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INDIGENOUS KNOWLEDGE ON TREE CONSERVATION IN SWAZILAND

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Degree of Master of Science by coursework and research:
A research report submitted to the Faculty of Science, University of the Witwatersrand, Johannesburg, in partial fulfillment of the requirements for the degree of Master of Science.

Johannesburg, 2009

DECLARATION

I declare that this research report is my own, unaided work. It is being submitted for the Degree of Master of Science in the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in any other University.

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_____ day of _____ 2009.

ABSTRACT

Indigenous knowledge used for the conservation of trees was investigated in a rural community of Swaziland. The content, perceived application, social distribution (by age, gender and education) and intergenerational transmission of this knowledge were explored. A survey approach was used and it entailed personal interviews, key informant interviews and focus group discussions.

A dependence on trees by the rural community was observed, as well as evidence of customary resource use practices. Harvesting practices and techniques, traditional rules, occurrence of sacred forests and tree planting constituted the indigenous management system that promoted the conservation of trees in the community. Protection of indigenous fruit trees and those with cultural significance, use of deadwood for firewood, and leaving a base stump when chopping a tree, represented some of the reported harvesting rules, practices and techniques respectively. A positive association was observed between age and knowledge of harvesting rules, whilst a negative correlation was identified between education and knowledge of harvesting techniques. Indigenous knowledge was mainly passed on through parent-child transmission. However, modernization and commercialization are eroding the use and transmission of indigenous knowledge. The preservation of indigenous knowledge could involve its introduction to school curricula.

DEDICATION

In loving memory of my grandmother Mrs. Ester Mdubeki.

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Chapter 1 – INTRODUCTION

1.1 Background

The conservation of biodiversity is a global imperative for environmental sustainability. Given that the planet and its resources are finite, there needs to be greater focus and effort in the sustainable management of our environment. The complex and dynamic suite of threats to biodiversity has necessitated the evolution of conservation biology in order to better address these challenges and as part of this evolution, new techniques and disciplines have been sought out to adequately respond to the varied threats facing the world's ecosystem (Drew 2005). The use of indigenous knowledge in the form of traditional ecological management practices represents such an approach. Indigenous knowledge has the potential to greatly augment conservation programs and help shape new ones, by providing location-specific knowledge, increased knowledge of environmental linkages and local capacity building and power sharing between scientists and local people (Drew 2005). Indigenous knowledge, also known as traditional ecological knowledge, is defined as "a cumulative body of knowledge, practice, and belief, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and with their environment" (Berkes *et al.* 2000, p. 1252). The use of indigenous knowledge in natural resource management has advanced since it was globally acknowledged in the eighties through publications such as the 1980 World Conservation Strategy followed by the 1987 Brundtland report, *Our Common Future*.

In recent years indigenous knowledge has been shown to contribute to the conservation of biodiversity and sustainable resource use in general (Gadgil *et al.* 1993; Berkes *et al.* 2000; Ruddle 2000). It has already been used by conservation biologists for ecological management plans, particularly in marine conservation (Drew 2005). In other instances indigenous knowledge has provided information that was not readily available in scientific literature due to the remoteness of the area, and could only be sourced from the local people (Valbo-Jørgensen & Poulsen 2000; Drew 2005; Chalmers & Fabricius 2007). It has also been useful in providing researchers with alternative worldviews that complement scientific knowledge. Formal conservation measures basically hinge on two principal mechanisms: national legislation and protected area systems. Protected areas typically cover a small

percentage of the area in which biodiversity exists. A lot of the biodiversity exists outside of protected areas and there are usually people relying on it for livelihood resources. Indigenous knowledge presents a potential for traditional conservation practices to be used in cooperation with western methods to develop management strategies with better success (Huntington 2000; Lykke 2000; Colding & Folke 2001).

In Africa there is a drive to revive the indigenous knowledge that "has long been ignored and maligned by outsiders" (Warren 1992). Today, discussions around the conservation of biodiversity in Africa rarely omit the relevance and usefulness of indigenous knowledge in conservation programs and management plans. In 2004 – 2006 the UNEP commissioned a project that was designed to harness and promote the use of indigenous knowledge in environmental conservation and natural disaster management in African countries. Four pilot countries were used for the project namely Kenya, Tanzania, Swaziland and South Africa, which have indigenous knowledge systems that are relatively intact in many of the communities. The project investigated indigenous knowledge used for nature conservation, natural disaster management and poverty alleviation (UNEP n.d.). There are indigenous knowledge resource centers that have emerged which have developed databases intended to capture this important resource that is at risk of extinction.

At a local level, some studies have been undertaken on the use and application of indigenous knowledge in Swaziland. The UNEP project conducted a study in the country to investigate the use and application of indigenous knowledge in nature conservation and natural disaster management (Amusan *et al.* 2006). The study was intended to harness and promote the use of indigenous knowledge in these events. With reference to nature conservation, the study identified several methods for protection of fauna, flora and soil. The restriction of animal use to specific clans (e.g. the royal family) was a means of protecting rare species. Methods of plant protection included harvesting practices that encourage re-growth, caution against over-exploitation, fire-control and non-commercialization of resources. Soil fertility was enhanced by the use of weeds as green manure, the use of kraal manure and agroforestry. Another study by Mavimbela (2004) has demonstrated the role and importance of indigenous knowledge in biodiversity management. Specifically it documented indigenous knowledge held by rural women in Swaziland on traditional food plants, including the management and conservation strategies used. The study further showed how indigenous knowledge not only

ensures sustainable biodiversity management but also how it contributes to food and livelihood security of rural communities.

Biodiversity has a significant role in the lives of the Swazi people who rely on it for various livelihood uses. Swaziland as a contracting party to the Convention on Biological Diversity (CBD) is obliged to conserve biodiversity for the benefit of its people. Swaziland has a population of over a million people with approximately 70% residing in the rural areas (Central Statistical Office 1997a). The rural population resides on Swazi Nation Land (SNL) which is communal land that is governed by traditional authority – chiefs – on behalf of the King. The rural communities living on communal land, that covers more than half of the country, use the natural resources available to them for their livelihood. The use of natural resources on SNL has historically relied on judicial use of forest products which were governed by practices sanctioned by traditional structures. Thus leadership was required to ensure sustainable use of forest and woodlands through the implementation of community-based resource management regimes. In traditional culture, people were only required to harvest forest products to meet basic needs for fuel, shelter and food. Felling of trees was only allowed for building material, while for fuel people were supposed to harvest undergrowth or deadwood. Trees were also used to collect fruits, which was a seasonal occurrence. It must be appreciated that for common property regimes to be successful they required the rural community to be custodians and to also abide by the rules of harvesting, use and overall management of resources. Enforcement of the practices and rules was possible through punitive measures which were agreed upon and meted by the chief's council.

The 2006 Convention on Biological Diversity Status Summary report lists local threats to Swaziland's biodiversity as habitat destruction, over-exploitation of natural resources particularly forests, impact of exotic species, weak law enforcement, ignorance, population growth and lack of equity in ownership and management (Swaziland Environment Authority 2006). Some of the factors implicated in these threats to biodiversity include socio-economic factors such as poverty, urbanization, unemployment and commercialization of products. For Swaziland where the human poverty index value is high at 35.4, this is driving the poor, who are largely rural, to rely heavily on natural resources due to lack of alternative livelihood strategies. Forest resources have traditionally formed a critical aspect of the rural people's

livelihood, as they use them for fuel, food, building material and traditional medicine. However, with the modernizing influence of a capitalist economy, forest resources are increasingly being harvested for commercial purposes.

1.2 Problem Statement

The existing literature on Swaziland's biodiversity is increasingly sounding the call about the varied threats to the country's biodiversity, specifically the deforestation and degradation of natural forests and woodlands (DANCED 1998). The country's total forest cover (natural forests and plantations) as a percentage of land in 2005 was 31.5% while forest cover change from 1990 – 2005 decreased by 0.7 thousand km^2 (UNDP 2007). The problem of deforestation and degradation of the country's indigenous forests and woodlands is due to complex factors such as the conversion of land to agriculture, uncontrolled extraction of forest products from communal land, large livestock populations and other socio-economic issues that work against the judicious use of forests and woodlands (Ministry of Agriculture and Cooperatives 2002). The current management of natural forests and woodlands in Swaziland is relatively weak. Of particular concern are the natural forests and woodlands that occur on SNL because of the challenges of managing communal resources. Forest resources on communal land are generally subject to over-exploitation by rural communities. The potential value and use of indigenous knowledge in nature conservation has not been explored sufficiently, whereas it could contribute significantly to sustainable resource use on communal land. The National Forest Policy acknowledges indigenous knowledge as a "critical element of defining ecologically responsible forest use" and has made policy the recognition, protection and application of indigenous knowledge in the conservation of natural forests and woodlands (Ministry of Agriculture and Cooperatives 2002). But now there is need to establish the specific indigenous knowledge which is held by the local people and how it is used, and the constraints in the use of indigenous knowledge in the conservation of our forests at present.

There have been efforts undertaken by the Swaziland government to promote the conservation and management of biodiversity. Firstly, there are several laws designed to provide protection of biodiversity in the country. A relevant example being the Swaziland Flora Protection Act of 2000, which provides legal protection of certain plant species and special habitats (Swaziland Environment Authority 2001). Secondly, there are *in-situ*

conservation measures which involve the establishment of protected areas such as game and nature reserves. There is a network of protected areas within the country including both state and privately owned entities. There are a total of 17 protected conservation areas in Swaziland (Swaziland Environment Authority 2001). Thirdly, *ex-situ* conservation measures also exist. It is mainly plants that are conserved in this manner, wherein the Gene Bank (under the auspices of the Ministry of Agriculture and Cooperatives) preserves plant genetic resources mostly of crops and crop relatives (Swaziland Environment Authority 2001). Specifically for sustainable forest management several major forestry projects have been implemented: the Forest Policy and Legislation Project; tree planting programmes; management of indigenous forest and wattle plantations; and tree seed propagation (DANCED 2000c).

Although there are good measures in place for the conservation of biodiversity, these efforts are not sufficient, primarily because protected areas only cover about 7% of the total land area in the country. This means that the vast majority of biodiversity is found outside of protected areas and is vulnerable to over-exploitation and erosion. The management of land and resources on the land is dependant on the land tenure. Therefore the land tenure system will determine the resource management regime used on that land. The land tenure system in Swaziland comprises two major types of land ownership. There is Swazi Nation Land (SNL) and Title Deed Land (TDL). SNL is land that is held by the King in trust for the Swazi nation and makes up about two-thirds of the total land area of the country, whereas TDL is freehold owned by individuals and corporate estates (DANCED 1998). As a result, the majority of biodiversity will be found on SNL which is communal land. Approximately 70% of the Swazi population resides in rural areas on SNL. Consequently, the onus of conserving biodiversity on communal land rests with the rural communities who depend on it for survival. Management of resources on communal land necessitates the employment of a common property regime, which could ideally be used in conjunction with indigenous knowledge to bolster the system.

Swaziland is very rich in culture and tradition which form the backbone upon which indigenous knowledge is based. Since time immemorial rural communities have used indigenous knowledge systems to manage natural resources in their environment. These indigenous knowledge systems were applied through traditional practices and rules that were

developed to protect the soil, water and natural vegetation ensuring resources for rural populations (Mavimbela 2004). However, this cultural treasure has been reduced and is gradually being lost due to "western" influence. Another compounding factor is the lack of documentation of indigenous knowledge. The need to develop practical strategies for supporting sustainable resource use by communities is now generally viewed as a fundamental imperative in ensuring livelihood security and preserving biodiversity. Thus, in order to protect biodiversity it is crucial to document the knowledge that is deep-rooted in the traditional lifestyles of the local people (Natarajan 2002). The potential value of indigenous knowledge for sustainable resource use is still largely untapped in Swaziland.

The problem for this study is that indigenous knowledge on the conservation of trees has not yet been documented on the protection, harvesting and cultivation of trees. Furthermore, there is a need to know the extent of application of indigenous knowledge by people on communal land, the mode of transmitting this knowledge and finally how such knowledge various among groups by age, gender and educational status of the people.

