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THE SALIENT TRADITIONAL MEDICINAL PLANTS AND CONSERVATION STRATEGIES OF THE LOITA MAASAI OF KENYA

Jedidah Nankaya
Clemson University, jsjedidah@gmail.com

THE SALIENT TRADITIONAL MEDICINAL PLANTS AND CONSERVATION STRATEGIES OF THE LOITA MAASAI OF KENYA

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by
Jedidah Simantoi Nankaya
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Accepted by:
Dr. Patricia A. Layton, Committee Chair
Dr. Karen C. Hall
Dr. Elizabeth D. Baldwin

ABSTRACT

Approximately 80% of the rural population in developing countries relies on traditional medicinal plants for their health care needs. As a result, people have developed their knowledge of these traditional medicines through their experiences and daily observations. In the Maasai community, this information is deeply rooted in their culture, transferred from one generation to the next orally and along gender lines.

This study explored the traditional medicinal plants used by the Loita Maasai to treat human health problems with the aim of identifying the salient medicinal plants of the Loita Maasai and their uses (Chapter 2). In addition, due to their dependence on the environment, the Maasai have developed traditional mechanisms to protect these plants. To investigate these strategies, this study documented the traditional conservation methods used by the Loita Maasai to protect their medicinal plants (Chapter 3). The data was collected through face-to-face freelisting interviews of 31 women and men from the three villages in Loita of Ilkerin, Inkopon and Entasekera, identified through purposive sampling and snowball sampling and analyzed using ANTHROPAC software and thematic analysis for qualitative data.

Orkonyil (*Rhamnus prinoides),* Oleparmunyo (*Toddalia asiatica),* Olkiloriti (*Acacia nilotica*), Olamuriaki (*Carissa edulis),* Olngonguenyi (*Acacia kirkii),* Olmisigiyioi (*Rhus natalensis),* Olperelengo, Oloirien (*Olea europaea),* and Osokonoi (*Warburgia salutaris)* were identified as the most salient plants, with some reported to have more than one medicinal use. In addition, the results revealed three primary traditional conservation

strategies used in the study area to protect medicinal plants. Sustainable harvesting is a technique used to harvest these plants without damaging them to ensure their availability in the future. Second, the monitoring of these plants is seen as the collective responsibility of all the members of the community, meaning that everyone is responsible for protecting them. Third, a community structure is in place for resource management; the Council of Elders, composed of members elected by the community, is tasked with overseeing the management of natural resources in the study area.

DEDICATION

This manuscript is dedicated to my mother, Joyce Nankaya, whose love and inspiration continue to strengthen me to achieve my desired goal in life.

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CHAPTER1. INTRODUCTION

The cultural knowledge of traditional medicinal plants, their uses and the indigenous conservation strategies of the Loita Maasai are not well documented (Ole-Miaron, 2003). As the elders die, the wealth of this tradition, including their general traditional ecological knowledge, is in danger of being lost if it is not recorded and passed on. For this reason, there is an urgent need to identify and document the salient medicinal plants, and their uses. Additionally, there is an urgent need to explore the local traditional conservation strategies put in place to protect the medicinal plants to ensure that this cultural knowledge remains part of the society even after its elder members are gone.

Despite the demand for traditional medicine and the fact that traditional ecological knowledge of natural resource management can contribute to biodiversity conservation (Berkes et al., 2000; Folke et al., 1998; Gadgil et al., 1993; Pierptti & Wildcat, 2000; Turner et al., 2000), little research has been conducted in this area, particularly on the identification of the salient traditional medicinal plants, their uses, and the traditional conservation strategies used to protect them in Loita. In addition, and perhaps more importantly, there has been resistance to the introduction of conservation methods that do not align with traditional knowledge and traditional conservation strategies. Therefore, for conservation projects and programs to be successful, these strategies based on traditional ecological knowledge need to be understood and incorporated into contemporary conservation practices (Berkes & Turner 2006).

