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Local Vegetation Use and Traditional Conservation Practices in the Zambian Rural Community: Implications on Forest Stability

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Abstract

Understanding the relationship between biodiversity and people outside protected areas is a great challenge to biologists and policy makers. Vegetation use and traditional conservation practices by local communities was studied in Mongu and Senanga districts in Western province of Zambia. The focus was mainly on woody species for practical reasons. At least 57 species of woody plants were found to be useful among the local people. These were used for construction, medicines, food and firewood. There was no significant difference in the way people in the two districts use vegetation for medicines and food, but there was a difference in uses for construction and firewood. Senanga was found to have a relatively higher number of species that were regularly in use. Within each of the two districts, gender, age and geographical location were factors found to affect the use of vegetation. There was no difference in the use of vegetation for food and firewood between villages near and those further away from forests, but differences were found in medicinal and construction species, where people living near forests mentioned much higher number of species. Of the species being used, four are declining, predominantly those used for construction while four species are observed to be increasing in abundance. Traditional conservation methods exist among the local people. These include preservation of sacred landscapes acting as refugia for threatened species, myths and taboos restricting use through dos and don'ts, spiritual values associated with forests and individual species, and harvesting methods. The local administration had administered rules and regulations before Zambia gained independence. Although traditional conservation methods are under threat due to population increase, acculturation and commercialisation of plants with market value, these practices have substantially contributed to conservation of forest biodiversity. The cumulative impact of selective harvesting of woody species especially for construction and firewood may induce positive and negative feedbacks on forests and thus impact on the overall both stability of the forest ecosystem. The combination of species and ecosystem conservation approach through community natural resources management provide a supplementary option to traditional conservation methods already in practice. For continued sustainability of forest biodiversity, conservation and management strategies need to recognise local knowledge in both content and practice.

Key words: Zambia, Western Province, vegetation use, traditional conservation, forest biodiversity, local people. (Word count: 14, 017)

Contents

Introduction

People value forest biodiversity in different ways: spiritually, economically, aesthetically, culturally, and scientifically. Its values also differ on international, national, and local levels. The conservation of forest biodiversity is important and directly relevant to local residents, for whom biological resources often represent their primary sources of livelihood, medicines, and spiritual values. The use of vegetation and other non-forest products by the local communities, and their conservation is a subject of interest in management of forest biodiversity. In the past, conservation efforts in Africa (and elsewhere) have tended to emphasise the scientific values of biological diversity and focused on areas of endemism and protected areas. These values have largely dictated what, where, and how conservation efforts have taken place. In a narrow sense, Zambia's rural population's overwhelming dependence on forest biodiversity demands strategies for conservation ideals that incorporate national and local values with local traditional conservation systems that have sustained ecosystems for decades.

Social-Ecological systems

People of different cultures around the globe living in natural environments rely on the use of plants in all aspects of daily life, from food and shelter to medicines and for religious purposes (Case et al. 2005). People are culturally and historically attached to forests that are essentially important habitats for terrestrial biodiversity. This integrated concept of humans in nature has been referred to as a social-ecological system (Berkes 2004, Berkes et al. 2003). In their frequent use of wild plants, local people communicate and transfer profound ethnobotanical knowledge of plant resources from generation to generation in their local environments built around experiences and closely related to a way of life (Berkes 2004). Therefore, local people harbour important information on valuable plants and vegetation dynamics. This knowledge base is recognized to be useful for the management strategies aimed at sustainable conservation of forest biodiversity (Lykke 2000, Berkes et al. 2000; Kristensen and Lykke 2003, Case et al. 2005). Biodiversity conservation projects have been shown to be more successful when local knowledge has been incorporated and built into the planning and implementation of conservation activities (Pretty and Smith 2004, Berkes 2004, Olsson and Folke 2001). There is equally growing evidence that such actions are likely to sustain stewardship and protection of biodiversity over the long term (Uphoff 2002). The combination of closeness to forests and dependence on natural resources, customary proprietorship and indigenous knowledge gives the local people intrinsic moral and *de facto* authority to participate in the management of these resources (Mbile et al. 2005).

More than 40 % of Zambia's population live in rural areas (CSO 2003) with traditional production systems and cultures, in which natural resources account for he major component for the local residents' livelihoods (MTENR 2002). The majority of the Zambian rural livelihood strategies build on traditional knowledge, which allows them to cope with adverse and unpredictable conditions. They depend on agro- and forest biodiversity for their day-to-day lives, i.e. for food, fuel, water, fodder, building materials and health among other services. According to Berkes, et al (1994), communities may be termed 'ecosystem people' who are motivated not only to utilize natural resources prudently, but also conserve them in the long term through social behaviour and practices that tend to exhibit resource use restraints. Their dealings with nature are hedged by manifold prescriptions as to what, when, and how much is to be left undisturbed. These prescriptions are part of the rich tapestry of the traditional culture of societies of ecosystem people. People in rural communities of the Western Province of Zambia have utilized forest biodiversity for their livelihood for a very long time. For as long as local people have managed natural resources, they have engaged in centuries-old resilience systems. Collective actions have been institutionalised in forms of traditional systems.

From the social-psychological literature (McFarlene 2005, Gagnon-Thormson and Barton 1994), human beings' value orientation concerning biodiversity is generally classified as biocentric and anthropocentric. An anthropocentric orientation reflects a utilitarian view of nature whereby biodiversity is defined in terms of satisfying human wants and needs, and their contribution to economic prosperity and human welfare. The local people from the study areas (Western Province as a whole) reflect the interface between biocentric and anthropocentric orientation. Biocentrism looks at a broader range of values including for example aesthetic, spiritual and passive use values of biodiversity. This is reflected in the way people from Mongu and Senanga use the local resources to satisfy their economic, social and cultural needs. These concepts dictate the direction of conservation attitudes and priorities of their society. Although they have contributed substantially to understanding the economics of biodiversity conservation and the tradeoffs associated with conservation options, there remains a need to understand the factors that motivate rural communities to behave in a certain fashion towards conservation. In this regard, forest biodiversity and how it is managed is a crucial issue to the sustainability of rural communities.

Knowledge acquisition of complex systems such as forest biodiversity is an ongoing, dynamic learning process, and such knowledge typically emerges with local people living in proximity with such systems. By looking at the vegetation use and conservation perceptions of local people of Western Province, the study sought to understand this complexity of forest biodiversity in

relationship with people and their knowledge. The way such knowledge is being organized and culturally embedded, its relationship to ´professional science`, and its role in catalysing new ways of managing forest biodiversity are important subjects today (Kellert et al. 2000, Gadgil et al. 2000, Armitage 2003). The management and governance of complex forest biodiversity may benefit from the combination of different knowledge systems that include both local knowledge and contemporary concepts (McLain and Lee 1996).

Problem statement

Indigenous conservation practices play a critical role in forest biodiversity management especially outside protected areas. In the Zambian scenario of Western Province, these are embedded in customary laws and have been practiced since the pre-colonial era. Traditionally, customary law enabled people to develop indigenous management systems that acted as controls in the exploitation of natural resources. Though over the years, these practices have been extensively modified by external influences such as colonialism that alienated communities from their resource base and acculturation, they still exist in many parts of the country where they are enforced side by side with modern statutory law (MENR 1999). However, there is no known literature evidence on the traditional conservation practices of forest biodiversity among the local people of Western Province. The project identifies the information gap regarding the usage of vegetation and their traditional conservation practices to enhance sustainability of forest biodiversity in rural areas of Mongu and Senanga of Western Province. The majority of the people in these areas depend on plant biodiversity for their daily subsistence either for medicines, firewood, construction purposes or food, aside other resources such as fisheries and wildlife. Indigenous knowledge on sustainable use of fisheries for livelihood in the province has occupied much space in literature such as in Thole and Dodman (Unknown year), Chileshe (Unknown year), Chiuta (1995) and Chidumayo (1992). Like most places in Zambia, wildlife information in Western Province is available. However, little is published on the use of plant biodiversity and traditional practices relating to conservation.

In the recent past, there is an assumed link between loss of biodiversity and continued presence of local people in the areas buffering Liuwa and Sioma Ngwezi national parks respectively (Anonymous 1992). Policy and practitioners have a mistaken assumption that the local people are inevitably mismanaging local resources (Beering 1986). Yet the long history of successful management of the commons in many parts of the world, which is prominent in Western Province, suggests that there is a way to approach this challenge. Pretty and Smith (2004) suggest that local people generally play a significant role in biodiversity conservation. In this regard, there is an apparent information gap in literature on the local vegetation utilization, and traditional conservation

practices of people like those in Mongu and Senanga villages and implications on forest biodiversity.

Research rationale

As far back as 1985, Zambia drew up its first National Conservation Strategy that was aimed at providing the framework for sustainable utilization of biodiversity (Aongola et al. 1997, GRZ 1985). Since then subsequent legal documents have been written. More than thirty legislative instruments dealing with conservation issues or protection of the quality of the environment have been documented (MENR 1998). Although most of the documents include clauses to allow the local people's participation in the sustainable management of biodiversity, both the content and the logic of the delivery methods, even those labelled participatory such as community based natural resource management (CBNRM), too often follow a western scientific model that often times undermine the local knowledge needed for the management of more complex ecological systems. These include among others, the Forest Act 1973 and Statutory Instrument No. 52 of 2000 on Joint Forestry Management (JFM), Fisheries Act No. 21 of 1974, and Wildlife Act No. 12 of 1998. In order to fully understand the notion of use of local knowledge in natural resource management, we need to know what is being utilised and understand the conservation perceptions relating to biodiversity within their local context.

The primary goal of forest biodiversity conservation is the long-term persistence of the whole biota in order to sustain ecosystems composition, structure and functions. There are two paradigms for the conservation of ecosystems: community based conservation (CBC) and protected area conservation (PAC) (Hume and Murphree 2001, Sinclair and Bryom 2006). Essentially, the concept of protected areas in its current international context is an unfamiliar concept to most rural communities in Sub-Sahara Africa, which finds its roots in strategic models that emerged in the 1960s in Europe and America (Mbile et al. 2005). Currently protected areas cover less than 10% of the global terrestrial surface and it is likely that it will not increase. In Zambia, 44.6 million ha is under forests and woodlands, which is 60% of the total land area. Nearly a third of this is under customary land (FAO 2001), while national parks established primarily for biodiversity conservation cover a total area of 6.358 million ha and forest reserves cover 7.4 million ha (MENR 1999). The current figures are not likely to increase substantially. Many protected areas are not large enough to maintain a viable population in isolation from the surrounding matrix dominated by people. If we are to ensure the persistence of the other half of the biota we must look to human-dominated ecosystems, so that we can employ community based conservation which takes into account local knowledge and practices (Sinclair and Bryom 2006).

Objectives

This study sought to determine the local vegetation use and the impact of traditional practices on the conservation of forest biodiversity, and identify key conservation issues that need to incorporate traditional and scientific methods to enhance forest biodiversity management strategies in Mongu and Senanga. The specific objectives were to: investigate the level of utilisation of forest biodiversity in Mongu and Senanga; examine traditional practices in the conservation of forest biodiversity in the area; evaluate how distance to a forest influences the local use and traditional conservation of biodiversity and, investigate if the local use and traditional biodiversity conservation changed over time in Mongu and Senanga. It is beyond the scope of this study to investigate the effectiveness of the traditional methods by any measurement.

In order to achieve these objectives, the following research questions were addressed: What vegetation resources do the local communities of Mongu and Senanga utilize? What are the traditional conservation practices that exist among the rural community and how do these affect the forest biodiversity stability? Do factors such as distance from forests to villages affect traditional conservation knowledge? Has there been any change over time on the traditional conservation knowledge?