1.3 Justification of Study

Although there have been many studies done on the use of indigenous knowledge in environmental management, there have not been many that have focused on the use of indigenous knowledge on the conservation of trees. The use of indigenous knowledge on the conservation of tree resources may be especially important for management on communal land. In Swaziland, the management of SNL resources is the responsibility of the Chief of that particular chiefdom (DANCED 2000b). Since there are still traditional structures of authority in the rural areas, indigenous knowledge systems can still contribute significantly to the common property regimes that can be used for conservation on communal land. A study done by the Ministry of Agriculture and Cooperatives on the non-timber forestry sub-sector revealed that there are traditional mechanisms such as local rules that regulate the use of Non-Timber Forest Products (NTFPs) on communal land (DANCED 2000a). It also highlighted that "NTFPs, common property regimes and indigenous knowledge are thus important issues…that should receive attention in Swaziland as well."

Swaziland has a population of over a million people with approximately 70% residing in the rural areas (Central Statistical Office 1997a). Most of the natural forests and woodlands

occur on SNL and are subject to use by rural communities. Natural forests and woodlands are of social, economic and environmental significance to Swaziland. The livelihood of the majority of rural people in Swaziland is highly dependant on the biological resources derived from natural forests and woodlands, which account for over 50% of the value of total household consumption expenditure (Ngwenya & Hassan 2005). This provides the country with a subsidy in terms of the funds that the government would have to generate to provide rural people with the necessary social services that are being catered for by the natural forests and woodlands. Ngwenya and Hassan (2005) estimate that national savings amount to 10% when valuing the benefits derived from natural forests and woodlands by rural communities. Tree resources also play a significant role in the culture of Swazi people, for instance the fruit obtained from a particular indigenous tree is used to make traditional brew (Marula) which is essential for important cultural events. Trees are also of environmental significance because they provide essential ecological services such as providing a habitat for fauna / biodiversity (McCullum 2000), serving as carbon storage thereby reducing atmospheric carbon dioxide (Scholes 2004), and prevention of soil erosion.

Natural forests and woodlands encompass indigenous trees which are of significant value to the lives of the Swazi people and therefore should be used in a sustainable manner to ensure their persistence for future generations. It is imperative therefore to establish management strategies that promote the sustainable use of these natural forests and woodlands.

1.4 Aim

The study aimed to investigate the indigenous knowledge used to conserve trees in a rural community in Swaziland.

1.5 Objectives

- To document existing indigenous knowledge on the protection, harvesting and cultivation of indigenous trees.
- To determine perceptions of the extent of application of indigenous knowledge for tree conservation.
- To assess how indigenous knowledge varies among a cross-section of the rural community according to age, gender and educational status.

- To examine how indigenous knowledge is transmitted amongst generations.

1.6 Research Questions

- What are the traditional practices that promote the conservation of trees?
- To what extent are they perceived to still be practiced?
- Does indigenous knowledge for the conservation of trees differ across age, gender and educational qualification of the rural community?
- How is indigenous knowledge transferred from one generation to the next?

1.7 Hypotheses

- Indigenous knowledge increases with age due to transmission and accumulation of knowledge over time.
- Indigenous knowledge is differentiated by gender because of gender-specific resource harvesting roles
- Indigenous knowledge declines with formal education as higher education is associated with higher socio-economic status and reduced reliance on woodland resources.

Chapter 2 – LITERATURE REVIEW

2.1 Indigenous Knowledge

2.1.1 Background

The realization that imposing scientific and technological solutions on less-developed countries is not always a sustainable solution has lead to more participatory approaches with local people and hence the acknowledgment of indigenous knowledge as a resource to be considered in development (Sillitoe 1998). Indigenous knowledge is defined as "a cumulative body of knowledge, practice, and belief, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and with their environment" (Berkes *et al.* 2000, p. 1252). Indigenous knowledge has been widely demonstrated to be the foundation of many community-based resource use and management systems (Berkes *et al.* 2000; Ruddle 2000). The concept of indigenous knowledge developed from ethnobiology, and in the nineteen eighties evolved into a growing interest of indigenous people's knowledge of their environment specifically in relation to resource management and conservation. (Berkes *et al.* 2000). According to Kaschula *et al.* (2005, p. 414) indigenous knowledge is useful to natural resource managers as "it is compatible with a more realistic view of ecological systems…but also in that it provides an example of how managers might make sense of the multiple kinds of information they are continually faced with within complex ecosocial systems."

Indigenous knowledge is described as essentially qualitative, intuitive and holistic in nature which differs from scientific knowledge that is typically quantitative, rational and reductionistic (Heyd 1995). Indigenous knowledge is often seen as concrete knowledge whereas scientific knowledge is viewed as abstract. According to Agrawal (1995) the presumed difference between indigenous knowledge and scientific knowledge is based on substantive, methodological and contextual grounds, but further deliberation reveals that the criteria used do not provide a clear and definite distinction between these two types of knowledge. The differences in characteristics between indigenous and scientific knowledge result in challenges in integrating the two, as pointed out by Kaschula *et al.* (2005).

2.1.2 Social Distribution of Indigenous Knowledge

Within any group knowledge generally tends to be unevenly spread and this also applies to indigenous knowledge. Indigenous knowledge can be distributed by gender, age (Ruddle 1993; Luoga *et al.* 2000a, Dovie *et al.* 2008) and even social class (Simpson 1997). Since indigenous knowledge is mostly linked to subsistence living it tends to be distributed according to divisions in labour at a household and community level (Ruddle 1993). Due to the different roles that men and women play in economic productivity and resource use, indigenous knowledge tends to be shaped by gender (Ruddle 2000). Age also plays a role as a formative influence on indigenous knowledge as generally the older generation tends to be more knowledgeable than the youth, who are consequently instructed by their elders (Ruddle 1993; Ohmagari & Berkes 1997). It is essential to review the variation of indigenous knowledge within a society in order to identify the local knowledge experts so as to obtain in-depth information from them which will result in the harnessing of valid and quality indigenous knowledge (Davis & Wagner 2003).

For traditional ecological knowledge, few individuals may have a holistic understanding of the environment, and tend to be the local experts, whilst others' understanding depends on the purpose for which they use the environment (Chalmers & Fabricius 2007). Ethnobotanical studies have shown age and gender to be variables that determine the distribution of indigenous knowledge (Luoga *et al.* 2000a; Dovie *et al.* 2008). These studies revealed that males and older people were more knowledgeable on the particular uses of tree species than their counterparts. In the southern African context, indigenous knowledge is influenced by the role of the individual within the family and community. For instance, women and children tend to be the main collectors of firewood, whereas men are largely responsible for collecting timber for building purposes (Che & Lent 2004). In Swaziland for example, women tend to be custodians of indigenous knowledge related to traditional food plants whereas men will have indigenous knowledge on wild and domesticated animals and traditional healers on medicinal plants (Amusan *et al.* 2006).

2.1.3 Transmission of Indigenous Knowledge

The transmission of indigenous knowledge is a key issue to the discussion of indigenous knowledge. The main concern about indigenous knowledge is its impending loss, therefore the mechanisms that perpetuate the existence of indigenous knowledge are pivotal to the

dialogue. Knowledge is the pillar of any society and its transmission is an important fundamental socio-cultural process. The transmission of indigenous knowledge shapes society and culture which in turn shape knowledge, thereby making it an essential cultural resource (Ruddle 1993). Despite the importance of indigenous knowledge transmission, literature on the mechanisms by which it is transmitted is sparse and remains a neglected field as observed by Ruddle (1993). There are some general characteristics that have been observed from societies around the world. These include traits such as being gender and age specific, and transmitters being particular kinsfolk usually parents. Indigenous knowledge is passed down from generation to generation through cultural transmission. The vertical parent-to-child transmission has been shown to be the most common mode of cultural transmission particularly in rural subsistence communities (Hewlett & Cavalli-Sforza 1986; Ohmagari & Berkes 1997). This could mainly be due to the fact that indigenous knowledge tends to be relevant to survival, for instance subsistence skills, and is therefore a necessity in the development of the child, which is ultimately the responsibility of the parents. Furthermore, this vertical transmission tends to have a gender bias in that generally fathers transmit to sons and mothers transmit to daughters (Hewlett & Cavalli-Sforza 1986). The medium of transmission of indigenous knowledge involves oral transmission in the form of lore (Heyd 1995), as well as practical experience through hands-on training and apprenticeship (Ohmagari & Berkes 1997). Children learn the traditional practices from their older family members through an apprenticeship approach of observation and working under supervision until the skill is mastered (Ohmagari & Berkes 1997). The age of skills knowledge acquisition was found to be generally about 15 years (Hewlett & Cavalli-Sforza 1986; Ohmagari & Berkes 1997). Indigenous knowledge tends to be lost when it becomes redundant for the livelihoods of the community or when the younger generation is uninterested in cultural practices due to the influence of formal education (Redford & Stearman 1993).

2.2 Natural Forests and Woodlands

2.2.1 Importance of natural forests and woodlands

Natural forests and woodlands fulfill quite a few vital ecological functions such as: providing wildlife habitat; fertilizing and nurturing the soil; cleaning the air by absorbing carbon dioxide and releasing oxygen; and soaking up rainfall and releasing it slowly into the air and surface or sub-surface waters (Chenje & Johnson 1994). They also provide natural resources

that are used for subsistence and commercial purposes. The natural forests and woodlands in southern Africa are of great significance to rural people (Lawes *et al.* 2004). They provide a variety of benefits in the form of direct and indirect values. The direct benefits include goods such as firewood and charcoal used as a primary source of energy, poles and construction products, timber, materials for tool handles and household utensils, foods and medicines, leaf litter for soil fertilization and livestock fodder which in turn produces manure also used for fertilization of cultivated land (McCullum 2000). Indirect benefits include the services such as controlling soil erosion, providing shade, modifying hydrological cycles and maintaining soil fertility; and the use of specific trees or blocks of woodland and forest for cultural reasons (McCullum 2000).

2.2.2 Local use of indigenous trees

In the rural areas trees are especially important because the dependence is more direct. Rural people usually have little else to rely on except the available natural resources. They serve as the main contributors of biological resources that rural communities use for their livelihood, providing them with non-timber forest products (NTFPs) that cater for energy, shelter, food and medicine (Shackleton *et al.* 2007). These NTFPs are used for subsistence as well as income generation either on a regular basis or as a safety-net in case of adversity (Paumgarten 2005; Shackleton *et al.* 2007). These resources provide an important social and economic contribution to rural livelihoods as has been demonstrated in valuation studies within the region (Dovie *et al.* 2002; Letsela *et al.* 2002).

Trees due to their versatility are the predominantly used biological resource in the day-to-day lives of rural people, in terms of quantity (mostly due to the provision of fuelwood) and uses (Luoga *et al.* 2000b; Dovie *et al.* 2004). Their woody nature allows for them to be used as poles for the construction of shelter, fences and kraals, and for carving handcrafts. Trees provide resources that cater for the basic human needs in the way of fuel, food, shelter and medicines. In southern Africa, tree resources are mostly used as fuelwood, wild fruits, wooden utensils, twig hand brooms and wood for construction (Twine *et al.* 2003a; Letsela *et al.* 2003; Shackleton & Shackleton 2004). The predominant use of trees for subsistence in rural areas is fuelwood and construction timber (Luoga *et al.* 2000b; Dovie *et al.* 2004). Rural lifestyle also includes the use of medicinal plants for health care. Medicinal plant resources are obtained from bark, roots, leaves and fruits. Studies have shown that the bulk

of medicinal plant products are derived from bark, which is why trees provide the greatest portion of medicinal products that are traded commercially in southern Africa (Botha *et al.* 2004a; Shackleton *et al.* 2007). Many threatened tree species in the region are those used for medicinal purposes (Dovie *et al.* 2008). Some medicinal species like *Warburgia salutaris* (the pepper-bark tree) are at risk from heavy harvesting for commercial purposes and this particular tree has been listed as a priority species for improved management and propagation (Botha *et al.* 2004b). In Swaziland, a significant amount of tree products such as roots, leaves and bark are harvested for medicinal purposes and exported to neighbouring countries.