To address these issues, this study documents the culturally salient medicinal plants used by the Loita Maasai of Kenya, including their uses and scientific names if

known. In addition, it explores the traditional conservation strategies used by the Loita Maasai to protect their medicinal plants. The findings of this study, obtained from interviews, can offer valuable information on the management of these plants and of other natural resources as indigenous communities such as the Maasai have a significant amount of such knowledge accrued from observation and experience. The loss of this knowledge would be a detriment to society as much can be learned from such indigenous sustainable management of natural resources (Turner et al., 2000)

In addition, the documentation provided by this research is also important in sustaining the Maasai culture of traditional medicinal plant use and the conservation of these salient medicinal plants, which are under collection pressure from the local community members. The documentation of these plants is an important step as it helps in the prioritization of their conservation for sustainability purposes, both for the current and future generations. Furthermore, the identification of the salient medicinal plants and their traditional conservation strategies will ensure this important cultural knowledge is not lost.

To document the medicinal plants and their conservation strategies, face-to face freelisting interviews were used for data collection. The data were analyzed using ANTHROPAC software and thematic analysis for qualitative data. To identify the salient medicinal plants, two methods, frequency and Smith's S, were used.

Using the two methods, nine plants were identified to be the most salient in the study area they include, Orkonyil (*Rhamnus prinoides),* Oleparmunyo (*Toddalia asiatica),* Olkiloriti (*Acacia nilotica*), Olamuriaki (*Carissa edulis),* Olngonguenyi

(*Acacia kirkii),* Olmisigiyioi (*Rhus natalensis),* Olperelengo , Oloirien (*Olea europaea*, Osokonoi (*Warburgia salutaris).*

Additionally, three major conservation strategies used to protect the medicinal plants in the study were identified. They include; (1) sustainable harvesting, a technique used to harvest the medicinal plant in the study area without damaging the plants. It involves harvesting with respecting negative impacts to ensure the plants can be harvested from again in the future, (2) a collective responsibility by all the members of the community, where everyone is responsible to protect the medicinal plants in the study area, and (3) a community structure is in place for resource management; the Council of Elders, composed of members elected by the community, is tasked with overseeing the management of natural resources in the study area.

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CHAPTER 2. THE SALIENT TRADITIONAL MEDICINAL PLANTS OF THE LOITA MAASAI, KENYA

ABSTRACT

Traditional medicinal plants are used by a majority of the population in Africa, including the Maasai of Kenya. It is through their experiences and daily observations that these indigenous people have developed their knowledge of these traditional medicinal plants, information that is transferred from one generation to the next orally and along gender lines. Thus, the use of these plants is deeply rooted in their culture, forming an integral part of their lives. These plants, however, are currently under environmental pressure that could lead to their extinction, and therefore, the loss of this cultural knowledge.

This study explored the traditional medicinal plants used by the Loita Maasai to treat human health problems with the aim of identifying the salient medicinal plants of the Loita Maasai and their uses. The participants in this research included 31 women and men 18 years or older from the three villages in Loita of Ilkerin, Inkopon and Entasekera identified through purposive sampling and snowball sampling. The data were collected using face-to-face freelisting interviews and analyzed using ANTHROPAC 4.983 software.

The results suggest that the Loita Maasai have an extensive cultural knowledge of their medicinal plants. Of the 70 species plants freelisted, 9 -- Orkonyil (*Rhamnus prinoides),* Oleparmunyo (*Toddalia asiatica),* Olkiloriti (*Acacia nilotica*), Olamuriaki (*Carissa edulis),* Olngonguenyi (*Acacia kirkii),* Olmisigiyioi (*Rhus natalensis),* Olperelengo,

Oloirien (*Olea europaea),* Osokonoi (*Warburgia salutaris),* were identified to be the most salient. Some of the salient plants identified were reported to have more than one medicinal use; for example, *Warburgia salutaris* is used to treat four (4) human health problems in the study area, specifically the cleansing of the uterus after birth, aiding in healing after delivery, and the treatment of the common cold and stomach pains.