In this regard, the following hypotheses were tested:
H_o: Local vegetation use **does not differ** among different villages in Mongu and Senanga in the Western Province of Zambia;
H_1: Local vegetation-use **differs** among different villages in Mongu and Senanga in the Western Province of Zambia;
H_o: Traditional practices among local communities **do not contribute** to the conservation of forest biodiversity.
H_1: Traditional practices among the communities **contribute** to the conservation of forest biodiversity.
H_o: Locations of villages **have no influence** on the vegetation use and perceptions of conservation.
H_1: Locations of villages **have influence** on the vegetation use and perceptions of conservation.
H_o: Traditional biodiversity conservation **has not changed** over time in Mongu and Senanga in the Western Province of Zambia.
H_1: Traditional biodiversity conservation **has changed** over time in Mongu and Senanga in the Western Province of Zambia

Scope of the study

Vegetation use and traditional conservation methods fall within ethno-ecological studies. Ethno-ecological and forest biodiversity studies may be wide and complex. Areas that generally concern traditional methods of conservation

of forest biodiversity and its use require understanding of, among many other issues, historical and ethnic issues, and socio-political systems relating to the local environment. Knowledge of ecological settings and anthropogenic factors of the areas is a prerequisite in such studies. However, the scope of this research was only concentrated on the three areas that are deemed core of the subject: vegetation use, conservation methods and their implication on forest biodiversity. The study therefore had limited itself to the investigation of vegetation species used for medicines, food, construction and firewood, and the traditional methods that are used in conservation of the species. It is beyond the scope of this study to investigate the effectiveness of the traditional methods by any quantitative measurement. The study however discussed the implications of these conservation methods on the conservation of biodiversity.

The Study Area

The study was conducted in Western Province with 84% of the population living in rural areas. The specific areas of the study are Mongu and Senanga districts (Fig 2.1). Mongu is a provincial capital of Western Province where the administrative function of the government and traditional rulership is based.

The Western Province, formerly Barotseland, covers one sixth of the country's surface area or approximately 130,000 Km^2. The province is part of the Okavango Basin with an altitude above sea level ranging from 900m in the south and 1350m in the northeast, characterized by the savannah woodlands type of vegetation. The biome constitutes of tropical and subtropical grasslands, savannas, and shrub lands. The Zambezi River bisects the province into two regions. The Barotse wetlands, which are part of the Zambezian flooded grasslands ecoregion lie between the main north and south portions of the Western Zambezian Grasslands. The southern portion of the ecoregion is an area of Kalahari sands grassland surrounded by *Baikiaea* Woodland. This area has a long history of human habitation and parts of it have been settled for centuries (Turpie et al. 1999). The vegetation has adapted to some human disturbance, most notably, frequent fires (Gils 1988).

The Liuwa Plain National Park and the Sioma Ngwezi National Park are the only protected areas in the province. The large Western Zambezi Game Management Area (GMA) joins and surrounds these two national parks. The area is predominantly Kalahari woodland with *Baikiaea* species and *Miombo* woodland with pockets of Western Zambezian Grassland. The GMA comprises communal lands in which hunting is permitted through a licensing system administered by the Wildlife authority.

Mongu and Senanga districts are located between the Western Zambezi Game Management Area and communal lands. These two districts were chosen because they lie in the interface between the two National Parks and create an opportunity to study the consciousness of the rural communities in conservation issues. Unlike the Sioma Ngwezi National Park with a diverse range of tree species, towards the Liuwa National Park, the trees become fewer and lead to almost treeless plains upwards in the north. These two districts are positioned in two different ecological zones and the comparisons are important to understand the complexities of the local social-ecological taking into account the homogeneity in ethnicity and culture. Given the unique traditional lifestyle of the Lozi community and their interaction with natural resources in their daily subsistence, the areas avails a platform to test the hypotheses raised in this study. Forest resources, particularly wildlife and vegetation in the Western Province have been protected as far back as the second half of the nineteenth century, until when Liuwa was declared a game reserve by King Lewanika of Barotseland. The Litunga (the Paramount Chief of the Lozi people) officially administered this park, as well as Sioma Ngwezi, until 1972 when they were declared national parks and their management was taken over by Zambia's Department of National Parks and Wildlife Service (now ZAWA). The people living in Liuwa Plain were not moved. These villages are concentrated along the eastern and western boundaries of the park, and villagers and their livestock have co-existed with wildlife under a system of conservation regulation for a long time.

Historically, the Zambian economy has been based on the copper mining industry. The government is currently pursuing an economic diversification program to reduce the reliance on the copper industry. This initiative seeks to exploit other components of Zambia's rich resource base by promoting agriculture, eco-tourism, and hydropower. Western Province is a key player in the eco-tourism sector owing to its vast plains, wildlife and unique culture. The province is famous for the *Kuomboka* ceremony, a Lozi tradition that attracts millions of tourists per annum from within and from a far. In addition to tourism, beef, fisheries and timber industries have been the mainstay of the provincial economy. The majority of the inhabitants still practice subsistence farming in maize, cassava and rice.

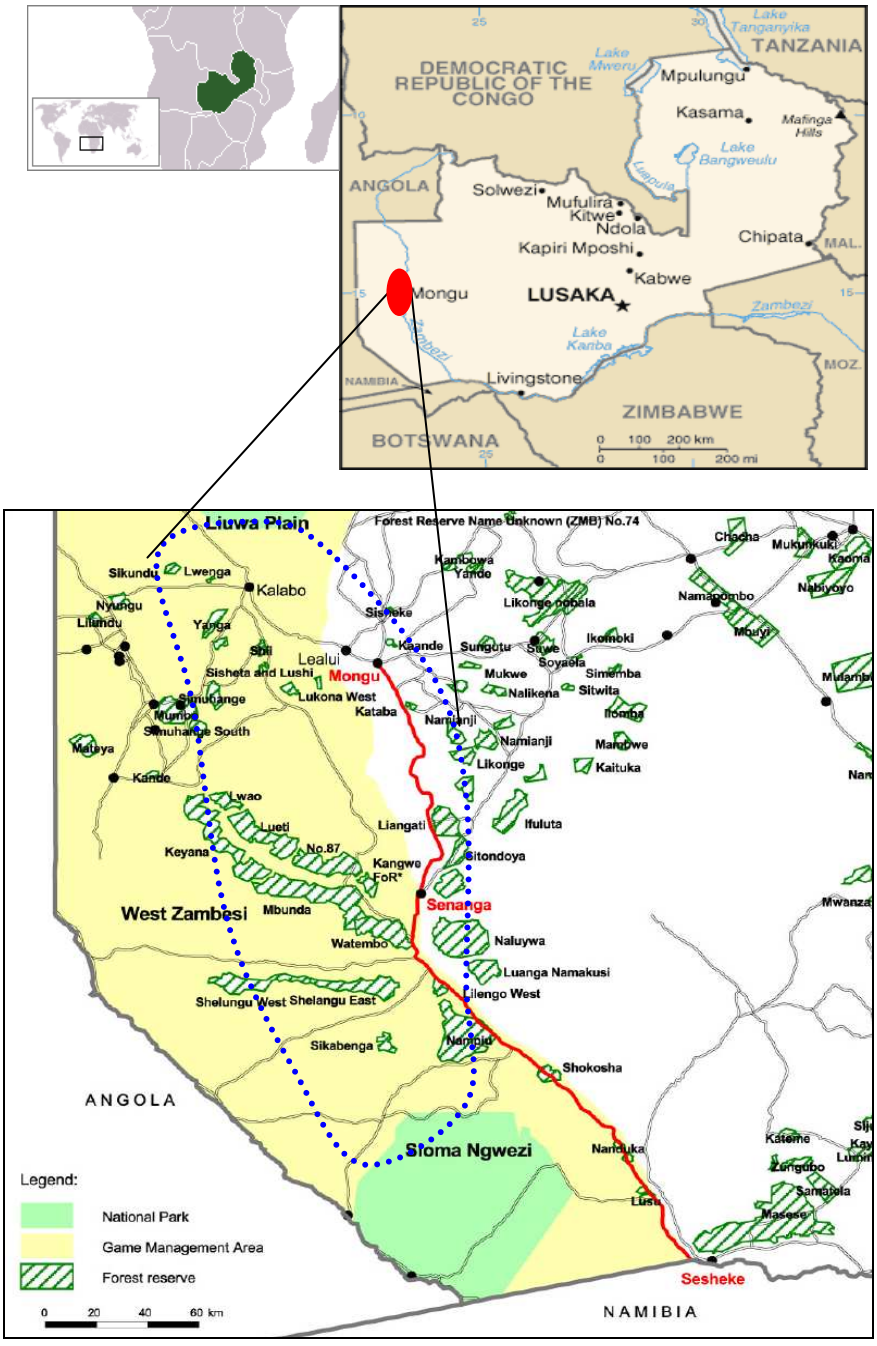

Figure 2.1: The study area showing major forest reserves and the Game management Area. Villages sampled are located in the Game Management Area between Liuwa and Sioma Ngwezi National Parks. (Map adapted and modified from COWI 2007).

Cultural settings in the Mongu and Senanga district

Senanga district has a total of 20,956 households and Mongu has a total of 32,054 composing the largest share in the province. Western Province forms 8% of the country's total population. The Lozi and Nkoya communities with traditional conservative lifestyles and practices predominantly occupy the province. By the late 18th century, the Lozi tribe was a powerful kingdom encompassing the Western Province and parts of the North-Western and Southern Provinces and Angola. The Lozi kingdom was centralized to a remarkable degree with graded officialdom and councils. During the pre- and postcolonial era, historical evidence attests that Barotseland implemented policies and legislation that encouraged sustainable use of the natural resources (van Gil 1988). Unique methods of management of forests, wetland and wildlife resources were in force and are still practiced to some degree today.

Local governance system and natural resources

The 'Litunga' is the title of the Lozi king that means 'of the earth' or 'owner of the earth' signifying that the King of the Lozis is a caretaker of all the lands of the Lozi kingdom. The Litunga in consultation with the Ngambela (spokesman) appoints an Induna (headman) to be in-charge of specific natural resources and to advise the Litunga on appropriate methods of managing natural resources. Zambia holds a dual land tenure system: statutory leasehold and customary land. This system spells conflict of interest between the state and traditional leadership. Studies (Lewanika unpublished) highlights that local people have more allegiance to Barotse Royal Establishment than to government. In a Lozi society, all land and mushitu (forests) and its products belong to the king, and the king is obligated to provide his subjects with land and protection. In addition, every subject has the right to fish in public waters, hunt on public lands, and to use the natural raw materials of the land at will within the local regulations (e.g., clay, iron ore, grasses, reeds, trees). Traditionally, in return for the use of the land and its products, the king had the right to claim the allegiance of everyone living on his land, to demand tribute from their produce, to control the building of villages, and to pass laws affecting land tenure and use of forests. The king also retained direct control over unallocated land, had residuary rights to land for which an heir could not be found, and potentially had the right to give unused land to landless people or to use it for his own purposes or for public works. Land allotted by the king to villages was held in the name of the village headman, who, in turn, distributed parcels of land to his fellow villagers.

The Legal System of Barotse Royal Establishment is based on the five cornerstones which are ***milao*** (laws), ***liswanelo*** (rights), ***litukelo*** (rights of particular position or social status), ***mikwa*** (methods or ways of doing things),

and ***mulatu*** (an offence or wrongdoing). The five cornerstones of the Barotse Legal System have been in existence since the beginning of the kingdom. However, most laws were institutionalised during the reign of King Mulambwa in the 18th century. This included laws pertaining to acquisition, use and disposal of natural resources.

Research Methods

Data collection

Data used in this research was collected during fieldwork between July and November 2006. The data was collected from primary and secondary sources. Both quantitative and qualitative data were realized through structured questionnaires and semi-structured interviews in twenty-two selected villages in Mongu and Senanga districts. A total of 176 key participants were included in the study. The selection of the key participants was done in collaboration with village leaders, and advices from forest department and statistics office in Mongu. Village registers in the custody of village headmen were requested to help determine the selection of key participants. Earlier studies (Lykke 2000) have shown that practically all local people in a rural area could give information about varieties of useful species and management practices. However, care was taken to administer questionnaires to a representative selection of key participants with respect to age, gender, educational levels, and geographical positions of households within the different villages. Each participant spent an average of 40 minutes to answer a questionnaire.

Summary of important questions in the questionnaire:
Social-economic information
These included age, gender, occupation, size of family, marital status, education level,
Traditional Knowledge

(i) Have you travelled elsewhere from your village before for more than one month?
(ii) How long have you been in this village?
(iii) Do you think forests are important to you and/or your family?
(iv) How long do you take to walk to the nearest forest from your household?
(v) What activities/actions do people in your area (including yourself) do to ensure that you can continue to get the natural resources you mentioned before.
(vi) Do you think the local traditional authority has a role to play in taking care of (protecting) the forests?

Are you aware of any legislation concerning protection of forest?

Ecological information

(i) List different species that you know from the forest for each kind of category (i.e. firewood, medicine, construction, food, other). Please indicate which species are the most important for you and your family, mode of harvesting, reason for preference. Also specify if you think each species is increasing, decreasing or are stable.

