The plan divides the forest into seven management zones (Table 3). The management plan proposes a five-year management cycle for each zone (Forestry Commission 1992). The plan was revised in 1999.

From the time Fuller Forest was gazetted, the provisions of the Forest Act of 1949 regulate use of the forest products by local people. Any use without a permit or licence is an offence subject to prosecution in a court of law. Despite the restriction, local people have continued to illegally

harvest a diversity of forest products from the forest (Forestry Commission 1994a; Sparrow 2000). The illegal practices have pitted the local people against the forest managers.

Table 3. **Fuller Forest management zones**
(*From Forestry Commission 1992*)

ZONE	AREA (HA)	DESCRIPTION OF PRODUCTS AVAILABLE
A	3 655	Poor stocking of teak, mukwa and mchibi. Area provides an informal summer grazing for a single ward. Thoroughfare of poachers to Matetsi Safari Area. Potential for wildlife production.
B	7 668	Good teak population; some mukwa present. Heavily logged during the early 1930s. Western portion is a wildlife production area and poaching is rife in the eco-tone area between the teak and the mopane woodland. A winter safari hunting area but high cases of illegal summer grazing.
C	5 932	Good population of most timber species; good wildlife population. The block is a non-livestock grazing area since it is an important wildlife management block, which supports both the hunting and photographic safaris of Ngamo Safaris, a Division of the Forestry Commission. From 1987 to 1992 the block was leased to a neighbouring commercial farmer as a safari hunting area. The block is home to resident populations of different species of antelopes.
C1	2 000	Good wildlife habitat: some good teak population. The block is the most northerly in Fuller Forest and is the area set aside for photographic safaris. The Ngamo Safari's Jafuta Photographic Lodge is located in this block. The block has a high wildlife population, especially resident elephant and buffalo, supported by populations of the same species that migrate from the Zambezi National Park through the Nakavango Farms. During the 1980s and early 1990s the block was leased to Matetsi Wildlife (Pvt) Ltd. The block is another of the non-grazing areas for communal area cattle.
D	20	Vlei area where annual thatch and broom grass is harvested.
E	1 600	Teak coppice and resprout.
F	2 125	Mvutu forest, previously heavily logged, high population of coppicing teak.

4. METHODOLOGY

4.1 Selection of the study site

Several protected forest reserves were considered for this study: Gwaai, Bembesi, Ngamo, Mafungabusi and Fuller. However, Fuller Forest was selected for this study for several reasons. It forms part of the protected indigenous forest estate but was subjected to being degazetted as it formed part of the Victoria Falls Master Plan. There was need, therefore, to demonstrate its relevance with respect to forest conservation and its value to the public. This is important, as the results would be used to argue against similar moves to degazette any of the other protected forests. Three land use categories i.e. communal areas, resettlement areas and commercial farms, surround the forest whereas one or two of these land use categories have common boundaries with the other forests. Local use of forests is experienced in all the protected forests but the intensity of use was considered considerably higher in Fuller whose surrounding community was relatively poorer than around the other forests (PlanAfric 2000). Activities related to wood-based curio carving are high around Fuller in comparison to other forests (Mukwekwerere *et al.* 1998). The first fire protection activities were implemented in Fuller Forest in 1925 (Judge 1975). The same protection methods were applied to other forests and have not changed considerably since then. One of the earliest timber concessions in western Zimbabwe was granted in the Fuller area between 1919 and 1929 (Judge 1975). The current status of the vegetation structure and composition in Fuller may be partly a reflection of this long history of fire protection and timber harvesting. Based on these issues Fuller was considered representative for extrapolation of the results to other protected forests and woodlands in Zimbabwe and in Southern Africa where people live adjacent to protected forests. If the integration of local forest use and forest

conservation in protected forests can be implemented successfully in Fuller Forest, then this philosophy or approach from this study could be disseminated more widely as a useful model.

4.2 Socio-economic assessment

4.2.1 Selection of sample villages

An initial meeting with the local traditional leadership, including the local Chief and five headmen, was first held at the Forest Commission's offices in Fuller Forest to lay out issues related to the management and local use of Fuller Forest. This approach was chosen since the local forester had always dealt with the local leadership whenever there were problems with respect to the use of Fuller. The local forester had already established a working relationship with these traditional leaders. It was also important to get acceptance and trust of the traditional leadership before going out into their constituencies. The discussions with the local traditional leaders were to inform them of the forthcoming visits into their constituencies to discuss with households issues related to the use of Fuller Forest. This required getting to the villages to conduct village group discussions, user group discussions and key informant interviews to get information on how villagers used Fuller Forest.

A pre-analysis of the study area with respect to the socio-economic aspects as summarised in Chapter 2 was confirmed as correct by the local leadership during this initial meeting. This was followed by discussions on which wards and villages to work in the available time frame. Meeting participants agreed that it would be difficult to cover all the 12 villages surrounding Fuller Forest in the given time frame. Finally, five villages were randomly selected from the twelve villages. The Chief was asked to randomly pick from a hat three and five pieces of paper with names of the four wards and twelve villages respectively written on them. At least one ward

and one village each met the criteria of proximity to the forest. Three of the picked villages had common boundaries with Fuller Forest while the other two were further away. The local leadership were subsequently requested to go out to their respective constituencies and invite as many of their subjects to village meetings.

4.2.2 Group discussions and interviews

The socio-economic part of the study was carried out in two ways: first by holding group discussions in the form of village participatory workshops and second by holding key informant interviews and focus user group discussions with selected individuals and groups. A house-to-house survey was not carried out since it was considered that the desired information would be obtained using these two methods.

4.2.2.1 Village Participatory Rural Appraisal workshops

Participatory Rural Appraisal (PRA) techniques, following Chambers (1992, 1994a,b, 1997) and Kumar (1993), were used for group discussions in sample villages to determine the overall use patterns of forest products by rural communities living around Fuller Forest. The methods were used with modification where necessary as dictated by local situation e.g. high level of illiteracy. Individuals who attended the PRA meetings were those who heeded their traditional leadership calls for the meetings and did so at their own will.

Arrangements for the village meetings were done with the help of the resident Forester at Fuller Forest and three village research assistants. The assistants were selected for their knowledge and fluency in local ethnic dialects (Ndebele, Tonga & Nambya). They were also selected on the basis of their knowledge of Participatory Rural Appraisal (PRA) exercises that they gained

during the work done in the villages by the Canadian International Development Agency (CIDA) and a consortium of Zimbabwean NGOs and government agencies for the development of the Victoria Falls Master Plan. In addition to these attributes, the village research assistants were given a one-week refresher course on PRA methods by the researcher. They were also introduced to the issues relevant to the research. In the field two days were spent at each sample village.

The PRA methods that were used were:

(i) Historical profile discussions – to find out the communities' knowledge of the history of settlement in the area.

(ii) Forest products use analysis – to find out the types of products harvested from Fuller Forest, who harvested them, what they are harvested for and peoples' preferences of the products.

(iii) Trends in forest products availability – to find out people's perceptions on forest products availability over a given period of time.

(iv) Ecological trends – to establish people's perceptions and understanding of use impacts on the forest resource base.

(v) Livelihood analysis – to detail local livelihood strategies and their relation to the forest.

(vi) Seasonal calendars – to get some impressions of seasonality of use of forest products by users.

At each village meeting participants were randomly divided into groups, each group averaging eight members of mixed gender and age. Participants called out numbers 1 to 6 according to the list of types of information required as shown above. All those who called out 1 made group one and those calling two made group two and so on till six groups were formed. Each group was

given a different task to work on according to the issues stated above. Each group selected its own chairperson to lead the discussions and a spokesperson to report back on group findings in a plenary session. The groups were assisted in their tasks by the researcher, the forester and the three village research assistants. The following sections give summaries of the procedures used during the village PRA workshops to obtain the required information.

4.2.2.2 Historical profile of the study area

The historical profile exercise was done in plenary at each village PRA meeting. Participants gave accounts of the history pertaining to Fuller Forest and the surrounding areas. Discussions were guided and focused on finding out who where the original inhabitants of these areas, arrivals of other ethnic groups into the area, set-up of the traditional and political institutions and their roles, use patterns of local forest resources before the advent of the Forestry Commission, advent of the Forestry Commission, its operations and its relations with local people.

4.2.2.3 Forest products use analysis

At each sample village participants were asked in plenary to list the products and services they extracted and/or used from Fuller Forest. A list of these products and services was written on flip charts in the local language (Ndebele), which is spoken by the majority of the people in the study area. These flip charts were stuck on the wall. The forester transferred the list of products onto individual cards for each resource. The researcher and the forester later translated names of listed plants and animals into scientific names.

After that one group was tasked to work on the resource use patterns exercise. The exercise involved matrix scoring of (a) relative importance of each resource to women and men. The group collected the cards with names of the products from the forester and randomly arranged

them in a column on the floor or on the ground. Groups used local materials (e.g. seed or small stones) for scoring the importance of each resource to women and men. The most important resource to either gender received the highest scoring by having the highest number of pebbles or seeds placed beside that resource. The least number of pebbles or seeds were placed against the least important resource. Importance of a resource was defined as its usefulness or relative contribution to a household's livelihood. (b) Assuming there were 100 households in a village, group participants were asked to score the proportion of households using each of these products as a percentage of the total number of households. The two hands were a tool that was used for estimating the percentages, where ten fingers represented 100 %, 9 fingers 90 %; 8 fingers 80 % and 1 finger 10 % of the total households. (c) The two hands tool and the process as above was also used to score the proportion of households collecting each resource for own use and/or for sale. Results of the group work were presented in plenary. Plenary discussions served the purpose of giving the workshop representatives the chance to reflect on the findings of the other groups.

4.2.2.4 Establishing Trends in forest resource availability over time

One group per village looked into the trends in the availability of forest products over a given time period and reported the outcome in plenary to the other participants. The groups generated their own list of the forest products they wanted to consider.

The groups were given pre-determined dates for which they were to indicate the relative availability or abundance of listed products over the given time periods. The time periods were 1955, which was when the communal area adjacent to Fuller Forest was officially settled; 1990, which was ten years after Zimbabwe independence and a time which saw initiatives towards

community management of natural resources and finally the present. It was noted that 1955 was a time period far back in the past and that presently there might not be many living individuals who were around at that time. People who were present during that time may not have clear memories of the situation then. However, information gathered from the research assistants and the Chief indicated that there were elderly men and women in some villages who could give perspectives on forest resources with respect to the time period.

The groups used local materials e.g. small stones and/or wild fruit seeds for a matrix scoring of the relative availability of each resource across the given dates. More stones or seeds were allocated for a resource with higher relative availability and least stones for low availability per given date. Groups provided comments on their scoring trends for each product across the dates. The groups transferred their information from the ground onto flip charts, where the number of stones or seeds per time period for a specific resource was represented by an equivalent number of dots and a numerical figure.

4.2.2.5 Perceptions on ecological impact arising from forest resource use

At each village PRA workshop, one group out of six worked on perceptions of ecological impact arising from the different uses of the forest. The groups drew matrices of three columns on the ground or flip charts. The groups generated lists of activities that they perceived as causing ecological problems. For each activity, the ecological impact or problem was explained and in the next column strategies for mitigating the impacts were suggested.

4.2.2.6 Wealth ranking and livelihood strategies

At each village, one group out of six worked on the wealth ranking exercise. First, the group generated indicators of wealth according to local perceptions of what constitutes wealth. The group then generated wealth categories using the indicators. The group decided on the wealth indicators that made a wealth category.

The group used 100 pieces of counters equivalent to the total number of households in a village to score the relative number of households under each category. The scores were expressed as a proportion of the total number of households in the village. Using counters equivalent to the proportion of households in each wealth category, group participants further indicated the number of the households that were headed by males and those headed by females. Male or female-headed households were defined as situations where either the male or female was never married or where a spouse was deceased. The researcher transferred the information on flip charts assisted by the group members, where equivalent number of dots represented the number of seeds scored. A group representative presented the group results in plenary for discussion.

Livelihood strategies were first defined to workshop participants as activities that households would engage into make a living. For this exercise scores were the relative importance of a given livelihood strategy out of ten, where importance was defined as the level of dependency on the livelihood for the four wealth categories. Higher scores indicated a high level of dependency on the livelihood strategy while lower scores were a reflection of less dependency on the livelihood strategy for the wealth category. Group results were presented to other workshop participants in plenary.

To authenticate most of the information and data obtained from the village PRA discussion sessions; crosschecking or triangulation was done through focus user group discussions, key informant interviews and analyses of the relevant secondary literature. This triangulation was essential in order to make pertinent conclusions on issues tackled during the village meetings.

4.2.2.7 Focus user group discussions

Focus group interviews were conducted with different user groups: i) thatch grass harvesters (a sample of 10 individuals from six villages was selected from 41 permits issued the previous season); ii) livestock owners (households were selected from dip tank registers in three villages - a sample size of 6, with two households owning 20 cattle and more, another two households owning between 5 and 10 cattle and last two households owning less than 5 cattle); and iii) curio carvers (one carver was selected per stall, from 11 stalls along the Bulawayo – Victoria Falls Road). Discussions were guided and focused on how each group accessed forest products, gender involved in harvesting and carving, estimates of income from curio sales, social, ecological and economic constraints faced by users, the status and condition of the resource base, control mechanisms to regulate use and potential for local participation in forest management.

4.2.2.8 Key informant interviews

Key informant interviews were conducted with four village headmen, Chief Mvutu, the Forester and Forest Protection Officer at Fuller, Forestry Commission's Chief Conservator of Forests, Camp Manager at Jafuta Photographic lodge and the Manager of a private game ranch bordering with Fuller. Two headmen were from two sample villages and the other two were from non-sample villages. Since most of the information for this study had been obtained from villagers it was considered important to get views of local resource managers. These key informants were

selected on the basis that they controlled the management of a wide range of natural resources that were used by local communities.

4.2.2.9 Secondary literature review

This mainly involved consulting various Forestry Commission reports, maps, management plans, timber harvesting plans, the forest policy document and the Forest Act, anti-poaching records and resource use permit books. These materials were located at various centres i.e. the local, regional and national offices. At Hwange Rural District offices a relevant document that was consulted was the Hwange Rural District Profile document. The Victoria Falls Master Plan document was also consulted.

4.3 Ecological assessment of the forest resource base

This part of the study was done for two reasons. First, to assess the resources base on which the local people claimed they depended on in order to be able to develop the sustainable use-management model for the forest. Secondly to validate perceptions that the poor condition of the resources base was due to impact of local use practices. Only the woody component of the resource base was assessed at this stage because of an observation from the socio-economic assessment indicating that most households used wood in one from or the other in sustaining their livelihoods.

The method and procedure used in this study to assess the woody component in the forest follows that of Shackleton (1993b). A co-ordinate system was laid over aerial photographs of Fuller Forest. The potential sample plots were generated by simple unrestricted random selection without replacement and marked on the overlay. The sample plots were located in the field using a Global Positioning System (GPS) according to the random distribution of the plots on the

overlay. Concentric circular sample plots with a radius of 12 m (452 m^2) and of 2 m (12.6 m^2) for tallying the woody component and regeneration respectively, were used. Altogether 91 plots were sampled. Within each 12 m – radius plot the following parameters were recorded:

1. The diameter at breast height of each woody stem for stems equal to or greater than 2 cm. For coppices, each stem was measured separately and averaged to obtain an estimated diameter of the main rootstock. A minimum diameter of 2 cm was opted for because it was observed that considerable quantities of this size were being harvested for the construction of granaries, poultry and small livestock pens.
2. The taxonomy of each measured stem.

In the 2 m – radius plots regeneration by species was tallied. Stems less than 2 cm in diameter at breast height were considered as recruitment through seed germination or through vegetative reproduction. This definition may include stems from previous seasons that had died back during the non-growing season (Chidumayo 1992a, b). The definition also provides an index of the reproductive capacity of the tree species. This definition does not include under canopy shrubs as regeneration material. The shrubs are inherently multi-stemmed and the stems are generally less than 2 cm in diameter.

Diameter size classes were determined as 5 cm increments in diameter at breast height. Class 1: 2 – 6.9 cm dbh; class 2: 7 – 11.9 cm dbh; class 3: 12 – 16.9 cm, and so on (17 –21.9 cm; 22 – 26.9 cm; 27 – 31.9 cm; 32 – 36.9 cm; 37 – 41.9 cm; 42 – 46.9 cm; 47 – 51.9 cm; 52 –56.9 cm; 57 – 61.9 cm; 62 – 66.9 cm, and class 14: 67 cm and above. All stems greater than size class 14 were pooled in a single size class.

Descriptive statistics of species density, basal area, frequency, dominance and importance values were determined following Curtis and McIntosh (1951) and Kent and Coker (1992).

5. RESULTS

The main results from the study are presented in this chapter. The chapter is structured into two main sections. The first section provides results of the socio-economic analysis of forest resource use. The second section deals with results related to the status of the forest resource base.

5.1 Socio – economics of forest resource use

5.1.1 The meeting with the local leadership

Altogether there were 27 people at the meeting including the local Forester and the Assistant Forester, the Forest Protection Unit Officer, the Chief, 4 Headmen, one Councillor, 3 Ward and 16 Village Committee Chair persons for three wards and sixteen villages. The meeting generated a vigorous and high level of debate amongst the participants. Initially there was suspicion and mistrust on the part of the local leaders. They were not sure of the Forestry Commission's intentions after the researcher explained the main purpose of the meeting to them. The suspicion and concerns can be summarised in the following quotations:

> "*Why is the Forestry Commission coming at this point to discuss forest use issues when it had exhausted all valuable resources? It is surprising that all local leaders have been called for this meeting, when in the past forest managers used to talk to the Chief only. What has changed such that the Forestry Commission now wants to speak to all of us?*"

It appeared such meetings to discuss use of forest resources were rare between the locals and the forest managers. At this point the researcher stressed that it was important that the two main

stakeholders take the opportunity to exchange views on the use of Fuller Forest so that there was a win-win situation.

Other concerns from the leaders as far as the discussions were concerned focused on restricted access of communities to resources in the forest. Accusations were levelled against the forest managers' insensitivity to local peoples' needs.

> "*Your animals, elephants and lions are destroying our crops and livestock and you do nothing about it. You refuse us to graze our cattle in the forest and arrest people found collecting or harvesting forest products in the forest and yet you call us here to discuss use of Fuller. How is that possible?*" asked the vocal Councillor of Chidobe ward.

If ever people were to be part to the protection of the forest, the Councillor advocated for local people's involvement in eco-tourism activities and timber concession so that they would benefit financially from the "*valuable"* forest resources;

"*We also need the money that Ngamo Safaris and Savanna Wood are getting from resources from this forest.*"

This was with reference to the Forestry Commission's Wildlife Division and the concessionaire currently harvesting commercial timber from the forest. There were implications that the villagers also protected and cared for the forest.

> "*We have protected this forest for a long time. This is why you have been getting a lot of money from it*"

Most leaders did not believe that the line of thought advocated by the Councillor would be possible given past experiences and knowledge of how the Forestry Commission favoured "*rich and influential people*" when granting timber concessions and eco-tourism leases. A female representative from Chikandakubi Village wished that the forest be given up for resettlement as people were overcrowded in the adjacent communal land. Some participants supported this view pointing out:

> "*The liberation war of Zimbabwe was fought so that we could go back to our ancestral lands*".