INTRODUCTION AND LITERATURE REVIEW

Medicinal plants play an important role in human survival. According to Kala (2000), approximately 3 billion people in the developing world depend on medicinal plants for their health care needs, and forms an integral part of life (Bussmann, 2006). For example, it is estimated that 80% of the population in Africa depends on traditional medicinal plants for their primary health care needs (WHO, 2010; Marshall, 1998). This percentage is even higher in Kenya, where almost 90% of the rural population depends on traditional medicinal plants for health problems (Njoronge et al., 2010; Bussmann, 2006). For the Maasai, the use of medicinal plants is deeply rooted in the culture, providing an avenue through which their heritage is preserved and respected (Kiringe, 2006). It is through their experiences and daily observations that the Maasai have developed their knowledge of the medicinal value of plants, information that is transferred from one generation to the next orally and along gender lines. Girls acquire this knowledge from their mothers and grandmothers while boys acquire it from their fathers as they look after livestock in the fields (Maundu et al., 2001). This ecological knowledge of the Maasai obtained from their close relationship with nature emphasizes the history of their dependence on the surrounding environment for survival.

Unfortunately, however, reports indicate that these medicinal plants face the threat of extinction (Hamilton, 2009), most likely as a result of human interference on the environment in various ways. For instance, overharvesting may potentially result in the loss of the existing populations (Kiringe, 2005), and modernization, specifically cultural adoption, threatens the cultural knowledge of indigenous societies. Other factors affecting this knowledge include the time spent in school by children acquiring a formal education and an aging population of elders as well as urbanization (Sindiga, 1995; Kiringe, 2005; Akerele et al., 1991). To address the issue of this loss of critical cultural and practical knowledge, the goal of this study is to document the salient traditional medicinal plants of the Loita Maasai and their uses.

Definition of salience

For the purposes of this research, salience is defined as "a measure of how much knowledge informants share and how important that knowledge is to them" (de Munck, 1998), its score being produced by rank and frequency (Quinlan, 2005). Specifically for this study, it is defined as the culturally important medicinal plants and their uses shared by the community members, identified from their freelists, using frequency and Smith's S.

Study objectives

The objectives of this study are listed below:

1. To identify culturally salient medicinal plants used by the Loita Maasai of Kenya
2. To list the salient medicinal plants identified in Maasai and by scientific name if known
3. To list the uses of the salient medicinal plants identified

The Maasai history and lifestyle

The Maasai are predominantly nomadic pastoralists who occupy the southern part of Kenya. Their ancestors came through Ethiopia and Sudan before settling in East Africa (Hughes, 2006), occupying the Rift Valley savanna plains from Lake Turkana in northern Kenya to the Maasai steppe in Central Tanzania. In 1911, they were evicted by the British from their original land confining them to their present-day Kajiado and Narok districts (Fratkin, 2007).

The language of the Maasai, Maa, is believed to have its origin from the Chari-Nile branch of the Nilo-Sahara language family (Bussmann et al., 2006). It is divided into two major dialects, the Northern and the Southern. The Northern is spoken by the Samburu and the Njemps while the Southern group, which comprises the majority of the population, includes the Ilmoitanik, Isiria, Ilwuasinkishu, Ilpurko, Ilkeekonyokie, Ildamat, Iloitai, Sikirari, Iloodokilani, Ildalaletuk, Ilkaputiei, Ilmatapato and Ilkisonko (Vossen, 1988).

The Maasai have a unique tradition and culture that has attracted much interest worldwide particularly from travelers, missionaries, historians and anthropologists

(Akama et al., 1996; Akama, 1997). However, despite western influence and modernization, the Maasai community has maintained their distinct traditions and culture in Kenya (Kiringe, 2005).

The Maasai have an intimate relationship with the environment and wildlife, due to their dependence on nature for survival (Thompson & Homewood, 2002). They depend on it for such basics as firewood, construction material, weapons, and water as well as for pasture for their livestock, which provide their social-economic livelihood and serve as symbols of their cultural identity. Because of their love for and dependence on livestock, the Maasai have been referred to by scholars as "people of the cattle" (Galaty, 1982).

More important for the research reported here, the Maasai have extensive knowledge about traditional medicinal plants used to treat both human and animal diseases and their symptoms (Ole-Miaron, 2003). They are known for and respected in Africa for their knowledge for example, of the identification of medicinal plants, their methods of preparation and the quantities to be taken. This knowledge supports the community's holistic system of health care, which includes the physical, psychological, spiritual and social dimensions of illness (Burford et al., 2001). While different parts of the plants can be used for treatment, depending on the health problem, the most commonly used ones are the roots, bark, and leaves (Kakwaro, 2009). The method of preparation also depends on the parts being used as well as the illness being treated, with the most commonly used methods being boiling and soaking (Ole-Miaron, 2003).