Two focus group discussions (in Mongu and Senanga respectively) were conducted consisting of village headmen and other selected members of villages. Each discussion group spent about two hours. In order to reduce the bias due to male dominance in the discussion, three local people moderated the discussion. One was a female and two were male, (one of the men was primarily recording information). Issues under discussion related to perceptions about use of forest resources, observed changes in the forests before and after independence, traditional practices relating to conservation of forest resources to date. In addition, local authorities including the *Ngambela* (spokesperson to the Litunga, sometimes referred to as the Prime Minister of Barotseland), Forest Department, Zambia Wildlife Authority and other conservation agencies were interviewed to verify information concerning the status of the forest biodiversity.

Data analysis

Due to the informant consensus-based nature of the study, data collected were mainly qualitative in type and therefore, analysis and interpretations is largely based on descriptive statistics.

Variables considered in looking at traditional conservation practices are village locations, relative use-values (RUV) and conservation perceptions (ranked priorities and observed vegetation dynamics). Relative use value measures how many plant uses one informant knows relative to the average knowledge among all key participants. (Lykke 2000, Kristensen and Balslev 2003, Kristensen et al. 2003). RUV was a measure to understand what forest products are utilised, and consequently determine the implications on the overall conservation objectives. Average ages were used in descriptive statistics to determine whether it affects use of forest resources for each category and differences in conservation perceptions between villages. In order to understand the effects on relative use value of distance from village to the nearest forest, village location was analysed. Gender was used to determine whether it affects the relative use value of forest biodiversity within, between and among villages and also between the two districts. Conservation perceptions were used to analyse the dynamics on the vegetation.

To investigate the relationship between distance from forests and relative use-value of the mentioned categories, Spearman rank correlations were calculated and tested individually at $\alpha = 0.01$ and 0.05. Responses on traditional conservation methods were categorised into six groupings and distances were put into three categories. In order to determine the relationship between the numbers of methods known from each village and the distances to nearest forest where resources are collected, a chi-square test of association was calculated.

Problems in the Field and their Possible Solutions

The study was conducted in the rural communities where language barriers were expected. A majority of the people spoke Lozi, a local language. The research questionnaires were prepared in English. However, a three days training orientation to Research Assistants was conducted to interpret the questions appropriately. A problem encountered was that botanical names were given in the local language or using common names. During interviews, pictures from Palgrave (2002) and Storrs (1995) were used to get the right names. In addition, Forest department and Museum personnel gave some assistance in translating local names into scientific names. Local names that could not be translated into scientific names have been listed in appendix 1.

Reliability of information

Local description of vegetation under consideration was compared with available species data at the Forest Department at the provincial headquarters in Mongu. Informal discussions were held with forest officials to confirm the information collected from villages. The data from the questionnaire were repeated in the structured focused group discussion that assumed more of a free discussion, and responses were compared. In spite of having no availability of aerial photos to ascertain vegetation dynamics in the areas over a period of time, discussion was held with staff of one of the oldest NGO, SNV-Zambia that has been conducting environmental orientation studies in Western Province since early 1990s.

Ethical Issues

Like any other research procedure, there are professional expectations in conducting research. The right procedure of seeking permission to conduct interviews and administer questionnaires was sought from the responsible authorities and any regulations pertaining to the handling of information was adhered to including the confidentiality of personal information from key participants. Before each focus group discussion, key participants were asked if there could be any conditions pertaining to the confidentiality of any

information especially that which relates to medicinal use of specific diseases. Any form of reference material, be it literature or interview, has been duly acknowledged.

Results

Key participants profile

Of the total 176 key participants in sampled villages of Mongu and Senanga, 80 were men and 96 were women. The majority of the key participants (90%) were small-scale farmers or retired farmers and seasonal fisher folks. The remaining ten percent of the participants either never indicated their occupation or "do not know." Ages raged from 18 to over 95 years with an average of 46, and most key participants indicated that they had lived their whole life in the areas. All key participants showed profound dependence in one way or another on the forests for their daily subsistence. Education level among key participants was low because the majority (60%) of the key participants had only attained primary education (some had never been to school), 36% had obtained secondary education and only 4% had obtained tertiary education. However, most key participants were quick to mention that they have attended other forms of farmer training programmes administered by non-governmental organisations. Most of the key participants (86%) frequented the nearest forest for their daily supplies for firewood, medicines, food, and construction purposes. All key participants indicated profound knowledge of the importance of conserving some of the species they had mentioned as having use-value.

Impact of Age, and Gender on Relative Use Value

Two-way analysis of variance indicate knowledge variation with respect to informant's age ($F_{3,15}$= 3.57, p = 0.059). All key participants in age groups had considerable knowledge in all categories (Figure 4.1). Different age groups have different knowledge concerning vegetation in respective use-categories ($F_{3,15}$= 11.57, p = 0.002). Figure 4.1 shows that ages 45 – 60 years mentioned slightly more species for medicinal plants and ages 31 – 44 mentioned slightly more construction species. However, ages above 60 were the least in the species knowledge in all categories except for food species.

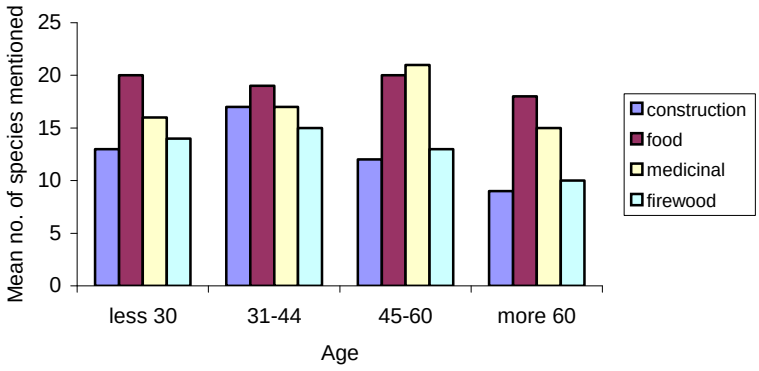

Fig 4. 1. Average knowledge of species used for construction, food, medicinal purpose and firewood in each category among different age groups in Mongu and Senanga.

Gender was evaluated to determine the relationship with use-values of forest vegetation. Responses of men and women from each village were computed to show whether utilization of species differed between men and women in Mongu and in Senanga.

Table 4.1. Comparisons of utilization of forest products in four categories between Gender in Mongu and Senanga Districts. In each category, males and females are compared (t-test). n= number of villages; df = degree of freedom, t = t-test; p = probability value.

	Category	*n*	*df*	*t*	*p*
	Medicinal	12	11	-2.929	0.014*
	Food	12	11	1.147	0.276ns
	Construction	12	11	6.169	0.000***
Mongu	Firewood	12	11	-1.603	0.137ns
	Medicinal	10	9	-1.158	0.277ns
	Food	10	9	-0.655	0.529ns
	Construction	10	9	4.869	0.001**
Senanga	Firewood	10	9	-1.769	0.111ns

ns = non-significant at α = 0.05

The results indicate that there is no significant difference between males and females in the knowledge of food species and firewood species in villages of Mongu and Senanga. However, construction species differed significantly among the gender of Mongu (p=0.000) and Senanga (p=0.001), where men knew more species than women. In Mongu villages, gender had an effect in species knowledge of medicinal plants (p=0.014), as women knew more medicinal species than men. In Senanga gender was found not to influence medicinal species knowledge.

Utilisation of forest resources

The rural communities of Mongu and Senanga that were surveyed reported a total of 57 woody plant species as having relative use-value. The key participants were asked to list vegetation species that they knew are extracted from forests and then ranked in order of preference of use in each category. It was assumed in this study that people ranked species according to their view on use-value. Therefore, knowledge of species can be used to determine the use-value attached to vegetation. These resources are extracted from the *Mushitu* a local term referred to forests. In this context therefore, the term forest is used in the sense as understood by the local. According to the key participants, forests mean a natural wilderness mainly composed of trees (*Sikota*), although ecologically these forests are in fact *Kalahari* and *Miombo* woodlands. In addition, many non-woody species such as mushrooms and grasses were reported although they were difficult to quantify as one local name could refer to many species (see Appendix 1). The categories of species used consist of medicinal, edible plants (fruits, vegetables and tubers), construction and firewood plants.

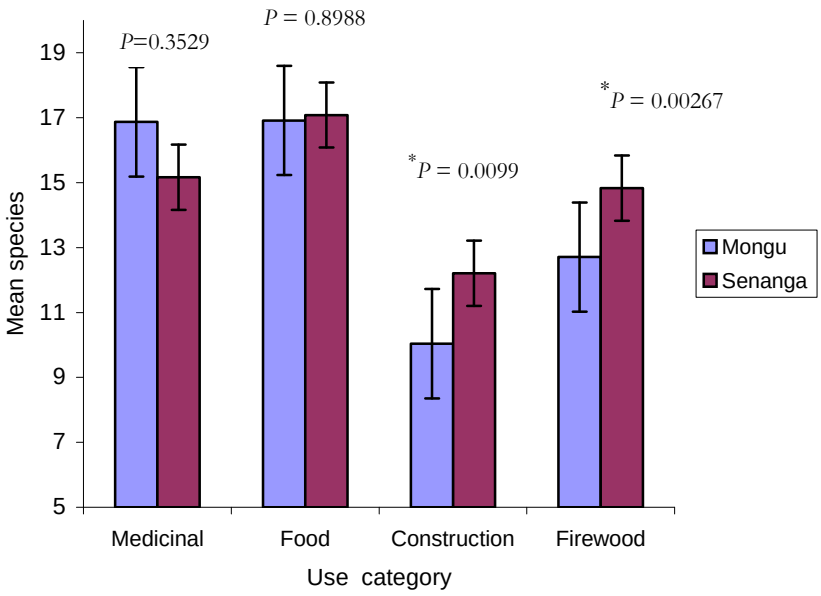

Figure 4.2. The comparison of mean number of species mentioned by key participants in Mongu and Senanga as used in each use category. Significantly different groups are marked with asterisks, *P*-values from t-test.

Figure 4.2 shows the mean number of species in each of the four categories in all sampled villages. In both areas (Mongu and Senanga), the mean relative use-values of vegetation were higher in medicinal and food species, although there were no notable differences in knowledge between Mongu and Senanga

districts. Relative use-value of firewood and construction species differed between Mongu and Senanga ($p = 0.00267$, $p = 0.0099$ respectively).

Plate 1a. A woodland on Kalahari sand where local people collect products such as medicines, firewood, construction and food in Senanga district at Namushakande area. Common species are *Buikiaea* species.

Plate 1b. A typical Miombo woodland in Mongu near Munyawa village in Mongu district. Common species in this type of woodland are *Brachystegia spiciformis, Burkea Africana, Guibourtia coleosperma, Brachystegia bakerana*, and *Ochna pulchra*.

Food species

The five most preferred edible plants are *Ricinodendron (Schinziophyton) rautenenii, Strychnos* species*, Guibourtia coleosperma, Berchemia discolor* and *Parinari curatellifolia.*

These species are important to the local people. 86% and 84% of key participants in Mongu and Senanga respectively ranked *Ricinodendron (Schinziophyton) rautenenii* as the most important tree species in the food category. One key informant explaining the use of this species said "the creamy yellow nutmeat is oily and nutritious for us; it is very good eaten raw and even more delicious when it is roasted, we extract cooking oil from the seed." The sweet fruit flesh from *Strychnos cocculides* is sucked from the kernel and is popular, especially amongst younger people because it is sweeter than the flesh of *S. pungens*. Both the seed and the red skin of *Guibourtia coleosperma fruit* with the aril are eaten, "but it is the red skin that is preferred". *Berchemia discolor* is another important and common food tree. The fruits are eaten fresh and the pulp can be used for a drink. Non-woody species frequently mentioned included mushrooms (*Ndwindwi, Nakandama*) and wild yams (*Siboyani*).

(a) *Strycnos cocculoides* (Muhuluhulu) are commonly sold at local markets

(b) Wild yams (siboyani) are commonly sold at local markets

(c) A young woman showing a ripe *Strycnos pungens* (Muhwahwa)fruit at the local market in Mongu.

(d) A woman packing *Vangueria infansta* (Mumbengele) in readness for sale at a local market in Mongu

Plate2. Women sell wild fruits an tubers to earn some money to supplement household income.

Table 4.2. The most common species used for food in Mongu by 96 key participants. The table shows total number of key participants mentioning that species and relative percentages.