To the view whether national laws and regulations related to forestry were important, the majority of the participants had the perception that the laws and regulations discriminated against them. Some argued that locals were ignorant of the laws regulating use of the forests since no one had ever explained the laws to them. Again the woman from Chikandakubi interjected and disagreed pointing out that people were aware of the laws as herself and other women often got permits to cut thatch grass from the forest.

To the question whether the situation should be left as it were, where people would continue accessing forest products illegally, the Chief and Headmen from BH 11 and Chikandakubi interjected and called upon representatives to take the opportunity to finding a solution. The Chief and the Councillor for Chidobe Ward were instrumental in changing the tone of the meeting towards cooperation when they each stressed the wisdom for the proper management of natural resources stressing that:

"*This forest is the property of the government. It is also our property. It is the only remaining local forest with valuable resources that we can hand over to our children for example, the different wildlife species and commercial timbers. These resources are no longer there in areas we live. We must protect the forest*,"

In the final analysis a plan for meeting with villagers to continue discussing the issues concerning the use of Fuller was agreed upon. These initial deliberations enabled the researcher to work in the communal area with cooperation from the villagers. On average forty-five people of mixed gender and age per village attended the Participatory Rural Appraisal (PRA) meetings in sample villages. At these meetings there were usually more women than men at an average ratio of 2:1. Although youths attended in low numbers at each meeting, on average there were five youths of mixed gender at each village meeting.

All of the group meetings were extremely successful. The exercise generated a vigorous and high level of debate amongst villagers, far more than would have occurred if questions had been asked of individual household members. Interest in woodland resources was aroused at village level, where a total of 300 individuals out of a population of 3000 in the sample villages took part in the participatory village discussions sessions.

5.1.2 Social histories of Fuller Forest and the surrounding area

Historical accounts of Fuller Forest and its immediate surrounding communal area revealed eight distinct historical phases i.e. (i) the initial settlements around Fuller Forest, (ii) the arrival of the Forestry Commission and the Rhodesia Native Timber Concession, (iii) the arrival of relocated households from other districts, (iv) evictions of households from the gazetted forest, (v) introduction of some wildlife species and the subsequent hunting safaris, (vi) the advent of

indigenous African Foresters, (vii) the establishment of the Forest Protection Unit, and (viii) the land redistribution programme.

The local Tonga and Nambya ethnic groups displayed extensive knowledge of the history of Fuller Forest and the surrounding areas. They were the oldest ethnic residents of the area around Fuller Forest. These ethnic groups are concentrated in Monde and Chidobe villages. Three and two elderly PRA workshop participants from Monde and Chidobe sample villages respectively reported their first encounter with Forestry Commission was when they were employed as patrolmen in the early 1940s. Another early event they remembered was the timber logging concession by the Rhodesia Native Timber Concession, popularly known as RNTC locally. The Forestry Commission and the concessionaire prohibited local people from cutting commercial timber species such as *Baikiaea plurijuga*, *Pterocarpus angolensis*, *Guibourtia coleosperma* and *Afzelia quanzensis*. Hunting of any wildlife was also prohibited. Some forest managers allowed locals to graze their cattle in the forest and collecting forest products while others strictly prohibited the activities. A Mr Sparrow, a forester at Fuller between the 1960s and 1970s was reported to have been particularly good to locals as he was a Friend of the Chief and was not very strict when people grazed their cattle in the forest.

Three elderly men aged about 63 years from Monde sample village remembered that European Foresters marked the boundaries of Fuller Forest in the early 1930s. The Forestry Commission's records indicate that the forest was gazetted as a protected state forest in 1936. They further added that households that were resident within the boundaries of the protected forest were evicted between 1968 and 1970.

To quote one Tonga elderly man with respect to the demarcation of the forest and the subsequent application of forest legislation:

> "*It was clear to us that the forest was no longer ours. The Forestry Commission considered us abusers of the forest and poachers. How can we be called poachers, yet it is the Forestry Commission that encroached onto our ancestral land?"*

Asked why locals could not simply respect the forestry laws and regulations as required, villagers displayed ignorance of the provisions of these laws and regulations. Contrary some villagers were aware that people could get permits from the forest offices every Thursday. One woman from BH 28 Village said,

> "*Maybe people are simply reluctant to get permits because the forest offices are very far away and there are dangerous wild animals in the forest such as buffalos*"

The curio carvers' user group discussions substantiated the restricted access to commercial timber species. The group suggested that they should be considered for timber concessions for their trade as well. To the question why they do not tender for such concessions when the opportunities arise some individuals indicated that they were usually not aware when the tenders were advertised yet others said they would not be able to meet the tender requirements let alone afford the timber royalty fees. Interviews with the Chief Conservator of Forests confirmed that tenders for timber concessions were regularly advertised in the print media including local publications and notices were usually posted at the local forest office.

Interviews with a sample of livestock owners revealed that they were aware of grazing leases operating in other protected forests yet such an opportunity did not exist in Fuller Forest. Contacted for comments, the Chief Conservator and the local Forester indicated that on several occasions arrangements had been made with locals to graze their livestock in the forest at certain times of the year. More often than not such arrangements were discontinued when livestock owners abused the agreed system. According to this discussion group the desire was for people

to graze cattle in the forest throughout the year. Asked about the apparent conflicts amongst forest users despite the Fuller management plan, the forester pointed out that the plan was rarely put in practice.

In all five sample villages elderly men reported that the early timber concessions and Forestry Commission's fire protection activities provided employment opportunities to locals. Young males at meetings in these villages disputed the fact citing that the opportunity no longer existed for locals but for relatives of forest and safari camp managers who were imported from outside the district even for manual jobs. A summary of these social histories is given in Table 4.

5.1.3 Range of forest users around Fuller Forest

The lists of forest users as generated by local villagers during the fieldwork are given in Table 5. The lists were almost similar across the five sample villages. This was particularly so for harvesters of poles and thatch grass, licensed timber loggers, timber poachers, hunting and photographic safari operators, carvers, collectors of pit sand and livestock owners. The users ranged from those within sample villagers and those from outside sample villages. Some came from outside Hwange District in which Fuller Forest is located. For example, owners of Savanna Wood timber concession came from Bulawayo. Some curio carvers came from as far as Masvingo and Harare towns whose average distance was 400 km. This information tallied with records at Hwange Rural District Council which issued permits to curio carvers in the district, criminal records of forest based offences at Victoria Falls Police Station and Forest Protection Unit records at Fuller Forest Office. These records showed that some of the users came from nearby and distant villages, districts and towns. Nearby was arbitrarily defined as being within 10 km radius of Fuller Forest.

Table 4. **Summary of social histories of Fuller and the surrounding area.**

Village	Date	Events
BH28	1932	Forestry Commission started its operations in Fuller. Employment opportunities for forest patrolmen to check on poachers and arsonists, and for fire protection and timber logging operations. Forest legislation applied to local use of forest products.
	1952	Arrival of households from Masvingo, Matobo and Kezi
	1970s and Present	Forestry Commission evicts all people from the forest. People still use the forest as before but one has to avoid the Forest Guards.
BH 11	1947	Forestry Commission operations started. Forest legislation applied to local use of forest products.
	1951	
	1970s	Arrival of people from Masvingo.
	2002	Relations with the FC strained as it evicts all forest residents as they were now regarded as squatters.
	Present	Land redistribution – people should be allowed to settle in the forest We are still being arrested for using the forest even after independence
Chikandakubi	1931	Coming in of Forestry Commission and pegging boundaries of the forest. Forest laws restricted use of forest products by locals.
	1970	
	1980s	Hostilities start between Forestry Commission and forest margin communities because of evictions.
	2000	Escalating conflicts with the Forestry Commission as the Forestry Commission reintroduces management after the war of liberation. More difficult to harvest or collect forest products. Land reform.
Chidobe	1930	Forest Officer. Fire protection activities
	1933	RNTC logging timber in Fuller
	1950	Arrival of people from Kezi and Matobo who were displaced by establishment of commercial farms.
	1967	Introduction of Zebra, kudu and impala in Fuller.
	1970	Elephants and buffalo hunted by white men – safari hunting
	1984	Mr Tafaune replaces Mr Sparrow
	1992	Jafuta photographic camp built by Ngamo Safaris
	Present	Savanna Wood cutting timber in Fuller. Many people doing curios
Monde	1925	Arrival of Forestry Commission FC Officer First fire protection activities and guards employed to monitor and report fire occurrence.
	1930	Rhodesia Native Timber Concession commences timber logging. Men employed for loading timber and sawmilling.
	1950	Arrival of new people from Masvingo, Kezi and Matobo Districts
	1965	Wildlife management and utilisation introduced in Fuller Forest.
	1969-1981	Households evicted from Fuller Forest Protection Unit was established. The Forest Guards arrested people found harvesting forest products without permits
	1983	Arrival of first Black African Forester.
	1990	Photographic safaris introduced in Jafuta area
	2002	Savanna Wood Concession logging timber in forest
	Present	Relations not good with our neighbour.

Altogether there were 20 main users of different forest resources in Fuller Forest. Villagers raised concerns with respect to conflicts over resources between the various users. Livestock owners were disgruntled about their cattle being impounded by the Forestry Commission when

Table 5. **Lists of forest users generated by participants at village participatory discussion sessions.**

Chidobe Village	BH 11 Village	BH 28 Village	Monde Village	Chikandakubi Village
Hunting safaris	International hunters	Carvers from Victoria Falls and from local villages.	Curio carvers from Victoria Falls	Mbizha villagers
Grass cutters from Vic Falls	Timber companies e.g. Savanna Wood	Victoria Falls township residents for firewood, thatch grass and poles.	Wildlife poachers and safari hunters	Chenamisa villagers
Carvers from other provinces, districts and towns Livestock owners.	Curio carvers from Victoria Falls town	The Forestry Commission's Ngamo Safaris (hunting, photographic safaris): Tourists – hunters and photographers	Falls and Hwange construction companies for pit sand	Ndlovu villagers
Zimbabwe national Army for training purposes	Photographic safaris. Firewood harvesters, construction poles harvesters	Kwidini Construction company – pit sand	The Forestry Commission	Folosi village residents
The Forestry Commission's employees	Poachers from towns	Timber concessions e.g. Savanna Wood,	Ngamo Safari (consumptive & non-consumptive ecotourism)	Monde villagers
Photographic safaris	Collectors of pit sand e.g. Kwidini	Private safari operators	Falls residents for fire wood, timber, mulch	Lupinyu villagers
Timber concessions	The Forestry Commission employees	Victoria Falls Town Council – for firewood	Timber concessions - RNTC & Savanna	Chidobe villagers
Mushroom collectors	The Forestry Commission	Vegetable growers from Vic Falls – leaf mulch	Traditional healers from Vic Falls and Hwange	Milonga villagers
Harvesters of firewood, thatch grass and poles	Ngamo Safaris	Traditional healers from Byo, Vic Falls, Hwange, Harare	New settlers under the resettlement programme	Chewumba villagers
	Those being resettled in surrounding farms	Honey collectors, firewood and thatch grass harvesters	Livestock owners, wild fruit collectors, harvesters of construction poles, firewood, thatch grass and mopane worms	Siamwele villagers
	Thatch grass harvesters from Victoria Falls and those from local villages			Simadubi villagers
	Traditional healers from towns and other provinces			Resettled families
	Fire wood vendors from Victoria Falls			Safari operators

the cattle were found grazing in the forests. There was a general perception that outsiders were the root cause of resource destruction in the forest. In addition, wildlife poachers were raffled by arrests from the Forest Guards and hunting safaris Guides. Savanna Wood, who have a logging concession in the forests are in conflict with curio carvers as both compete for the same species.

5.1.4 Range and types of forest products harvested and used by local people

The extraction and use of 23 different products was recorded across the 5 sampled villages (Tables 6). Firewood, building poles, thatch grass and grazing were the most extensively harvested resources. Other commonly harvested products were medicinal plants, wild fruits, edible caterpillars and honey, wood for carving curios, ilala leaves, reeds, bark fibre, broom grass and mushrooms. Residents of the five villages extracted a wide range of forest products that was relatively similar across the villages.

The only resources extracted by 100% of households in at least two sample villages were firewood and building poles. Mean usage across all five villages indicated that firewood was the most widely harvested resource followed by building poles and thatch grass. The top five forest resources in terms of the mean proportion of households using them were fuelwood, building poles, thatch grass, wild fruits and broom grass. Monde and BH 28 residents made greater use of the forest than the other villages as evidenced by the diversity of resources harvested and used. The total number of different resources harvested by these two villages was 15. Although resources used were almost similar across villages, each village also had its own peculiarities. Curio carving was clearly important in Chidobe and Monde with respect

to the proportion of households using wood for that purpose. Reeds and ilala were peculiar to Monde. Pit sand and stones for building and leaf manure for fields were peculiar to BH 28 and BH 11 respectively.

Table 6. Proportion of households per sample village extracting products from Fuller Forest and the types of products extracted.

Forest product	**Village**					**Mean**	**Top 10 ranking products**
	BH 11	**Chidobe**	**BH28**	**Chikandakubi**	**Monde**		
	Proportion (%) of households (about 45 households per village at meetings)						
Firewood	100	100	100	80	80	92	**1**
Building poles	100	100	90	60	70	84	**2**
Thatch grass	100	0	80	90	60	66	**3**
Fruits	100	100	50	40	20	62	**4**
Broom grass	100	0	80	60	50	58	**5**
Grazing	0	0	70	75	80	45	**6**
Wood for implements	100	0	70	50	0	44	**7**
Caterpillars	80	50	40	0	15	37	**8**
Mushrooms	0	100	70	0	15	37	**8**
Medicines	40	90	10	10	12	32	**9**
Fencing branches	100	0	40	10	0	30	**10**
Honey	20	10	20	60	20	26	**11**
Dyes	80	0	0	10	0	18	**12**
Manure for fields	10	0	0	0	0	2	**16**
Wood for furniture	0	10	0	10	0	4	**15**
Wildlife	0	10	0	0	0	2	**16**
Pit sand	0	10	10	0	0	4	**15**
Dagga for bricks	0	0	20	0	10	6	**14**
Stones for building	0	0	10	0	0	2	**16**
Fibres	0	0	0	30	40	14	**13**
Timber for carving	0	20	0	0	70	18	**12**
Reeds	0	0	0	0	5	1	**17**
Ilala	0	0	0	0	5	1	**17**
Total	**930**	**590**	**750**	**585**	**552**		
Rank	**1**	**3**	**2**	**4**	**5**		
Total number of resources extracted	**12**	**11**	**15**	**13**	**15**		

When the different genders were asked to rank the products according to their importance for household and economic use, women generally allocated higher priority than men to harvesting thatch grass, broom grass, firewood, medicines, ilala and reeds. Men prioritised grazing, construction poles, wood for carving curios, medicines and bark fibre.

Sources of poles and firewood were indicated as parts of the forest adjacent to the villages. Plenary discussions revealed that, in general, these resources were collected from wherever they were available even from the village woodlands. For preferred sizes and species people went to the forest and sometimes ventured deeper into the forest in search for the desired goods. Poles were reported to be more difficult to find than firewood even in the forest because of the need to be more selective.

When participants were asked to differentiate gender roles for forest-based activities, women and girls were found to be the principal collectors of firewood for domestic uses and were highly selective in the species and sizes collected. They were also the principal harvesters of thatch grass and broom grass, caterpillars and mushrooms. Girls and boys harvested fruits either when herding livestock or returning home from school. They sometimes brought home some of the fruits. Boys and young males usually hunted for honey and small wild game such as birds, mice, hares and the smaller antelopes. Males collected firewood when it was required in large quantities and in large sizes particularly for special occasions like weddings and traditional ceremonies. Men also harvested poles required for the construction of various structures at the homestead. They were also responsible for harvesting bark fibre used during the construction and repairing of dwelling structures, livestock pens and fences.

Of the 21 tree species listed as being used for firewood, the most preferred species were *Combretum collinum*, *Baikiaea plurijuga*, *Brachystegia spiciformis*, *Colophospermum mopane* and *Burkea africana*. *Brachystegia spiciformis* and

Colophospermum mopane were more favoured than the others. These species were preferred because both gender reported that the species had desired characteristics such as production of hot flames, burning with little smoke and have lasting embers.

Men from Monde and Chikandakubi Villagers pointed out that Fuller Forest played an important role in the supply of construction poles. They reported that the forest still contained good quality poles of the preferred species and sizes than the village woodlands. During visits to the villages for the meetings it was observed that most dwelling structures were constructed using poles and the majority of large and small livestock pens were constructed out of different sized poles. In addition, interviews with the Forester and the Forest Protection Unit Officer at Fuller Forest office revealed that every year people are arrested for illegally cutting trees for construction poles. In 1999 and 2000, 82 and 166 individuals respectively were apprehended for tree cutting. The total number of various sizes of trees that were illegally cut was 3276. Of the 13 tree species reported as useful in the construction of walls and roofs of houses, animal pens, grain storage structures and as fence posts, the most favoured species were *Burkea africana*, *Croton gratissimus, Colophospermum mopane, Baikiaea plurijuga, Erythrophleum africanum, Diplorhynchus condylocarpon, Terminalia* species and *Kirkia acuminata.*

Grazing is a valuable resource for livestock owners living adjacent to Fuller Forest. Owners of livestock use the grazing resource during the wet season, from November to March.

Villagers identified 20 woody species that provide edible food in the form of fruits, seeds, leaves and young shoots of which 14 species are wild fruit species (Table 7). Wild fruits are the most commonly harvested edible foods and the most popular were *Adansonia digitata, Flacourtia indica, Grewia flavescens, Strychnos cocculoides, Ximenia caffra, Vangueriopsis lanciflora and Vitex payos.*

Table 7. **Woody plant species providing edible foods and parts of the plant used.**

Species	**Part used for food**
Adansonia digitata	Fruit/young leaves, eaten fresh
Afzelia quanzensis	Young leaves, eaten fresh
Bauhinia thonningii	Pods and seeds
Boscia albitrunca	Roots, dried and ground into powder for porridge
Diospyros mespiliformis	Fruit eaten fresh or preserved for latter use
Ficus sycomorus	Fruit, eaten fresh or dried
Flacourtia indica	Fruit, eaten fresh
Friesodielsia obovata	Fruit, eaten fresh
Grewia bicolor	Fruit
Grewia flavescens	Fruit, eaten fresh or dried
Grewia retinervis	Fruit
Guibourtia coleosperma	Seed boiled and the syrup eaten, seed roasted and eaten
Schynziophyton rautanenii	Nuts
Strychnos cocculoides	Fruit, eaten fresh
Strychnos madagascariensis	Fruit, pulp can be dried and eaten latter
Vangueria infausta	Fruit, eaten fresh or dried
Vangueriopsis lanciflora	Fruit, eaten fresh or dried
Vitex payos and Vitex mombassae	Fruit
Xanthocercis zambesiana	Fruits, eaten fresh or dried and ground into powder that makes porridge
Ximenia caffra	Fruit, eaten fresh

Fuller Forest has several species of wildlife that are harvested for food. Some of the wildlife species mentioned by participants at PRA village meetings are listed in Table

8. Wild game is usually poached by snaring or is hunted using dogs. According to the forest Act wildlife use without a permit or licence is a criminal offence. And according to the local Forest Protection officer, there were more offences related to

Table 8. **List of wildlife species generated during village meetings and their general uses.**

Species	**Main use**
Baboon	Not preferred for subsistence.
Buffalo	As above but also poached for subsistence
Bushbuck	Highly preferred for subsistence
Bush pig	Highly preferred for subsistence
Duiker	Preferred for subsistence
Elephant	Hunting and photographic safaris
Hyena	Hunting and photographic safaris
Impala	Highly preferred for subsistence
Jackal	Not preferred for subsistence
Kudu	Highly preferred for subsistence and safaris
Leopard	Hunting and photographic safaris
Lion	Hunting and photographic safaris
Monkey	Not preferred for subsistence
Reedbuck	Poached for subsistence
Sable	Highly preferred for subsistence and safaris
Steenbok	Poached for subsistence
Warthog	Highly preferred for subsistence
Waterbuck	Hunting and photographic safaris. Rarely poached
Zebra	Hunting and photographic safaris
A variety of bird species	Harvested for subsistence
A variety of rodent species	Harvested for subsistence

wildlife poaching than any other resource. His 1998 records showed that 798 individuals had been apprehended for various wildlife related offences compared to 510 for other various resources. Wild game in the forest is also used for consumptive and non-consumptive tourism. There are three safari camps in the forest. Two are for hunting safaris and one is for photographic safaris. The Forestry Commission operates

all of them. Some parts of the poached animals (bones, teeth, tails, skins) are used in the traditional health care system. Information on how people caught the animals and how the meat was disposed of was difficult to obtain.