The Maasai use of traditional medicinal plants is best illustrated by their occasional forest retreats at Orpul, a men's camp for reenergizing, refreshing, and boosting their immune system. During the retreat, which can last up to a month, cows and goats are slaughtered and medicinal plants collected for a soup (Burford et al., 2001) prepared by boiling the plants with the meat. The women also use these traditional plants for their medical needs, for example, for prenatal, delivery, and postnatal care. In addition to medicinal purposes, the Maasai use plants in such ceremonies as traditional blessings, rites of passage and circumcision.

This knowledge of these sustainable forms of livelihood and culture are passed from one generation to the next orally during daily activities (Ole-Miaron, 1997) along gender lines. For example, the young men primarily look after the livestock, searching for green pastures and water throughout the day while the young girls collect firewood, water and material for house construction among other house-related duties. In the process of fulfilling these duties, both genders acquire the knowledge of the different of plants in their environment and their uses. As the boys pass through childhood to adulthood, becoming *Morans,* they undergo further, more specialized cultural training that teaches them the skills for coping with such environmental factors as droughts, wild fires and other disasters as well as enhancing their cultural skills and traditional ecological knowledge.

METHODS

Description of the study area

This study focused on Loita, the geographical region between the Nkurumani-Magadi escarpment and the Maasai Mara National Game Reserve and home to the *Naimina Enkiyo* Forest that is owned and managed by the local Maasai. This area is characterized by three types of vegetation, the savanna lowlands, the evergreen bush land and the upland dry forest. It receives an annual rainfall ranging from 600-700 mm to 1270 mm in some parts of the forest, with the wet season occurring in April and May and the driest in September and October. The temperatures range from 20-30°c in the rangelands to 17-20°c in the forest, with the latter fluctuating to approximately 10°c during the cold season (Saitabau, 2011).

The *Naimina Enkiyo* Forest, meaning Forest of the Lost Child, covers an area of 33,000 hectares. It borders the Nkurumani-Magadi escarpment in Kajiado County on the east, Tanzania to the south, and the Maasai Mara National Game Reserve to the west. It is classified as a dry land montane, with an altitude of 2,300 feet above sea level. The only remaining closed canopy, truly indigenous forest in Kenya (Ongugo et al., 2011), it is owned by the Loita Maasai who use their traditional ecological knowledge and unwritten customary laws to manage and conserve it. The forest is an important source of the tribe's livelihood, serving as a source of water, medicinal plants, firewood, edible fruits and pasture for their livestock. In addition, the forest has further cultural significance to the community as its traditional ceremonies are held there.

It is estimated that Loita is home to 24,000 people, with an average population density of 10 people/ km, most of who are located on the open western edge of the forest (Maundu et al., 2001). Grazing and the collection of firewood are open to all community members who, as a result, are responsible for utilizing forest resources sustainably. The Council of Elders, who are appointed by the local community members, are tasked with the management and decision making on the use of the natural resources in the area. The Loita Maasai speak the Maa language; their location is far off from urban towns hence, minimum interaction with other none Maasai communities. As a result, they are perceived to have maintained their cultural values (Maundu el al., 2001).

Sample size and selection

The participants for this research included 31 women and men 18 years or older from three the villages in Loita of lkerin, Inkopon and Entasekera as seen in the map in Figure1.0. According to Creswell (2007), a sample size of 20-30 participants is adequate for an ethnographic study, a size supported by (Weller & Romney 1988) as the minimum number of participants appropriate for freelisting interviews. The researcher used the Maa language for interviewing these participants who were identified through purposive sampling and snowball sampling, a qualitative technique used to select new participants based on recommendations from the ones already interviewed (Babbie, 2010).