2.2.3 Sustainable harvest of NTFPs

Any form of resource extraction from forests and woodlands will result in an ecological impact of that ecosystem. For the exploitation of NTFPs to be considered sustainable the harvest should have no long term detrimental effect on the reproduction and regeneration of populations being harvested in comparison to similar non-harvested natural populations, additionally there should be no discernable adverse effect on other species in the community or on ecosystem structure and function (Hall & Bawa 1993). The essence of conserving these ecosystems necessitates the examination of the key factors that determine sustainable harvesting of NTFPs. According to the ecological primer by Charles Peters (1994), the overall ecological impact of forest resource exploitation depends on the floristic composition of the forest, the nature and intensity of harvesting, and the particular species or type of resource under exploitation. Furthermore, tree species differ in their potential for sustainable use, due to their contrasting biological characteristics. Key characteristics are those that determine the regeneration capacity of the species, including reproductive biology and regeneration characteristics. As per the ecological primer, the vast variety of NTFPs can be grouped into three major categories: (1) fruits and seeds, (2) plant exudates (e.g. latexes, gums and resins), and (3) vegetative structures (e.g. stems, leaves, roots, barks and buds). Theoretically, when properly extracted, plant exudates are the most likely resource type to conform to the ideal of sustainable harvesting. Fruits and seeds are likely to have a significant impact when harvested commercially, as this decreases the capacity for recruitment of new individuals into the plant population. The harvesting of vegetative structures such as leaves has a fairly benign impact compared to the harvesting of roots and bark, which is usually destructive to the tree. The primer suggests six steps toward

sustainability which include: species selection, forest inventory, yield studies, regeneration surveys, harvest assessments and harvest adjustments.

2.3 Indigenous Conservation of Trees

2.3.1 Introduction

Indigenous conservation has often evoked polarized views. Some scholars believe that indigenous people are able to live in balance with nature and have negligible impacts on their environment (Posey 1985; Bunyard 1989; Gadgil *et al*. 1993), while other scholars question this theory of indigenous people as "ecologically noble" (Brightman 1987; Diamond 1991; Redford 1991; Smith & Wishnie 2000). Some researchers have debated whether indigenous people are conservationists or merely optimal foragers (Hames 1987; Alvard 1993). Johannes (2002) claims that to argue that indigenous people do not have a conservation ethic because they have in the past utilized resources unsustainably is not persuasive an argument, because they would have needed to reach resource limits to understand that resources are finite and therefore need to be conserved. This debate necessitates an understanding of what constitutes conservation. Smith and Wishnie (2000) argue that for any action or practice to qualify as conservation it must prevent or mitigate resource depletion, species extirpation, or habitat degradation, and must be intended to do so. This approach poses a challenge for traditional conservation practices which are based on indigenous knowledge which is intuitive in nature as opposed to rational characteristic of scientific knowledge. Since indigenous peoples concept of conservation is fundamentally different from that of western conservationists (Alcorn 1993), the premeditated aspect of conservation may not be obvious or evident in traditional conservation.

Indigenous conservation involves common property resources (e.g. game, fish, plants, etc) on which the communities of native people rely for subsistence. Contrary to the theory popularized by Hardin (1968) that common property is subject to overexploitation due to open access, Feeny *et al*. (1990) have demonstrated that sustainable resource harvesting is possible under common property regimes. In order to be successful, common-property resource management should have traits that include "socially regulated access, management rules governing resource harvests, means of monitoring compliance to these rules, and sanctions to punish those who violate them" (Smith & Wishnie 2000, p. 504).

There is no question that indigenous people possess intimate knowledge of their environment. In some instances this knowledge has been shown to be consistent with western knowledge (Lykke 2000, Chalmers & Fabricius 2007), in other cases indigenous knowledge has been used in marine conservation (Drew 2005), fisheries management (Valbo-Jørgensen & Poulsen 2000) and biodiversity and landscape management (Gadgil *et al.* 1993). Indigenous conservation consists of practices such as traditions of maintaining sacred forest areas, community-enforced rules of forest and game use, and social taboos on resources and habitats (Clarke 1994; Colding & Folke 2001; Todd *et al.* 2004; Luoga *et al.* 2005).

2.3.2 Harvesting tree resources

There are cases where indigenous people harvest forest resources unsustainably due to certain pressures. For instance, the commercialization of medicinal plants has resulted in unsustainable harvesting often involving ring-barking which leads to tree mortality (Botha *et al.* 2004b). In other cases, the scarcity of resources such fuelwood has lead to local people disregarding harvesting rules and cutting down live trees, which ultimately exacerbates the problem (Twine *et al.* 2003b). However, there have been instances where indigenous people have been shown to use tree resources sustainably. This has been achieved through sustainable harvesting methods and practices. One practice is the collection of firewood dead wood (Luoga *et al.* 2000a; 2005). Harvesting techniques that reduce tree mortality and enhance coppice growth have been employed by rural communities to ensure sustainable resource use (Shackleton 1993; Kaschula *et al.* 2005). Herbalists harvesting for medicinal resources mostly use leaves or peel a portion of the tree bark usually facing the sun, to allow for rapid regeneration (Che & Lent 2004).

2.3.3 Protection of trees

Where communal land is governed by traditional leaders, there are certain traditional rules that exist which are designed to manage communal resources. These rules are designed to prevent open access to communal resources which results in over-exploitation. With regards to trees specifically, the general rule required permission of the traditional leadership (chiefs, headmen and elders) for the harvesting of live trees (McCullum 2000; Amusan *et al.* 2006). This was a way of preventing the indiscriminate felling of trees thus controlling the use of natural resources on communal land and also ensuring that resources were used by the people

entitled to them. In Swaziland the main rules that applied to most chiefdoms included the use of only dry wood for firewood; the protection of indigenous fruit trees; and no free access to commercial exploitation of trees in communal areas (DANCED 2000b). However, in some locations traditional rules regarding the harvesting of natural resources are increasingly under pressure and becoming ineffective due to a combination of interlinked factors. These factors include a decline in authority of traditional leaders (as a result of political changes), poverty, unemployment and population growth (Twine *et al.* 2003b; Kirkland *et al.* 2007).

Traditional religious beliefs have also played a role in conservation. The Kuna of Panama were known as "the first indigenous people in Latin America to set aside a large area of intact rain forest as a nature reserve" (Redford & Stearman 1993, p. 251). This stems from the belief in 'spirit sanctuaries' wherein a specific landscape is believed to be the home of ancestral spirits and is therefore maintained in a pristine condition so as not to disturb the spirits. In Zimbabwe, forests have been preserved because they were believed to be sacred because they harbor ancestral spirits and in the Mazarabani area the remnant patches of dry forests that remain are or have been a part of the sacred forests (Byers *et al.* 2001). Hence the religious beliefs of indigenous people have played a role in conservation.

Other means of protecting trees have been through the use of totems and taboos. There are totem trees that are associated with certain surnames or clans and by custom members of this group will respect and protect the tree that is their totem (Amusan *et al.* 2006). This practice limits the use of the tree since certain people will be refrain from using it. Taboos are also used as a means of protecting trees that are possibly rare or do not propagate easily or have some specific usefulness. In such cases the trees will be tabooed from uses other than the specialized function. An example is the species *Minquartia guianensis* used as construction timber by some Amazonian Indians because of its strength and resistance to rot, it is therefore taboo to use it as firewood (Cotton 1996). In Zimbabwe, the use of trees such as *Philenoptera violacea, Ochna* and *Gymnosporia* species for firewood are considered taboo (McCullum 2000).

2.3.4 Cultivation of trees

The planting of trees is another means of preventing complete deforestation whilst meeting the need for fuelwood and other woodland resources. Most countries in the SADC region

have attempted to improve fuelwood resources in rural areas by promoting the planting of community woodlots. These have mostly consisted of eucalyptus trees which have not been popular with rural people for several reasons. Although eucalyptus trees provide good poles they have poor burning qualities compared to their indigenous counterparts and they can not substitute for the multitude of other resources provided by natural forests and woodlands (Chenje & Johnson 1994). In Zimbabwe, tree planting by rural communities was mostly of fruit trees and these were generally confined to the homesteads (Clarke 1994).

Woodlot projects have been implemented in Swaziland by both government and various NGOs, with the aim of establishing plantations in order to reduce land degradation and to supplement fuelwood shortages arising from deforestation (DANCED 2000c). A study was done to compare the fuelwood production versus consumption in two rural communities of Swaziland, in bid to investigate the growing fuelwood scarcity. The communities (Sigombeni and Bhekinkhosi) were utilizing woodlots for the production of fuelwood. These were primarily wattle woodlots that were grown on individual farms or on communal areas. These woodlots were quite effective, accounting for 45% of all production in Sigombeni and 73% in Bhekinkhosi (Allen *et al.* 1988).

Ideally the community woodlots should be of indigenous trees which are adapted to the prevailing environment and are useful to the local people. The challenges of this endeavour are that indigenous trees are more difficult to plant from seed than exotics, and they tend to grow slowly (Chenje & Johnson 1994).

Chapter 3 – METHODOLOGY

3.1 Study Area

3.1.1 Swaziland

Swaziland is a landlocked country situated in the south-eastern part of Africa. It is has two neighbours, South Africa on the north, west and south side, and Mozambique on the eastern side. The country spans a land area of about 17000 km^2. Swaziland has a diverse topography, geology and climate which support the rich biodiversity found in the country. It has six distinct physiographic zones based on elevation and relief. These regions run longitudinally north to south of the country. Starting from the west moving east, these regions are known as the Highveld, Upper Middleveld, Lower Middleveld, Western Lowveld, Eastern Lowveld and Lubombo Range. The ecosystems in the country are classified into two main biomes, grassland and savanna. The western part of the country is mostly montane grassland; whilst the savanna is mainly in the eastern region forming a savanna-woodland mosaic (Swaziland Environment Authority 2006).

The country is made up of four administrative regions known as the Hhohho, Manzini, Lubombo and Shiselweni districts. The land tenure system comprises three main categories of land tenure which are Swazi Nation Land (SNL), Crown Land and Title Deed Land (TDL) (Swaziland Environment Authority 2001). SNL is communal land that is held in trust by the King for the Swazi nation. It is mostly controlled by chiefs, and is allocated for three main purposes – settlement, growing crops and communal grazing. Crown land is owned by the government and TDL is privately owned. The population of just over one million people is about 70% rural and 30% urban. The rural population resides mostly on Swazi Nation Land (SNL) which is governed by traditional leadership.

3.1.2 Traditional Leadership

The country is made up of *tinkhundla* (constituencies) formed by groupings of *imiphakatsi* (chiefdoms) which comprise *tigodzi* (communities). The chiefdoms are governed by chiefs.
At the chiefdom level, the head of local authority is the Chief (*Sikhulu*) who is assisted by the Headman (*Indvuna*) and the Chief's Runner (*Umgijimi*). The Chief is responsible for governing the land under the chiefdom. The Headman is the chairman of the Inner Council (*Bandlancane*) and the Community Police (*Emaphoyisa emmangu*). The Inner Council

comprises of long-time residents of the area (*Imisumpe*), relatives of the Chief, upstanding men and women of the community. The Inner Council is the administrative leadership of the community and their responsibilities include overseeing the development of the community; and the enforcement of traditional rules such as customary and common laws.

3.1.3 KaLanga Chiefdom

The study was conducted in the kaLanga chiefdom within the Siteki region. The study area is geographically positioned between 26°22' – 26°30' south and 31°48' – 32°04' east. The landscape is characterized by relatively undulating terrain with altitude ranging between 250 – 600m, with the Lubombo Mountains to the east. The Mlawula River is the main water body in the area, generating a moderate network of streams. Siteki is situated in the Lowveld and is generally semi-arid. The climate consists of hot and rainy summers occurring from October to January, as well as cold and dry winters from May to July. The temperatures vary from 17 to 27°C and rainfall ranging from 550 – 625mm annually.

The eastern region of the country is a savanna ecosystem and Siteki falls within the Eastern Lowveld and the Lubombo Range physiographic zones. The vegetation in this area consists of a combination of mixed savanna, acacia savanna and hillside bush (IDEC 2004). Siteki is located in the eastern region of Swaziland which forms part of the Maputaland Center of Plant Diversity, a global biodiversity hotspot that is characterized by plant endemism (Swaziland Environment Authority 2006). The Siteki region consists of areas such as Mahhuku which have been identified as one of the Protection Worthy Areas in Swaziland (Roques 2002) and is therefore a significant natural resource base hence its relevance to this study.

KaLanga is situated in the Lubombo district and falls under the Siteki constituency. The area is mainly communal land and is inhabited by rural people who survive largely through subsistence farming and harvesting natural resources such as forest products. The communities covered under the kaLanga chiefdom were Mahuku, Mvundlane / Maphatsindvuku, Matjeni (kaMzilikazi), Lukhula, Ngcamini (Matsetsa), Lugongolweni, Sitsatsaweni and kaLanga.