Forty-five plant species from Fuller Forest were reported to have medicinal value. At least one group of mixed gender and ages at each village meeting produced a list of the medicinal plant species and their uses. The medicine was harvested for own use or for sale. These most common medicinal plant species are shown in Table 9. Of these species the favoured ones are *Bauhinia petersiana, Dialium englerianum, Diplorhynchus condylocarpon, Markhamia acuminata and Terminalia sericea.* The roots, leaves, seeds and bark of the species are used in the traditional health care system. Plant material combinations are used for simple and common ailments such as diarrhoea, coughs, headaches, minor wounds, colds, eye infections and backaches.

In each sampled village between 1% and 100% of households collect forest products for own use or direct household consumption rather than for sale (Table 10). Mean collection across the villages indicated that building poles are the most harvested products for own use, followed by firewood, thatch grass, honey, fruits and broom grass. The products collected for own use by all households in at least three villages were building poles, firewood, fencing branches and grazing. Proportions of households collecting forest products for own use varied across the sample villages i.e. from 0 to 100%. Chidobe village had the least proportion of households dependent on Fuller for forest products for own use and Monde village had the highest.

Table 9. **List of common medicinal plant species generated by villagers during PRA workshops in 5 sample villages**

Species	**Part(s) used**
Afzelia quanzensis	Roots, infusion claimed to cure bilharzias
Bauhinia petersiana	Leaves boiled and inhaled for common colds
Bauhinia thonningii	Bark crushed to treat minor woods
Burkea africana	Roots for treatment of sores
Clerodendrum glabrum	Leaves and roots to treat stomach-aches and snakebites respectively
Combretum zeyheri	Roots cure chronic nose bleeding and haemorrhoids
Crossopteryx febrifuga	Crushed and soaked bark and leaves used in treatment of fever
Dialium englerianum	Leaves when crushed are a remedy for coughs
Diospyros mespiliformis	Small twigs, leaves and bark for various ailments
Diplorhynchus condylocarpon	Roots to treat diarrhoea & leaves for headaches
Dombeya rotundifolia	Infusion of bark to induce labour in women
Flacourtia indica	Roots, bark
Markhamia acuminata	Small roots are slightly burnt and ground into a black powder rubbed into incised skin to relieve backache
Ochna pulchra	Roots as lucky charms
Olea europaea	Fresh bark relieves colic
Schrebera trichoclada	Roots used as eye lotion
Stereospermum kunthianum	Chewing the pods relieves hard coughs
Terminalia sericea	Roots cure diarrhoea
Ziziphus mucronata	Leaves, roots, bark for several ailments

The top ten products collected or harvested by households for sale or commercial purposes include timber for furniture and for curio carving, caterpillars, medicines, fruits, honey, dyes, broom grass, firewood and thatch grass (Table 11). There is considerable variation in the proportion of households (0 to 98%) collecting forest products for sale. Chikandakubi and Monde villages collected a wider diversity of products for sale than the other villages i.e. 10 and 11 products respectively. The highest proportion of households that collected forest products for sale are found in Chidobe village and the least proportion of households that sold forest products are in BH 28 village.

Table 10. **Proportion of households in the five study villages collecting forest products for direct household consumption.**

Forest product	Village					Mean	Ranking
	BH 11	Chidobe	BH28	Chikandakubi	Monde		
	Proportion (%) of households (about 45 households per village at meetings)						
Building poles	100	95	100	100	100	99	**1**
Firewood	100	75	100	100	95	94	**2**
Thatch grass	100	0	90	85	90	73	**3**
Honey	100	15	100	98	85	79.5	**4**
Fruits	70	25	98	98	95	77.2	**5**
Broom grass	60	0	99	98	100	71.4	**6**
Medicines	20	25	90	95	90	64	**7**
Caterpillars	80	50	50	50	85	63	**8**
Fencing branches	100	0	100	100	0	60	**9**
Mushrooms	0	100	100	0	90	58	**10**
Wood for implements	100	0	95	90	0	57	**11**
Dyes	60	0	0	96	0	31.2	**14**
Manure for fields	100	0	0	0	0	20	**15**
Timber for furniture	0	2	0	2	0	0.8	**17**
Wildlife	0	100	0	0	0	20	**15**
Pit sand	0	100	100	0	0	40	**12**
Grazing	0	0	100	100	100	60	**9**
Dagga for bricks	0	0	100	0	100	40	**12**
Stones for building	0	0	100	0	0	20	**15**
Fibres	0	0	0	98	95	38.6	**13**
Timber for carving	0	1	0	0	15	3.2	**16**
Reeds	0	0	0	0	100	20	**15**
Ilala	0	0	0	0	100	20	**15**
Total	**990**	**587**	**1422**	**1210**	**1340**		
Rank	**4**	**5**	**1**	**3**	**2**		

5.1.5 Perceptions of resource abundance and decline over time

The five sample villages reported a general decline in the availability of most forest products in the last ten years. BH 11 indicated the highest number of resources declining in the forest and Monde the least. The general consensus among villagers, including the traditional leaders, was that resources had declined considerably since they first arrived, although there were still adequate supplies of wood for their needs. Most villagers expressed the change as a difference in forest tree density. They could now see through the forest whereas in the past the forest had been much denser.

Table 11. **Proportion of households per sample village extracting products for sale.**

Forest product	Village					Mean	Ranking
	BH 11	Chidobe	BH28	Chikandakubi	Monde		
	Proportion (%) of households (about 45 households per village at meetings)						
Wood for furniture	0	98	0	98	0	39	**1**
Timber for carving	0	99	0	0	85	37	**2**
Caterpillars	20	50	50	50	15	37	**3**
Medicines	80	75	10	5	10	36	**4**
Fruits	30	75	2	2	55	22	**5**
Honey	0	85	0	50	15	20	**6**
Dyes	40	0	0	4	0	8.8	**7**
Broom grass	40	0	1	2	0	8.6	**8**
Firewood	0	25	0	0	5	6	**9**
Thatch grass	45	65	40	25	80	5	**10**
Building poles	0	5	0	0	10	3	**11**
Fencing branches	0	0	0	0	0	0	
Wood for implements	0	0	5	10	0	3	**11**
Manure for fields	0	0	0	0	0	0	
Mushrooms	48	25	0	55	75	2	**12**
Wildlife	0	0	0	0	0	0	-
Pit sand	0	0	0	0	0	0	-
Grazing	0	0	0	0	0	0	-
Dagga for bricks	0	0	0	0	0	0	-
Stones for building	0	0	0	0	0	0	-
Fibres	0	0	0	2	5	1.4	**13**
Reeds	0	0	0	0	0	0	-
Ilala	0	0	0	0	0	0	-
Total	**303**	**600**	**118**	**273**	**335**	-	-
Rank	**2**	**1**	**5**	**4**	**3**	-	-
Total no. of products sold	**7**	**10**	**6**	**10**	**10**		

Villagers pointed out that the abundance or scarcity of some forest resources was related to seasonal and annual variations. For example, abundance of mushrooms, caterpillars, fruits, thatch grass and grazing was said to be seasonal and could increase or decrease significantly depending on amounts of rainfall received during the year. Asked about the reasons for the trend in scarcity of the forest products during plenary discussions, participants at all meetings indicated the high population density of wildlife e.g. elephants and buffaloes that damage vegetation; destructive fires, over-exploitation by timber concessionaires and over-hunting by safari operators, and

droughts that kill woody plants and animals and people cutting many poles for fence posts for crop fields and animals kraals. In years of good harvests, many new poles were cut to improve grain storage facilities.

Responses to the question 'What do you think the state of the forest will be in 10 years from now?' were varied. Some people thought that resource stocks would not be much different from present levels because some households could by then be using electricity that is being distributed nationally. Some were of the opinion that trees which had been cut would have regenerated so that cutting of new trees would be unnecessary. Some said that tree stocks, especially of large trees, would continue to be depleted for construction of houses and use as fence posts. The majority of people, however, felt that unless present practices were changed, the forest resource base would continue to decrease.

The greatest problem encountered by the villagers, and one which they believed could eventually cause the total destruction of Fuller, was the uncontrolled use of forest resources by outsiders e.g. those from Victoria Falls and carvers from other towns, districts and provinces.

5.1.6 Spatial proximity to forest and use patterns

Observations revealed that the forest was more degraded where the forest and villages had common boundaries than in the forest interior. More tree stumps and crowns of trees cut for poles, timber for carving and firewood were observed at the forest/village boundary than in the forest interior. An analysis of poaching and arrest records indicated that most sites of poaching crimes were located at the forest boundaries. For

example, there were 331 arrest cases at the forest boundary compared to 119 in the interior of the forest in 2000.

Women at the Chikandakubi participatory group sessions concurred with the Forest Protection Officer that there were increasing incidences of thatch grass harvesters coming from villages more than 10 km away. The women reported going for thatch grass harvesting trips with their relatives living in villages far from the forest. Thatch grass harvesters obtain permits from the local forest office that allow them to camp in the forest for three weeks or more harvesting thatch grass. The thatch grass permit book at Fuller Forest for 2000 showed that 28 harvesters came from Victoria Falls Town that is 25 kilometres away. A greater proportion of permits, 63 in total, were issued to individual harvesters from forest adjacent villages.

Groups that generated lists of wildlife species that are found in Fuller Forest reported in their groups and in plenary that wildlife poachers came as far away as Victoria Falls Town and camp in the forest for extended periods during their hunting and game trapping expeditions. There were attempts at some of the sample villages such as BH 11 and Chikandakubi to exonerate local people from wildlife poachers. Participants at meetings in these villages either refused to talk about the wildlife poaching subject or denied that their counterparts engaged in illegal wildlife hunting activities.

During the cropping season and especially in drought times some cattle herders from villages 10 to 12 km away camp in the forest where the grazing resource would be in abundance and water for their livestock would be available from the artificial game watering points. During this study the Forest Protection Unit impounded 28 herds of

cattle found drinking water at a water point in the photographic safari zone. These cattle belonged to households from Mbizha Ward that does not share boundaries with Fuller Forest.

In years when the mopane worm is in abundance, harvesters come from different parts of the province and only leave the forest after processing and packaging the worms. Mopane worm harvesting activity is generally illegal as was found during an analysis of forest-based offences at Victoria Falls Police station.

Individuals from outside Hwange District owned four of the 13 curio carving and vending stalls on the section of Fuller Forest along the Bulawayo-Victoria Falls Road. These four came from Harare, Bindura, Lupane and Masvingo. Interviews with three owners of these stalls revealed that some of the carvers were the owners' relatives. During key informant interviews the local Forester and the Conservator of Forests expressed concern on the increasing numbers of outsiders setting up curio stalls along the highway that passes through Fuller Forest. A German entrepreneur built a curio warehouse near a business centre adjacent to the entrance road to Fuller Forest Office. The German bought various types and sizes of curios that he was shipping to Europe.

5.1.7 Seasonality of harvesting forest products

The harvesting and use of forest products in Fuller Forest was found to be seasonal (Table 12) after one group at each sample village drew up a matrix of type of resource and month(s) of the year when the resource was usually harvested or collected. The same groups went on to comment on the reasons why a particular resource was

Table 12. **A summary of seasonal patterns of forest products extraction and use from five groups in five sample villages**

Resource	Month											
	J	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
	Season											
	Wet & Warm				Cold & Dry					Wet & Warm		
Trusses & cross members	•	•	•	•	•	•• •	••• •	••• •	••• •	••	•	•
Thatch grass						••• ••••	••• ••••••	••				
Broom grass						••• ••••	••• ••••••	••				
Construction poles	•	•	•	•	••	•••	•••	••••	•••	•••	••	••••
Reeds						••	••	••				
Ilala						••	••	••				
Grazing	•••	•••	•••	••								•••
Fire wood	•	•	•	•	•	•••	•••	••	•	•	••	•••
Mopane worms	•										•	•••
Honey					••	•••	•••					
Wild fruits	•	•	•	•	•	•	•	••	••	••	••	••
Bark fibre	•	•	•	•	•	•	••	••	••	••	••	••
Medicinal plants	••	••	••	••	•	•	•	•	•	•	•	••
Mushrooms	••	••	••									
Timber for carving					•	•••	•••	•••	•••	••	••	••
Honey				••	••	••						

Notes: *More dots denote higher intensity of harvesting of the product during the given month of the year.*

harvested or collected during a particular month. The summary of these comments is given in Table 13. During plenary discussions there were contradicting comments with respect to when and why some resources e.g. reeds, ilala, grazing and broom grass were harvested or collected at specific times of the year. Individuals who had used a resource for a long time knew the best times for collection than opportunistic users.

Wild fruits, firewood, construction poles and medicines are harvested throughout the year. Building of various structures is staggered through the year but with a concentration of the activity from June to December. This is the time pole harvesting activity peaks. Although firewood is used throughout the year, women strongly felt

that far more collection took place during the cold season. Availability of some products such as mopane worms, mushrooms and some wild vegetables are linked to the wet season. Grazing in the forest is generally practised during the wet season although cattle were seen in the forest even during the dry season.

Table 13. **Villagers' comments on seasonality and use patterns of forest products**

Resource	**Comments**
Trusses & cross members	Increased construction and repair works during months when there are less agricultural activities.
Thatch grass	The product will be mature this period.
Broom grass	As above.
Construction poles	Increased activities of repairs & new construction works.
Reeds	Product will be ready for harvesting.
Ilala	Product will be ready for harvesting.
Grazing	Increased use of forest during wet season, when cattle are to be kept away from crop fields. Strategy of reserving communal area grazing resource for winter. FC encourages cattle removal during the hunting season (April to November).
Fire wood	Harvested throughout the year, with peaks in cold season and during traditional ceremonies and public holidays.
Mopane worms	Heaviest outbreak experienced in December.
Honey	Good yields in cold season.
Wild fruits	Availability & yields variable between wet & dry season. Harvested mainly by women and children.
Bark fibre	Heavy use during construction time, but need may arise any time. Bark may be stocked for emergency repairs.
Medicinal plants	Increased harvesting in wet season, easy to identify plants when in leaf.
Mushrooms	Abundant during the wet season. Yields may be reduced due to fire that consumes growth substrate.
Timber for carving	Activity intensifies pre and during public holidays. Generally, carving takes place all year round. Numbers of buyers peak in April, August and December so more timber required.

The harvesting of some of the forest products is concentrated in the dry season e.g. for construction and fencing poles and in winter e.g. for firewood, thatch and broom grass. During plenary discussions at village PRA meetings it became apparent that these activities were related to off-cropping season and weather conditions respectively.

5.1.8 Households' wealth status and reliance on forest use

The PRA exercise to determine households' wealth status or well-being identified four wealth categories namely rich, average, poor and very poor. The indicators of descriptors for these different wealth categories are given in Table 14.

The common wealth indicators across the five villages were: (i) Livestock ownership; (ii) Size of land cultivated; (iii) Size of a season's harvest; (iv) Type of housing; (v) Type of food eaten; (vi) Type and quality of clothing; (vii) Ownership of movable property e.g. furniture, farm implements, car, etc; (viii) Children's level of education; (x) Formal employment; (xi) Number of wives; and (xii) Number of children.

The wealth indicators across the villages were relatively similar. Although livestock includes cattle, goats, pigs, donkeys, sheep and fowls, cattle is the most important wealth indicator. The rich own between 50 and 150 cattle, while the very poor do not own any cattle. The rich cultivate up to 5 hectares of land while the very poor cultivate between 0.5 and one hectare of land.

Table 14. **A summary of the descriptors of the different wealth categories per sample village.**

Wealth category	Wealth descriptors								
	Livestock	**Size of field (Acres)**	**Average harvest/yr**	**Type of houses**	**Movable property**	**Type of food**	**Children's education**	**Type of employment**	**No. of wives**
	BH 28 Village								
Rich	50	14	100 bags maize and other crops	7 structures of Brick and asbestos housing	Car, bicycle, large table, double beds, cart	Eat whatever they want. Clean food. Occasionally slaughter goats and fowls	Up to university	Manager in town/city	1-2
Average	20	7	75 bags of maize and other crops	4 structures. Brick and asbestos	Bed, table, cart, bicycle, wheel burrow	Mainly thick porridge and vegetables	Up to 'O' level	In town or District council or self	3
Poor	2	4	5 bags of maize and other crops	3 huts at least main bedroom of bricks	Blankets,	Has hardly enough	Primary level	Contract labour	1
Very poor	0	0	1 bag or less	1 or two pole and dagga huts	Few blankets	Nothing most times	None	Contract labour or piece work	1 but always being deserted due to lack of food
	BH 11 Village								
Rich	50 – 100	23	80 bags	8 house of brick under asbestos	Adequate household furniture and farming equipment, bicycle	Very good food, rice, meat, milk	University	Managing Director	1
Average	20	15	35 bags	4 huts thatched and of mud bricks	Some few household effects but no furniture, ox-plough	Thick porridge, rice and meat at special times	'O' and 'A' levels	Middle management in civil service or private sector	2
Poor	0 – 5	10	7bags	2-3-Pole and dagga and thatched	Owns wardrobe, cupboard, hoes	Thick porridge	Junior certificate	Supervisor	1

Wealth category	Wealth descriptors								
	Livestock	**Size of field (Acres)**	**Average harvest/yr**	**Type of houses**	**Movable property**	**Type of food**	**Children's education**	**Type of employment**	**No. of wives**
Very poor	0	5	0-1	1 Pole and dagga and thatched	Few pots and plates	Thick porridge, wild foods	Primary or none	General hand	1
	Chikandakubi Village								
Rich	60 cattle, 30 goats, 10 donkeys	16	75 bags maize	4 rooms, brick under asbestos, 3 granaries, fenced home, toilet	Ox plough, cultivator, car, borehole, scotch cart, bicycle, wheel burrow, furniture	Eats well, plenty of thick porridge, buys grocery every month, meat and rice	University and boarding schools	Chief Executive in big companies	1
Average	15 cattle, 5 donkeys	9	40 maize	4 pole and dagga huts neatly thatched,	Ox plough, cultivator, furniture	Has adequate thick porridge everyday, meat and rice occasionally	'A' level	Civil servant	1
Poor	3 donkeys, few chickens and 2 goats	5	8 bags maize	3 pole and dagga thatched huts, has no toilet	Relies on borrowing farming equipment, home made furniture	Thick porridge and vegetables	Primary	Supervisor	1
Very poor	0	1-2	1-2 bags millet	I pole and dagga hut rough thatched	Wooden stools, few pots and plates	Hardly has enough thick porridge	Primary or none	Casual labour	1
	Chidobe Village								
Rich	50-100	23	160 bags maize and other crops	All 5 houses brick under asbestos.	Household furniture and farm equipment, bicycle	Adequate meals all times, meat, milk, groceries monthly	University and college	General Manager in town	2
Average	20	15	75 bags maize and other crops	4 roomed thatched house under mud bricks	Ox plough, some cultivator, bicycle, few furniture items	Adequate meals everyday, meat and rice during public holidays	'A' Level	Middle management in town or council	2
Poor	0-5	10	10 bags maize	3 Pole and dagga thatched huts	Wardrobe, cupboard, basic tillage equipment	Enough for two meals a day	Primary	General hand	1

Wealth category	Wealth descriptors								
	Livestock	**Size of field (Acres)**	**Average harvest/yr**	**Type of houses**	**Movable property**	**Type of food**	**Children's education**	**Type of employment**	**No. of wives**
Very poor	0	5	1-3 bags maize	1 pole and dagga thatched hut	Small table and chairs, stools, pots, plates	Sometimes no food, borrows food often	Primary or none unless sponsored	Casual labour or piece work	1
	Monde Village								
	Livestock	**Size of field (Acres)**	**Average harvest/yr**	**Type of houses**	**Movable property**	**Type of food**	**Children's education**	**Type of employment**	**No. of wives**
Rich	80	12	55	Brick under asbestos	Car, farming equipment e.g. ox plough, cultivator, planter, good bedroom and dining furniture, cart	Affords variety all times, slaughters goats during public holidays and cow once a year	College and university	Managing Director at big companies like hotels	2
Average	15-25	8	30	Brick under thatch	Ox plough, bicycle, wheel burrow, furniture, cart, fence	Adequate meals everyday, slaughters fowls occasionally, kills goat at Christmas	Secondary	Manager, teacher, train driver	2
Poor	5	6	8	Pole and dagga and thatch	Basic farming equipment,	Thick porridge and vegetables, sometimes not enough	Junior certificate	Contract labour	1
Very poor	0	3	0-2	Pole and dagga and thatch	Few household items	Begs for food most times	None	None, most is casual work	1

While the rich use mostly brick and asbestos and/or iron sheets for their housing, most average, poor and very poor households rely mostly on forest products such as poles and thatching grass for constructing and repairing their houses.