Latin name	Family	No. key participants mentioning use	%
***Ricinodendron rautanenii* Schinz**	**Euphorbiacceae**	**83**	**86%**
***Guibourtia coleosperma* (Benth.)J. Leonard**	**Fabaceae**	**73**	**76%**
***Strychnos cocculoides* Baker**	**Loganiaceae**	**72**	**75%**
***Berchemia disclor* Hemsley**	**Rhamnaceae**	**68**	**71%**
Parinari curatellifolia	**Chrysobalanaceae**	**67**	**70%**
Grewia falcistipula	**Tilaceae**	**11**	**11%**
***Vangueriopsis lanciflora* (Hiern) Robyns**	**Rubiaceae**	**67**	**70%**
***Strychnos pungens* Solereder**	**Loganiaceae**	**61**	**64%**

Table 4.3. The most common species used for food in Senanga by 80 key participants. The table shows total number of key participants mentioning that species and relative percentages

Latin name	Family	No. key participants mentioning use	%
Guibourtia coleopsperma (Benth.)J. Leonard	Fabaceae	76	95%
Ricinondendron rautenenii Schinz	Euphorbiacceae	67	84%
Strychnos spinosa Lam	Loganiaceae	66	83%
Berchemia disclor Hemsley	Rhamnaceae	60	75%
Strychnos pungens Solereder	Loganiaceae	60	75%
Strychnos cocculodes Baker	Loganiaceae	54	68%
Parinari curatellifolia	Chrysobalanaceae	51	64%

Status of food plant species

Key participants demonstrated knowledge of several edible tree species and their abundance. Figure 4.2 shows the most frequently mentioned plants and there perceived status (17 species). Only species mentioned by at least five key participants were included. Most species are said to neither decrease nor increase except for *Parinari curatellifolia,* which is decreasing in Mongu and increasing in Senanga district.

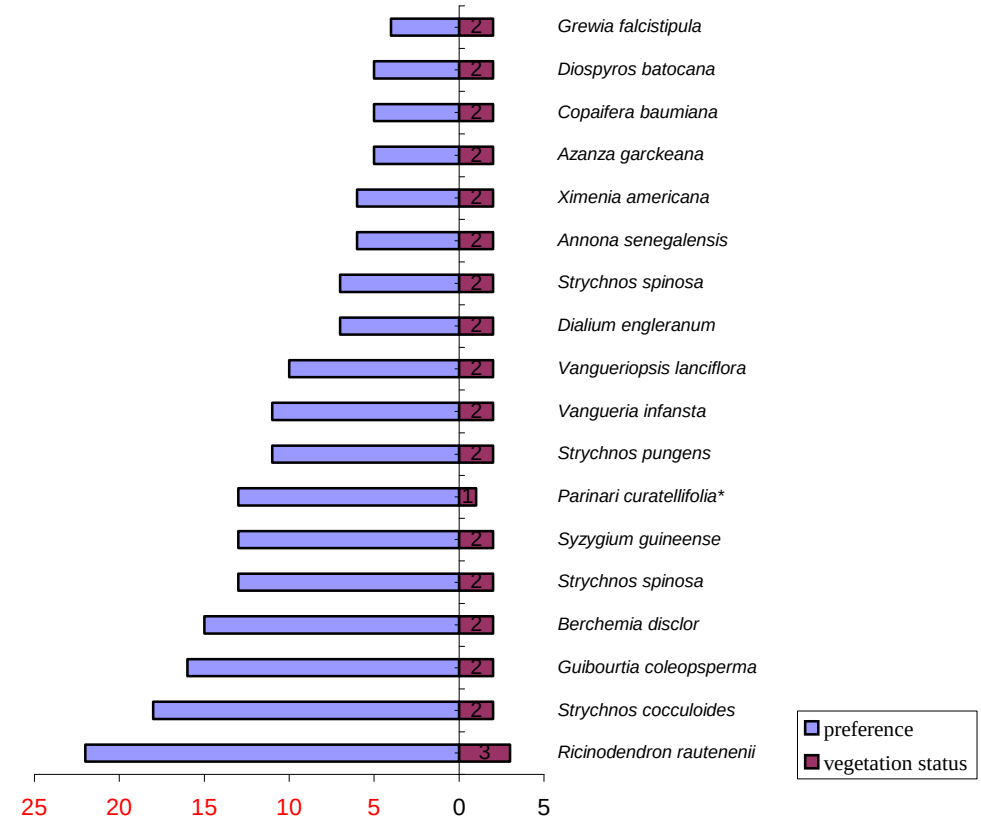

Figure 4.3. Edible species mentioned as highly preferred by local people of Mongu and Senanga, and their perception of the conservation status. 1 is perceived to be decreasing, 2 is perceived to be stable, 3 is perceived to be increasing. Note: *Parinari curatellifolia* is decreasing in Mongu only

Twelve of most used firewood species in Mongu and Senanga coincided with Of the total key participants in Mongu, 33% felt that species for firewood was becoming difficult to find while 65% said it was easy to find firewood species. 2% did not know. In Senanga, only 18% felt that it was difficult to find species for firewood where as the majority (82%) did not find it difficult to find firewood species.

Table 4.4. Nine common species used for construction and firewood in Mongu and Senanga and reasons for preferences.

	Reason for preferred use	
Species	**Construction**	Firewood
Brachystegia bakeriana Benth (Caesalpiniaceae)	Used by generations	Most abundant
Burkia africana	Bark contains poison (saponin which forms sapotoxins) to prevent insect attacks	Abundance
Ochna pulchra Hoof.f. (Ochnaceae)	Wood is tough and close-grained,	
Acacia albida Del (Mimosoideae)	Not given	Not given
Baphia massaiensis Taub(Fabaceae)	Abundant	Has good burning properties
Brachystegia spiciformis (Leguminosae)	Soaked in water for weeks to increase durability, its moderately heavy, tough, hard with interlocked close grains	Ash can be used for cooking relish as Na2CO3, Has good burning properties
Guibourtia coleopsperma (Benth.)J. Leonard (Fabaceae)	Most abundant in Kalahari sand soils and used for generations.	Most abundance and used for generations
Parinari curatellifolia (Chrysobalanaceae)	The bark does not warp but can easily be attacked by insects (but soaked in water for weeks to increase durability)	Produces an acceptable charcoal
Cryptosepalum exfoliatum De Wild (Fabaceae)	Dominant tree in most parts	Abundant

Medicinal plants

The present study shows that 46% of all mentioned species fell into the category of medicinal use-value with *Baphia massaiensis* and *Guibourtia coleosperma* having the highest response frequency. Figure 4.4 shows most mentioned medicinal plant species and their status level as alleged. Eleven species are perceived to be neither declining nor increasing, whereas, *Pterocarpus angolensis* and *Diplorynchus candrocarpon* are observed to be declining in the last twenty years. The species *Baphia massaiensis, Terminalia sericea, Parinari capensis*, and *Baikiaea plurijunga* are reported on average to be increasing. At least one medicinal plant, *Pterocarpus angolensis,* is exported from Zambia. Supply of this herbal medicine to traditional healers is affected by competing uses such as timber logging (Mudenda and Maus 1995).

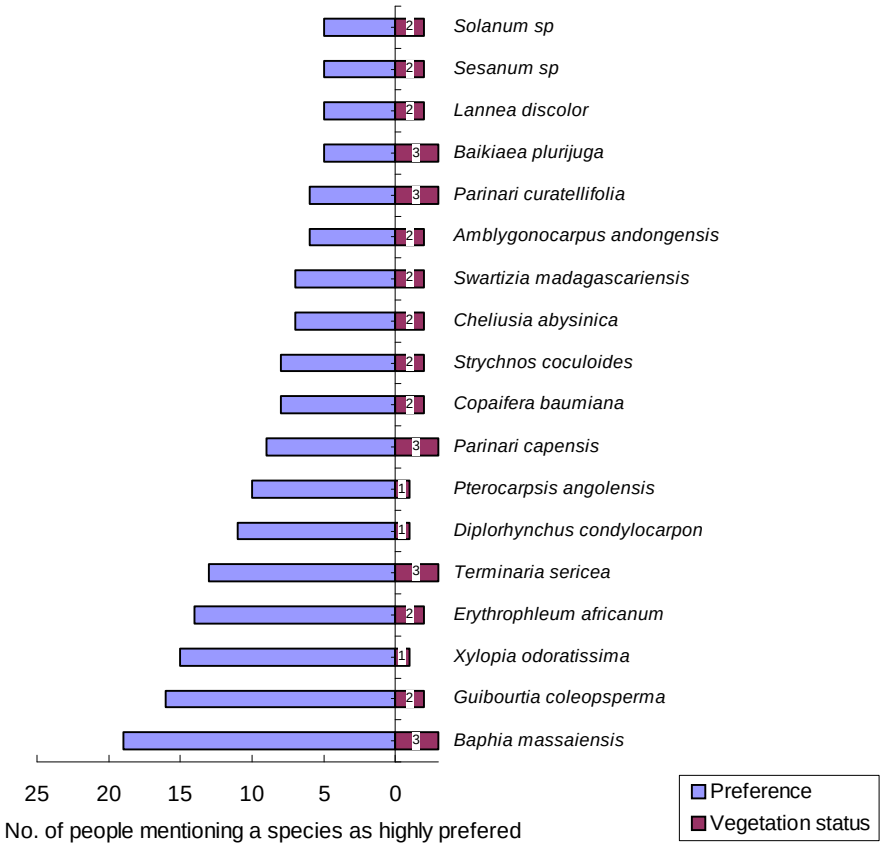

Figure 4.4. Medicinal species mentioned as highly preferred by local people of Mongu and Senanga, and their perception of the conservation status. 1 is perceived to be decreasing, 2 is perceived to be stable, 3 is perceived to be increasing. Note: Parinari curatellifolia is increasing in Senanga only

Conservation of medicinal plants

The plant parts harvested for medicinal uses are leaves, the bark and roots. Various traditional conservation methods of extraction of medicinal plants have sustained abundance and composition of vegetation to some considerable levels. Among the common methods frequently cited fell in myths and taboos categories. Local people believe that "when one cuts the whole plant for medicinal use, all the diseases that it can cure will be transferred to the family members". Presumably, this knowledge was meant to allow plant regeneration. Local people believe that "our ancestral spirits do not allow us to debark a tree on the side where the sun rises or sets when harvesting tree barks". This concept allows the harvested plant to survive and, subsequently, reduces the rate of forest destruction. Medicinal knowledge is passed on verbally from one

generation to another through elderly members of the family in each family. The extended family system is still intact among the family Lozi structures. These persons are responsible to educate younger one on how to conserve the medicinal species using myths and taboos. An example was cited in Senanga about *Terminalia sericea.* One key informant explaining the use of *Terminalia sericea* said that "the roots are used as charms to purify villages or people who have become unclean through contact with dead people". It is against this background that local people especially among the elderly people preserved this plant. However, due to acculturation, elderly people lamented that younger people generally are discarding traditional beliefs relating to dos and don'ts of medicinal plants.

Conservation Perceptions among key participants

Key participants were requested to state their conservation perceptions by prioritising the species mentioned in each category of use. Three classes of conservation priorities of the species were made, namely low, moderate and high conservation priorities. These categories were classed according to people's perception of what they felt was threatened and thereby requiring conservation. Of the total 57 species of vegetation mentioned, 42% of the species were ranked as low conservation priority, 21% moderate and 37% high priority. Figure 4.5 below shows the details of each use category.

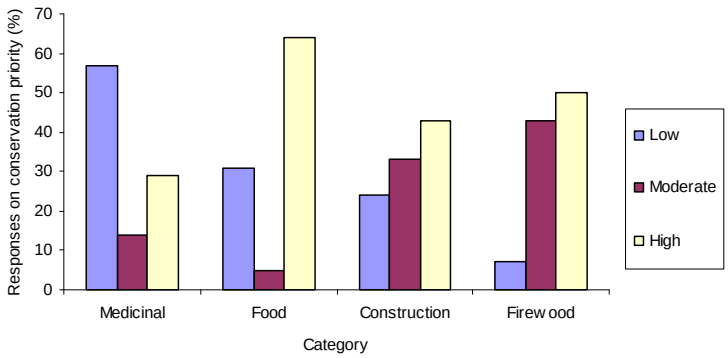

Figure 4.5. Local communities' perception of conservation priorities of species in each use-category in relative percentages

The study indicates that 57% of the medicinal species are of low conservation priority, where as more food species (64%) are considered of high priority. Half of the species used for firewood (50%) were noted as being of high conservation priority.