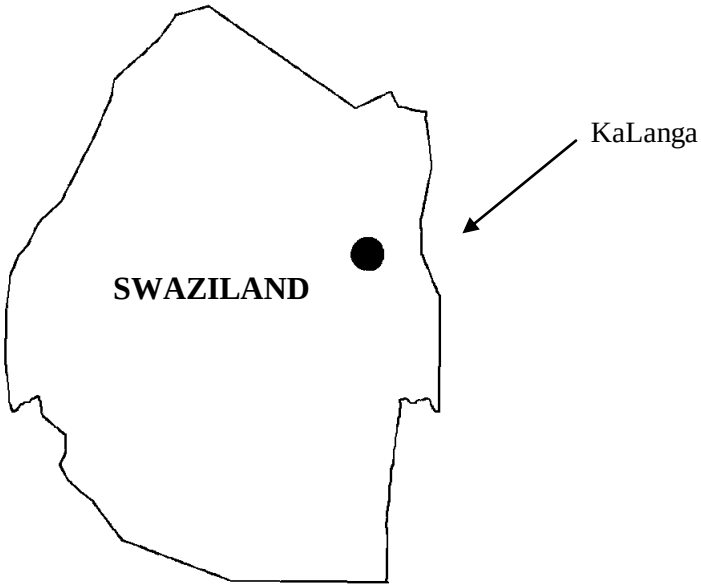


Figure 3.1 Location of KaLanga study area

3.2 Research Design

The study sought to gather information on indigenous knowledge that is used for the conservation and sustainable use of trees in rural communities. It was therefore deemed appropriate to use survey research to collect the data. The survey method used a combination of personal interviews and focus group discussions. The personal interviews were conducted at household level and with key informants, using semi-structured questionnaires. The focus group discussions were targeted at obtaining gender and age biased information, where in-depth discussion was expected to enrich the information solicited from the interviews.

3.3 Sampling

The population of the area is approximately 5916 comprising about 1176 households. The targeted sample size was 120 households, where one person was interviewed per household. Individuals were selected based on age and gender, whereby 60 males and 60 females where sampled across ages (a) 18 – 35 years, (b) 36 – 59 years and (c) 60 years and above. Interviews were done on a one-on-one basis because in addition to household resource use patterns, data at the individual level, particularly on indigenous knowledge, was required. The household data gave background context to individual-level results. The purpose of this

sampling frame was to explore how age and gender shaped individual knowledge and perceptions. Purposive sampling was used to identify the target sample. This approach allowed the researcher to capture those households which were able to provide the relevant information.

3.4 Data Collection

Field data were collected between June and October 2008 using semi-structured interviews (for household and key informants) and focus group discussions.

For the household survey, semi-structured questionnaire interviews were administered to 120 households in eight communities under the kaLanga chiefdom. Household selection was based on a visual assessment of the home and traditional Swazi homes (which are built from wood) were targeted because they were assumed to use tree products. Questionnaires were used to collect household socio-economic information, natural resource use and conservation data (Appendix A). Interviews were conducted on a one-on-one basis to ensure minimal interference from third parties.

Similarly the key informant interviews were also conducted using semi-structured interviews (Appendix B and C). Key informants interviewed were traditional leaders and traditional healers. The traditional leaders included members of the Inner Council of the kaLanga chiefdom. The traditional healers interviewed were those that are resident in the area.

For the focus group discussions, three groups were selected and interviewed (Appendix D and E). These groups included youth (both genders), elderly men and elderly women. These were designed to obtain the different views and attitudes of the groups with respect to the indigenous knowledge systems on tree conservation.

3.5 Data Analysis

Data gathered from the household interviews was prepared and coded for data entry into the computer. The data was coded and entered into Microsoft Excel and thereafter exported to a statistical package – SPSS (Statistical Package for Social Scientists). Data was analysed using both descriptive and inferential statistics.

Descriptive statistics generated included means and standard deviations from continuous data, and frequencies, percentages and cross-tabulations from categorical data. Continuous data was analyzed using the t-test and ANOVA to test inequality of means, together with a Tukey post hoc test to determine differing means. Chi-Square test was used for quantitative analysis of the categorical data. The test of independence was used to determine whether a relationship existed between categorical variables.

Chapter 4 – RESULTS

The data collected by the study is presented in three sections. The first section includes household survey data which is mostly quantitative and presents descriptive and inferential statistical illustrations. It starts with a socioeconomic profile of the study group, followed by resource use data, then a description of the indigenous knowledge systems used for tree conservation, and features of indigenous knowledge such as its application and transmission. Thereafter, a presentation of findings on the factors (age, gender and education) that influence indigenous knowledge, and lastly a view of the respondents' perception of tree custodians and the extent of tree felling in the area. The ensuing sections are a narrative description of information gathered from the key informant interviews and focus group discussions.

4.1 Household Survey Results

4.1.1 Socio-economic data

Household size ranged between 1 and 22 individuals, with an average of 7.6 people per household. These were permanent members of the household. This is fairly consistent with the 1997 census results which found the average number of people per household in rural areas to be 6.3, which is higher than that of urban areas at 3.6 (Central Statistical Office 1997b). Rural households are traditional and comprise an extended family hence the higher number of members.

Resident status was solicited in order to establish the respondents' familiarity and knowledge of the area with respect to the environment and resource use information. The majority of respondents interviewed were resident in the area by birth (61%), followed by those who had married into the area (22%) and the rest of the respondents (17%) were residents of the area due to other reasons, namely employment and through *kukhonta* (occurs on Swazi Nation Land when a Swazi family is apportioned land by the chief on which to settle, grow crops, plant trees and rear livestock). Distribution by gender revealed that none of the males were resident by marriage. There were equal numbers of females that had married into the area as those who had been born in the area. Males formed the majority of people who were residents by birth.

Education was another parameter that was sought as a socio-economic indicator. This information was solicited to depict the literacy levels of the respondents as well as the influence of formal education on the indigenous knowledge they possess on tree conservation. Many of the respondents, 40%, had only reached primary school level of education, whilst 24% had no formal education, 20% had secondary education, 13% had high school education and a mere 3% had attained tertiary level of education. Statistically, there was no relationship between gender and education (χ^2 = 8.940, p=0.063). However, there was a relationship between education and age (χ^2 = 29.119, p<0.001). The level of education decreased with age. The majority of people with a low level of formal education were of the older generation. All of the elderly people (60+ years) either had no formal education or had only attained primary school level education (Fig 4.1).

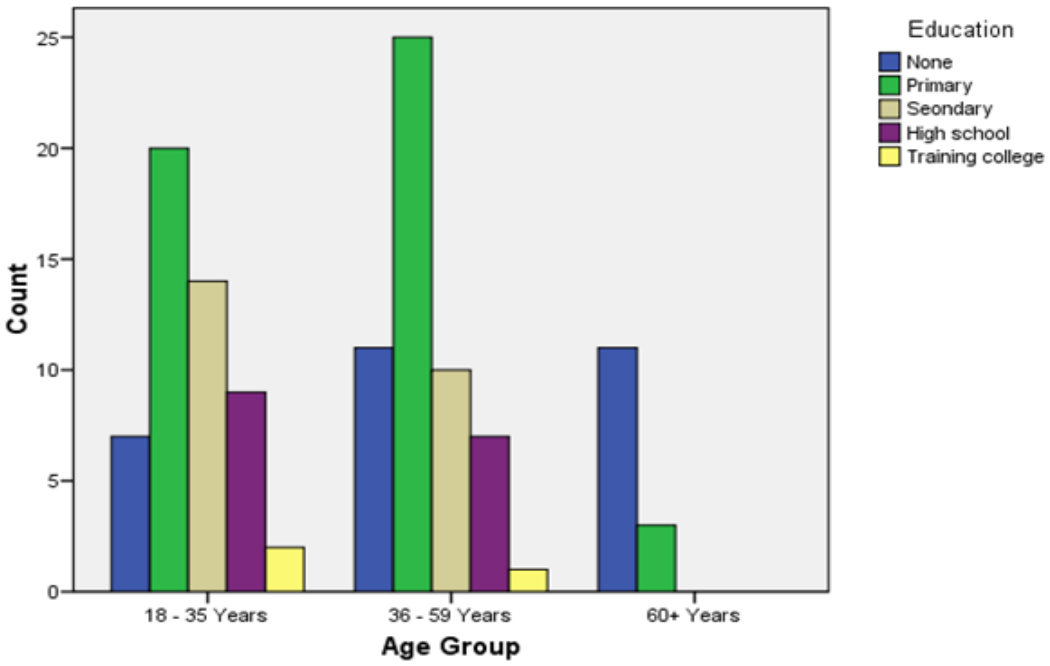


Figure 4.1 Level of education per age category

Livelihood strategies depicted how households sustain themselves. These strategies were not mutually exclusive as households often engaged in more than one. Subsistence farming was the predominant means of survival amongst the households interviewed (47%), followed by

informal trading (33%) and local wage income (30%). Commercial farming (13%), use of natural resources for income generation (3%) and migrant wage income (2%) were minor forms of livelihood strategies (Fig 4.2). The wealth status of households was determined by establishing ownership of certain household assets such as stoves, fridges, televisions, cars and livestock. The percentage of households that owned the specified assets were as follows: 51% owned goats, 44% owned TVs, 42% owned stoves, 42% owned cattle, 36% owned fridges and only 23% owned cars.

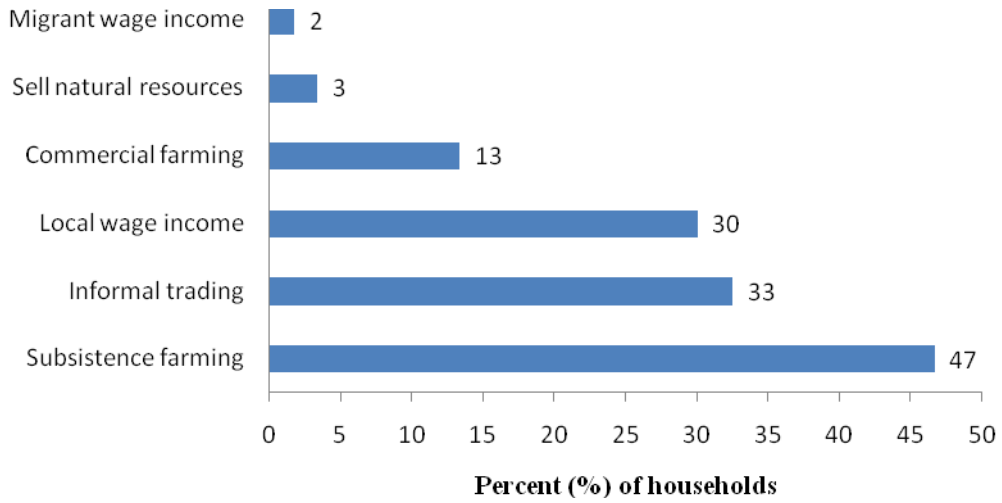


Figure 4.2 Frequencies for livelihood strategies of households

4.1.2 Resource use data

The major uses of trees listed by households were for firewood (98%), building fences (90%), building kraals (86%) and building houses (79%). Other uses of trees recorded were for medicinal products, fruits, handcrafts and for shade (Table 4.1). When respondents were asked to rate the importance of tree uses, the top four most important uses were firewood, poles for building, poles for fencing and fruit, respectively.

Table 4.1 Tree uses by households

Tree Use	Count	Percent (%) of households
Firewood	117	98
Building fences	108	90
Building kraals	103	86
Building houses	95	79
Medicinal products	53	44
Fruits	48	40
Shade	9	8
Handcrafts	7	6
Other	5	4

In terms of the tree resources actually collected by individual respondents interviewed, the main resource collected was firewood (73%) followed by poles for building (47%), poles for fencing (43%), fruits (39%), medicinal products (26%) and least of all handcrafts (1%) as shown in Table 4.2. Some of the respondents, particularly the elderly, indicated that they do not personally collect any resources because they are old but instead the children within the home would collect resources. Consequently, the investigation of tree parts harvested for the above uses demonstrated that branches and trunk were high on the list at 33% and 32% respectively. These were followed by fruits (15%), bark (10%), roots (7%) and leaves (3%). However, the data indicates that these resources collected are derived predominantly from deadwood (69%) than from felling live trees (31%).