Across the five villages, 50.6% of the households are poor, 19% are very poor, 24% are of average wealth and only 6.4% are rich (Table 15). Of the rich households none is female headed across the 5 sample villages. Across the villages about 32% of the households are female headed. Using the wealth indicators referred to above a stratified sample of households was obtained for each sample village (Table 15).

Table 15. **Stratified sample of households in the five sample villages**

Village	Wealth category	% of Households	% of male-headed households (%)	% of female-headed households (%)
Chidobe	Rich	5	5	0
	Average	20	14	6
	Poor	35	30	5
	Very poor	40	20	20
BH 11	Rich	9	9	0
	Average	17	11	6
	Poor	54	40	14
	Very poor	20	9	11
BH 28	Rich	7	7	0
	Average	13	8	5
	Poor	65	53	12
	Very poor	15	9	6
Monde	Rich	6	6	0
	Average	10	7	3
	Poor	74	54	20
	Very poor	10	2	8
Chikandakubi	Rich	5	5	0
	Average	60	40	20
	Poor	25	10	15
	Very poor	10	3	7

An analysis of livelihood strategies was necessary to establish reliance of households on forest resources. Tables 16 to 20 list the livelihood strategies for the residents in the sample villages, scored out of 10 to indicate level of importance of the particular

strategy. Ten represents the most important strategy while 0 represents the least important. Livelihood strategies were different across the sample villages.

The most important livelihood system for the rich and average households is agriculture, i.e. livestock and crop production. The production of curios is increasingly becoming an important livelihood strategy for the rich who apparently can mobilise the required capital assets such as finance, physical and human resources.

Table 16. **Livelihood strategies – Chidobe Village (Values are scores out of ten)**

Livelihood strategy	Wealth category			
	Rich	Average	Poor	Very poor
Livestock	8	7	5	1
Vending	1	6	3	0
Cropping	7	5	2	0
Carving	5	7	8	9
Knitting	0	3	5	1
Selling beer	0	4	6	0
Gardening	0	3	1	0
Clubs	1	5	2	0
Sell of bushmeat	0	2	5	5
Traditional healing	1	3	1	0

Table 17. **Livelihood strategies – BH 11 Village. (Values are scores out of ten)**

	Wealth category			
Livelihood Strategy	Rich	Average	Poor	Very poor
Livestock	9	7	3	1
Cropping	7	5	3	1
Carving	1	4	7	8
Knitting & sewing	5	1	4	3
Building	0	1	5	2
Formal employment	4	6	3	0
Herding	0	0	4	7
Remittances	0	4	1	0
Selling thatch grass	0	1	5	7
Thatching	0	0	6	6
Traditional healing	0	0	3	4

Table 18. **Livelihood strategies – BH 28 Village. (Values are scores out of ten)**

	Wealth category			
Livelihood Strategy	**Rich**	**Average**	**Poor**	**Very poor**
Livestock	7	5	3	2
Cropping	8	2	2	1
Carving	1	1	7	8
Business	2	3	1	1
Formal employment	1	2	1	0
Piece work	0	0	3	7

Table 19. **Livelihood strategies - Monde Village. (Values are scores out of ten)**

	Wealth category			
Livelihood Strategy	**Rich**	**Average**	**Poor**	**Very poor**
Livestock	8	6	5	0
Vending	0	4	5	0
Cropping	7	5	2	1
Curio carving	1	7	7	7
Brick moulding	0	2	7	8
Harvesting Forest products	0	3	8	9
Employment in Tourism industry	1	3	2	1

Table 20. **Livelihood strategies – Chikandakubi Village. (Values are scores out of ten)**

	Wealth category			
Livelihood Strategy	**Rich**	**Average**	**Poor**	**Very poor**
Livestock	9	6	4	1
Vending	0	2	6	2
Cropping	8	6	3	1
Carving	2	5	8	9
Piece work	0	1	6	8
Remittances	2	5	1	0

There is a wide variation in strategies for the poor and very poor households across the villages. Engagement in the woodcarving industry scored highly for the poor and

very poor households. During plenary sessions it was revealed that skilled carvers employ members of the poorer households to procure wood for carving, do the carving under instructions, polishing, varnishing and selling the artefacts. Other important strategies for these poorer households include piecework, vending, herding, cultivating and harvesting crops and brick moulding. The poor and very poor households are also engaged in harvesting and selling thatch grass, wild fruits and firewood.

For the average, poor and very poor households a number of livelihood strategies are forest based. These include involvement in the carving industry activities, selling of bushmeat, thatch grass, poles, firewood and fruits. Some members of these households obtain employment in the local tourism industry as general hands and/or semi-skilled labour.

5.1.9 Local perceptions on resource use impacts

Perceived ecological impacts arising from local harvesting activities of forest products are presented according to the activities (Table 21). Harvesting of a wide range of forest products were perceived to have negative impacts on products harvested and the forest environment in general.

In considering the mitigation strategies, residents appeared to distance themselves from active engagement in making good the impacts of their use of the forest. Most of their strategies placed emphasis on effective policing by the Forestry Commission.

The researcher failed to get proof of the actual examples of activities related to the reported mitigatory measures.

Table 21. **Summary of villagers' perceptions on impacts arising from harvesting forest products.**

ACTIVITY	IMPACT	MITIGATION
Indiscriminate and destructive cutting of trees.	Loss of species. Destruction of reproductive adults. Less regeneration. Forest degradation Soil erosion after removal of vegetation cover.	Tree planting in village lands Effective control of harvesting activities by FC. Establish indigenous tree nurseries at Fuller Forest & planting in the forest. People must harvest and collect dead wood only.
Cutting thatch grass before maturity.	Reduced thatch grass yields & destruction of seeds.	Only harvest after maturity & need to monitor activity through permits.
Hunting without authority (poaching).	Reduced numbers of animals Reduced numbers of animal species.	Formalising local use and management through CAMPFIRE approach. No hunting without authority: FC to institute citizen hunting.
Use of sledges to transport poles & firewood.	Soil erosion.	No sledges in the forest.
Causing wild fires when herding, collecting honey and hunting game.	Loss of grazing resource. Trees of all ages are killed. Soil erosion when vegetation cover is removed.	Local fire prevention strategy is required. The Forestry Commission should teach villagers on correct use of fire.
Wildlife management and control	Increased numbers of animals and hence increased damage to trees.	Numbers of some species (elephants, buffalo) must be reduced.
Uncontrolled grazing.	Degradation of the grazing resource. Soil erosion.	Numbers of cattle grazing in forest must be controlled. Encourage rotational grazing.

5.2 Status of the woody resource base in fuller forest

5.2.1 Species composition

A total of 75 woody species were recorded in the forest. The demography of 23 species that had a relative density greater than 1% is shown in Table 22. There is considerable variation in the descriptive statistics for the commonly harvested tree species.

These 23 species constituted 91% of stems per hectare for all the species recorded in the forest. Out of these 23 species only seven, *Baikiaea plurijuga*, *Bauhinia petersiana*, *Commiphora mollis*, *Commiphora mossambicensis*, *Commiphora*

angolensis, Baphia massaiensis and *Kirkia acuminata* had more than 50 stems/ha and these 7 species contributed 70% to the total relative density of all stems measured.

Table 22. **Demography of species with relative density > 1% and commonly harvested species**

Species	Stems/ha	Relative density (%)	Frequency (%)	Basal area/ha (m^2)	Relative dominance (%)	Importance value	IV Rank	Mean dbh (cm)
Baikiaea plurijuga*	483	34.90	78.02	7.74	39.21	74.11	1	11.6
*Kirkia acuminata**	53	3.83	56.04	2.48	12.56	16.39	2	21.6
*Commiphora angolensis**	86	6.21	26.71	1.03	5.22	11.43	3	7.9
Bauhinia petersiana	135	9.75	49.45	0.24	1.22	10.97	4	4.0
Commiphora mollis	95	6.86	59.34	0.35	1.77	8.63	5	10.8
Erythrophleum africanum*	41	2.96	50.55	0.90	4.55	7.51	6	14.7
*Brachystegia spiciformis**	33	2.38	32.97	0.67	3.39	5.77	7	11.8
*Colophospermum mopane**	44	3.17	12.09	0.43	2.18	5.35	8	9.3
Commiphora mocambicensis	55	4.05	19.78	0.23	1.17	5.22	9	6.5
Baphia massaiensis	57	4.12	29.67	0.08	0.41	4.53	10	3.9
Brachystegia boehmii	34	2.46	2.19	0.18	0.91	3.37	11	10.4
*Terminalia sericea**	24	1.79	35.16	0.23	1.17	2.96	12	9.2
Guibourtia coleosperma*	18	1.34	16.0	0.41	0.73	2.18	13	3.0
Pseudolachnostylis maprouneifolia	21	1.52	35.16	0.15	0.75	2.27	14	8.3
*Combretum collinum**	23	1.66	46.15	0.08	0.41	2.07	15	5.4
Julbernardia globiflora	16	1.16	15.38	0.18	0.91	2.07	516	10.6
Diplorhynchus condylocarpon*	25	1.81	17.58	0.04	0.20	2.01	16	4.2
Euphorbia matabelensis	22	1.59	17.58	0.02	0.01	1.60	17	3.1
Ochna pulchra	20	1.45	35.16	0.08	0.41	1.86	18	5.8
Croton gratissimus	15	1.08	3.30	0.07	0.35	1.43	19	6.7
Pterocarpus angolensis*	13	1.22	9.51	0.67	0.35	1.31	20	5.0
Vangueriopsis lanciflora	14	1.01	1.02	0.02	0.01	1.02	21	3.6
Afzelia quanzensis*	6	1.00	1.00	0.20	0.1	1.01	22	3.0

* Commonly harvested species

In the 91 sample plots (4.113 ha), there were 1439 stems/ha with diameter at breast height greater than 2 cm. There is considerable variation in stem absolute density amongst species, ranging from 1 to 483 stems/ha. The most dominant and commonest species is *Baikiaea plurijuga* with an absolute density of 483 trees/ha, a relative density of 34.9% and frequency of 78.02%. Other woody species with high frequency of occurrences are *Commiphora mollis* (59.34%), *Kirkia acuminata* (56.04%), *Erythrophleum africanum* (50.55%) and *Bauhinia petersiana* (49.45%).

The absolute densities of species favoured for firewood were *Baikiaea plurijuga* (483 stems/ha), *Brachystegia spiciformis* (33 stems/ha), *Colophospermum mopane* (44 stems/ha), *Combretum collinum* (23 stems/ha) and *Burkea africana* (9 stems/ha) and their frequency of occurrence ranged between 78.02% and 12.09%. Species favoured for construction poles had the following absolute densities: *Kirkia acuminata* (53 stems/ha), *Colophospermum mopane* (44 stems/ha), *Erythrophleum africanum* (41 stems/ha), *Terminalia sericea* (24 stems/ha), *Croton gratissimus* (15 stems/ha) and *Burkea africana* (9 stems/ha). Frequency of occurrence of these species was between and 56.04% and 3.30%. Species favoured for woodcarving, i.e. *Pterocarpus angolensis* and *Afzelia quanzensis*, had absolute densities of 13 and 6 stems/ha respectively.

The total basal area in the 91 sample plots (4.113 ha) was 81.40 m^2 (estimated mean 19.74 m^2/ha). *Baikiaea plurijuga* had the highest basal area (7.74 m^2) per hectare. The basal area of those species with relative density greater than 1% ranged from 0.02 m^2 to 7.74 m^2. The mean diameters at breast height of these species ranged from 3.1 cm to 21.6 cm (Table 22).

5.2.2 Stem diameter size class distributions

Pooled data for all stems encountered in the sample plots displayed a negative exponential stem diameter size class distribution profile (Figure 5). The stem diameter size class distribution of selected commonly harvested species was analysed to determine the status of populations of these species (Figure 6).

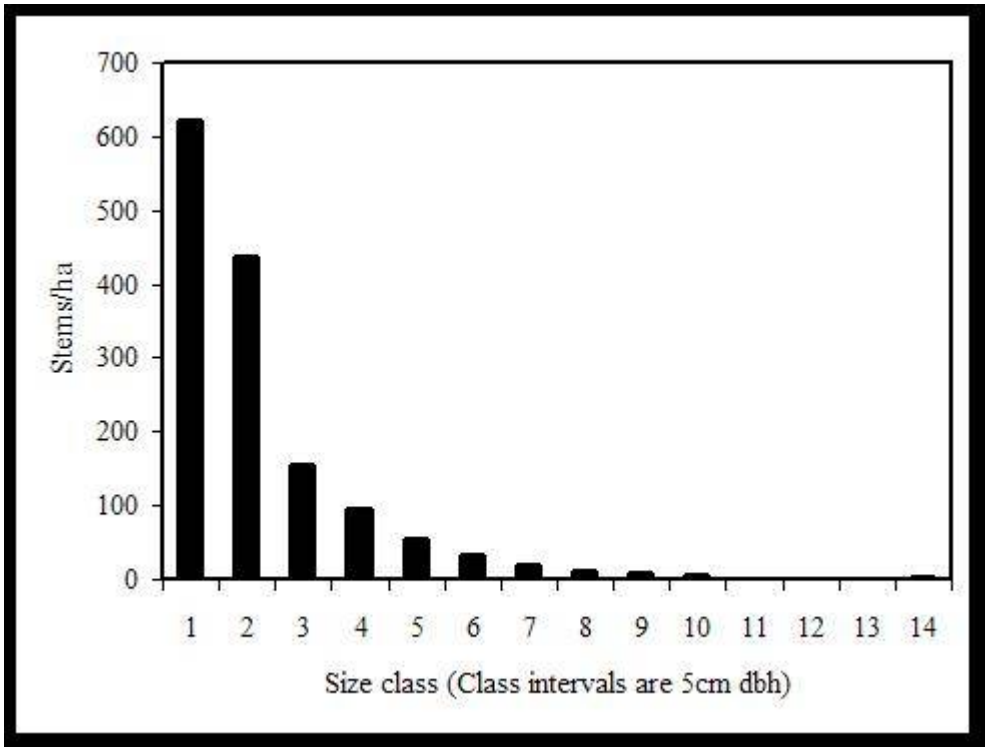
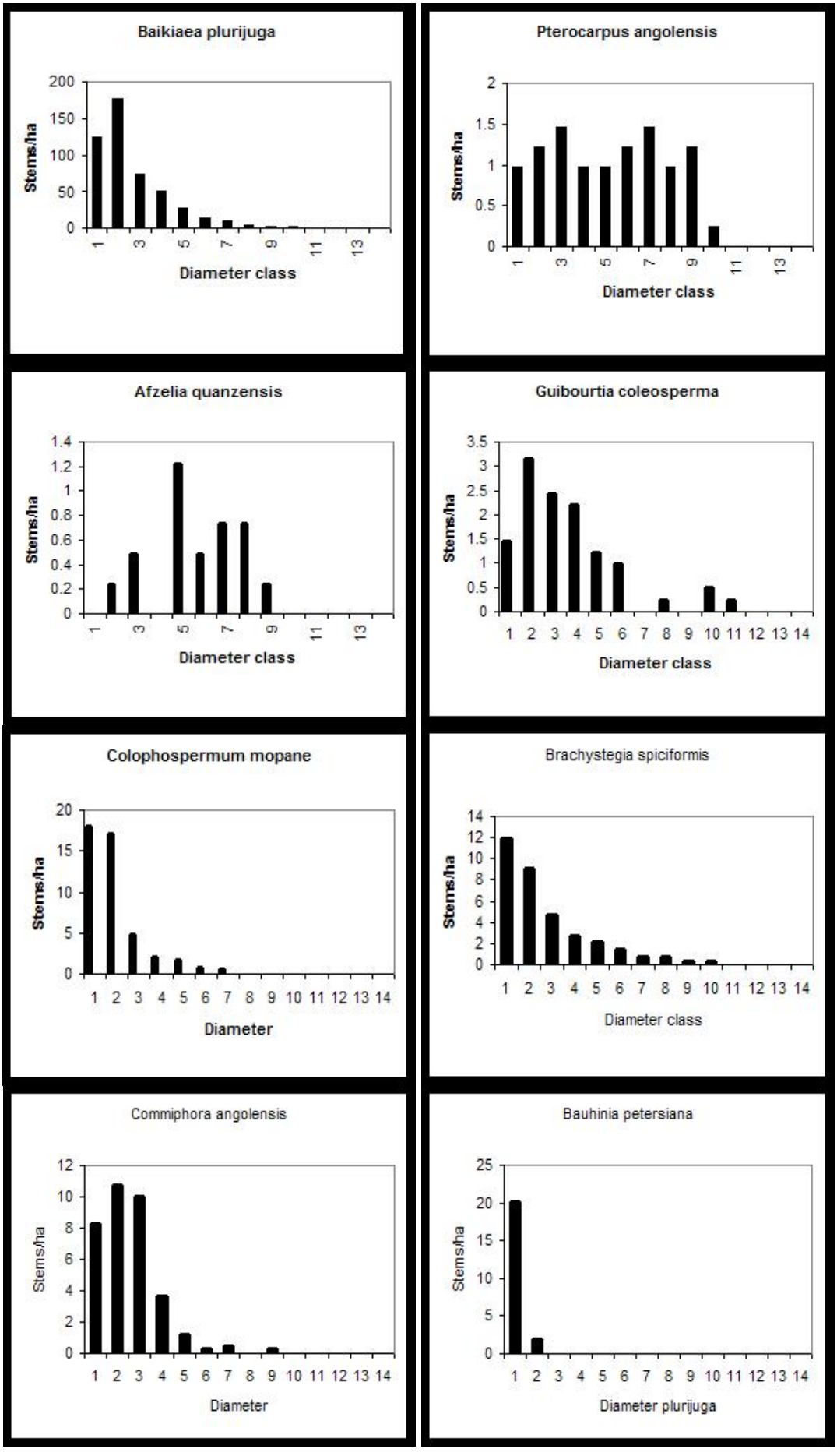


Figure 5. **Stem diameter distribution of stems of all species encountered. Diameter class limits: 1**: 2 – 6.9 cm; **2:** 7 – 11.9 cm; **3:** 12 – 16.9 cm; **4:**17 –21.9 cm; **5:** 22 – 26.9 cm; **6:** 27 – 31.9 cm; **7:** 32 –36.9 cm; **8:** 37 – 41.9 cm; **9:** 42 – 46.9 cm; **10:** 47 – 51.9 cm; **11:** 52 –56.9 cm; **12:** 57 – 61.9 cm; **13:** 62 – 66.9 cm; and **14:** 67 cm and above.