Traditional conservation methods in Mongu and Senanga

The responses from key participants and the focus group interview reviewed various conservation practices done either purposefully or by virtue of traditional courtesy emanating from the social norms. These practices have been put into categories for discussion purposes as shown in Figure 4.6. The categories used are *Taboos and beliefs, sacred landscapes, spiritual values, royal tradition of the Barotse Royal Establishment, livelihood tradition* and *harvesting methods*. There were overlaps in the classifications due to the fact that distinctions between classes are theoretical rather than practical.

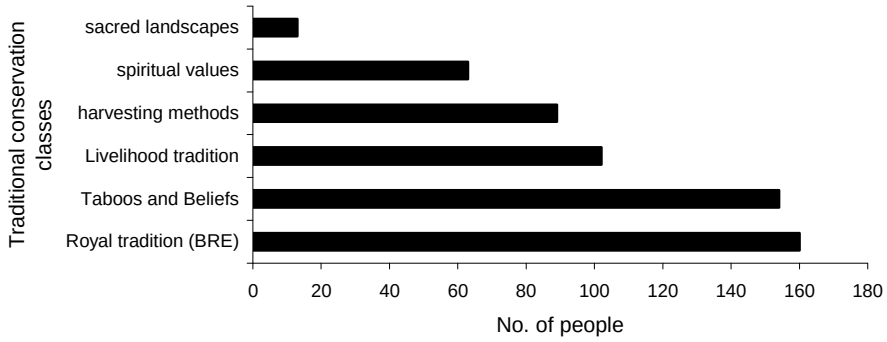

Figure 4.6. The traditional conservation practices mentioned by the key respondents in Mongu and Senanga in the Western Province of Zambia. The responses were grouped according to similarities and six classes were made for easy discussion and comparisons. These were responses

Practices that related to socially accepted "unwritten rules, or social prohibitions," without tangible explanations were considered as *taboos and beliefs*. For example, cutting of certain tree species was forbidden. Traditionally, wild fruits are used to measure the expected rainfall patterns of that particular year i.e. more fruits in the forests (*mushitu*) were considered a sign of low rainfall and that meant their gods had given them alternative food from the cultivated crops. When asked to state the regulations relating to forests, 160 key participants were of the opinion that Barotse Royal Establishment rules worked better. "When we looked after our resources through our own rules and regulations, we had no conflicts because the headmen always consulted us. All families cooperated in some way, we were sending our young boys to help burn the forests (*mushitu*) immediately after the rain season" said a 73 years old man from Nalikwnada village during the focus group discussion. Those practices referring to the rules and regulations as enforced by the local traditional governance systems were classified as Barotse Royal establishment methods, which saw the birth of Barotse Forest Service later. The Service had operated in *Mukusi* (Baikiaea) forests to safeguard certain species such as the

Baikiaea plurijuga, Burkea africana, and *Pterocarpus angolensis.* These included rules regulating the controlled burning of forests, seasonal harvesting of fruit trees and wild vegetable products. The main reason for controlled burning was twofold: firstly, it was done to reduce fire risks during late burning that destroys vegetation intensely and secondly, early burning proliferates the growth of pastures for the livestock. Headmen (*Silalo induna*) regulated the commercialisation of food species. Discussing the role of government authorities in the current setting, one lady asked "if forests belong to the government, why do they come to us to ask us to tell them the names of trees and rivers found here?" she added "They come and take away our land" in an apparent reference to the agreement between the Zambia Wildlife Authority (ZAWA) and a South African investor, African Parks Zambia Limited for management of Liuwa National Park in 2004.

Livelihood traditions included activities emanating from skills and experiential knowledge on sustainable use of resources such as treatment process of poles, and soaking of construction material. *Sacred landscapes* refer to restricted places such as gravesites or forest patches dedicated for royal spaces. In these areas, access is restricted. *Spiritual values* include activities confined either to a certain clan, family or individual's attachment to a forest resource. The information about specific knowledge of tree specifies is passed on through folklores or unique experiences of family members. For example, if a certain medicinal plant had healed somebody from a chronic illness, or was used to induce fertility in a barren man or woman, family members look at that tree as a spiritual medium for healing. Consequently, such a tree species will be of spiritual value to that family or clan. Although the initial idea is not for conservation, the activity could be appreciated from a conservation point of view because this helps maintain species diversity and abundance thereby the functioning of the ecosystems. *Harvesting methods* referred to extraction methods such as firewood collection by picking only without cutting the whole tree, or non-destructive picking of the fruits. The parts used for medicinal purposes are roots, leaves and barks. Debarking of medicinal trees during extraction is done in strips, unlike ring debarking. This is done in order to allow the survival of the tree because the combium on areas left with barks continues to function in transporting nutrients from the roots to other parts of the plant. After extracting the roots for medicinal use, people are encouraged to burry the dug holes to avoid the plant to die off.

Conservation practices among the key participants were reported to be declining for various reasons. For example, elderly people bemoaned that "a long time ago, some tree species could not be used for firewood but nowadays, literally any tree can be used due to population increase with limited trees around. The other problem threatening our local knowledge of conservation" they said, "is the rising western culture in our society that has affected our

youths as they can not respect the local knowledge". The declining knowledge in conservation practices may have an effect on the conservation perceptions among the key participants especially among the young (less than 30 years).

Table 4.3 shows the methods in traditional conservation and their likely implication on the overall conservation goals of forest biodiversity.

Table 4.3. The traditional conservation methods in Mongu and Senanga, explained using contemporary scientific views.

Details **Category of conservation method**	**Implication on forest biodiversity**	
Royal traditional rules (BRE)	**Reference**	
i. Controlled burning of forest landscape ii. Seasonal harvesting of natural resources iii. Preservation of certain species of trees perceived for royal use e.g. for making canoes, royal drums (*maoma*), royal property	i. To allow regeneration, increase heterogeneity of landscape; improve resilience as a buffer for other disturbances. ii. To avoid over exploitation of natural resources and also to allow regeneration and breeding of a species. iii. Normally, these a re large trees with longer rotation period, hence there preservation to avoid extinction	Sinclare & Bryom 2006 Berg, T. 1996
Taboos and belief system		
i. Dos and don'ts without tangible explanations e.g. children are not supposed to eat certain fruit trees	i. Where conventional laws can not be enforced to regulate over exploitation, taboos and beliefs enables people to conserve biodiversity out of respect of traditional norms	Pandey, D.N. (1993) Colding,J. & Folke,C. (1997)
Livelihood tradition		
i. Poles and rafters for making shelter are treated ii. Knowledge of nature induces intrinsic respect for conservation	i. To reduce on harvesting frequency and thus enhances regeneration ii. Promotes conservation of biodiversity	Walter, B.B. (2005) Colding,J. & Folke,C. (1997 Pandey, D.N. (1993)
Harvesting methods		
i. Picking of fruits that fell on the ground ii. No cutting of fruit trees iii. For firewood, cut only dead wood iv. Debarking of medicinal plants should be done only on one side where sun does not shine directly v. Do not cut whole medicinal plant lest the disease come to you	i. Reduces competition among people, birds and fruitvores thereby balancing the ecosystem ii. Reduces on deforestation and balance of ecosystem for fruitvores iii. Reduces on deforestation iv. Regulates the drying rate of trees after debarking. v. Reduces on deforestation	Nunes, P.A.D. and van den Bergh, J.C.JM. (2001) Lanis, A., kanyan, C. and Bunde, P. 2003.
Spiritual values		

i. Forest are considered spiritual spaces ii. A dense forest is synonymous to "bring rainfall" iii. Ancestral spirits rest in wilderness iv. A belief that forests needs to be respected	i. Reduces human induced negative disturbances on forest biodiversity ii. Promotes water cycle and sustainability of an ecosystem iii. Reduces human induced negative disturbances on forest biodiversity iv. Promotes sustainable ecosystem functioning through reduced human impact.	Pandey, D.N. (1993) Nablam, G.P. 1997, Harris, M. 1979 Colding,J. & Folke,C. (1997
Sacred landscapes		
i. No harvesting near grave sites to give respect to the dead	i. Ethnoforest refugia for threatened species, breeding for faunal and floral species, promotes corridors as dispersal zones	Pandey, D.N. (1993) Githito, A.N. 2005 Ramakrishnan et al. 1998, Berkes 2000

Relationship of distance, Relative Use Value and traditional conservation methods

The relative use value and knowledge of vegetation was correlated with the distance of respective villages from the nearest forest where the people get natural resources. Initially, three categories were made: villages with less than 5Km, 5-7Km and more than 7Km from nearest forest. Respondents indicated that all villages were located above 5Km from a nearest forest. 68% of the total villages sampled are between 5-7Km from nearest forests while 32% are above 7Km away from nearest forests.

Table 4.4. Spearman rank correlation coefficients based on category of use (species mentioned) against the distance of villages from nearest forest, and traditional conservation methods. Spearman rho is given and significant correlations are marked with asterisks.

Spearman's rho		Distance	Medicinal	Food	Construction	Firewood
Distance	Correlation Coefficient	1.000	-0.872(**)	-0.048	-0.682(*)	-0.024
	Sig. (2-tailed)	.	0.000	0.882	0.015	0.940
	N	22	22	22	22	22
Methods	Correlation Coefficient	0.390	0.685(**)	0.126	0.263	0.200
	Sig. (2-tailed)	0.072	0.000	0.578	0.237	0.373
	N	22	22	22	22	22

** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed).

The results shows that there is a correlation between distance and relative use-value of medicinal species ($R^2 = 0.67$ at α-level 0.01) and species used for construction purposes ($R^2 = 0.42$ at α-level 0.05). People living near forest (5-7Km) demonstrated knowledge of more species of medicinal and construction

species compared with to those living a distance of more that seven kilometres to the forest (Figure 4).

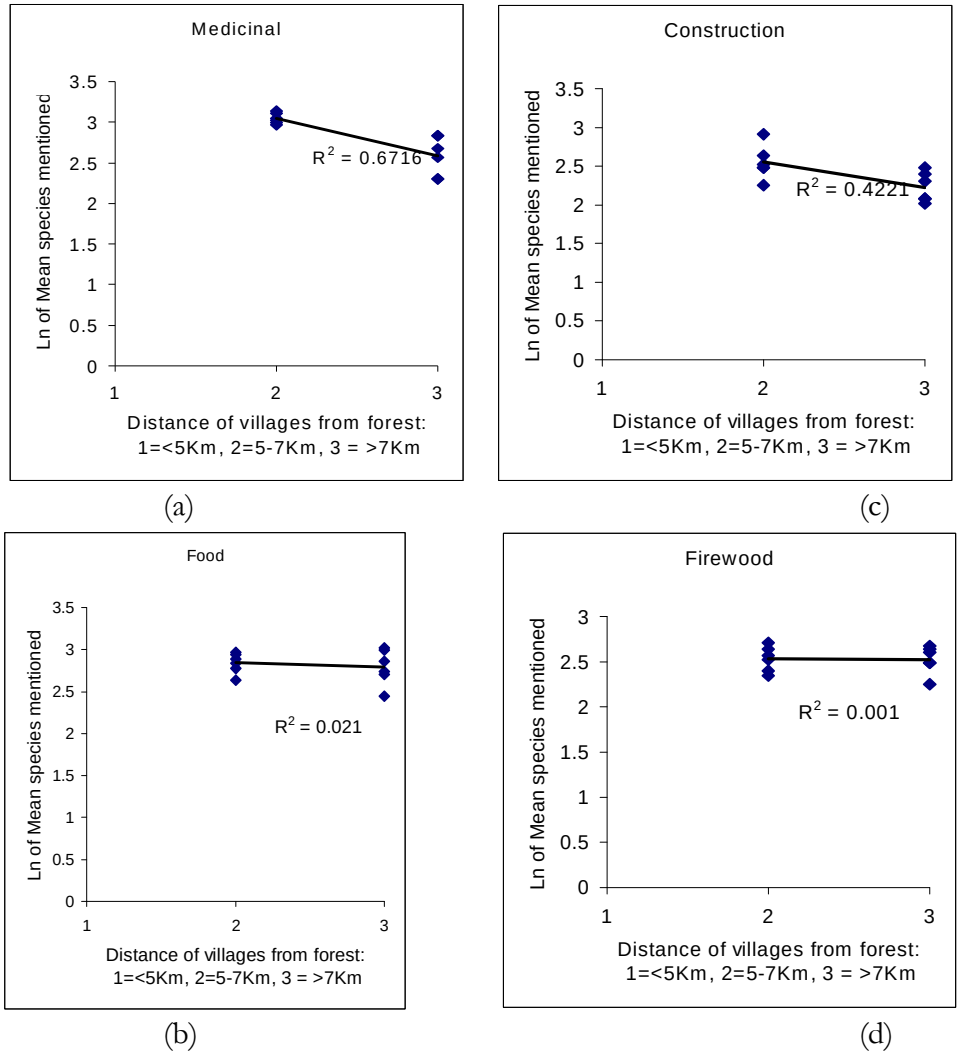

Figure 4.7 (A-D). The correlation between distances from villages to forests, and the mean number of species mentioned in each village (Natural logarithm). A and C: Villages near the forest have more mean knowledge of medicinal and construction than those further away. B and D: distance does not affect mean knowledge of food and firewood species.