Table 4.2 Tree resources collected by respondents

Tree Use	Count	Percent (%) of respondents
Firewood	87	73
Poles for building	56	47
Poles for fencing	51	43
Fruits	39	33
Medicinal products	31	26
Handcrafts	1	1

The tree resources collected by the households were mostly for consumptive and subsistence purposes, as demonstrated by 63% of the respondents that did not use tree resources for commercial or income generation purposes. Of those households that used tree products to generate income, firewood was found to be the predominantly traded resource (68%), followed by building poles (18%), fruits (18%), handcrafts (5%) and lastly medicinal products (2%).

4.1.3 Indigenous knowledge and management systems for tree conservation

Information was sought on harvesting practices and techniques, traditional rules and other measures that constituted indigenous management systems of trees in rural communal areas. Harvesting practices were basically guidelines that were followed in collecting tree products, whereas harvesting techniques were the specific ways in which tree parts were removed from the tree or gathered. There seemed to be an overlap in some instances whereby certain items would be listed as a practice and others would list them as a rule.

Respondents identified several harvesting practices which they claimed to follow when gathering tree resources. The most commonly mentioned practice by far was the use of only dry or deadwood as firewood. Harvesting practices and percent of respondents are listed below:

- use of only dry or deadwood as firewood (65%)
- use of 'strong' trees (e.g. *Newtonia hildebrandtii* and *Acacia nigrescens*) for building as long lasting material (12%)
- harvesting branches only from live trees (10%)
- spreading out harvesting to prevent clearing an area (8%)
- using live trees only for building purposes (5%)
- not felling specific trees (3%)
- only chopping down a tree that will be used for a purpose (3%).

There were also a number of harvesting techniques that the respondents said they use when collecting tree resources, and these are listed below together with the percent of respondents:

- when chopping a tree, it was cut above the base or close to the base to leave a stump for regeneration (34%)
- only the branches or extra trunks would be cut down (13%)

- tools used for chopping trees were a saw, axe or bushknife (16%)
- harvesting bark included cutting bark on one side of the tree (30%) and cutting it superficially i.e. not too close to the trunk (5%)
- ring bark harvesting was avoided (18%)
- roots were harvested on one side of the tree (4%)
- only secondary / lateral roots were harvested (13%)
- the area where roots had been dug up was covered again to prevent drying up of tree (4%)
- when collecting leaves, few leaves were taken from each tree thereby spreading out the harvesting and preventing overexploitation of one tree (2%).

Traditional rules are issued by the community leadership and are applicable to all residents of the chiefdom. Community police and members of the inner council of the chiefdom are responsible for enforcing these rules. Community members also monitor each other and report those who deviate from rules to the inner council. There was acknowledgement of traditional rules that exist within the chiefdom with regard to the use of trees in the area. Only 5% of respondents were not aware of any rules. The principal rule mentioned was that certain tree species were not to be felled. This rule is supported by the finding that a majority of respondents (94%) confirmed that there are protected tree species in the area. The main reasons given for this protection was that the trees were either fruit trees and thus provided food, or were used for royal purposes, or that it was just taboo to use these trees. Trees listed as not to be felled include indigenous fruit trees such as *Sclerocarya birrea (umganu), Berchemia zeyheri (umneyi), Vangueria infausta (umtulwa), Ximenia caffra (umthunduluka), Syzygium cordatum (umncozi), Ficus* spp. *(umkhiwa)*, and indigenous trees used for cultural functions such as *Bolusanthus speciosus (umhhohlo), Olea* spp. *(umncuma), Gymnosporia senegalensis (umncanco), Ziziphus mucronata (umlahlabantfu).* A summary of traditional rules identified is listed below together with the percent of respondents:

- certain trees were not to be felled (90%)
- permission was required from the chiefdom for felling live trees, if there was genuine need for live trees (21%)
- generally live trees were not to be felled (8%)
- there was to be no wastage of trees when harvesting (7%)

- excessive felling was prohibited (5%)
- only drywood was to be used as firewood (3%).

Some participants (48%) indicated that there did exist in the area some forests that were restricted from use for certain reasons. Most of these forests were royal burial grounds, or they contained some tree species which are used for sacred royal functions or they merely were areas where the King's animals were kept.

With regards to tree planting, a considerable number of respondents (67%) planted trees within their homesteads. The main reason for planting trees was for fruit, however, most fruit trees being planted were exotic species such as mango, pawpaw, avocado, peach and guava. Only 8% of respondents reported planting indigenous fruit trees. The main reasons mentioned for not planting trees were water scarcity and the area not being conducive (because of insufficient rainfall, excessive heat, rocky landscape and termites) for tree planting. Most people who planted trees used their own knowledge, very few were guided by extension officers. Some respondents mentioned that there were certain Non-Governmental Organizations (NGOs) that promoted the cultivation of trees by giving residents seedlings, but not much technical advice was offered.

4.1.4 Application of indigenous knowledge

Participants were asked whether indigenous conservation practices for sustainable use and conservation of trees were still applied in the area, and their responses are depicted in figure 4.3 below. The majority confirmed that traditional practices were still being applied by residents.

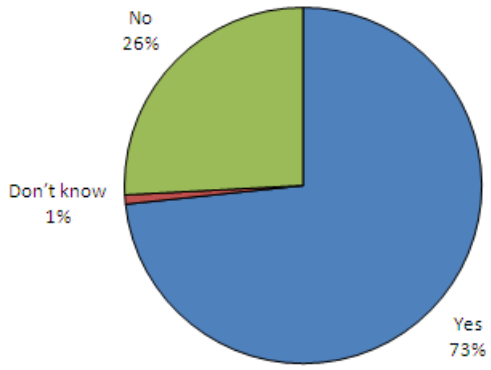


Figure 4.3 Perceived application of indigenous knowledge (percent of respondents)

There were reasons given to explain why indigenous conservation practices were still being applied. Residents followed traditional rules out of respect for the community leadership. Furthermore, people care about the environment and want to conserve trees from depletion. Conversely, disciplinary action is taken against those who break traditional rules. For those who said that indigenous knowledge was not being applied, their explanations were that residents lacked knowledge on tree conservation practices, people disregard the traditional rules and harvest anyhow, and some people use trees for income generation purposes.

4.1.5 Transmission of indigenous knowledge

Respondents were asked where they had acquired indigenous knowledge and their responses indicated that most of the knowledge was acquired from family members, predominantly parents and grandparents, followed by other relatives, community members and the traditional authority (Table 4.3).

Table 4.3 Source of indigenous knowledge acquisition

Variable	Count	Percent (%) of respondents
Mother	58	48
Father	53	44
Grandmother	53	44
Grandfather	39	33
Other relatives	28	23
Community members	28	23
Traditional authority	14	12
Other	10	8

The main mode of transmission of indigenous knowledge was verbal instruction from parents or elders, or practically from observation of parents and elders, and lastly through community meetings at the chief's kraal. An inquiry on whether indigenous knowledge was still being transmitted to younger generations revealed a resounding affirmation of intergenerational transmission (Fig 4.4). This observation is examined in more detail in later sections. Reasons given for intergenerational transmission no longer taking place included the following: modernization caused youth to not want to follow old traditional ways, there was a lack of people to teach youth traditional ways, and there was a lack of traditional mechanisms for knowledge transmission.

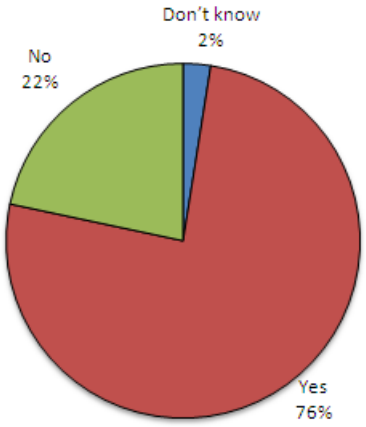


Figure 4.4 Occurrence of intergenerational transmission of indigenous knowledge

4.1.6 Indigenous knowledge and socio-economic status

The analysis of general patterns of indigenous knowledge presented above was followed by assessment of the influence of socioeconomic factors such as age, gender and education. Each of these factors was tested against the number of harvesting practices, harvesting techniques and traditional rules mentioned by a respondent, in order to determine whether a relationship exists between them. Age categories used for this test were 18 – 35, 36 – 59, 60+ years, and education classes included none, primary, secondary, high and training college.

The analysis showed no association between number of harvesting practices and techniques against age, gender and education (Table 4.4). Traditional rules showed no association between gender and education. However, a relationship was observed between traditional rules and age (Table 4.4). Figure 4.5 displays the number of traditional rules known by respondents per age group. The relationship indicates an increase in the number of rules known with age. Therefore the older people were more knowledgeable about traditional rules.

A comparison of the mean number of practices, techniques and traditional rules was also evaluated. The results only showed a significant difference of means for two variables. The mean number of traditional rules listed by respondents (Table 4.5) differed significantly between age categories ($p=0.00023$, $F=9.01$). A Tukey post hoc test indicated significant differences between all three means. The older age groups were therefore more knowledgeable about traditional rules as compared to the younger group. Specifically, the middle age group knew more because they had the highest average number of rules. Similarly, the mean number of recorded techniques (Table 4.6) differed significantly between education classes ($p=0.0345$, $F=2.69$). The Tukey post hoc test identified six pairs of means that differed significantly from each other. The knowledge of harvesting techniques was negatively correlated with educational level. The less educated people had more knowledge of harvesting techniques.

Table 4.4 Chi-square test ($p < 0.05$, in bold) of influence of socio-economic variables on knowledge of indigenous practices, techniques and rules.

Variable	Age		Gender		Education	
	χ^2	p-value	χ^2	p-value	χ^2	p-value
Harvesting practices	11.06	0.087	1.02	0.797	17.59	0.129
Harvesting techniques	9.75	0.638	9.42	0.151	23.90	0.468
Traditional rules	24.40	**0.002**	2.53	0.639	12.39	0.717

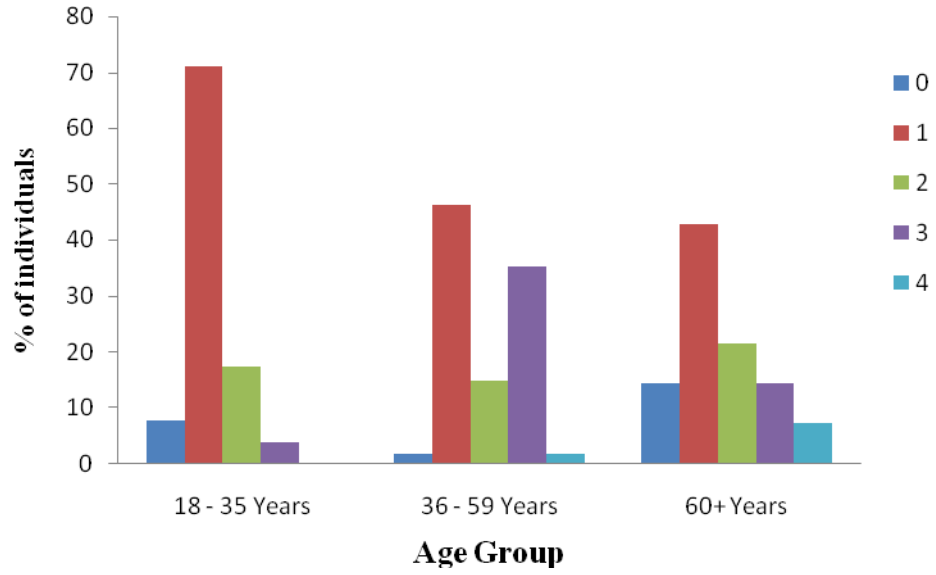


Figure 4.5 Number of traditional rules known per age group

(Note: colour categories represent the number of rules listed by respondents)

Table 4.5 Statistics for number of traditional rules per age category

Age category	Traditional rules	
	Mean	Standard deviation
18 – 35 years	1.17	0.62
36 – 59 years	1.89	0.98
60 + years	1.57	1.16

Table 4.6 Statistics for number of harvesting techniques per education category

Education category	Harvesting techniques	
	Mean	Standard deviation
None	2.172[a]	1.44
Primary	2.000[a,b]	1.56
Secondary	1.125[c,d]	1.12
High school	1.500[b,c]	1.51
Training college	0.667[d]	0.58

(Note: means not sharing superscript letters are significantly different)

4.1.7 Custodians of tree conservation

The perception of respondents on whom they believed to be custodians of tree conservation was investigated. Traditional leaders (53%) and men (46%) were viewed as the main custodians of tree conservation. This view is supported by the fact that most people (68%) perceived men and women to use tree resources differently. Women were seen as mostly collecting firewood, whilst men harvested poles for building and fencing and thus frequented the forests more often.