The commonly harvested species indicated a variable set of density distributions, including a reversed J-shaped curve (*Colophospermum mopane, Combretum collinum, Brachystegia spiciformis* and *Terminalia sericea*), a poorly defined bell shaped curve (*Pterocarpus angolensis*), a bell-shaped curve (*Baikiaea plurijuga,*


Baikiaea plurijuga
Stems/ha
Diameter class
Pterocarpus angolensis
Stems/ha
Diameter class
Afzelia quanzensis
Stems/ha
Diameter class
Guibourtia coleosperma
Stems/ha
Diameter class
Colophospermum mopane
Stems/ha
Diameter
Brachystegia spiciformis
Stems/ha
Diameter class
Commiphora angolensis
Stems/ha
Diameter
Bauhinia petersiana
Stems/ha
Diameter plurijuga

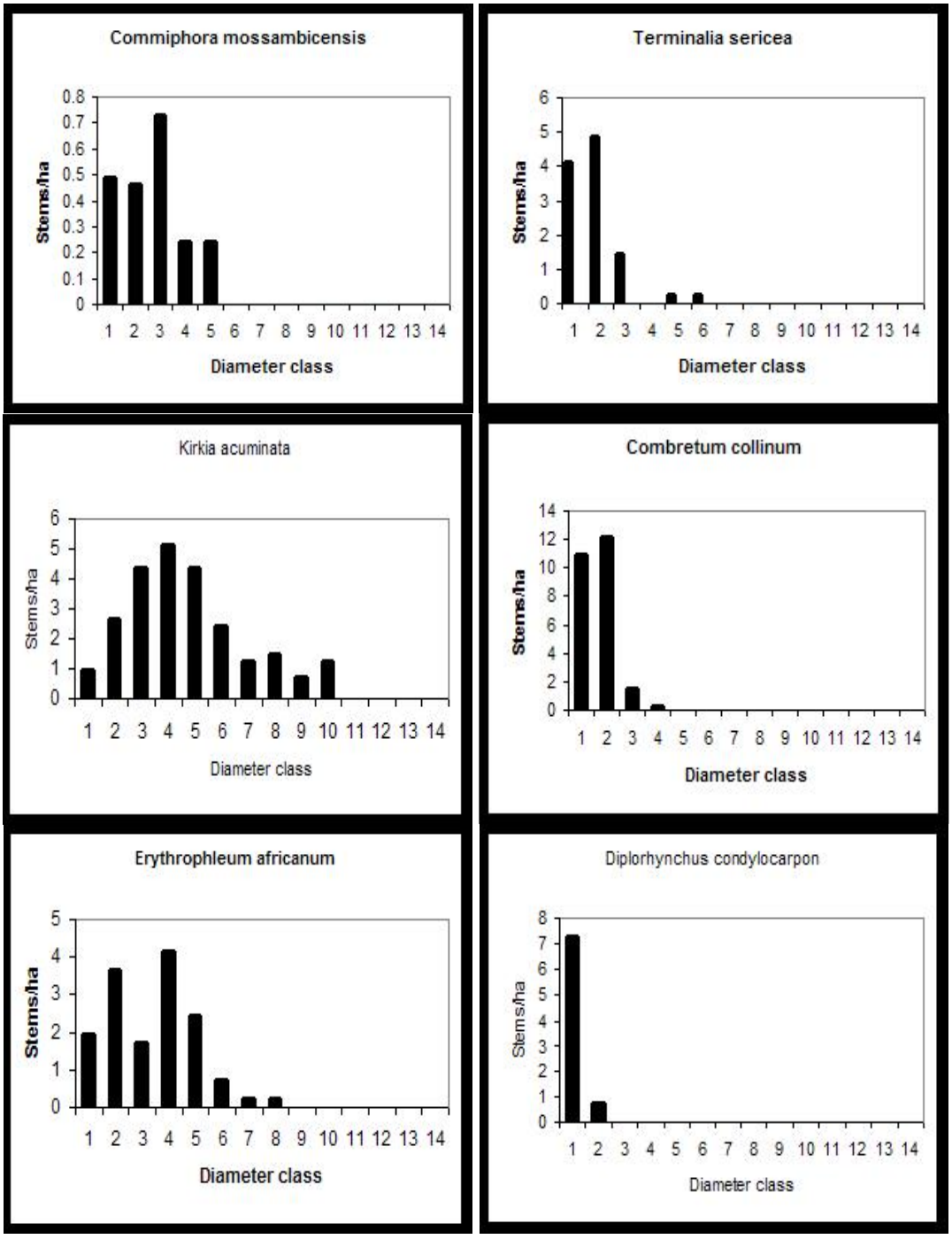


Figure 6. **The variation in population structure of commonly harvested woody species.**
Diameter class limits: 1: 2 – 6.9 cm; **2:** 7 – 11.9 cm; **3:** 12 – 16.9 cm; **4:**17 –21.9 cm; **5:** 22 – 26.9 cm; **6:** 27 – 31.9 cm; **7:** 32 –36.9 cm; **8:** 37 – 41.9 cm; **9:** 42 – 46.9 cm; **10:** 47 – 51.9 cm; **11:** 52 –56.9 cm; **12:** 57 – 61.9 cm; **13:** 62 – 66.9 cm; and **14:** 67 cm and above.

Kirkia acuminata, Guibourtia coleosperma, Afzelia quanzensis, Erythrophleum africanum and *Commiphora angolensis*) and a truncated curve (*Diplorhynchus condylocarpon*).

About 94% of stems per hectare for all species are below 27 cm diameter (size class 6) at breast height and 84% are below 12 cm (size class 3) (Figure 5). The data revealed very low numbers of trees in the larger size classes. Only 2% or 41 stems/ha are above 27 cm dbh (Figure 5).

Species with a tendency of multi-stemming e.g. *Bauhinia petersiana* have a narrow range of size classes. Another species with a narrow range of size classes is *Diplorhynchus condylocarpon*. All species except *Baikiaea plurijuga, Brachystegia spiciformis, Colophospermum mopane,* and *Bauhinia petersiana* are represented by less than 12 stems/ha in the available size classes (Figure 6). Some size classes of *Guibourtia coleosperma, Afzelia quanzensis, Commiphora angolensis* and *Terminalia sericea* are not represented by any individuals at all.

6. DISCUSSIONS

6.1 Participatory village discussion sessions

The initial preparatory meeting with the local leadership of the communal area adjacent to Fuller and the participatory group discussion sessions in sample villages were extremely successful. The exercise generated a vigorous debate over past and current patterns of forest resource uses. This could not have been possible if questions had been asked of individual members. Interest in woodland resources was aroused at village level, where households of different gender and ages were included in the discussions. This gave this study a higher status than would have been the case if a household survey had been conducted.

One disadvantage of preparatory meetings, especially under situations of poor relations between stakeholders, is that they create an opportunity for either party to take predetermined positions in order to forward desired outcomes. In addition, people may say things that they do not actually practice on the ground if they want to gain favour. How villagers perceive the researcher and those helping him will often affect their answers, and they may make their situation appear better or worse than it is. In this case the emphasis was on local use dynamics of forest resources and the potential ecological effects of subsistence use of forest products. In their desire to get sympathy, villagers wanted to show that the Forestry Commission was more antagonistic and unsympathetic to their social plight. In addition the villagers appeared to be more concerned with the negative effects of unsustainable forest use than was the actual situation. In all sample villages participants attempted to exonerate themselves from poaching activities and giving impressions that they cared for the

forest. Groups that dealt with perceptions of the ecological impacts of resource use appeared to indicate villagers practiced the listed mitigation strategies, but non were found on the ground. Again livestock owners indicated that they only used the forest for grazing during the wet season, yet the researcher observed presence of cattle in the forest during the dry season.

Chambers (1994a,b, 1997) suggests the use of triangulation methods of smaller user group discussion interviews and key informant interviews to limit this kind of disadvantage. In this study the triangulation methods were found particularly useful in extracting information that indicated real practices on the ground for example local use of bushmeat, sale of timber species to curio carvers, use of the forest for livestock grazing purposes and access to non-sanctioned products e.g. deadwood for fuelwood. During the village participatory discussion sessions people were reluctant to admit exercising these practices for fear of legal sanctions.

Another disadvantage of group meetings over individual discussions is that some people may have felt overwhelmed by the group dynamics and may not have been able to openly disagree with group decisions. As noted by Grundy (1995), sometimes it is also not possible to investigate the issues of interest in great depth using participatory group discussion sessions since some people may feel threatened or uncomfortable in groups. During the village meetings people were divided into groups of not larger than 10 individuals and this allowed active participation of the usually disadvantaged gender and age groups such as women, the elderly and youths.

However, participatory group discussion sessions have some advantages. The tools and techniques allow interaction between the researcher and members of a community. They provide a qualitative approach to learning about local level conditions and local people's perspectives. The techniques are designed to gain insights of the community's perceptions of their local situation in terms of social, economic and environmental issues (IDS 1996; Chambers 1997). The participatory meetings conducted during the study allowed useful interaction between the research team and those who attended the meetings. Frank discussions in the initial meeting with the traditional leadership had the effect of allaying fears and suspicions about the intentions of the research. The results of the preparatory and participatory village meetings were useful in that they provided the building blocks for developing a sustainable forest resource use model for Fuller protected forests. The participatory discussion sessions also managed to extract useful information about how forest resources were being utilised by locals. The patterns of use had often been perceived without empirical evidence.

6.2 Social histories and the reservation of Fuller forest

After Fuller Forest was gazetted, access to products in the forest was restricted through the application of the forest legislation. This was followed by the eviction of the local inhabitants from the forest (see Table 4 for details). The social histories revealed what happened elsewhere in southern Africa and the world with respect to forest reservation and the alienation of indigenous peoples (Leach and Mearns 1988; Matose and Clarke 1993; Banerjee 2000; Bhat *el al.* 2001). It was the trend and process during the colonial era for States to take over forests under the pretext of the conservation, commercial and scientific values of the forests. During the process,

communities' role in the control and regulation of the extraction of forest resources was reduced through the enactment of forest laws that transferred that role to the State. Community rights over the resources were reduced to privileges, and free access was replaced with restricted access (Lowore 1993; Katerere *et al*. 1993; Bhat *el al.* 2001).

The resulting conflicts over forest access and resource use, in addition to the States' decreasing ability to manage the protected forests, resulted in situations where biodiversity conservation has been compromised (Kajembe and Monela 2000; Timmermans 2000; Wily 2000). It can be argued that there are advantages and disadvantages to the proclaiming and gazetting of protected forests. First, the protected forests are the remaining landscapes that are at the centre stage for initiatives to enhance local livelihoods because at least there are still resources to talk of. Had these resources not been protected there would be no forest left or the forests would have been seriously degraded like forests and woodlands outside formerly protected areas. Secondly, the state protected the forests for the benefit of the nation with respect to generating revenue and ensuring protection of soil and water, for example. The state also needed to meet the local and external demand for industrial timber. These were and are still valuable objectives for proclaiming forests.

The disadvantage of forest proclamation and protection was that it excluded local use by the indigenous people who had historically subsisted on these forests without giving them alternatives. The dependency of local people on the forest was one factor that was not seriously considered and acknowledged during the process of proclaiming forests. For millennia indigenous people have had knowledge and

experience of sustainably managing their local forests and woodlands through coordinating agricultural and forest based activities. The problem then, as now, was that the traditional systems were not allowed to evolve parallel to conventional systems. They were despised as backward and unscientific. Interestingly it is now the combination of these traditional systems and conventional forestry that is being advocated in current community or participatory forestry initiatives worldwide (Scott 1998; Michell 2000).

The issue concerning restricted use of resources in the protected forest is interesting given that traditionally and before reservation of the forest the Chief and his Council exercised almost the same kind of controls on local forest resources as the State did. It appears that in this situation the problem is with accepting the authority of the Forestry Commission. The Forestry Commission is considered alien and an outsider as was indicated during the village participatory meetings. The Forestry Commission is unpopular with the locals because of its enforcement regime. Controlling illegal activities in the forest has proved difficult because the residents of the adjacent communal area regard the forest as theirs. Villagers were unanimous that the forest belonged to them. These views are not unique to Fuller Forest. Kajembe and Monela (2000) reported similar views with respect to state forests in Tanzania.

Further, some objectives enshrined in the reservation of the forest were not apparent in the traditional forest management practices e.g. there was need to meet increasing national demand for industrial and furniture timber through sustainable production and offtake, to conserve biodiversity, to generate national revenue through timber and wildlife use and to protect the watersheds and the fragile Kalahari Sand for national

and local benefit. These objectives needed to be explicit rather than being implied and this was achieved through forest reservation.

Despite the above historical views and perceptions it can be argued that the forest legislation in Zimbabwe did not mean outright exclusion of local communities (Mohamed Katerere 2000). Section 41 of the Forest Act provides in paragraph (a) that unless authorised in terms of subsection (3) or (4) of Section 44, no person shall

> *Cut, fell, injure or destroy produce in or remove any forest produce from any demarcated forest or protected private forest.*

These sections indicate that local use is permissible provided one obtains permission from the relevant authority. Even under the traditional management systems people had to get authority from the traditional institutions of the Chief and Headmen to use local forest resources. The issue here is that use of forest products has to be controlled in order to avoid plundering of the resources.

Under Section 66 the Forestry Commission has power to make by-laws that are in its opinion necessary or expedient for the proper control and good management of any demarcated forest. Subsection 2 provides that these by-laws may be provided for the control or prohibition of

- *The use of land in a demarcated forest for residence, cultivation, grazing, camping or picnicking,*
- *The entry of persons into demarcated forests,*

- *The use by persons of facilities provided in demarcated forests including the prohibition of the use of facilities otherwise than on the basis, terms and conditions on which they are provided.*

Depending on interpretation and the focus of forest management the current forest legislation and its by-laws allow for a number of activities to take place in protected forests as shown above. It appears that the problem lies in that the foresters and forest managers fail to interpret and apply the legislation particularly when that might appear to conflict with the major focus of the forest authority (Kajembe and Monela 2000). Local communities could view protected forests in a different way if they are regularly made aware of the provisions of laws, rules and regulations pertaining to the protected forests, particularly on what locals can and cannot do in the protected forests. It can further be argued that the present situation is worsened by the fact that colonial and postcolonial forest policies and forest legislation are developed without consultation of those sectors of the society who might be dependent on the forests for survival. An analysis of the discourses at village participatory meetings reveals that communal area residents regard forest laws as weak, irrelevant and detached from local realities.

In the final analysis the forestry profession has struggled with the problem of finding suitable models of linking the conflicting objectives of conservation, economic and social aspects of protected forests management under prevailing policies and legislation frameworks. As advocated by Scoones and Matose (1993), the legal frameworks need to be reviewed and reformed to reflect practices on the ground recognising that forest resources should be used and managed on a sustainable basis.

The current use of Fuller Forest by communal area residents is linked to the process of forest proclamation and gazetting, a process that did not consider the interests and needs of these residents. The illegal use of the forest is a direct reaction of the communal area residents to Forestry Commission's unpopular forest legislation. However, it has been shown that when interpreted properly and when people are properly educated about the provisions of the forest legislation the current negative perceptions about protected forests could change.

6.3 Dynamics of the surrounding forest resource use

6.3.1 Range and types of forest resources harvested and used

Typically, the communities adjacent to Fuller Forest use several forest goods and services to meet their everyday livelihood needs for food, fuel, shelter and medicine. These goods and services include firewood, poles for construction, wild fruits, thatch grass, medicinal plants, bushmeat, grazing, honey, mushrooms, edible caterpillars, reeds and ilala. Out of these goods and services the top five most commonly used resources include firewood, thatch grass, grazing, wild fruits and broom grass. Between the five sample villages 100% of the households harvested and used the top five ranking products in BH 11 and Chidobe villages (Table 6). In BH 28 village between 50% and 100% of households used the top five products while in Chikandakubi the proportion of households was between 40% and 80%. In Monde village between 50% and 80% use the top five ranking products. Across the villages between 25% and 100% of households harvested the top five products, firewood, construction poles, thatch grass, honey and wild fruits for own use (Table 10) while

between 5% and 98% harvested timber for furniture and carving, caterpillars, medicinal plants and wild fruits for sale (Table 11). This statistic clearly indicates the level of dependency of the local people on forest resources.

The findings of this study are important in that few studies in Zimbabwe (Vermeulen 1993; Forestry Commission 1994a; Cunliffe 2000) have attempted to establish the range and types of goods and services extracted and obtained from a protected indigenous forest. The information from this part of the study gives empirical evidence on types of resources obtained from Fuller Forest. The forest manager at Fuller Forest can no longer assume what products forest neighbours need from the forest. The forest manager can now properly plan for the collection and harvesting of those resources that locals need with confidence.

Millions of people throughout the world make extensive use of biological resources from protected forests (Cunningham 2001; Koziell and Saunders 2001; Michell 2004; Grundy and Michell 2004). These resources are harvested for both subsistence and commercial use either frequently or as a fall back during times of hardship (Shackleton and Shackleton 2003). The types of resources used and the degree of use appear to vary from village to village, based on factors such as accessibility and control by the Forestry Commission. In addition to these factors, Arnold (1998) observed that use also varied between villages with respect to human population densities, personal and cultural preferences and household income levels.

Woody plants, particularly trees, provide by far the largest number of products harvested from Fuller Forest. For example, 13 species were used for firewood, 21 for

construction and fencing, 20 provide edible fruits and 45 were reported as useful as medicinal plants. The various tree-based products contribute to rural household welfare in a range of ways, providing food and non-food goods, inputs into income generating activities and inputs into agricultural production. Firewood is collected and used by almost 100% of the households adjacent to the forests. For those households involved in selling firewood, a market exists in the peri-urban area of Victoria Falls town. Commercialisation of firewood is specific to Chidobe and Monde Villages. This could be explained by the fact that they are the most backward villages with high proportions of poor households. In planning for fuelwood harvesting and income generation from this resource the village specific factors such as those for the above two villages should be taken into consideration. Use of resources might not be uniform between villages and amongst households. In their study, Shackleton and Shackleton (1997) found that numbers of households involved in fuelwood sales vary from village to village, with 5 – 53% of households in the Bushbuckridge area of Limpopo Province engaged in fuelwood commercialisation. In this study the proportion of households involved in the commercialisation of fuelwood across the villages for example, is between 5 and 25%.