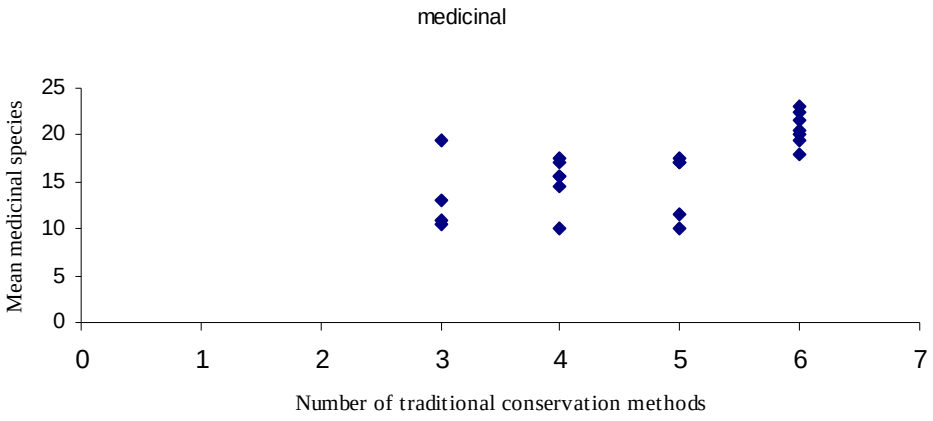

Figure 4.7. The relationship between numbers of traditional conservation methods mentioned by villages with the mean number of species used for medicinal purposes in Mongu and Senanga.

Distance does not affect the utilisation of firewood and food species (R^2 = 0.001, R^2 = 0.021 respectively) (compare Table 4.3). RUV and vegetation knowledge of food species did not vary with distance. There was no significant relationship between distances of villages from the forest and conservation methods cited by respective key participants (X^2 = 0.841, d.f = 3, $p > 0.05$). The explanatory variable (number of conservation methods) shows that it does not depend on the distance. However, the study indicates that there is a relationship between the numbers of conservation methods with the mean number of species of medicinal plants used (P = 0.000) i.e. communities with the largest number of conservation methods also used the largest number of medicinal plant species.

Discussion

This study has unveiled certain fundamental issues: (i) local communities depend on their natural environment for survival; (ii) they possess valuable ecological knowledge on the vegetation status observed over long periods and (iii) also hold within their local context traditional knowledge on the conservation of biodiversity. This body of knowledge from local communities is an essential building block in the conservation strategy of biodiversity especially outside protected areas.

Utilisation of forest resources

Ethnobotanical knowledge is one of the means available to obtain information on vegetation status and structural changes over decades due to both anthropogenic and ecological factors. Observations by local people are central in getting information on aspects of long-term vegetation change and distribution of most species, which are difficult to investigate by means of vegetation studies (Lykke 1998; Lykke *et al.* 2004). The key participants were asked to list vegetation species that they knew are extracted from forests. It is not always that species mentioned as known means they are utilised. Therefore, participants were further asked to rank in order of preference of use in each category. It was assumed in this study that people ranked species according to their view on use-value and individual experiences. Therefore, knowledge of species of people can be used to determine the use-value attached to vegetation. The people of Western Province mentioned at least 57 species used in four main categories as seen from the results presented. Demographic factors affecting the level of vegetation utilisation are age and gender. Significant variation in use was found with respect to age. The study shows that the differences in knowledge of species utilisation are correlated with different roles defined by the society. For example, knowledge and use of construction species were higher in the age group 31-40, an age considered more active in household duties. One explanation for no differences in age for relative knowledge in food species in Mongu and Senanga is that all key participants demonstrated a high level of dependence on natural resources for their daily subsistence. Other studies have argued that perhaps knowledge of edible fruits is obtained rather early in life (Philip and Gentry 1993; Kristensen and Balslev 2003) such that by the time they are adults, they already have substantial knowledge. Although the ages less than 30 years mentioned less species except for food, this could be attributed to linguistic problem arising from intermarriages and multicultural interactions among the new generation thereby local species names are being lost. These results are similar to other quantitative ethno-botanical studies such as Case *et al* (2000) and Luoga *et al.* (2000). The obvious expectation was that older people (more than 60 years) would have shown knowledge of more species in all categories. However, the

results showed this age group was the least knowledgeable in construction and firewood species. Three reasons can be attributed to this outcome: firstly, the culture of the area is that as one grows older, hard work such as construction or firewood collection is left to be done by younger ones and hence the knowledge lessens in some old people. Secondly, the memory of old people is not always as accurate as that of younger people. This was observed during interviews, where some old people had difficulties and struggled to remember most construction and firewood species and; thirdly, there could be some changes in use patterns over time of vegetation. In old days, people had specific species used for firewood and construction, however, due to decline in abundance of those species arising from many years of exploitation, people are now using alternatives species that old people may not familiar with, hence this disparity in the number of species mentioned between age groups.

Both males and female have profound knowledge relating to the utilisation of resources, principally because these communities depend on forest resources for their livelihood. The knowledge about vegetation use seems to be obtained at an early stage in the life of an individual, either from parents or through interactions. The different roles of men and women seem to influence the knowledge of use. For example, there was a difference between men and women in knowledge of medicinal plants in Mongu where women knew more species than men. The reason could be that women are closer to the family members and are more concerned with the health of the children. On the other hand, men's chores incline them to know construction species for building houses or barns. These findings are a departure from other studies; examples in Manus island (Case et al 2005) and Burkina Faso (Kristensen and Balslev 2003), where males expressed higher knowledge in all use categories of vegetation use. Case (Case et al. 2000) attributes the apparent higher knowledge of males of these other studies to the nature of the interview. Culturally in African societies, women shy away from male interviewers, especially those of a different race (Mead 1968). In this study, the three interviewers, one female and two males came from the same society and therefore, free interaction with the key participants is expected. This was done to reduce any prejudice in the responses where one gender dominates the outcome.

Senanga district has much more woody species diversity towards Sioma Ngwezi national park compared to Mongu where a larger share of the land is covered by grassland and plains towards the Liuwa national park. This difference in vegetation is likely responsible for the differences in construction and firewood species knowledge between the two districts (figure 4.2). Food species play a critical role in the livelihood of the rural communities in both Mongu and Senanga. Although people do not primarily depend on wild crops for food, the study has shown that high knowledge of these species indicates

the emphasis people put on them. *Ricinodendron rautenenii* is usually common in the vicinity of most villages, especially in Senanga. Archaeological studies have shown that the nuts of *Ricinodendron rautenenii* have been utilized in the western Kalahari, of which Western Province is a part, for at least 7000 years (van Wyk and Gericke 2000). The main reason is because fruits and nuts remain edible for a large part of the year. Similarly, *Strychnos cocculoides* is perceived to be an important species because it is exploited for its fruits and traded in local markets to foster household income. Of particular interest is *Parinari curatellifollia* that is used in the local brew, which the local villagers see as important for refreshments after long a day of work. Other non-woody species frequently mentioned included as food are mushrooms (*Ndwindwi, Nakandama*) and wild yams (*Siboyani*).

Firewood is the only source of energy supply among the villages in Mongu and Senanga with an exception of few households in *Limulunga* royal village where the paramount chief resides. Twelve of the most used firewood species in Mongu and Senanga coincided with the commonly used species for construction. This is because people tend to use almost all species for construction with a few exceptions. In order to increase durability and reduce on frequency of going to cut more trees from forests for construction purposes, local people hold traditional knowledge on treatment of construction material. For example, treatment of poles for construction is soaked in water to remove a substance that may attract termites. This knowledge is classified as livelihood traditional method of conservation because it borders on informal skills on sustainable utilisation.

More than 80% of the key participants in Mongu and Senanga largely depend on natural remedies and indicated less capacity to access conventional medicines because either the health facilities are far away or cannot afford the medical bills for treatment. Knowledge about medicinal plants is not readily shared with "outsiders". The information about remedial uses of plants is shared between family members and where necessary with neighbours. The main reason for this is unclear. Probably, the local people keep such information pertaining to medicinal use confidential. Although this study indicates that 46% of the total species mentioned are used for medicinal purposes, it is probably an underestimation. During the interview, two medicine-men gave a long list of plant names for medicinal uses. According to some informant-consensus based studies (Philip and Gentry 1993; Kristensen and Balslev 2003), species mentioned by only one person should not be included in the analysis because a single informant's knowledge may be difficult to validate. Of course this argument is a case-by-case situation and it depends on the type of key participants involved. If the informant is a special holder of particular information, then the information is worthwhile

considering. In this study, vegetation use was based on consensus approach where the majority's responses were considered rather than individual persons.

Perceptions of Vegetation changes in Mongu and Senanga

In the Western Province, Mongu inclusive, drought and floods have had adverse effects on the vegetation structure over a long period of time as observed in *Cryptosepalum* forest and upland and central sand by Forestry Department staff talked to. People in the area generally believe that bigger trees bring rains. Therefore, when British South Africa Company (BSA) cut a lot of bigger trees of *Pterocarpus angolensis* for timber before independence, this was believed to affect rainfall patterns. In an apparent reference to the advent of BSA Company, an old man said "before they came, we knew where our gods had hidden our lives." Pointing at some distant forest, he said "it was in the forests at the backyard; there we found food and water". Vegetation has changed recently in composition but not in abundance especially western part of Sioma Ngwezi in *Baikiaea-Copaifera* and allied woodlands on central plains. However, there is an increase in abundance for some tree species such as *Baikiaea plurijunga* in Lusese (Burkia woodlands on Karahari sand passing into *Diplorhynchus* shrub-grassland on western plains). According to Bingham (2006) species of *Combretum* and *Terminalia* are usually scarce in both plateau miombo and Kalahari Woodlands, but are available in this study probably because they have experienced no serious disturbance for many decades in Western Province. This abundance of these species coincides with the information given by local people that *Terminalia sericea* have been viewed as a traditionally important tree as earlier discussed and conserved through a taboo. General observations are that forest changes are an ecological response to succession shifts due to anthropogenic influences.

Cultural lifestyles that seek to promote conservation are still prevalent in the Western Province such as the *Kuomboka* ceremony that maintains the Lozi identity. Respect for sacred landscapes and sustainable harvest of forest products are commonplace among the communities of Mongu. Headmen regulate the commercialisation of fruit trees on markets. While there has been dilution of traditional governance system by the modern democracy, it is evident that local people still value their local leadership. Hence, rules made by the council of headmen on utilisation of resources were respected to some extent. Native forest laws under Barotse Royal establishment are well known by people and have an influence on perceptions of the local people towards forest use. Certain trees (names were not mentioned for cultural reasons) are never cut because of traditional beliefs. Local people still believe that bad omens are expected to fall on would-be violators. However, there was general understanding that traditional conservation practices are steadily declining among the Lozi community especially among the young people. The main

reasons are complex. The elderly people generally cited population increase in the areas as a major threat because nowadays people use any plant regardless of its cultural significance in order to meet their immediate needs. Other reasons mentioned from the group focus discussion was the rate at which acculturation was gaining influence among the young generations. It is apparent that commercialisation of fruits and timber trade is also contributing to the erosion of indigenous knowledge towards conservation. The recommendations of the people were to find amicable means of working with the government through the comanagement of biodiversity so that the local knowledge should not be lost.