The rate of tree felling was assessed based on the opinions of the respondents. Most people (68%) did not think that trees in the area were being cut down at a fast rate. The main reasons associated with this view was that trees were being used in a responsible manner; people in the area were now leading a modern lifestyle and therefore had less requirement for tree resources; and that the area was still generally endowed with many trees. Those who thought that trees were being cut down a lot said that it was mainly due to people requiring trees for household needs and for income generation purposes.

4.2 Key Informant Interviews

Key informant interviews were designed to acquire specific information from those individuals deemed to have expert knowledge on certain aspects of the use and conservation of trees in the chiefdom. The key informants interviewed in this study were community leaders and traditional healers of the area. Community leaders were targeted as those individuals having more knowledge on the traditional governing of the environment in the area, with a higher familiarity of the traditional rules and harvesting practices used for tree conservation. Traditional healers were pursued as those individuals who use tree resources

frequently as part of their livelihood and trade, with a greater understanding on traditional harvesting techniques and practices that promote the conservation of trees.

4.2.1 Community leaders

The traditional leaders included members of the Chiefdom's Inner Council who are involved in the running of the area. The interviewees consisted of the Headman, Chief's runner and a member of the Inner Council.

The informants indicated that the custodian of nature in the area was the traditional authority by virtue of being the custodian of the land. The Chief being the "King's eye" (governs chiefdom on behalf of the King) is responsible for looking after nature in the area as well. Conservation of trees in the chiefdom is ensured through the Chief admonishing residents on the sustainable and judicious use of trees, and through traditional rules. Initially, certain trees known as the King's trees (tree species used for royal purposes) were protected by the chiefdom, but this has also spread to other trees that have some usefulness such as indigenous fruit trees. These trees are protected by traditional rules that forbid the felling of such trees and anyone found in breach of this rule is taken through disciplinary action at the chiefdom, which was usually in the form of a fine. Other rules include the requesting of permission from the chiefdom for chopping down trees, outsiders not being allowed to harvest in the area, and permission being required by outsiders for harvesting medicinal products from trees in the area.

Community police monitor the community to ensure that the rules are enforced and they report offenders to the chiefdom. Alternatively, community members also report offenders to the Chief's runner who brings the matter to the chiefdom. One of the respondents indicated that residents do abide by the traditional rules because they respect the chiefdom. The other respondents stated that residents did not follow these traditional rules either because the rules were not adequately enforced or because people need tree resources for income generation and therefore harvested frequently and indiscriminately.

The traditional rules are conveyed to the community through community meetings at the chief's kraal. Each community has a representative in the form of a Chief's runner (*umgijimi*) who communicates these rules to those people who did not make it to the

meetings, to ensure that everyone gets to hear about the rules. The traditional conservation practices listed by the informants included the following:

- Young trees not felled to allow natural propagation
- Harvest small parts from each tree to conserve
- Root – dig up and cut small portion needed and cover up exposed area to prevent drying of tree
- Bark is cut on one side instead of ringing bark
- Chop tree close to base for regeneration/resprouting/coppicing

There were some trees that were recognized as being taboo for household uses e.g. *Euclea* spp. *(incitamuzi)* because it causes destruction of the home by resulting in the disintegration of the family. Other trees were considered totems because they were not used by certain surnames, an example being *Gymnosporia senegalensis (umncanco)* which is not used by the Maziyas. One of the respondents mentioned that some trees like *Ximenia caffra (umthunduluka)* and *Vangueria infausta (umntulwa)* were not supposed to be used as firewood because they cause swollen testicles in males. Incidentally, both these species are indigenous fruit trees. *Spirostachys africana (umtfombotsi)* was also not to be used as firewood because it generates toxic smoke which results in the food cooked with it causing diarrhea to those who consume it.

The informants also confirmed the existence of sacred forests in the area. These forests occurred in the Matsetsa, Mangoleni, Mhlumeni and Sitsatsaweni areas. These forests were said to have certain trees that are used for sacred royal purposes or have medicinal plants used exclusively by the royal family.

4.2.2 Traditional healers

There were three traditional healers interviewed who were resident in the chiefdom. The respondents recognized the chiefdom as the custodian of nature in the area. They also confirmed that there were some rules set by the chiefdom pertaining to tree usage. These rules included the following:

- Certain trees, such as fruit trees, were not to be felled
- Permission is required from the chiefdom for felling trees

- Permission is required for harvesting firewood for selling because wet wood gets harvested

It was also noted by the respondents that people who failed to adhere to these rules were liable to punitive measures by the chiefdom such as being fined for the offense. There was an observation that people of the area generally follow the stipulated rules because these rules have been emphasized by the chiefdom and the residents respect rules laid down by the chiefdom. One respondent had an opposing view, noting that people do not adhere to the rules because they clear large tracts of land in order to build homes and other things, thus resulting in the loss of several medicinal trees.

Information gathered from the respondents revealed that tree parts used for medicinal purposes include bark, roots, leaves and occasionally fruit. When the respondents were asked on the frequency of collection of tree resources, they could not give a definite rate. One said that it was dependant on the client and the type of illness they had because sometimes the medicinal products at hand were not useful for that client's illness. The others said it was dependent on the tree and therefore seasonal in some cases, for example leaves can only be collected when the tree is blossoming. The respondents were asked about the harvesting techniques they use to collect these resources and these are listed below:

- Bark – only one piece is cut off from one side of the tree then another tree is used to harvest another piece. Bark is taken from the middle of tree trunk and the patch from which it is cut is smeared with soil to prevent drying up, or with leaves to prevent contamination.

- Roots – a small portion is dug up some distance away from the trunk. Only the secondary roots not the main root are harvested, and the dug up area is covered again.

- Leaves – only a few are collected from each tree. Leaves are collected at specific times for instance when the tree is blossoming and not collected in winter.

The respondents acquired their traditional knowledge from their ancestors during the apprenticeship / training for traditional healers *(ekutfwaseni)*, and one from his grandmother who was also a traditional healer / diviner.

4.3 Focus Group Discussions

Focus group discussions were carried out to obtain information on specific group knowledge and perceptions about the use and conservation of trees. There were three groups which comprised a youth group (mixed gender), an elderly group of men and an elderly group of women. The perception of the researcher was that elderly people were the custodians of indigenous knowledge and that gender produced different perspectives of knowledge. Indigenous knowledge held by youth was believed to be low and gender was not assumed to have an impact on it, hence the mixed group of youth. The youth group consisted of five people, the elderly male group had three people and five people comprised the group of elderly women.

4.3.1 Youth

The youth group mentioned that they mostly use tree products for domestic purposes such as collecting firewood, poles for fencing and medicinal products such as leaves for curing minor ailments. They also mentioned that they collect firewood for selling to generate income. The youth recognized that there are traditional harvesting practices and techniques and traditional rules that govern the sustainable use of tree resources. Traditional practices incorporated the following:

- Spread out harvesting of trees to prevent clearing an area
- Not harvesting small trees to allow them to grow and propagate
- Not starting a fire next to trees

Harvesting techniques, which were perceived as ways of harvesting more sustainably, included the following:

- Avoiding ring bark harvesting
- Cutting bark on one side of the tree
- Covering up area where root has been dug up

The group had unenthusiastic views about the traditional rules pertaining to trees. Their comment was that the rules only protected those trees from which something was to be gained, for instance *Sclerocarya birrea* because traditional brew is made from its fruits, other indigenous trees with no direct benefit were not protected. Furthermore, these rules from the

chiefdom were not stringent enough or enforced adequately to be effective. Another general comment from the group was that nature can not be destroyed because it is resilient and has the ability to regenerate, therefore people can not deplete trees when using them for the "right" reasons (i.e. household use). When chopping down indigenous trees, they resprout naturally as soon as the rains come and the felled area becomes dense with trees again.

The group's view on the traditional mechanisms by which indigenous knowledge is transmitted, was that the lifestyle of the area had changed and no longer permitted the transmission of knowledge from parents to children particularly because parents worked until late and had no time to spend with their children. Suggestions that were put forward to effectively transmit indigenous knowledge were through the formation of youth clubs that would teach a group of youth who would then teach other youngsters in the community. Furthermore the effective enforcement of traditional rules would make people refrain from overexploiting trees.

The influence of age, gender and education on indigenous knowledge was a view that was sought from the group. The groups' assessment was that age was directly correlated with indigenous knowledge, in that one gains more knowledge with age, as one observes things they become clearer with age. In terms of gender, indigenous knowledge was more inclined to males. This is because males are more exposed to nature because they are usually outside of the home, frequenting forests for hunting or for collecting medicinal products. Education was seen as contributing negatively to indigenous knowledge because it taught western ways instead of traditional ways.

4.3.2 Elderly men

The elderly men indicated that they mostly use trees for obtaining poles for building houses, fences and kraals and for obtaining medicinal products. They were also aware of traditional rules pertaining to the use of trees. These rules prohibit the felling of indigenous fruit trees and other trees used for royal functions in the area and were enforced by the Chief's runner and Headman who could fine residents in breach of these rules. Harvesting practices known to the group include cutting bark on one side of trunk and using small portions enough for personal use, avoiding ring bark harvesting, digging up small portions of root and covering up area dug up, and chopping down tree midway along trunk to allow regeneration of tree. According to the group these traditional practices are used very widely by people within the

community. The nature of the tree is also another factor that determines how one is to use it. The group mentioned that they had obtained knowledge on these practices from the chiefdom and parents, and also from observing and copying other elders in the community.

When asked how they transmit this knowledge to younger generations, they said that the youth does not want to listen to elders and they also do not attend community meetings. They also pointed out that the traditional mechanisms of indigenous knowledge transmission, such as *emasango*[1] and *emaguma* were no longer effective, and suggested that the youth should be taught indigenous knowledge at school with the rest of the knowledge they acquire from there. They indicated that traditional ways were now being lost due to formal and western education.

The group was asked about their views on how factors such as age, gender and education affect the prevalence of indigenous knowledge. With regards to age the group thought that the older generation was more knowledgeable about traditional ways and therefore had more indigenous knowledge. They believed men to be more knowledgeable about trees as they were more frequently outdoors than women, either harvesting poles or herding cattle. Education was seen as contributing to the loss of indigenous knowledge because it was opposed to traditional ways of living, therefore those who were more educated (particularly youth) had less indigenous knowledge than those who were not educated.

4.3.3 Elderly women

The women mostly use trees for obtaining firewood, medicinal products, fruit and for making traditional brew (Marula) and also sell Marula crushed seeds to the Swazi Indigenous Products (a company which makes cosmetic products from Marula). Harvesting practices were that they only use dry wood for firewood, collect branches from live trees as a way of pruning to preserve the tree, ring bark harvesting was not allowed, bark was to be cut from one side of the trunk, and digging only a small portion of roots and not all of the roots. The traditional rules they were aware of were that certain trees were protected from being cut down, particularly indigenous fruit trees (such as Marula) and other trees used for cultural

[1] *Emasango* and *emaguma* are areas within a Swazi homestead where traditional transmission of knowledge takes place. The males (father and sons) assembly at *emansango* and females (mother and daughters) at *emaguma*, and gender-specific indigenous knowledge is transmitted from parents/elders to children.

purposes. They also acknowledged that there were forests in the area that were restricted from harvesting.

The participants said they had acquired knowledge on these practices from traditional leaders and fellow community members and that generally these practices were widely followed by residents of the area. Then as parents, they transmitted knowledge to their children, since the youth do not attend community meeting at the chiefdom. However, they noted that the traditional means of knowledge transmission (*emasango* and *emaguma*) were no longer effective because of changes in lifestyle and modernization. They suggested that the youth should be taught on indigenous knowledge at school because they would be compelled to learn it since they would be tested on it in order to pass.

The views of the group were solicited on how they perceived age, gender and education to impact on indigenous knowledge. Age was seen as positively contributing to indigenous knowledge. This is because the older generation had more knowledge on traditional lifestyle than the youth. For gender, their opinion was that men tended to have more knowledge because they visited forests more often for chopping trees for building, etc and therefore would have amassed a lot of knowledge on trees. Education was perceived contributing negatively to indigenous knowledge because it was part of modernized life and therefore did not offer traditional ways or knowledge.