Female firewood harvesters around Fuller Forest do not favour large diameter firewood even when available because it requires splitting before use and it is heavy to transport since the firewood is often transported by headloads. Mudekwe (1997) had similar findings for villagers who harvested firewood from protected private areas in the Central Lowveld, South Africa. A small sample (n = 105) of firewood pieces at three homesteads in three sample villages around Fuller Forest indicated preference for stems of 4 – 16 cm in circumference. In South Africa, Shackleton (1993a) found

harvesters generally harvested stems of 5 - 40 cm in circumference, with preference of 11 – 25 cm. The preferred sizes and the narrow range of size in Fuller could be a reflection of the abundance of the resource in comparison to Shackleton's study site. Selection for size may have implications for forest structure in general or populations of target species (See Sections 5.2.2 and 6.4).

Other tree-based products are wooden curios. There is considerable production of wooden curios for the tourist industry around Fuller Forest. Household members are involved in wood carving for cash income. The woodcraft industry has become a dominant forest-based activity around Fuller Forest and a significant number of households are involved in the industry (Mufandaedza 2003).

Access to the wood for carving was a problem for the local carvers. The situation was aggravated by the fact that illegal harvesting from the protected forest could result in arrest and prosecution. The increasing scarcity of the preferred raw materials for carving was of concern to curio carvers. Most now travelled distances of approximately 5 or 8 kilometres deep into the forest to obtain the specific wood they require. The need to search for the favoured species and sizes exposes the carvers to the Forest Protection Guards who regularly patrol the forest. Arrests and prosecution may be avoided if users first gained permission from the Forestry Commission as suggested in Section 6.2 above. Shortages of certain species are often quite localised and craftsmen respond by shifting their collecting sites. Chidari *et al.* (1992) pointed out that statements regarding tree shortages in the carving industry may refer more to the rarity of a specific form of that tree rather than to an overall rarity of that species. Nevertheless, many woodcarvers around Fuller expressed concern that in the future,

perhaps within a few years, certain species would no longer be available. There were concerns that *Pterocarpus angolensis,* whose wood is most favoured for curio carving, is seriously declining due to unsustainable harvesting. As a result carvers were gradually switching to alternative species such as *Afzelia quanzensis*, *Kirkia acuminata*, *Baikiaea plurijuga*, *Guibourtia coleosperma* and *Schinziophyton rautanenii* that are still relatively abundant. Braedt and Standa-Gunda (2000) also report on switching to alternative species in the face of scarcity of preferred ones for carving.

Most of the carvers were aware of the importance of only using deadwood so as not to destroy standing stocks of the preferred species populations. However, this was not what they always did as reported by key informant interviewees. Most of them used both dry and wet wood. Both the carvers and the Forestry Commission officers acknowledged that there were very high incidences of poaching of live stems of *Pterocarpus angolensis* and *Afzelia quanzensis*. There is need to institute arrangements that reduce poaching practices. In South Africa, illegal medicinal bark harvesters obtained formal harvesting licences from the Forest Department and the arrangement has gone a long way in controlling and monitoring bark harvesting activities (Geldenhuys 2004). A similar arrangement could be put in place in Fuller Forest for the carvers in order to minimise poaching of the wood resources.

In 1997, the Forestry Commission put in place a programme of selling dead mukwa (*Pterocarpus angolensis*) to carvers but the programme was suspended due to the costs involved (Forestry Commission 2000b). When asked why the carvers did not obtain harvesting permits or negotiate for a concession area they indicated that the

process was time consuming and there was no guarantee that the Forestry Commission would favour them over the traditional timber concessionaires. Forest managers interviewed on this issue were of the view that carvers were difficult to deal with in terms of controlling their activities. In addition, carvers were perceived to be poor such that they would not be able to pay royalties for the timber they require. However, the carvers' perceptions and the forest managers' views can be challenged given that in the same forest substantial quantities of timber of the favoured species are left behind by commercial timber loggers after log conversion for sawlogs. A more integrated use of felled trees could be encouraged to optimise use of felled trees. This practice would allow the carvers as well as harvesters of fuelwood and construction poles to use reject wood left behind by the concessionaires.

Several studies have been conducted on the woodcraft industry (Shackleton 1993c, 1996; Matose *et al.* 1996; Steenkamp 1999; Braedt and Standa-Gunda 2000). Little research has been undertaken on the environmental consequences of the woodcraft enterprises (Mhone 1991; Mufandaedza 2004). The woodcarvers offering information on their tree-cutting practices indicated a rough felling rate of 25 to 60 trees per year although in practice this could be more. In his study in Fuller and Pandamasuie Forests, Mufandaedza (2004) found skewed population structures towards young and small diameter stems for *Pterocarpus angolensis* and *Afzelia quanzensis*. He attributed this to the intensive selective harvesting of these species by curio carvers and commercial timber loggers.

In villages adjacent to Fuller Forest a number of different tree and shrub species were used in the construction of homestead structures, e.g. living quarters, grain storage

structures and livestock pens and as fence posts. Like elsewhere in protected forests and savanna woodlands (Shackleton 1993a, b; Timmermans 2000), there is considerable selection for species, sizes and wood quality when users harvest the construction materials. Many rural people cannot afford the expensive modern building materials, which are on the commercial market. Rural people usually rely on the available forest resources for construction purposes. The construction materials from the forests are often free, or cost very little.

Villagers adjacent to Fuller Forest reported of the increasing scarcity of the preferred species and sizes in the forest/village boundary zone where harvesting of forest resources is most concentrated. In the first instance the Forestry Commission only allows the legal harvesting of dry wood for firewood and all construction purposes. When the Forestry Commission issues permits to harvest wet timber, the species are often specified. According to the villagers the specified species for construction, such as *Brachystegia spiciformis, B. boehmii, Commiphora spp, Kirkia acuminata* were not the preferred ones for that purpose. The species are regarded as less durable for the purposes. Currently, villagers travel longer distances into the forest than before in search of the preferred species and desirable sizes and qualities for firewood, construction, fencing and curio carving. It is likely that the selective harvesting for species, size and quality will have some ecological effects on species composition, forest structure and quality of the residual resources (Shackleton 1993a; Peters 1996). Selective harvesting could particularly have serious implications on the stability of populations of target species, considering that homestead structures needed to be replaced at frequent intervals (Grundy *et al*. 1993; Vermeulen 1993;, see also Sections 5.1.4 above and 6.4 below).

Another important aspect of rural life around Fuller Forest is the use of plants for medicinal purposes. Fuller Forest has 45 species reported as useful medicinal plants and five were reported able to treat different ailments (Section 5.1.4). As reported by households adjacent to Fuller Forest, different parts of plant species may be used for medicinal purposes to cure various ailments. Traditional medicines are important to rural communities for medical, psychosomatic and economic reasons (Gelfand *et al.* 1985). In their studies Gelfand *et al.* (1985), Coote *et al.* (1993) and Chihongo (1995) reported that traditional medicinal products included the roots, bark, leaves, small branches and twigs, stems and flowers of trees, shrubs, climbers, epiphytes and parasites. Although it was not explored in depth in this study, there were indications of the commercialisation of traditional medicines. Villagers indicated that local herbalists and healers were trading medicines in Victoria Falls town. Elsewhere in southern Africa traditional medicines are increasingly becoming important to the rapidly growing urban black population (Geldenhuys 2002; Williams *et al*. 2001). The medicines have a local and national multi-million dollar trade between rural sources and urban markets (Williams *et al*. 2001) and have become important sources of non-farm income for many rural households.

Availability of certain medicinal plants was reported to be on the decline as a result of over-harvesting. One cited cause of over-harvesting was that a lot more people were currently using traditional medicine than before. The trend was due to the high costs of hospital consultation fees and that of conventional drugs. As reported by Gelfand *et al*. (1985), harvesters of medicinal plants were forced to travel deeper and far into the forest and woodlands in search of prized species as preferred species become scarce.

The greatest problem encountered by the local herbalists and healers, and one which they believed could eventually cause the total destruction of the medicinal resource, was the damaging harvesting practices by outsiders. Populations of *Terminalia sericea*, *Combretum zeyheri*, *Schrebera trichoclada, Ochna pulchra, Diplorhynchus condylocarpon* and *Burkea africana species* were reported to be most affected by digging and uprooting the plants. Saplings and pole stage individuals of these species were often dug for their roots. The practice differs from that in South Africa where bark is the most prized plant part harvested (Geldenhuys 2004).

There are about 20 different types of users of forest resources in Fuller Forest (Section 5.1.3 and Table 5). Cases of resource use conflicts between users were reported during discussion sessions in the sample villages and during user group discussion interviews. These conflicts are partly a result of the process of forest proclamation and the local perceptions of the legitimacy of the Forestry Commission over Fuller Forest (see Sections 5.1.2 and 5.1.3). The major conflicting users are the Forestry Commission and the local communities living in villages adjacent to Fuller Forest in general, but specifically between the Forestry Commission and livestock grazers, woodcarvers and wildlife poachers. Other conflicting users are woodcarvers and the timber concessionaires, between livestock owners and consumptive and non-consumptive safari operators and between local users and outsiders. It appears the major problem is lack of co-existence between the Forestry Commission and its neighbours and lack of planning by all users for the sustainable utilisation of forest products. Integrated planning for holistic use-management of resources could benefit the users and the forest environment. For example, there is potential of woodcarvers to use wood left behind by timber concessionaires. On the other hand hunting safaris

are conducted from April to October hence livestock owners could graze their cattle in the forest during the intervening months (the wet season). This coincides with the time when villages want cattle away from their fields. A practical management plan that zones the forest into different use and management areas could be a useful tool to reduce resource use conflicts.

Conflict over resource use has been reported in several studies (see for example, Matose and Clarke 1993; Odhiambo 1997; Anderson et al. 1997; Banarjee 2000; Wily 2000; Grundy and Michell 2004). Traore and Lo (1997) note that conflict over resource use may arise at various levels i.e. at the primary level involving the family and within the village involving families, communities, and/or ethnic groups. There may be also conflicts involving the state or government agencies and grassroots users of natural resources. Just like in the study area the most apparent conflict is that between the Forestry Commission as representing the state and grassroots users of the forest as represented by the local communities. As suggested by Anderson et al. (1997), Odhiambo (1997) and Traore and Lo (1997) with reference to West Africa, East Africa and Africa as a whole, the conflict such as in Fuller Forest originates from the legal status of the forest. Since the forest legislation is often unfavourable to local people and the general public, the latter circumvent rules and regulations or interpret them according to their own interests much to the dismay of the state forest departments, which in response use force to curb illegal use. Eventually, tension, mistrust and hate amongst the users broods conflict (Traore and Lo 1997).

However, the situation pertaining to Fuller Forest is not hopeless and without solutions. It is a truism worth acknowledging here that diverse users (Section 5.1.3)

will inevitably end up in a conflict situation with respect to use of forest resources. There are usually opportunities and constraints under such circumstances (Bingham 1986; Pendzich et al. 1994). In Fuller Forest the opportunities for the Forestry Commission in particular exist through fostering productive communication between itself and the diverse local users using tools such as conflict anticipation and collaborative planning in order to effect change (Anderson et al. 1997). On the other end, intervention can be through managing or resolving existing conflicting interests through negotiation, mediation and consensus building (Crowfoot and Wondolleck 1990).

The Forestry Commission could engage in dialogue with local and external users and discuss areas of conflicts. A participatory approach could be most appropriate to find lasting solutions to the identified conflict areas. Participants in these discussions should be able to identify the local and external stakeholders and analyse the stakeholders' interests and objectives. However, given the mistrust and conflict between the Forestry Commission and the local and external users it could be necessary to engage an external facilitator to break the ice. In the process the external facilitator would gradually retreat into the background leaving the Forestry Commission and its neighbours to forge ahead with planning for the sustainable use-management of Fuller Forest.

6.3.2 Seasonality of harvesting and use

In the study site, forest products collection and harvesting was constrained by the season. Some wild fruits are only available during the wet season, so are mushrooms

and mopane worms. A number of edible insect species e.g. grasshoppers and termites are seasonal food sources commonly harvested during the wet season.

In the study area, the dry season (May to October) is the time when households' labour is relatively free after agricultural activities. This is the time when people repair old and construct new homestead structures such as huts and livestock pens. People around Fuller tend to extract more products needed for these purposes during this time of the year. Schools and public holidays are times when there is an increased demand for curios mainly by international and local tourists. During these holidays many more people get involved in carving in anticipation of potential cash income from tourists.

In the sample villages, households seemed to agree that the cold season was the time of greater collection and use of firewood. In his study, McGregor (1991) however, suggests that the seasonal pattern of use is more complicated, with peaks and valleys during the year. For example, apart from high firewood consumption in winter, there could be a second peak of harvesting and/or collection and use during the harvesting period when more cooking is done due to abundance of different kinds of crop foods. In this study, the only peak was during the dry and cold months of the year i.e. May June and July. The absence of other peak periods, as suggested by McGregor, could be a result of low agricultural yields in this dry region of the country.

While many of the forest products in the study area are seasonally available, construction poles may be harvested at any time of the year. Seasonality of construction is probably a function of supply of labour and the need for the structure

(Vermeulen 1993). Most construction in the villages surrounding Fuller Forest is done in the dry season when constraints of labour are least. Cattle, goat, sheep and donkey pens are built towards or during the rainy season to keep the livestock away from crops. Seasonality of construction was found to be similar with that described for a communal area in Shurugwi (McGregor 1991) and in the communal area adjacent to Mafungabusi Forest (Vermeulen 1993).

6.3.3 Perceptions of resource abundance and decline

In this study a proxy indicator of sustainability was attempted using local perceptions with respect to trends in resource supply over a given period and perceptions on ecological impacts that might arise due to local use. Local perceptions on forest resources supply and ecological impacts of use varied between villages and across resources. There was a general perception that declining supplies were due to the large proportion of the local population that is dependent on forest resources for direct household provisioning and for commercialisation. Fires, poaching, over-exploitation and damaging harvesting practices were other factors implicated for impacting on sustainability of the resource base. The blame for this unsustainability was placed on outsiders, whom it was said, harvested any product indiscriminately so that the incentive for the forest adjacent communities to abide by the existing legislation is diminished.

In general people said that rules regulating use were not respected. Residents in forest adjacent villages did not feel they had the power to prevent the poaching of forest resources by outsiders. The result was that abundance and availability of resources was affected. Villagers were generally of the opinion that they themselves used the

resources sustainably, and that if it were not for the problem of poaching, they would continue to find all the required goods and services in the forest areas *ad infinitum*. A handful of villagers disagreed with this view, however, saying that to blame poachers and outsiders was merely using them as a scapegoat, and thought that the local villagers too should change their behaviour if Fuller Forest was to survive and continue to provide for their needs. As reported earlier (Section 6.1), people wanted to gain favour by portraying themselves as mindful of unsustainable practices of forest resource use in comparison to outsiders. In reality, the forest adjacent communities are the main illegal harvesters of resources from the forest (Section 5.1.4), suggesting that they cause the greatest impact on forest resources and their sustainability.

There are few empirical studies of the sustainability of use of many forest products used by forest adjacent communities. Limited studies have been done on isolated resources in South Africa (e.g. Dzerefos 1996; Geldenhuys 2004). Shackleton *et al.* (2000a) suggest that sustainability can be assessed through determination of the rate of production of a resource in an area and the rate of harvesting. If the rate of production or supply is greater than the rate of use or demand then resource use is sustainable. Most forest resources used by communities have not been assessed within the context of sustainability. Users are often aware of declining trends in forest resource availability but in most cases have no capacity to address the causes (Shackleton *et al.* 2000b). For example, local users may lack the capacity to prevent outsiders from harvesting and using forest resources and lack of this capacity has implications on resource use sustainability. A shortfall of this study is that such an assessment of the rate of resource production and the rate of harvesting were not attempted. For integrated and sustainable use-management of forest resources in

protected forests such assessments must be prioritised in conjunction with ecological assessments of target populations as suggested in Section 6.4 below.

6.3.4 Spatial proximity and use patterns

Spatial proximity appears to have a strong bearing on local people's use of forest resources from Fuller Forest. The opportunity to get permits and permission to camp in the forest for extended periods changes the whole pattern of use with regards to distance from the forest. These scenarios greatly expand the spatial bounds of the forest using community.

Several studies have demonstrated the impact that distance and spatial variation in woodland resource availability have on the pattern of woodland resource use and on the woodland itself (Wilson 1989; Fortmann and Nabane 1992; Grundy *et al*. 1993). In Fuller Forest it was observed that the number of tree stumps increases with proximity to the settled areas. This appears to reflect that there are fewer costs involved by harvesting near homesteads in terms of time and availability of transport required to move the products from deeper in the forest. This observation was supported by villagers who pointed out that good quality construction poles had become scarce at the boundary of the forest due to harvesting pressure such that people currently travelled deeper into the forest to find preferred material. It was also observed that households further away from the forest maintained fuelwood, bark fibre and thatch grass stocks at their homesteads unlike those nearer the forest who could afford to extract the resources as and when they required them.

Harvesting patterns of forest products may also be influenced by location and accessibility. In this study, neither the location of the forest nor the rules governing accessibility deterred users from accessing resources from the forests. However, in a way distance from the forest influenced intensity of forest product harvesting. Harvesting activities were concentrated at the village/forest boundary and seemed to decrease with distance from the boundary. This is in agreement with the study of Grundy *et al.* (1993) and Shackleton (1994) who found that harvesting pressure decreased with distance from peoples' homes. The implications of these findings is that management activities of the different types of products may need to be concentrated where there is heavy harvesting pressure relative to the forest interior with the objective of maintaining balanced standing stock between the forest/village boundary and the forest interior. The aim should be to achieve stand normality in all parts of the forest to ensure sustainability of the different types of the resources.

6.3.5 Household wealth status and patterns of forest resource use

In terms of household wealth status for the five sample villages, 50.6% of the households are poor, 19% are very poor, 24% are of average wealth and only 6.4% are rich (Table 15). Of the rich households none is female headed across the 5 sample villages. Across the villages about 32% of the households are female headed. This statistic is important in that when looking at the livelihood strategies the poor and very poor households indicated more reliance on the forest for sustenance. However, this does not rule out the dependency of richer households on forest-based resources. Rich households own more cattle and make extensive use of the forest for livestock grazing. Any management scheme for Fuller Forest that involves local communities

should note the reliance of both the poor and the rich on the forest but more so for the poorer households.

This study revealed that households around Fuller Forest depend on a mix of strategies to meet livelihood needs. No matter how diverse the livelihood strategies of rural people around Fuller Forest are, crop and livestock production continues to be a predominant component of survival for most, but more so for the wealthier households. In savanna areas, harvesting forest products is intricately linked with crop and livestock production (Bradley and Dewees 1993; Clarke *et al.* 1996). although remittances and woodcarving are also important local livelihood strategies.