In Senanga, there is an increase in some tree species such as *Baikiaea plurijunga* and in *Cryptosepalum* forests, while other tree species have been declining towards the central Barotse (mainly grassland in alluvial flood-plains) due to population pressure on surrounding *Baikiaea-Coipaifera* woodlands. Large pockets of *Commiphora* thicket on chestnut sands and *Copaifera mopane*, including pockets of *Baikiaea* forests are still intact with little changes in both abundance and composition. On the general scale, forests have been changing in terms of composition and not abundance per se, due to increasing droughts and population pressure.

Older people argued that young people do not respect sacred landscapes and disregards local rules governing utilisation of resources. However, the younger people attribute vegetation changes to rising rural poverty due to decreased farming activities, thus they opt to selling of woodcrafts and charcoal (cutting more trees). Fruits from tree species such as *Strychnos sp, Berkemia discolor, Hyphaene petersiana (Mukulwani* for weaving baskets) and handles for hoes are sold in nearby towns to earn some income. Accessibility of most tree species is easy except for some food species that are seen to be competitive on the commercial markets. From the focus group discussion, elderly people stressed that before independence, all tree species were easy to find as it was seen as a taboo to sell fruits or firewood (these were perceived as gifts from God and could not be sold). Since the management of natural resources are no longer entirely in the custody of traditional systems, elderly people attributed the dwindling of some resources to modern laws that lacks means of enforcing unlike traditional BRE laws that imposed various sanctions on offenders. Grasses such as *Coudetia simplex (Mwange)* and *Hyperthelia dissolute (Matengenya)* are becoming difficult to find for thatching due to droughts and frequent fires that has become characteristic of the area.

Vegetation status

Food species

Although other factors such as population changes may have an effect on the status of edible forest products, traditionally, people of Western Province do not encourage cutting of fruit trees or removal of any vegetation that provide food such as vegetables. This kind of knowledge is common among the local people. They find solace in wild foods during hash months of the year when cultivated food stocks are low. This tradition has been passed on through many generations. For example, in 1912 Lewanika declared a number of forest reserves in Western Province for fruit production, canoes, timber, arrow poisons and medicines. Guidelines were put in place for administration of forests in the hands of traditional leaders, where violators were fined money or herds of cattle. No one was allowed to harvest tree products off–season without the permission of the *Kuta* (traditional court) through the *Silalo induna* (Ward headman). This scenario is seen in the manner that people use some food species in sustainable manner such as *Ricinondendron rautenenii*. Figure 4.3 shows that of the seventeen most mentioned species, only *Parinari curatellifolia* is perceived to be declining in Mongu while *Ricinondendron rautenenii* is perceived to be on the increase in both areas. *Parinari curatellifolia* is highly exploited for canoe construction that requires large trunks. The reason for observed increase in *P. curatellifolia* in Senanga when it was observed to decline in Mongu is quite speculative. The key participants did not clearly state the reasons. The Forest Department staff attributes this to low levels of utilisation in Senanga as opposed to Mongu. The annual ceremony, the *Kuomboka*, takes place in Mongu and probably the demand for canoes puts the pressure on forest resources such as *Parianari curatellifolia.*

Medicinal species

The status of medicinal plants in Mongu and Senanga is a worrying subject to the local communities especially for *Diplorhynchus candrocarpon* and *Xylopia odoratissima. Diplorhynchus candrocarpon* is one of the trees used regularly for several ailments and also for construction purposes due to its excellent curving properties. Due to droughts that leave the forest cover dry for most times of the year, early forest fires are becoming a major threat to most medicinal plant species. However, people were quick to mention that no immediate measures seemed to be in place, as the situation had not reached alarming levels. The conservation of *Baikiaea plurijunga* had pushed harvesting pressure on *Pterocarpus angolensis. P. angolensis* both a medicinal and is an expensive valuable exploitable hard wood timber, thus most villagers are tempted to exploit it for high economical gain foregoing its medicinal values. The tree was observed to decline in the late nineteen nineties and was classified as protected species by the Forest Department. After opening of the canopy in *Baikiaea-Coipaifera*

woodlands by cutting most *Pterocarpus angolensis,* the pioneer species seems to be *Baphia massaiensis* that has been observed to increase despite being mentioned as the highly exploited species. Of the canopy species *Guibourtia coleosperma* now predominates, being more tolerant to forest fires, which become a significant factor with the proliferation of the grass *Eragrostis pallens*. People in rural areas are very conscious about their conservation of *Terminalia sericea, Parinari capensis* and *Baikeaea plurijunga* because they are important in treating many common ailments and thus are seen to increase. In the 1920s a decline of these species was noted because the *Mawiko* immigrants from Angola cleared lots of forest for their *matema* gardens (shifting cultivation). This situation prompted *Litunga Yeta* III in 1931 to put conservation measures in place. Until now, species such as *Baikeaea plurijunga, Erythrophleum africanum, Pterocarpus angolensis and Guibourtia coleosperma* are protected by Forest Department and people are encouraged to conserve these species.

Firewood and construction species

Most of the species commonly used such as *Guibourtia coleopsperma* and *Cryptosepalum exfoliatum* are abundant in the Kalahari sands (dominant in Western part of Zambia). The extraction of species for firewood and construction is based on selection advantages shown in table 4.4. Where biodiversity is concerned, selective harvesting has a long impact on the overall stability of the ecosystem. The abundance of *Guibourtia coleopsperma* and *Cryptosepalum exfoliatum*, makes the key participants more complacent as they do not see the urgent need to conserve these species.

Traditional conservation methods in Mongu and Senanga

It is often difficult to identify and generalize about indigenous practices that function in resource and ecosystem management (Berkes et. al. 2000). Practices and mechanisms discussed here are not considered as separate phenomena but interlinked with one another and coevolving. The traditional knowledge on biodiversity conservation is examined in the light of contemporary research on traditional knowledge systems and demonstrates their value and usefulness to address the biodiversity conservation at a local scale. The responses from key participants and the focus group interview reviewed various activities done either purposefully or by virtue of traditional courtesy emanating from the social norms. The stated conservation practices in this study is by no means exhaustive but merely a starting point for the further identification of social–ecological linkages and their contribution to the use of locally based ecological knowledge in forest biodiversity conservation. These activities have been put into categories for discussion purposes as shown in Figure 4.6. The common property theory tells us that when resources are open-access, they are prime candidates for exploitation and depletion (Ostrom 1990) considering

population of people and resource availability. By contrast, locally used resources are rarely open-access or freely available to all; rather, there are often local rules about how resources should be used. These sets of "rules-in-use," or institutions, as common property researchers often use the term, may facilitate conservation (Berkes 2004).

In the traditional society of Mongu and Senanga, people in rural communities of Western Province of Zambia have utilized forest biodiversity for their livelihood for as long as they have lived in this area. They have accumulated centuries-old resilience knowledge, evolving by adaptive processes and handed down through generations by cultural transmission at least as far back as the second half of the nineteenth century and maybe much further. Collective actions have been institutionalised in forms of traditional systems. The classification used in this discussion may have overlaps because of thin lines of distinctions between these classes. Responses obtained form key participants posed a challenge to know the boundaries between for example, what constitutes sacred landscapes or taboos and beliefs or spiritual values. Due to this shortcoming in the methodology used in the classification, there could be some underestimates or overestimates in some cases. However, these traditional methods, if properly sustained and harnessed within the local governance systems, can be useful tools for biodiversity conservation. Sacred landscapes may serve for the protection of specific habitats, and continue to be important. Studies elsewhere in many areas of Africa (Gadgil et al. 1993, Berkes et.al. 2000), argue that though disappearing as a result of change of rural economies and denigration of local traditions, habitats protected by sacred locales may be recruitment areas, for example, for populations of seed-dispersing birds and bats, that are of importance for renewal of surrounding ecosystems. They are also important for birds controlling insect outbreaks on adjacent crop fields, and may serve as seed banks for locally adapted crop varieties and medicinal plants. Even small sacred landscapes may be surprisingly effective in conserving biodiversity.

Distance from respective villages to forest is an important factor to determine use patterns of the local communities. Distance of villages from forests is correlated with the knowledge of tree species use by the people in the area. Villages living near forests (5-7Km) demonstrated a profound knowledge of more species of medicinal and construction species than those further away. The reason could be that villages further away from forest (>7Km) tend to use alternative material for construction of houses and barns such as grasses of *Mwange (Loudetia simplex), Matenegnya (Hyperthelia dissolute)* or *Makelele (Miscanthus species)* with mud or more permanent materials available near their villages (see table 4.3). Distance does not affect the utilisation of firewood and food species ($R^2 = 0.001$, $R^2 = 0.021$ respectively) (compare Table 4.3). Regardless of the

distance of villages from forests, local communities have very limited options for sources of energy. Local people living far from forests walk long distances to collect firewood because fuel wood is the only source for cooking on a daily basis. Like firewood, vegetation knowledge of food species did not vary with distance, and local people walk long distances to collect wild fruits, tubers and vegetables for household consumption and for trade.

The relationship between village location and the traditional knowledge of conservation is a complex one with historic factors of settlement and tenure systems playing significant parts. The correlation was established by the number of traditional methods cited and distances from each village. This study does not reflect the effectiveness of the cited methods but rather measures the consciousness of the conservation of forest biodiversity simply expressed by the number of methods and practices known. The elderly people interviewed revealed that in the native Barotseland, forests represented social and cultural spaces. Distance of villages from the forest does not seem to affect the traditional conservation methods known by the people. This may be due to the level of interaction between local people. All key participants indicated that they had been to other places beyond their villages and to other districts. It is possible that knowledge about conservation of biodiversity is easily shared within the same culture. Other studies have shown that cultural differences play a larger role in the transfer and maintenance of indigenous knowledge than simple geographical distance (Case et. al 2005). This implies that forest conservation strategies in Mongu and Senanga that takes into account location of villages from forests may assume similar contents. Traditional knowledge is vital for sustainability of biodiversity including forests and agro ecosystems across landscapes spanning from households through villages and wilderness.

Role of Local governance and natural resources management

All the land and natural resources in Barotseland is entrusted to the Litunga. It is for this reason that the Litunga is referred to as the owner of land and cattle (*Minya-Mupu-Na-Ngombe*) and the King of the earth (*Mbumu-Wa-litunga*). In close consultation with local people through the Kuta (judiciary), and with the views from indunas (headmen or local chiefs), the Litunga administers the general governance of Barotseland. He is the custodian of the customary land. His rights are clearly defined by the mandate of the local people through the recognition as the owner. Traditionally, Lozi people say that the King is the owner of Bulozi or Barotseland and its trees and animals, while the Ngambela (Prime Minister) is owner of the Lozi people (*Mbumu to minyo Uluyi ni itondo na bika ni ngombe, Ngambela to minyo Aluyi*). This saying emphasises the importance of the Litunga as the giver of material wealth and the importance of the

Ngambela as the leader of the nation. The Barotse Legal System is based on ***milao*** (laws), ***liswanelo*** (rights), ***litukelo*** (rights of particular position or social status), ***mikwa*** (methods or ways of doing things), and ***mulatu*** (an offence or wrongdoing). The five cornerstones of the Barotse Legal System have been in existence since the beginning of the kingdom. However, most laws were institutionalised during the reign of King Mulambwa in the 18th century. This included laws pertaining to acquisition, use and disposal of natural resources. Given this rich background on an elaborate governance system that draws much support from the subjects, it becomes much sensible to design natural resources that boarders on the already existing structure. Thus, collaborative management of natural resources with the people becomes the only panacea to sustain biological diversity in western province.

Implications for management of Biodiversity

Conservation of biodiversity is the "management of human interactions with the variety of life forms and ecosystems so as to maximize the benefits they provide today and maintain their potential to meet future generations' needs and aspirations" (Reid and Miller 1989:4).

In the management of biodiversity in areas such as the one in which this study was conducted, both the ecological and the cultural significance of forests need to be recognized (Donovan and Puri 2004). Socio-cultural considerations such as local governance structures are critical in designing the management options. This is because acceptability of conservation innovations varies with knowledge of local use and perceptions levels towards biodiversity. The study has indicated that traditional knowledge and proximity to natural resources is of prime importance in forest biodiversity conservation goals. The persistence of certain species can be attributed to the level of conscientiousness among the people about conservation. This knowledge of conservation is closely linked with traditional lifestyle that encourages sustainable utilization of biodiversity.