Chapter 5 – DISCUSSION AND CONCLUSION

5.1 Introduction

The aim of the study was to investigate the indigenous knowledge used to conserve trees in rural communities in Swaziland. In this endeavour the study documented the prevailing indigenous knowledge, explored the people's perceptions about the extent to which it is applied, assessed its social distribution among the community and intergenerational transmission. Indigenous knowledge was solicited from residents of varying age, gender and educational qualification. The better part of respondents were born and bred in the area and were therefore very familiar with the environment of the study area and thus served as reliable informants on the subject matter.

A dependency on tree resources by rural communities at KaLanga chiefdom was established by this study. Trees were used routinely for subsistence and to a lesser extent for income generation. There was a high reliance on trees for the provision of goods such as fuelwood, construction timber, food, medicinal products and carving materials. Firewood and construction timber ranked as the most important tree products used, as confirmed by branches and trunks being the most heavily harvested tree parts. There was evidence of community-enforced rules and practices of tree resource harvesting.

5.2 Indigenous Knowledge on the Use of Indigenous Trees

The indigenous knowledge systems used to promote tree conservation in rural communities of Swaziland included a combination of traditional rules, harvesting practices and techniques, existence of sacred / protected forests and to a lesser extent, tree planting.

Harvesting practices were essentially principles that guided the collection of tree resources by residents in the area. The most commonly reported harvesting practice was the use of drywood or deadwood as firewood. This is an important practice because firewood is a frequently harvested resource as it is used for cooking and heating, which are daily activities in the home. Thus, the use of deadwood for the most regularly harvested resource is a form of preserving live trees. Alternatively, the harvesting of branches from live trees was another conservation practice used by respondents. This practice of pruning promoted the growth of the tree all the while providing a resource for the user.

In rural areas the felling of live trees was only permissible for building purposes. Live trees could only be chopped down for obtaining poles for building, fencing and constructing kraals. This is an acceptable practice because harvesting for building is more of a once-off activity and therefore very infrequent. Fences and kraals are also built once, and may be repaired perhaps after two or three years, which is not so often, hence not many trees would be chopped down regularly for this purpose. Additionally, strong trees are chosen for building as these tend to be long lasting and will therefore not require regular repairs ultimately resulting in less trees being used. There were some species cited as strong trees used for building, namely *Newtonia hildebrandtii (umtfombotsi)* and *Acacia nigrescens (umkhaya)*. When harvesting tree resources for building, i.e. chopping down trees, harvesting is to be spread out to prevent clearing the area. The idea was to leave behind some sister species to those that had been harvested to allow propagation that would replace those that had been cut down. Trees were only to be cut down for a valid reason, and not just chopped haphazardly which constitutes wastage. There are specific tree species in the area that are prohibited from felling for functional and cultural reasons. The trees that are protected for functional reasons are indigenous fruit trees which are a source of food for people. Other trees have cultural relevance, for example, they may be used exclusively for building kraals at the Chief's compound or at the royal household.

Harvesting techniques encompassed specific methods by which tree resources were gathered. The respondents were also familiar with a number of techniques used for harvesting trees sustainably. The techniques related to the harvesting of tree parts such as bark, roots, leaves and chopping down tree trunks. These techniques are important in ensuring the survival of tree species and ultimately the sustainability of harvesting. The most important harvesting techniques are those of the tree parts that have a high (detrimental) impact on the growth or survival of the tree, which include the stem (trunk), roots and bark as indicated by Cunningham (2001). The community had relevant and sound techniques for harvesting these tree parts. Bark harvesting involved three main techniques. Firstly it was to be cut superficially, not too close to the trunk. Then it was only to be cut from one side of the trunk, and lastly ringing the bark was avoided because it is harmful to the tree. Bark is the most commonly used tree part for medicinal purposes. Root harvesting involved the preservation of the main root and only extracting the secondary roots. The exposed area where the root was dug up had to be covered again to prevent the drying up of tree. The cutting of the tree

stem was done in a way to leave a stump so as to enable regeneration or coppicing. However, data of the actual height and angle of the stump were not obtained because the study did not delve into that level of detail. Leaves were harvested sparingly from one tree and another was used to spread out the harvesting so as not to strip the tree of all the leaves which would have a negative effect on the tree. A point of note is that the most detrimental harvesting was for medicinal products which are derived from bark, roots and leaves; and for construction timber. What is worthy of note is that construction timber is not a frequently harvested resource because it is used for building and fencing. Furthermore, medicinal plant harvesting is also sporadic when done at the household level, the problem arises in the commercialization of medicinal plants which consequently has resulted in species such as *Warburgia salutaris* (the pepper-bark tree) being threatened.

Traditional rules also formed part of the customary practices of indigenous forest and woodland management. Local institutions are an integral part of traditional resource management regimes of communal resources as noted by Luoga *et al.* (2005). The traditional structures present in the chiefdom support customary conservation practices in play by providing mechanisms that enable monitoring, enforcing and sanctioning. Traditional rules are issued by the community leaders who are the custodians of nature on communal land. These findings were consistent with literature which showed that rules were used in southern Africa, for instance Zimbabwe and South Africa, for indigenous management of forests and woodlands within communal lands (Clarke 1994; McCullum 2000; Todd *et al.* 2004). The rules incorporated prudent harvesting practices and the protection of certain tree species. These protected species, which were prohibited from felling, include indigenous fruit trees such as *Sclerocarya birrea (umganu), Berchemia zeyheri (umneyi), Vangueria infausta (umtulwa), Ximenia caffra (umthunduluka), Syzygium cordatum (umncozi), Ficus* spp. *(umkhiwa)*, and indigenous trees used for cultural functions such as *Bolusanthus speciosus (umhhohlo), Olea* spp. *(umncuma), Gymnosporia senegalensis (umncanco), Ziziphus mucronata (umlahlabantfu).* Traditional rules were also responsible for protecting the integrity of sacred forests used as royal burial grounds or for other royal functions. The rules are enforced and monitored by the chiefdom through the chief's runners and community police, and residents found contravening them are reported to the chiefdom and sanctioned through fines. Although other studies have revealed that the decline in authority of local institutions (traditional authority) has rendered harvesting rules ineffective (Twine *et al.*

2003b; Kirkland *et al.* 2007), the advantage in Swaziland is that chiefs are still empowered to enforce sustainable use of forests and woodlands on their subjects. But appreciation of such management principles is the exception rather than the rule (DANCED 1997), which reveals an opportunity for reviving awareness of the importance of resource conservation at the chiefdom level.

Tree planting was a common practice with the respondents and this was mostly fruit trees. The practice of tree planting was a bit of a paradox. Although this was a good practice, the issue was that most of the trees reportedly planted were exotic species and therefore the agenda for planting trees was more for convenience rather than from a conservation perspective. Conversely, the respondents were aware of the value of planting a tree, such as preventing soil erosion which is of environmental significance. Even in other areas within Swaziland where trees were planted for fuelwood, exotic species like wattle and eucalyptus were used (Allen *et al.* 1988). There was no indication of woodlots within the study area.

5.3 Application of Indigenous Knowledge for Tree Conservation

The application of indigenous knowledge is inherently dependent on the structure and dynamics of institutions within the community (Berkes *et al.* 2000). As the implementation of contemporary conservation involves monitoring, enforcing and sanctioning mechanisms, so does traditional conservation (Colding & Folke 2001). Local institutions provide the foundation on which these mechanisms can operate within the community. The majority of respondents indicated that indigenous measures of tree conservation were reportedly in use throughout the community. These were in the form of sound harvesting practices and techniques, traditional rules and existence of sacred forests.

The enforcement and sanctioning mechanisms were drivers for promoting the application of indigenous knowledge for tree conservation, and these mechanisms were carried out through the traditional structures within the community. Corrective or punitive measures were put into play if one went against the norm. These sanctions came in the form of fines either monetary or payment of cattle. This is consistent with the social controls used to handle deviance and ensure compliance with social norms as described in literature (Ruddle 1993, Colding & Folke 2001). The traditional leadership has to be empowered with the capacity to regulate and enforce sustainable resource use practices. Fortunately, this is the case on Swazi Nation Land where chiefs have the authority to decide on land and resource use for their

subjects. Although sustainable resource use principles exist at the community leadership level, their execution is partly lacking.

The issues that seemed to hinder the application of indigenous knowledge for tree conservation were a need to generate income from tree resources. In such cases where people made money by trading tree resources, they usually did not abide by prudent practices and were instead driven by demand for these resources, as also seen in other locations such as South Africa (Twine *et al.* 2003b; Kirkland *et al.* 2007). This often resulted in indiscriminate harvesting including the harvesting of protected tree species and live trees without permission. A possible solution to this problem would be to restrict the commercialization of tree resources on communal land.

There is a need for future research to test the reported perceptions of the application of the indigenous knowledge systems for tree conservation. Methods such as surveying tree species harvested versus those not harvested to verify the protection of cited species would be necessary. In addition, checking features such as stump height and diameter, tree size classes and bark of harvested trees could determine whether the reported practices and techniques are in fact the dominant ones in reality.

5.4 Indigenous Knowledge and Socio-economic Status

The literature showed that indigenous knowledge was socially distributed according to certain factors such as age, gender, education and social class, (Simpson 1997; Luoga *et al.* 2000a; Ruddle 2000). Therefore, it was crucial to examine the factors that impact on its distribution and variation amongst the community. This assessment aids in identifying the local experts or those who possess the most knowledge in relation to customary tree conservation, which is highlighted by Davis and Wagner (2003) as a critical feature in the researching of indigenous knowledge. Age, gender and education were the socioeconomic features assessed in this study.

Age showed a relationship with traditional rules, as indicated by the chi-squared and ANOVA tests. There was more knowledge of rules as age increased. Traditional rules are set and issued by the community leadership at the chiefdom. These rules are conveyed to residents at the community meetings held at the chiefdom. The meetings are attended by adult residents of the chiefdom. Children (under 18 years of age) are not permitted to attend

these meetings. Parents relate the relevant information to their children where necessary. Youth generally do not attend community meetings even if they qualify to because of two main reasons. Firstly, they have a negative perception of traditional authority and secondly, they view community meetings as an activity for 'old' people. The contributing factors to why adults tend to have more knowledge on rules than youth could be due to adults taking more interest in attending the community meetings. Moreover, as noted by the youth in the FGDs, knowledge is accumulated by experience. Therefore, higher levels of knowledge exhibited by the elderly may also be a result of a lifetime of amassed knowledge. The youth may indeed accumulate more knowledge overtime as they get older. As a result there is need for more research on the relative importance of inter-generational transmission of knowledge versus accumulation by experience.

There was an observed difference in the use of tree resources by gender. Firewood was mostly collected by females than males. The gathering of medicinal products, poles for fencing and building was dominated by males. Respondents largely agreed with this view of segregation on resource use by gender. This observation stems from the customary distribution of chores between sexes within the home. However, there was no influence of gender on the indigenous knowledge held by respondents. Harvesting practices, techniques and rules showed no association with gender.

Education proved to have a relationship with harvesting techniques. This was demonstrated by the ANOVA test which showed differences between the means of harvesting techniques within education categories. The respondents with less education knew more harvesting techniques than those with higher levels of education. This could possibly be due to that less educated people are more reliant on woodland resources in their livelihoods and therefore spend more time collecting tree resources than those who are more educated. Higher levels of education are usually associated with higher levels of wealth, and therefore lower reliance on natural resources in their livelihoods.

5.5 Intergenerational Transmission of Indigenous Knowledge

Indigenous knowledge relating to the conservation and sustainable use of trees was mostly acquired from parents and grandparents, which is consistent with the vertical parent-to-child transmission observed in other studies (Hewlett & Cavalli-Sforza 1986; Ohmagari & Berkes 1997). Grandparents also played a big role in indigenous knowledge transmission because of

the extended family scenario typical of the traditional Swazi family. Grandparents form part of the family unit and tend to be looked up to for wisdom because they are perceived as the main reservoirs of knowledge and therefore are quite involved in teaching the young traditional and cultural ways. The mechanisms of intergenerational transmission of knowledge are embedded in social systems (Berkes *et al.* 2000) which is the case for Swazi society.