For the communal residents around Fuller Forest the common livelihood strategies are livestock and crop production, curio carving and harvesting thatch grass for income generation, vending, and sale of bushmeat, piecework and remittances. This shows a considerable diversification of livelihoods. Apart from crop production most of these strategies are forest based further confirming the importance of forest resources to the rural community. Nowadays farming on its own rarely provides a sufficient means of survival in rural areas (Ellis 1998). Diversification of livelihood strategies ensures survival of many rural households. Usually rural households have multiple livelihood strategies that include off-farm wage work, rural trading, and remittances from urban areas and from abroad and collection of forest products for household consumption or for sale (Reardon 1997). Livelihood strategies are often diversified for different reasons that include declining returns to farming activities, macro-economic impacts e.g. the structural adjustment programmes, risk reduction, overcoming income instability, improving food security, taking advantage of opportunistic markets and

generating cash in order to meet family objectives (Brigham *et al.* 1996; Ellis 1998; Shackleton and Shackleton 2000a; Shackleton and Shackleton 2003).

In terms of household provisioning, forest products provide a safety net in assisting households to cope in times of hardships, such as changes in the economic, social or climatic environments in which a household exists and functions (Shackleton and Shackleton 2003). For example, one interviewee said that he had come from Harare to Victoria Falls after being retrenched, so that he could engage in what he perceived to be a lucrative woodcarving industry. The interviewee also believed that there were more timber resources for the industry in forests and woodlands near Victoria Falls than in areas surrounding Harare. Being able to collect and use forest products to meet daily needs for energy, shelter, food and medicine allows the scarce household cash resources to be used to secure other household needs and to accumulate the necessary asset base for a more secure livelihood e.g. investment in agricultural tools, sending children to school and investing in small livestock such as goats, fowls and sheep (Shackleton *et al*. 2000b).

6.3.6 Commercialisation of forest products

Based on the analysis of information from participatory village discussion sessions, the commercialisation of forest products around Fuller Forest appears to be increasing. The products mostly commercialised in different quantities (Table 11, although the quantities were not established) include medicines, mopane worms, honey, bushmeat, timber, wooden curio artefacts, thatch grass, firewood, broom grass, wooden household utensils, mushrooms, bark fibre and wild fruits. Although it was not attempted in this study, the range of commercialised forest products and quantity

of off takes calls for some empirical studies in order to measure the comparative value of protected forest reserves, such as Fuller, against standard sources of income like livestock or crop production. This could be one route to advocate for political support against conversion of forests to other land uses and for the government to provide adequate financial resources required for the sustainable upkeep of the forests. Very few studies of this nature have been conducted in the protected forests of western Zimbabwe. Data from studies by Campbell *et al.* (1991, 1997), Lynam *et al.* (1994) and Cavendish (1996) in savanna woodlands in Zimbabwe may not be appropriate for extrapolation to protected forests due to differences in site and socio-economic settings.

Forest-based products that have experienced increased commercialisation around Fuller Forest are wooden curio artefacts. The woodcraft entrepreneurs are mostly family members. There are eleven curio stalls of different sizes along the stretch of the Bulawayo-Victoria Falls Highway that passes through the northeast of Fuller Forest. Each market stall has a specific organisational set-up, ranging from loosely structured production and marketing units to well organised units with joining fees, committees and various rules of conduct. The major markets for the wooden curios from these stalls are the international and local tourists using the highway, tourists embarking or taking off from the Victoria Falls International Airport and those staying in the Victoria Falls resort town. During the focus user group discussions it was estimated that a skilled curio carver can generate an annual gross income in the range of ZWD100 000 to 150 000, equivalent to USD1 800 to 2678 at the 2002 official exchange rate of US$1 to ZWD56. About 17% of the total households in the study area gain some income from activities related to the woodcraft industry.

Thatch grass is another product that was reported as experiencing an increase in its commercialisation. The rise was attributed to increased development of thatched safari lodges in the province. When the grass is abundant in the forest a single thatch grass harvester can harvest thatch grass with a seasonal gross value of ZWD60 000 to 75 000, equivalent to US$1090 to US$1364 at the 2002 official exchange rate of US$1 to ZWD56.

The forest-based incomes were reported to be important in filling seasonal or cash flow gaps and in helping to cope with particular household expenses. Curio carvers indicated that curios can be sold throughout the year but households usually responded to unusual opportunities like a rise in national and international tourism activities particularly during public and school holidays. During the course of this study an international exporter constructed a warehouse near the Victoria Falls International Airport just outside Fuller Forest for the storage of wooden curios prior to exportation. Local people involved in the curio industry were using this opportunistic facility for income generation. An analysis of sales invoices at this facility indicated that on average a carver using this facility could gross about ZWD150 000, equivalent to US$2678 at the 2002 official exchange rate of US$1 to ZWD56. However, the process at this facility required good negotiating skills as most of the products were bought at wholesale prices. The international exporter revealed that the destinations for his curios were Germany and Italy.

In a review of some case studies in South Africa Shackleton and Shackleton (2003) indicated some comparable mean annual incomes of R5000, R687 and R7602 from

forest products such as brush, marula beer and woodcarvers respectively. Income for the producers was reported to be highly variable from one producer to the next e.g. among brush traders gross income varied from a minimum of R30 to a maximum of R1100 per month (Shackleton and Shackleton 2003). These mean gross incomes are of the same order of magnitude attached to the use of savanna products from miombo woodlands in Zimbabwe (Campbell *et al.* 1997; Cavendish 2002) and they reflect the commercial contribution of forests to rural households' income portfolios.

Commercialisation of forest products is becoming a way in which the value of forest products to rural households is manifested and appears to be growing (Mander 1998; Shackleton and Shackleton 2000; Kepe 2002). Up until the 1990s no significant local markets existed for many of the forest products traded today. Trends in the commercialisation of forest products have been reported elsewhere in Zimbabwe (see for example, Braedt and Standa Gunda 2000; Campbell *et al.* 2002). In some areas there is potential to support these rural business ventures to enhance local livelihoods and reduce rural poverty (Geldenhuys 2004, 2005).

The demand for some of the forest products from Fuller Forest such as fruits, fuelwood and bushmeat was reported to be high in the Victoria Falls urban areas. The high rural-urban migration has meant that most of the urban dwellers have maintained some links with their rural roots. Thus, most of the urban dwellers have consumed these products at some point in the past hence they cannot resist buying the products when they are introduced in urban areas (Mangoyana *et al*. 2003).

6.4 The forest resource base

6.4.1 The ecology and sustainable use of forest resources

The use of a protected forest for diverse products has been highlighted in the above sections of this chapter. It would be a fallacy to assume that use can proceed in the absence of an understanding of the forest dynamics, particularly the ecology of the resource base. This aspect has to receive the most serious consideration if long-term management strategies that will result in sustainable resource levels and the upliftment of local livelihoods have to be realised. Through an understanding of the forest resource base forest managers can more carefully plan and implement methods of managing the diverse resources to achieve sustainable yields (Lawes *et al.* 2004) and hence sustainable local livelihoods.

From a management perspective, a sustainable system for using forest resources is one in which a product can be harvested indefinitely from a forest with little impact on the structure and function of the plant populations being exploited (Peters 1996). The populations for example, must be viewed in terms of their abundance, distribution and how they are influenced by disturbance (Cunningham 2001). One should be concerned with factors that limit tree population size if one is to be better equipped for developing a management system that will sustain woodlands into the future while obtaining an acceptable harvest of tree resources (Bond and Rathogwa 2000).

There is need to understand forest resource dynamics for sustainable use. Sustainable use requires the certainty of timely forest regeneration (Lawes *et al.* 2004). Without successful regeneration or ensuring that harvesting does not affect regeneration,

sustainable use or sustainable yield is impossible. Lawes *et al.* (2004) suggest some ecological factors that need to be considered and understood for the sustainable use of a forest resource, for example: (i) The size of the standing stock (number of stems or volumes) and how much can be safely removed in one harvest. This requires for example, information on the population structure of the target species. (ii) Which plant parts or plant individuals can be harvested and what method is appropriate? (iii) How do plants respond to harvesting (i.e. do they die or resprout)? (iv) Does harvesting of some species favour the non-harvested or non-favoured species? Therefore, an understanding of the dynamics of the resource base is fundamental to developing sound management systems for sustainable harvesting of forest resources (Cunningham 2001; Geldenhuys 2004)

The purpose of this section is to discuss ecological aspects for the wise use of the commonly harvested woody species in Fuller Forest. The emphasis is on trying to strike a balance between use and ecology of these woody resources.

6.4.2 Species composition and abundance

A total of 75 woody species were recorded in Fuller Forest (Appendix 1). Woody species composition in Fuller Forest appears superficially uniform over the whole forest, suggesting a broad similarity in key environmental conditions. The forest appears to be completely dominated by *Baikiaea plurijuga*. This apparent uniformity may be due in part to the remarkably similar physiognomy of this dominant species *Baikiaea plurijuga.*

However, differences in species composition appear to be apparent at a local scale. The determinants of species composition at the local scale over the predominantly extensive Kalahari Sand require further exploration. Intuitively the determinants appear to involve edaphic factors such as soil moisture, nutrients and depth (Astle 1969; Campbell *et al.* 1988), fire (Lawton 1978; Kikula 1986), wildlife impacts (Anderson and Walker 1974; Guy 1989), and past and present uses (Chidumayo 1987). *Baikiaea plurijuga* is dominant on the deep Kalahari Sand forest ridge. The species is typically found on deep sands (Calvert 1986b; Childes and Walker 1987), where its long roots enables access to deep aquifers which are important sources of water and nutrients in the permeable and infertile sands (Nyamapfene 1991). *Brachystegia spiciformis* invades Kalahari Sand where the soils become gravely and deep roots are not as important a competitive advantage (Calvert 1986b). *Kirkia acuminata* is more dominant on rocky areas of shallow soils. *Colophospermum mopane* occurs in depressions characterised by seasonal water inundation. Calvert (1986) notes *Terminalia sericea* as an indicator of deep sands, but Childes and Walker (1987) found that relative to *Baikiaea plurijuga* it was found at sites with poor drainage, which accords with the species distribution in the present study site. A detailed zonation of site conditions could have enabled a better analysis of species composition dynamics. Further research on this aspect would be required in order to inform decisions on use of woody resources in the forest.

The recorded number of species in Fuller Forest is comparable with results obtained from another protected forest located on Kalahari Sand. Mudekwe (2002) recorded 55 species in Mafungabusi Forest in the Midlands Province. Mafungabusi Forest has similar growth conditions as Fuller Forest. This similarity in number of species is

probably due to the uniformity in topography and soil physical and chemical properties of the dominant Kalahari Sand. In both forests there is little variation in altitude and there are little non-descript drainage systems that would normally form niche habitats for a more diverse species composition.

Woody species that are not normally preferred for subsistence uses, *Bauhinia petersiana* and *Commiphora mollis,* are more abundant in terms of numbers per hectare and occur more frequently in the forest than those preferred for firewood, construction poles and wood for carving (Table 22). It appears *Bauhinia petersiana* and *Commiphora mollis* have managed to compete successfully with the more preferred species and these two species now dominate several parts of the forest. In the past the development of these two species used to be checked by the trampling and feeding actions of large herds of elephants and buffalo (Calvert 1986). Human disturbances seem to have resulted in the migration of these wildlife species from the forest. For example, the respective density (stems/ha) and frequency (%) of species highly preferred for firewood was *B. spiciformis* 33 and 32; *C. mopane* 44 and 12 and *C. collinum* 23 and 46. The density of commonly harvested species i.e. *B. plurijuga, Kirkia acuminata, Commiphora angolensis, Erythrophleum africanum, Brachystegia spiciformis, Colophospermum mopane, Terminalia sericea, Combretum collinum, Diplorhynchus condylocarpon, Pterocarpus angolensis, Guibourtia coleosperma and Afzelia quanzensis was between 483 and 6 stems/ha.* Except for *B. plurijuga* density of the rest of these species was below 50 stems/ha. The low density of the preferred species could be an inherent factor in the life histories of these specific species. However, looking at the mean dbh of the individual species (Table 22), it can also be

that these species have been under immense subsistence and commercial harvesting pressure for a long time in the past.

Fuller Forest experiences annual wild fires (Forestry Commission 1992). Fire may affect species composition and abundance through killing of the fire intolerant species and killing of individuals of the fire tolerant and fire intolerant species (Calvert 1993). Since fire appears to be one of the determinants of species composition a cue on managing woody species under different fire regimes can be taken from Calvert's review of fire studies in Gwaai Forest (Calvert 1993). In burning trials in the *Baikiaea woodland*, Gwaai Forest, Calvert (1993) observed that fire (13 years data analysis) results in loss of trees of various species and caused a trend from single to group rootstocks and multi-stems. In this trial, fire sensitive species were observed to be *Baphia massaiensis*, *Pseudolachnostylis maprouneifolia*, *Commiphora mossambicensis*, *Baikiaea plurijuga* and *Guibourtia coleosperma*. The fire tolerant species included *Burkea africana*, taller (above 3 m) and large diameter stems of *Pterocarpus angolensis*, *Erythrophleum africanum*, *Diplorhynchus condylocarpon*, *Terminalia sericea*, *Ochna pulchra, Bauhinia petersiana* and *Combretum zeyheri*. An important conclusion made was that annual fire has a depressive effect on *Baikiaea* woodland in terms of a shift in species composition towards non-timber species and from single to multi-stemmed rootstocks. These conditions may be used to promote the development of selected non-timber species and to promote the development of those species with coppicing and resprouting characteristics.

Low abundance of the commonly harvested species is a concern for resource sustainability. Villagers raised the issue during discussion sessions and specifically,

curio carvers were concerned about the future availability of the species they favour in their trade. Species composition and density of individuals of the various species could only be improved through a better understanding of the silvicultural characteristics of individual species including their methods of and requirements for natural regeneration and how the species respond to varying intensities and frequencies of harvesting, grazing, browsing and fire (see for example Obiri and Lawes 2000, Bond and Rathogwa 2000, and Geldenhuys 2005). Presently, little is known of the silvicultural characteristics of the commonly harvested species. An adaptive management approach involving the local users is required for Fuller Forest where sustainable resource use can be matched to available resources through simple ecological monitoring of for example, species composition, species density and species frequency, in order to provide important information needed to plan for resource utilisation and management. It will be useful to use assessment indicators that the local users could easily use. This would enable the users to measure changes in the status of the resources and take appropriate decisions to adjust the harvesting rates.

Many indigenous trees can be regenerated through coppicing and resprouting. Resprouting and coppicing are common recruitment strategies in many savanna woodland species (Grundy 1995; Bond and Bathogwa 2000). The relevance of the resprouting and coppicing strategies to harvesting is important for the woody resources in Fuller Forest. All the species favoured for firewood, poles for fencing and construction and for carving (section 5.1.4) are vigorous resprouters and coppicers that can survive total removal of the above ground parts, such as by felling (Lawes *et*

al. 2004). This type of information would be useful in the management of the woody species in Fuller Forest particularly for harvesting of pole-sized stems.

Despite the purported stewardship and mitigation strategies by local villagers, these management prescriptions to improve species composition and abundance are not being practiced on the ground. Technically, the Forestry Commission also does not carry out silvicultural practices that would improve composition and abundance of target species despite its concerns about destruction and degradation of the woody component in Fuller Forest. These two issues need to be addressed in order to achieve integrated sustainable use-management of Fuller Forest. Peters (1996) and Geldenhuys (2005) give some useful guidelines on silvicultural management approaches of non-timber woody species in natural forests and woodlands.

6.4.3 Species population structure

The stem diameter distributions of the selected and commonly used tree species in Fuller Forest show how the different species vary in their population demographics across four main woodland types (Figure 6). The majority of the selected commonly used species had on average 6 size classes i.e. of trees up to 31 cm dbh. This seems to indicate that the forest has degenerated into a secondary forest dominated by small size stems for most species. Five species, *Diplorhynchus condylocarpon, Commiphora mocambicensis, Bauhinia petersiana* and *Terminalia sericea* had at most three size classes i.e. of trees up to 16 cm dbh. Except for *Terminalia sericea* the other three species are generally sub-canopy species and it is expected that they would only cover the smaller size classes. This means that harvesters have to concentrate all

their harvesting within a small range of size classes in these species. For example, it was found that firewood harvesters prefer to cut trees between 4 cm and 16 cm dbh for the product (Section 6.3.2). Depending on harvesting pressure, unplanned harvesting in these size classes may lead to decreased numbers of individuals in populations of target species. In the long-term the heavily affected size classes may eventually lose all individuals if remedial regeneration strategies are not put in place.

For the commonly harvested species the shapes of the density curves were quite dissimilar across the four common woodland types. The wide range of density curves appears to be a reflection of disturbance factors (harvesting, fire, drought, browsing) (Shackleton 1993b) in the target species although Geldenhuys (pers. comm.) argues that the variation in the range could have been narrowed if density curves were analysed based on site conditions and harvesting histories. The Geldenhuys argument agrees with the findings of Rao *et al.* (1990), who reported a decreased range of curve types in disturbed sites.

Of the selected commonly harvested species *Baikiaea plurijuga*, *Colophospermum mopane,* and *Brachystegia spiciformis* exhibited the inverse J-shaped diameter size class distribution profiles. The characteristic inverse J-shaped size class structure is generally indicative of stable and expanding populations (Geldenhuys 1993; Shackleton 1993b; Obiri and Lawes 2000). A higher abundance of individuals in smaller size classes than the larger size classes and an almost constant reduction in the number of trees from one size class to the next, leading to an inverse J-shaped size class distribution, is generally regarded as an indicator of adequate regeneration and

population maintenance (Lieberman 1996; Zagt and Werger 1998; Condit *et al.* 1998, 1999). Species with such a structure can be sustainably harvested.

Pterocarpus angolensis and *Afzelia quanzensis* have very few individuals in the forest to allow sensible deductions using the stem distribution curves. Despite their ability to resprout and coppice these species were not regenerating satisfactorily and their continued exploitation may lead to their extermination in the medium to long-term. This might be ascribed to lack of fire (Geldenhuys 1977). This is contrary to Von Maltitz and Rathogwa (2000) who seem to point to the fact that growth of *Pterocarpus angolensis* is improved if fire is excluded particularly during the fire sensitive sufftrutex and pole stages. These conflicting findings on the ecology of *Pterocarpus angolensis* point to the need of further studies despite the amount of information presently available.

Kirkia acuminata, Guibourtia coleosperma, and Erythrophleum africanum all had bell-shaped profiles. It appears these species regenerate in cohorts' fashion. In fire adapted systems, like the Kalahari Sand teak forests (Calvert 1986) the bell-shaped curve indicates fire intolerance. When fire is excluded the species regenerate and grow in such cohorts (Geldenhuys 1993). The present density profiles of these three species indicate that the intended complete exclusion of fire in the forest since 1925 (Judge 1975) has not been very successful. However, sustainability of these species in order that they provide required products on a sustained yield could be improved through targeted fire exclusion in sites where these species are dominant until such time when the trees reach 'escape height and diameter' where top kill and stem damage are no longer threats to the trees.

Diplorhynchus condylocarpon, Commiphora mocambicensis and *Bauhinia petersiana* exhibited relative linear decline in their populations. This linear decline is not a cause for concern as might be expected. Many woodland species exhibit diameter distribution profiles like those shown by these three species (Geldenhuys 2005). What is important is to guard against tree harvesting practices that would affect regeneration dynamics of the species e.g. non-selective cutting of seed bearing trees.