Asking whether traditional conservation practices work for the sustainability of biodiversity is too narrow a question. Rather one should ask how this knowledge could be used in the scale of knowledge systems required to conserve biodiversity. Local governance systems, that include practices and knowledge, are crucial for the management and sustainable use of biodiversity. As Pimbert and Pretty (1997:315) put it "resource degradation in developing countries, while incorrectly attributed to "common property systems" intrinsically, actually originates in the dissolution of local level institutional arrangements whose very purpose was to give rise to resource use patterns that were sustainable. Local people enforce rules, incentives and penalties for eliciting behavior conducive to rational and effective resource conservation and use". It therefore, becomes prudent to consider management options such as

community-based conservation where both scientific and traditional knowledge are inclusive. The concept of local participation may not be a new one (e.g. Foster 1973, Krishna et. al. 1997, Brosius 2006) but my argument relates to the mode of delivery that follows the western models as superior knowledge, which cede no control to local people. Participation is simply implied, as a vehicle to achieve externally desired conservation goals with prescriptions out of touch with local reality. Existing conservation institutions i.e. government, NGOs and professionals need to shift from being project implementers to new roles that facilitate local people's analysis and planning. The whole process should lead to strengthening of local institutions, so as to enhance capacity of the local people to take action on their own.

The cumulative impact of selective harvesting of species especially for construction and firewood in Mongu and Senanga may induce both positive and negative feedbacks on forests and thus impact on the overall stability of the forest ecosystem. A healthy ecosystem is one in which the biological diversity is functional at sustainable levels (Holling et. al 1995). Designing conservation strategies that target individual species may be in line with the traditional approach of the local communities. For example, the proliferation of *Baphia* species to replace the declining *Pterocarpus angolensis* may have positive and negative effects in relation with associated biodiversity. The culture of tree planting, though not prevalent today among the Lozi people, can be encouraged. Local communities have planted tree species such as *Baikiaea plurijunga* before (DFSC 2001). While this study does not contradict other studies advocating for an ecosystem approach to forest conservation (Carey and Curtis 1996), this author believes that the combination of species and ecosystem conservation approach through community natural resources management would provide a supplementary option to traditional conservation methods already in practice. Linkages between modern science and traditional knowledge need to be recognized and they need to be acknowledged as knowledge systems valid in their own right. For example, people of Western Province value forest for the spiritual values which science may not be able to express or appreciate as opposed to the much-emphasized economical and biological values. As Berkes (2004) and David (2002) put it, the cross-scale interplay of institutions involving horizontal and vertical considerations are important in biodiversity management at local and global level.

Already pockets of old forests towards Liuwa is undergoing restructuring mainly through frequent fires (Trapnell and Clothier 1996) arising from the decline of species such as *Pterocarpus angolensis, Diplorhynchus candrocarpon,* and *Xylopia adaratissina* that has opened up for proliferation of more *Diplorynchus* shrub grasslands and *Baphia* species. Other studies (Wright 2005) postulate that removal of individual tree species from an ecosystem may alter the dynamics and structure of the surviving forest. For example, after slash and

burn cultivation, significant changes occur. In particular, two shrubs proliferate, *Baphia massaiensis* (isunde) and *Bauhinia urbaniana* (muponda). To the north of Mongu, and south of Sioma, these may be replaced by other closely related species of the same genera. Of the canopy species *Guibourtia coleosperma* now predominates, being more tolerant of fires, which have become a significant factor with the proliferation of the grass *Eragrostis pallens* (Bingham 2006). The direct effect that can be anticipated from restructuring forests arising from individual species disturbances, are possible ecological shifts affecting the overall biodiversity stability at species and ecosystem levels. Definitely, these shifts have implications on the overall stability of forest biodiversity and ecosystem functioning and services.

Conclusion and Recommendations

Conclusion

Local vegetation use in Western Province is influenced by local culture and dependence on forest resources by local communities. There are 57 species of woody plant species and numerous non-woody species used for construction, food, firewood and medicines in Western Province. The local people have observed that four species are on the increase including the most important timber species *Baikiaea plurijunga* and *Ricinindendron rautenaii*. On the contrary, four species have been observed to decline including *Pterocarpus angolensis* and *Diplorynchus candrocarpon*.

The present study has illustrated that traditional societies of Western Province have developed an understanding of their biophysical environment over generations. Their practices and knowledge are grounded in ethical, spiritual and cultural values that they confer to nature. Majority of respondents in the study area showed that taboos and myths play an important role in the conservation of forest biodiversity. Other traditional conservation practices highlighted were embedded in the harvesting methods, sacred landscapes protection and perception about nature. Long before the advent of modern law governing the sustainable use of natural resources, local rules and regulations in the Barotse Royal Establishment had enforced conservation agenda.

Distances of villages to forests have an effect on the selective use of species for medicines and construction. Villages further away from forests tend to know less species than those nearby. The cumulative impact of selective woody harvesting of species especially for construction and firewood Mongu and Senanga may induce positive and negative feedbacks on forests and thus impact on the overall stability of the forest ecosystem. The combination of

species and ecosystem conservation approach through community natural resources management provide a supplementary option to traditional conservation methods already in practice. The challenge now is to bring together indigenous knowledge, values and management practices with western science, in order to create sustainable and culturally appropriate management strategies.

Recommendations

The present study highlighted that conservation objectives of forest biodiversity outside protected areas need to include rather than exclude indigenous people's knowledge and culture. Therefore, this study recommends the following options to be considered:

i. The strengthening of local regulations under the BRE that encourage sustainable use of forest resources,
ii. Encourage community based natural resources management at grass root levels.
iii. Study alternatives to the most used species to reduce the selection pressure on a small number of species currently under heavy exploitation.
iv. Develop and incorporate in education curriculums indigenous ecological knowledge to foster acceptance and consciousness of conservation of the younger generations.

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Appendix 1: Species list for Mongu and Senanga Trees and Shrubs

Construction species

Lozi name	Latin Name	English common Name	Family Name
munga	*Acacia albida* Del	Ana-tree	Mimosoidae
mukusi	*Baikiaea plurijuga*	Rhodesian Teak	Leguminosae
isunde	*Baphia massaiensis* Taub	Jasmine pea, Sand cam wood	Fabaceae
luundu	*Brachystegia bakeriana* Benth		Fabaceae
musheshe	*Burkea africana* Hook	Wild syringa	Leguminosae
mukwe	*Cryptosepalum exfoliatum* De wild		Fabaceae
munjongolo	*Diospyros batocana* Hiern	Batoka jackal-berry	Ebenaceae
mulya	*Diplorhynchus candrocarpon* (Mull. Arg.) Pichon		Apocynaceae
mubako	*Erythrophleum africanum*(Benth.) Harms		Leguminosae
mupulanga	*Eucalytus sp*	*Blue gum*	Myrtaceae
muzauli	*Guibourtia coleopsperma* (Benth)J. Leonard		Fabaceae
mulala	*Hyphaene ventricosa*	Forest toad-tree, Small-fruited toad-tree	Apocynaceae
munyenyele	*Ochna pulchra* Hoof.f	Peeling-back ochna	Ochnaceae
Mubula	*Parinari curatellifolia*	*Mobola*	Chrysobalanaceae
mukwa	*Pterocarpus angolensis*	Afrormosia	Fabaceae
mubeva	*Piliostigma thoningii* (Schumach.) Milne-Redh.	Monkey bread	Fabaceae
mukwa (mulombe)	*Pterocarpus angolensis* DC	Bloodwood	Fabaceae
muhuluhulu	*Strychnos cocculodes* Baker	Monkey orange	Loganiaceae
muli muhambelamema			
ndungunyu			

Medicinal species

Local name	Latin name	English common Name	Family Name
mukwati	*Amblygonocarpus andongensis* (Welw. ex Oliv.) Exell & Torre	Scotsman's rattle	Mimosaceae
mukusi	*Baikiaea plurijuga*	Rhodesian Teak	Leguminosae
isunde	*Baphia massaiensis* Taub	Jasmine pea, camwood	Fabaceae
mupulanga	*Eucalytus sp*	*Blue gum*	Myrtaceae
mukukuli	*Cheliusia abyssinica* Sch. Bip	Bitter leaf	Compositae
mukuwa	*Copaifera baumiana* Harms		Fabaceae
muulya	*Diplorhynchus candrocarpon* (Mull. Arg.) Pichon		Apocynaceae
mubako	*Erythrophleum africanum*(Benth.) Harms		Leguminosae
muzauli	*Guibourtia coleopsperma* (Benth)J. Leonard		Fabaceae

kabulabula	*Parinari capensis* Harv	Sand apple	Chrysobalanaceae
Mubula	*Parinari curatellifolia*	*Mobola*	Chrysobalanaceae
mubanganga	*Pericopsis angolensis* (Baker) Meeuwen	Afrormosia	Fabaceae
kamwengo	*Sesanum spp*		
mutebitebi	*Solanum spp*	Wild tomato	Solanaceae
Muhuluhulu	*Strychnos cocculodes* Baker	Monkey orange	Loganiaceae
mushakashela	*Swartizia madagascariensis*		Caesalpinianaceae
muhononositunduwanga	*Terminalia sericea*		Combretaceae
mumawa	*Xylopia odoratissima* Welw. ex Oliv		Annonaceae
tyolamuyandingo´ko			
ndonga			
ishamawa			
mumawa kayolamaundu			
ndonga			

Food species

Local name	Latin names	Common Name	Family Name
mulolo	*Annona senegalensis*	Wild custard apple	Annonaceae
Muzinzila	*Berchemia disclor* (Klotzsch) Hemsl.	Bird-plum	Rhamnaceae
makole	*Azanza garckeana*	African chewing gum	Malvaceae
Mutoya	*Syzygium guineense*	Bicoloured waterberry	Myrtaceae
mukuwa	*Copaifera baumiana* Harms		Fabaceae
muhamani	*Dialium engleranum*		Cassieae
munjongolo	*Diospyros batocana* Hiern	Batoka jackal-berry	Ebenaceae
namulomo	*Grewia falcistipula* K. Schum		Tiliaceae
muzauli	*Guibourtia coleopsperma* (Benth)J. Leonard		Fabaceae
Mubula	*Parinari curatellifolia*	*Mobola*	Chrysobalanaceae
mungongo	*Ricinondendron rautenenii*	Mungongo tree	Euphorbiaceae
muhuluhulu	*Strychnos cocculodes* Baker	Monkey orange	Loganiaceae
muhwahwa	*Strychnos pungens*		Loganiaceae
mwimbili	*Strychnos spinosa*		Loganiaceae
mumbengelenge	*Vangueria infausta*		Rubeaceae
mumonsomonso (Mumbole)	*Vangueriopsis lanciflora* (Hiern) Robyns		Rubeaceae
mungo´mba	*Ximenia americana*		Olacaceae
mumawa			
mumbole			
shumbumbu			
ndungunyu			

Firewood species

Local name	Latin name	English common Name	Family Name
munga	*Acacia albida* Del	Ana-tree	Mimosoidae
isunde	*Baphia massaiensis* Taub	Jasmine pea, Sand camwood	Fabaceae
luundu	*Brachystegia bakeriana* Benth		Fabaceae
mutuya	*Brachystegia spiciformis*		Fabaceae
musheshe	*Burkea africana* Hook	Wild syringa	Leguminosae
mukenge	*Combretum zeyheri*		Combretaceae
mukuwa	*Copaifera baumiana* Harms		Fabaceae
mukwe	*Cryptosepalum exfoliatum* De Wild		Fabaceae
muulya	*Diplorhynchus candrocarpon* (Mull. Arg.) Pichon		Apocynaceae
muzauli	*Guibourtia coleopsperma* (Benth)J. Leonard		Fabaceae
mumundu	*Hippocratia africana*		
munyenyele	*Ochna pulchra* Hoof.f	Peeling-back ochna	Ochnaceae
Mubula	*Parinari curatellifolia*	*Mobola*	Chrysobalanaceae
mumonsomonso (Mumbole)	*Vangueriopsis lanciflora* (Hiern) Robyns		Rubiaceae
muli			
mumawa			

Grasses

Lozi name	Latin name
Mwange	*Coudetia simplex*
Matengenya	*Hyperthelia dissoluta*
Makelele	*Miscanthus sp*
Makelele	*Hyparrhenia sp*
Makelele	*Pogonarthia squarrosa*
Makelele	*Brachiaria dura*
Makelele	*Sartida angolensis*

Others

Lozi name	English common name
Siboyani	Wild yam
Ndwinwi	Group of mushrooms