In the traditional Swazi home, knowledge transfer was gender-specific, in that boys were taught by men (be it father or grandfather) and the girls were taught by women, usually mothers or grandmothers. This practice is consistent with studies by Hewlett and Cavalli-Sforza (1986) and Ohmagari and Berkes (1997). Knowledge transmission tended to be informal, taking place in a relaxed atmosphere where parents and children would have casual discussions. There are specific areas within the homestead where these respective groups would gather to have their discussions. *Liguma* is an enclave of thatched wall that serves as a windscreen located near the cooking area, and this is where mother and daughters would assembly. The mother would teach her daughters on life skills, how to conduct themselves and life in general. *Lisango* is the area next to the gate near the kraals, where father and sons would get together and have their manly discussions. In this manner, parents would pass on knowledge to their children.

The main mode of indigenous knowledge transmission was oral through verbal instruction and also practical through observation of parents and elders when harvesting tree resources. Some indigenous knowledge was acquired from the chiefdom as it was seen as the source of traditional customs in the area. Rules were conveyed by verbal instruction to residents during the community meetings. Children younger than the age of 18 years are not allowed to attend community meetings at the chiefdom, therefore whatever information is given at these meetings they could only get from their parents.

The traditional mechanisms for the transmission of indigenous knowledge are fading due to the invasion of modern lifestyle and formal education (Ruddle 2000). Children now go to school and when they get back home, they do their chores then their homework and have to go to sleep. Parents also go to work and when they get home, there no longer is the time for sitting down to counsel children on life. Another issue was that the younger generation was questioning traditional ways and was no longer interested in listening to elders, a similar

observation noted by Redford and Stearman (1993). Suggestions on alternative means of transmitting indigenous knowledge pinpointed schools as a means for passing on this knowledge. This is a popular observation as other studies have also noted that indigenous knowledge should be introduced to schools (Ruddle 2000; Natarajan 2002).

5.6 Conclusion

The study established that indigenous knowledge used for the sustainable use and conservation of trees was prevalent in the rural communities of kaLanga. However, modernization and commercialization were threatening its application and transmission within the community. The hope of preserving this precious cultural resource is through its introduction to school curricula. In this way children could be assured of learning about their cultural and traditional heritage.

Since the traditional leadership governs land use on Swazi Nation Land and there is prevailing indigenous knowledge for the conservation of trees, this can form the foundation of sustainable indigenous forest management using a participatory approach that can be harmonized with contemporary management systems to form effective community-based natural resource management. Swaziland is fortunate in that the community-based institutional structure on Swazi Nation Land that is still in place might turn out to be a strong foundation for sustainable community management of forest and other natural resources (DANCED 2000b).

Natural resources on communal land provide a source of livelihood for rural communities. Since the people living on communal land require the resources inherent to the land, there needs to be a balance of resource use and protection of the resource. Community-Based Natural Resource Management (CBNRM) has been a strategy that has been deemed appropriate for managing common property resources. This strategy can be effective when the community involved uses management principles that are familiar and which have been proven to work. This is where indigenous knowledge can play a significant role as a component that can be blended with modern management strategies. Before that happens however, as noted by Ruddle (2000), indigenous knowledge must first be systematically collected and organized, and then evaluated and scientifically verified. This is why further studies are required, that will provide an in-depth analysis of the existing indigenous

knowledge and means by which it can be incorporated with science-based management approaches.

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APPENDICES

APPENDIX A

INTERVIEW SCHEDULE

HOUSEHOLD DETAILS

Date..... Household #.....

Family name…… Household size.....

SECTION A – BACKGROUND INFORMATION

1. Relationship to household head……

2. Gender: Female [ ] Male [ ]

3. Age: ……

4. Are you a resident in this area by:

(a) birth [ ]
(b) marriage [ ]
(c) other [ ]…… no. of years in the area……

5. Highest education attained:

(a) none [ ]
(b) primary [ ]……..
(c) secondary [ ]……..
(d) high school [ ]……..
(e) training college [ ]……..
(f) tertiary [ ]……..

6. What are the livelihood strategies for the household?

(a) farming: subsistence [ ] commercial [ ]
(b) wage income: local [ ] migrant [ ]
(c) informal trading [ ]
(d) use natural resources [ ]
(e) other (specify).....

7. What assets does the household have (and quantity of each)?

(a) Stove	[ ]	no.	[ ]
(b) Fridge	[ ]	no.	[ ]
(c) TV	[ ]	no.	[ ]
(d) Car	[ ]	no.	[ ]
(e) Cattle	[ ]	no.	[ ]
(f) Goats	[ ]	no.	[ ]

SECTION B – KNOWLEDGE OF TREE CONSERVATION

8. What do you use trees/tree resources for in this household?

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9. Please rate by order of importance the uses to which your household puts trees?

(a) firewood	[ ]	(b) poles for building	[ ]
(c) poles for fencing	[ ]	(d) fruits	[ ]
(e) medicinal products	[ ]	(f) handcrafts	[ ]
(g) other (specify)	[ ]		

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.....

10. Which of the above resources that you collect are used for income generation?

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.....

11. Which of the following tree resources do you personally collect for your household?

(a) firewood	[ ]	(b) fruits	[ ]
(c) poles for fencing	[ ]	(d) poles for building	[ ]
(e) medicinal products	[ ]	(f) handcrafts	[ ]
(g) other (specify)	[ ]		

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.....

12. Which part of the tree do you harvest for this purpose?

(a) branches	[ ]	(b) trunk	[ ]
(c) leaves	[ ]	(d) roots	[ ]
(e) fruits	[ ]	(f) bark	[ ]
(g) other	[ ]……		

13. How do you harvest/collect these resources?

(a) Cut down the tree [ ]
(b) Use dead wood [ ]
(c) Other (specify) [ ]

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14. What guidelines or practices do you follow when collecting tree resources?
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15. What harvesting techniques are traditionally used for the conserving trees?
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16. What are the rules pertaining to access of trees in communal forests and woodlands?

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17. Are there any specific tree species in the area that are protected from harvesting?

Yes [ ] Give names No [ ]

……
……
……

17. (a) Why are they protected?

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……
……

17. (b) How are they protected?

Prohibited by chiefs [ ]

Taboo to fell them [ ]

Part of a sacred area [ ]

Other (specify) [ ]

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……

18. Are there any areas or tree species within the communal forests and woodlands that are considered sacred or are restricted from use for religious beliefs?

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19. Do you know of any indigenous tree species that are rare in the area?

Yes [ ] No [ ]

How are these species protected from use?

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20. Are these practices being followed by most people in the community?

Yes [ ] No [ ]

If yes, why is it the case?

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……
……

If no, why is it the case?

……
……
……

21. How did you acquire knowledge to protect and conserve trees?

(a) From mother [ ]
(b) From father [ ]
(c) From grandmother [ ]
(d) From grandfather [ ]
(e) From other relatives [ ]
(f) From community members [ ]
(g) From school [ ]
(h) Radio or TV [ ]
(i) Other [ ]

22. How was this knowledge passed onto you by the above?

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……..

23. Is this knowledge still being passed onto younger generations within the community?

Yes [ ] No [ ]

If no, why is it the case?

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……..

24. Do you cultivate any trees?

Yes [ ] No [ ]

State reason below

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24. (a) If yes, where do you cultivate these trees?

Within the homestead [ ]

Within the community [ ]

Other [ ]

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25. What guides people on how to cultivate trees from which they obtain products?

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26. Do men and women use tree resources differently?

Yes [ ] No [ ]

If yes, explain.

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……...

27. Who do you think is/are the custodians of tree conservation in this community?

(a) Women [ ]

(b) Men [ ]

(c) Traditional healers [ ]

(d) Traditional leaders [ ]

(e) Youth [ ]

Why do you think they are the custodians?

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28. Do you think that trees are being cut down at a fast rate?

Yes [ ] No [ ]

Please explain your response above.

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29. Do you have any opinions/ideas on how indigenous knowledge can be better transmitted and used for conserving trees?

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30. Is there anything you would like to add on this topic?

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APPENDIX B

KEY INFORMANT: **TRADITIONAL LEADER**

Name: ……

Position: …….. Date: ……

1. Who is responsible for / is the custodian of nature that occurs in this chiefdom?

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   a. Why are they the custodians?

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   b. What is their role as custodians?

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2. How does the community leadership ensure the conservation of trees in this chiefdom?

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3. Where does the chief get information/guidance on how trees are to be conserved in this area?

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4. What are the rules pertaining to the use of trees in this chiefdom?

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5. How are these rules conveyed to the community?

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   a. How does the chiefdom ensure that all members of the community get to hear about these rules?

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6. How are these rules enforced?

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7. What is the penalty of not abiding by these rules?

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   a. Why is there such a penalty?
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8. Do people follow these rules?

   Yes [ ] No [ ] Elaborate on response.

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9. Are there any traditional conservation practices or methods by which trees are harvested in this chiefdom?

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a. Where and how do people in the community acquire knowledge on traditional practices and harvesting techniques that promote the conservation of trees?

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b. How is this knowledge passed on to younger generations?

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10. Are there any forests that are not used because they are sacred or are used for traditional religious purposes?

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11. Which trees are considered taboo for household use?

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a. Why are they considered taboo?

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12. Is there any other information that you would like to share about the conservation of trees in this chiefdom?

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APPENDIX C

KEY INFORMANT: **TRADITIONAL HEALER**

Name: …….. Date: ……

1. Who is responsible for / is the custodian of nature that occurs in this chiefdom?

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1a. Why are they the custodians?

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1b. What is their role as custodians?

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2. What are the rules pertaining to the use of trees in this chiefdom?

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3. How are these rules conveyed to the community?

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3a. How does the chiefdom ensure that all members of the community get to hear about these rules?

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4. How are these rules enforced?

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5. What is the penalty of not abiding by these rules?

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5a. Why is there such a penalty?

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6. Do people follow these rules?

   Yes [ ] No [ ] Elaborate on response.

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13. Are there any traditional conservation practices or methods by which trees are harvested in this chiefdom?

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    a. Where and how do people in the community acquire knowledge on harvesting techniques that promote the conservation of trees?

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    b. How is this knowledge passed on to younger generations?

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8. Are there any forests that are not used because they are sacred or are used for traditional religious purposes?

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9. Which parts of the tree do you use for medicinal purposes?

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10. How often do you collect or harvest these tree resources?

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11. How do you harvest the following?

Bark:

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Roots:

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Leaves:

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Fruit:

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Branches:

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Trunk:

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12. Which traditional practices promote the regeneration of trees after use? (need to probe)

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13. How did you acquire this knowledge?

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14. Are there any trees that are not used for medicinal purposes because they are considered taboo?

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14a. Why are they considered taboo?

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15. Is there any other information that you would like to share about the conservation of trees in this chiefdom?

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APPENDIX D

FOCUS GROUP DISCUSSION GUIDE

(YOUTH)

1. What is your (group) role in the collection and use of tree resources in the community?

2. What type of indigenous knowledge or traditional practices exists that promote the protection and conservation of trees in this community? (Religious beliefs, taboos, social controls, tribal laws, etc?)

3. How widely are these practices/indigenous knowledge applied within the community?

4. What contributes to the levels of application of this indigenous knowledge?

5. How do you (group) get to acquire this indigenous knowledge?

6. Do you think that the traditional mechanisms by which indigenous knowledge is passed on to younger generations are still valid and effective?

7. By what other mechanisms can indigenous knowledge be effectively transmitted to younger generations?

8. Do you think that age, gender or education is a factor that determines the levels of indigenous knowledge an individual will possess?

   What other factor could contribute?

APPENDIX E

FOCUS GROUP DISCUSSION GUIDE

(ELDERLY)

1. What is your (group) role in the collection and use of tree resources in the community?

2. What type of indigenous knowledge or traditional practices exists that promote the protection and conservation of trees in this community? (Religious beliefs, taboos, social controls, tribal laws, etc?)

3. How widely are these practices/indigenous knowledge applied within the community?

4. What contributes to the levels of application of this indigenous knowledge?

5. How did you (group) acquire this indigenous knowledge?

6. How do you pass on indigenous knowledge to younger generations?

   Is it an effective method of transmission?

7. By what other mechanisms can indigenous knowledge be effectively transmitted to younger generations?

8. Do you think that age, gender or education is a factor that determines the levels of indigenous knowledge an individual will possess?

   What other factor could contribute?