There is a marked absence of individuals of intermediate sizes in some size classes of populations of *Guibourtia coleosperma, Afzelia quanzensis, Pterocarpus angolensis* and *Terminalia sericea.* Although this was not empirically proved in this study, the absence of these individuals could be attributed to over-exploitation in the affected diameter classes although effects of other disturbance factors for example, fire and drought, cannot be ruled out. In their studies Shackleton (1993b) and Obiri and Lawes (2000) reported absence of individuals in specific size classes as being due to harvesting pressure in these classes.

There is a marked reduction of individuals in the smallest size class, the sapling growth stage, in *Baikiaea plurijuga, Kirkia acuminata, Erythrophleum africanum, Commiphora angolensis Guibourtia coleosperma, Afzelia quanzensis, Pterocarpus angolensis*, *Combretum collinum* and *Terminalia sericea.* It appears that stems in the seedling and sapling growth stages experience periodic difficulties in successfully recruiting into the pole and intermediate stages. Bond and Rathogwa (2000) allude to the fact that fire and browsing frequency and intensity limit recruitment of seedlings and saplings into large size classes. Annual fires and grazing are prevalent in Fuller

forest and it is hypothesised that these factors could be limiting recruitment from small to large size classes. However, this assumption requires that empirical studies be done so that key processes of how juveniles escape the disturbance factors to grow into larger size classes providing timber and poles are understood. If the bottlenecks are not removed or their amplitude reduced it can be predicted that populations of these species will decline in the future, as there would be no individuals to replace those being harvested.

Foresters and forest ecologists have long used population structure data to study the status of woody species. Forest stand structure, particularly tree diameter size class distribution is an important stand variable that must be considered in the development of sustained forest management systems (Harper 1977; Walker *et al.* 1986; Geldenhuys 1993; Shackleton 1993b). Stand structure is used as the basis for monitoring stand development when harvesting forest resources, as a tool in predicting regeneration status of tree species and as an indicator of disturbance history (Lorimer 1980; Geldenhuys 1993, 2004, 2005; Shackleton 1993b).

Tree diameter at breast height is the most commonly used variable in the analysis of woody plant structure although some studies have used tree height (Brown and Bredenkamp 2004**)**. In savanna areas analyses of population structure is restricted to size class since age class data are unreliable because for most tree species growth rings are usually not directly related to age but rather reflect fluctuations in environmental conditions (Lilly 1977).

Studies to characterise size class distributions of woody species are scarce in the protected indigenous forests such as Fuller Forest. There is limited knowledge of the effect of management and use practices on the structure and stability of populations of target tree species yet changes in population structure may indicate impact of management and use impacts. The changes may alert managers of situations of declining recruitment and development in populations of target species (Walker *et al*. 1986; Peters 1996).

Stable woody populations give the characteristic inverse J-shaped size class distribution curve (Goff and West 1975; Knowles and Grant 1983). Such curves usually mean that there is a balance between the recruitment and mortality of individual stems in a forest (Veblen *et al*. 1980). Depending on management and use practices the diameter size class distribution of a tree population may indicate species with expanding, stable or declining population (Geldenhuys 1993).

The present status of populations of the commonly targeted woody species within Fuller Forest was determined. All species need to be protected from fire and grazing during the seedling and sapling development stages. There is need to pay attention to species where individuals were completely missing from some size classes as in the long run these species might not be able to sustain themselves. At present *Baikiaea plurijuga*, *Colophospermum mopane, Brachystegia spiciformis, Diplorhynchus condylocarpon, Commiphora mocambicensis* and *Bauhinia petersiana* appear to have relatively stable populations.

The situation exhibited in the population structure of the commonly harvested species in Fuller Forest calls for better planning of harvesting and management practices to ensure that species populations are stable and self-sustaining. From the analysis of population structures of the target species it appears harvesting practices have had an impact on the populations although impact of other factors such as fire and grazing cannot be ruled out. Future management focus should be directed at achieving normal forest stands and reducing for example, situations where some target species have missing individuals in some size classes and situations where there is poor recruitment in the smallest size classes. Some of the species need silvicultural management to achieve a constant recruitment of stems in the smaller size classes, and recruitment to the next larger classes to allow for the minimum allowable harvest in each of the harvestable size classes. Managers and users should understand that the essential ecological processes for the woody vegetation community in Fuller Forest are those that maintain the system in a healthy state. As discussed in this thesis the most important processes are disturbances (harvesting, fire, grazing and browsing), and recovery from the disturbances through for example, seed regeneration, resprouting and coppicing. For this forest and any other forest the disturbance and recovery processes should form the basis of silviculture and management practices. The focus should be for users and managers to record observations of what happens to forest stands and individual trees after any disturbance. This aspect should form part of participatory monitoring, evaluation and adjustment of use practices. In a situation where a resource cannot recover from the current harvesting rates, alternative resources or products have to be developed. Lawes *et al.* (2004) observed that most rural harvesting strategies do not aim to maximise long-term yield. The selection of trees and forest products is often based on non-ecological criteria such as the urgency

of requirement or need. It is under such short-term interest that achieving sustainable forest resource use will be difficult.

An aspect that weakened the scope of this part of the study was the failure to explicitly address issues around stand dynamics related to site conditions and human resource use and zoning Fuller Forest according to site conditions and according to distance from villages and resource use impacts. Comparing stem diameter distribution patterns within a species across sites as determined by site conditions and resource use intensity could have been more useful and objective. True differences in species population structure caused by site and use could have been more apparent than the generalised situation here. However, the present information is still valid as a first step towards planning for the management of the woody resources to improve species composition, stocking and stability of target species in particular. It is recommended that the issues mentioned in this paragraph be given priority as further research areas in the process of implementing integrated forest management in this protected forest.

7. CONCLUSIONS AND RECOMMENDATIONS: SUSTAINABLE USE-MANAGEMENT OF FULLER FOREST

7.1 Introduction

Sustainable use-management of Fuller Forest requires a delicate balance between the availability of the forest products and the demand for the products. Here the options for sustainable use-management of Fuller are reviewed in the light of the findings of this research. The conclusions from the different components of the research are drawn together in an attempt to formulate guidelines for the sustainable use of this socio-economically and ecologically important forest. The most important aspect for the forest is that use and forest conservation should complement each other since both are equally important for local livelihoods and for the forest environment.

Communities adjacent to Fuller Forest harvest a wide variety of forest resources from the forest for home consumption and for sale. All along there has been limited evidence of the contribution that protected forests make to rural livelihoods, and in Zimbabwe very few studies have attempted to determine the products that forest adjacent communities obtain from protected forests. Local households harvested a wide range of forest products from Fuller Forest with the most frequently harvested products being fuelwood, wood for carving, wild fruits, thatch grass, broom grass and wood for construction and fencing and use of the forest for grazing. In addition households harvest some forest products for sale. Commercialised products include thatch grass, firewood, wild fruits, wood for furniture making and carving, honey, caterpillars, medicines and broom grass. Both rich and poor households harvest and

use forest products from Fuller Forest. While livelihood strategies are a mix of livestock and crop production and harvesting of forest products, most livelihood strategies of the poor households are forest-based.

The literature review in this study indicates that there is scant, mostly anecdotal information on the ecological sustainability of harvesting forest products in protected forests. An analysis of the woody forest resource base indicates that populations of some of the target species are not stable as indicated by low adult population densities, reduced numbers of individuals in the smallest size classes, some size classes not represented by any individuals and some species with missing size classes. It is likely that use practices accompanied by grazing, fire, browsing, climatic and edaphic factors, have had some impact on populations of the target species. Taken together, these factors have had overall detrimental effect on species composition, plant regeneration and densities of the target species. There is also evidence from published literature for other parts of the world that management and use practices of forest resources may be leading to overall forest degradation.

This study thus indicates that in the process of planning for forest use there is need to recognise the potential impacts of harvesting on target species. A more rigorous information base on important forest products in protected forests and the socio-economic profiles of local communities needs to be built up before undertaking planning for local harvesting or interventions. Much more research for the protected forests is required before it can be clearly understood to what extent the forests contribute to local livelihoods and to what extent livelihoods based on forest products can be compatible with forest conservation.

7.2 Factors influencing sustainable use-management of Fuller Forest

7.2.1 Forest policy and forest legislation

Forest policy and forest legislation can have a number of impacts on forests. Negative impacts include deforestation, forest degradation and loss of biodiversity where use is illegal as a result of restrictive policy and legislation (Banerjee 2000). Other impacts such as conflicts over resource use have forced some governments to initiate steps towards devolution and decentralisation in forest management in an attempt to reduce the destruction of forest resources. However, the essentials of forest policy are that the policy provides guidance on how forest and forest resources shall be managed to the benefit of all stakeholders. Forest legislation supports the implementation of the forest policy (Wily 2000; Willis 2004).

In their present forms the Zimbabwe forest policy and legislation do not explicitly address the needs and interests of local communities in terms of forest resources use. The Zimbabwe forest policy for the protected forests has a major focus on forest management for the production of commercial products such as timber and wildlife, protection of the forest environment to avoid degradation, soil and water conservation and enhancing the amenity value of the forests (Ministry of Lands 1971; Ministry of Environment and Tourism 1982). Nothing in the policy is specific as to the relationship between the protected forests and local people save for the ambiguous statements such as:

> "*The principle of multiple land use will be applied where practicable or desirable*" and "*in reserving this area every effort will be made to ensure that*

> *it is made up of forests distributed throughout the Colony. But account will also be taken of the need for optimum land usage, for the protection of watersheds and the establishment of nature reserves as well as the need for relatively small communal forests to supply the needs of local communities*". (Ministry of Lands 1971).

This is in contrast to forest policy and legislation of South Africa that specifically deal with the relationship between people and the resources provided by forests and include the use and husbandry of all types of the forest resources (see Willis 2004). For the sustainable use-management of protected forests the Zimbabwe forest policy needs to be reviewed to reflect the relationship between people and the forests. It should recognise the social and economic values of the protected forests to communities as has been elucidated in the present study.

Under the Forest Act the protected forests came under the authority of the Forestry Commission. The Forestry Commission acquired full and exclusive legal rights, including all rights of ownership and management (Mohammed Katerere 2000). The implication is that, legally, no one is entitled to any rights in any protected forest or to any produce, other than may be given to them in terms of the law by the Forestry Commission. Despite this provision it can be argued that the Act is not unnecessarily restrictive. Section 41 of the Forest Act provides in paragraph (a) that unless authorised in terms of subsection (3) or (4) of Section 44, no person shall

> *Cut, fell, injure or destroy produce in or remove any forest produce from any demarcated forest or protected private forest.*

This indicates that local use is permissible provided one obtains permission from the relevant authority. Further, Under Section 66 the Forestry Commission has power to make by-laws that are in its opinion necessary or expedient for the proper control and good management of any demarcated forest. Subsection 2 provides that these by-laws may be provided for the control or prohibition of

- The use of land in a demarcated forest for residence, cultivation, grazing, camping or picnicking,
- The entry of persons into demarcated forests,

So the Forestry Commission can potentially embark on a management approach that links local forest use and forest conservation using this piece of legislation. It is the duty of the Forestry Commission's local forest managers to encourage the public to obtain permission that allows them to utilise resources in protected forests. These awareness campaigns should be sustained on a regular basis. They also serve a dual purpose of providing the basis for dialogue that should enable the development of mechanisms for accessing forest resources. As pointed out by Kajembe and Monela (2000), it is the local forest manager who plays a pivotal role in transforming policies and legislation at the local level. The forest manager is the 'social interface' between the various stakeholders and the Forest Department and the state. His ability to establish smooth working relations with forest users is judged by the users' willingness to accept different interventions.

The forest policy of Zimbabwe was subjected to a World Bank review in early 1990 (Bradley and McNamara 1993) and the existing legislation was also examined and appropriate alterations advocated. Scoones and Matose (1993) discuss these reviews,

detailing the changes that would be necessary for the success of locally based forest management schemes. They advocated policy and legislation reforms that would emphasise the local communities as beneficiaries, allowing adaptive management based on local initiatives.

As made clear in Chapters 5 and 6, local peoples' dependency on protected forests during the pre-colonial, colonial and post-independence periods has not changed a great deal. Local people still harvest and collect a wide range of timber and non-timber products from these forests albeit illegally. Sustainable use-management of the protected forests can only be achieved when local communities obtain recognition as having some stake in the forests and the forest legislation and policy are reviewed to reflect practices currently taking place on the ground. Without such a framework, forest management and conservation programmes have slim chances of success.

The current protectionist approach by the Forestry Commission is not sustainable. There is no doubt that the Forestry Commission can no longer afford to continue denying their communal neighbours access to forest resources. This will only result in increased degradation of protected forest through illegal harvesting of the forest products. It is recommended that the Forestry Commission initiates a process that formalises use of the protected forests under some mutually agreed mechanisms backed by appropriate policy, legislation, rules and regulations.

7.2.2 Matching resource use needs with resource availability

An important issue concerning the sustainable management and use of the forest resources in Fuller Forest is matching resource use needs with resource availability. This should not only be part of the initial resource assessment, but must be a continuous process in order to achieve sustainable resource use (Geldenhuys 2005). The components and processes of both the biophysical and human environments provide for the development of integrated, sustainable resource management strategies and practices (Geldenhuys 2005). Peter (1996) gives comprehensive guidelines in respect of the process of achieving sustainable management and use of forest products. According to Peters, the process is composed of five basic operations: forest inventory to provide data about the resource base; yield studies to estimate resource productivity; regeneration surveys to assess the stability and status of the populations being harvested; harvest assessments and monitoring to establish any problems in the growing stock that might be due to harvesting activities; and finally, harvest adjustment. Harvest adjustment is necessary if any problems were observed in the growing stock as a result of harvesting activities. Harvest adjustment is necessary to ensure sustainability.

In situations where demand and needs are more than the available resources, then there is need to seek for alternative or substitute resources or to cultivate selected species to meet the demands. In the first case the cost of substitutes may be prohibitive to poor rural communities or the substitutes may not be readily available in remote rural areas. In the second instance the success of cultivating indigenous species have been dismal (Malaya 1986; Saramaki *et al.* 1986; Bila 1993). Given the

present state of data and information for Fuller Forest the likely option is to adopt an adaptive use-management approach where simple ecological monitoring of resource use and management impacts are implemented. Users must agree on using simple assessment indicators and criteria that are easy to understand. This should enable users to measure changes in the status of the forest resources and to take corrective measures where necessary (Geldenhuys 2005). This will require commitment on the part of all stakeholders for the approach to be successful.

An example of generic critical information to collect during monitoring could include the following:

- Record of names of harvested species;
- Types of products harvested;
- Record of harvesting impacts for example, cutting, digging, stripping, etc;
- Record of fire and drought occurrence and qualitative and quantitative assessment of damage;
- Record of occurrence of regeneration, coppice and resprouts and determining comparative growth rates over a given time period;
- Methods of harvesting;
- Amount of products harvested over a given time period;
- Names of monitoring individuals or monitoring committees;
- Relative location/sites where products are found;
- Record of system in place to control access to resources.

Given that local households indicated considerable dependency on the forest it is unlikely that it may not be prudent to completely ban use of the forest. An alternative

is that forest managers and users may wish to consider granting and agreeing to seasonal or periodic harvesting to ensure recovery of the forest. This period of forest rest may be based on growth rate information of the different regeneration strategies gathered during the monitoring practices.

The real shortfall concerning this study was that it did not determine the amounts of different products harvested and collected from Fuller Forest. While the main focus was to investigate what exactly the local people get from Fuller, a fuller picture could have been presented by giving estimates of quantities of the harvested products to find out if the harvesting rates were sustainable. Without this information, the Forestry Commission would need to be cautious in formalising access to the forest products currently being harvested to avoid over-harvesting.

At present a moratorium may be put on those species that showed that their populations were not stable and able to sustain themselves until such time when the status of their recovery has been established.

7.2.3 The way forward

Adapting the concepts of Geldenhuys (2002), sustainable forest resource use in Fuller Forest has three main components: social, ecological, and economic. Socially it is important to satisfy the livelihood needs of the people depending directly or indirectly on the forest resources. Ecologically the biophysical components and processes of the resource need to be sustained to ensure the functioning of the ecosystem. Economically it is essential to provide for viable forest-based businesses to ensure economic activities in the adjacent communal area.

This thesis has demonstrated some of the linkages between patterns of forest resources use and socio-economic and ecological trends. There is some potential that forest resource utilisation will progress within the limits of the present baseline information. At this stage, indications point towards the integration of development and conservation objectives. However, there is need for caution as it is not possible to reach any firm conclusions until further research is done. Such research need must focus on the issues of forest regeneration capacity and regeneration strategies, impacts of selective harvesting, fire and grazing. A critical observation from an analysis of the information and data from this study is connected to the need to manage Fuller Forest for multiple objectives as opposed to management for high value resources. The participatory management approach and initiative provides an ideal opportunity for user input and participation in resource use planning activities and in research activities directed at sustainability and maximising the socio-economic contribution of the forest.

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Appendix 1. Woody species recorded in Fuller

1	*Acacia karoo*
2	*Acacia elioroba*
3	*Acacia nigresence*
4	*Afzelia quanzensis*
5	*Azanza garckeana*
6	*Baikiaea plurijuga*
7	*Baphia massaiensis*
8	*Bauhinia macrantha*
9	*Bauhinia petersiana*
10	*Bolusanthus speciosus*
11	*Brachystegia boehmii*
12	*Brachystegia spiciformis*
13	*Burkea africana*
14	*Colophospermum mopane*
15	*Combretum apiculatum*
16	*Combretum collinum*
17	*Combretum molle*
18	*Combretum zeyheri*
19	*Combterum eleagnoides*
20	*Commiphora angolensis*
21	*Commiphora mocambicensis*
22	*Commiphora mollis*
23	*Croton gratissimus*
24	*Dalbergia melanoxylon*
25	*Dalbergia nitidula*
26	*Dialium englerianum*
27	*Dichrostachys cineria*
28	*Diospyros mespiliformis*
29	*Diplorhynchus condylocarpon*
30	*Dombeya rotundifolia*
31	*Erythrophleum africanum*

32	*Euclea divinorum*
33	*Euphorbia matabelensis*
34	*Ficus thonningii*
35	*Flacourtia indica*
37	*Friesodielsia obovata*
37	*Gardenia ternifolia*
38	*Grewia flavescenes*
39	*Grewia monticola*
40	*Guibourtia coleosperma*
41	*Julbernardia globiflora*
42	*Kirkia acuminata*
43	*Lannea discolor*
44	*Maytenus senegalensis*
45	*Maytenus heterophyla*
46	*Monotes glaber*
47	*Ochna pulchra*
48	*Pappea Capensis*
49	*Parinari curatellifoli*
50	*Paropsia brazzeana*
51	*Pavetta gardenifolia*
52	*Peltophorum africanum*
53	*Pseudolachnostylis maprouneifolia*
54	*Pterocarpus angolensis*
55	*Pterocarpus rotundifolius*
56	*Schinziophyton rautanenii*
57	*Securidaca longipedunculata*
58	*Strychnos cocculoides*
59	*Strychnos madagascariensis*
60	*Strychnos pungens*
61	*Strychnos spinosa*
62	*Swartzia madagascariensis*
63	*Syzygium cordatum*

64	*Terminalia sericea*
65	*Terminalia prunoides*
66	*Terminalia stenostachya*
67	*Uclea divinorum*
68	*Vangueria randii*
69	*Vangueriopsis lanciflora*
70	*Vitex mombassae*
71	*Vitex payos*
72	*Xeromphis obovata*
73	*Ximenia caffra*
74	*Zanha africana*
75	*Ziziphus mucronata*