Purposive sampling was used to identify the *Oloiboni*, the Maasai leader and medicinal plant expert in the Loita community and the three villages included in this research. The recruitment procedure for the study began with him; as the first participant, he recommended one elder from each village to participate in the study. The researcher

then visited each of these elders, requesting their participation. After agreeing to participate, they were interviewed and asked to recommend another participant from the same village. Using this snowball sampling technique, each individual interviewed was asked to recommend an additional person until saturation was reached. Participant saturation was achieved when no new names were mentioned for interviews. A total of ten (10) participants from each of the three villages were interviewed, for a total of 31 participants including the *Oloiboni.*

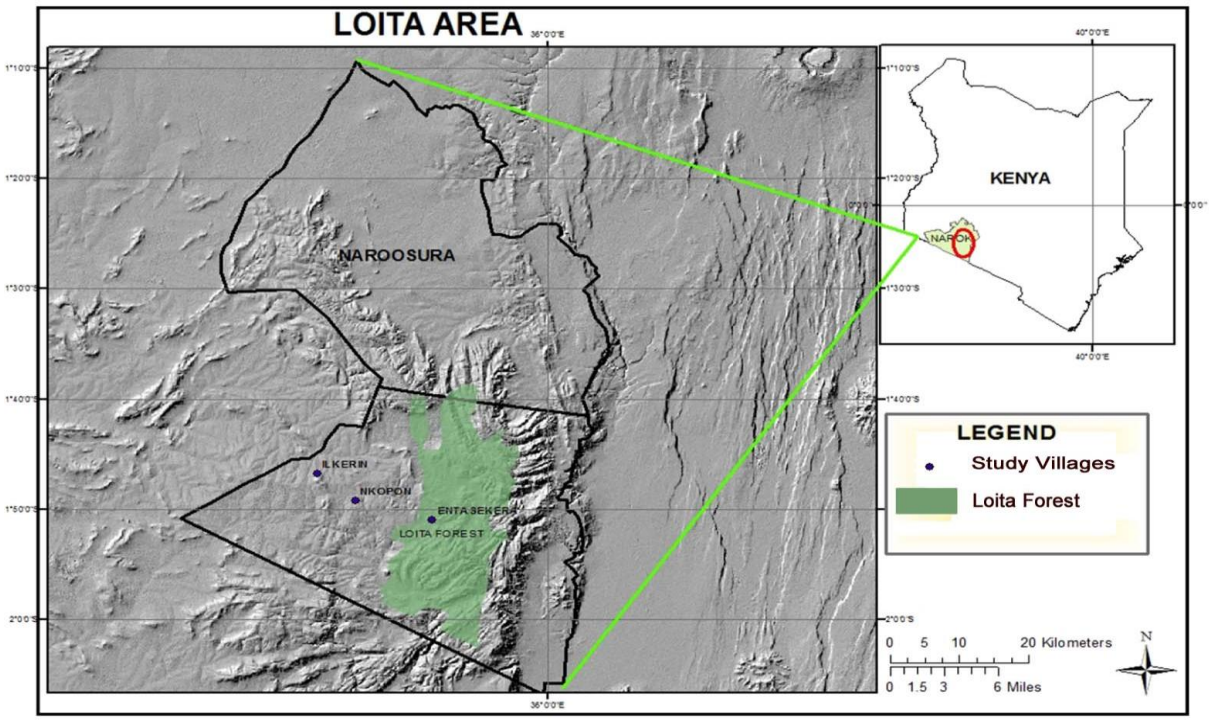

Figure 1.0 Map of Loita Area

DATA COLLECTION

To conduct these interview sessions, the researcher first obtained Institutional Review Board (IRB) approval, number IRB2013-149, from Clemson University. The researcher then developed a consent form for the participants, explaining the confidentiality safeguards, the benefits of participating in the research and the rights to withdraw. Ethical research procedures involving confidentiality, informed consent, anonymity and the rights of withdrawal were followed**.**

Freelisting

Freelisting is a data collection technique used to elicit information from members of a culture on a given domain (Ryan & Nolan, 2000). For the technique to be used, the domain to be investigated should be familiar to the participants (Romney, Weller & Batchelder, 1986). This technique involves asking the participants to list all the members of the domain of interest that they know (Quinlan, 2005). For the research reported here, since the participants could not read or write, they were instructed to list orally the traditional medicinal plants they know, with researcher writing down their responses in the order they were given. In addition, the researcher recorded all the interviews using a recording devise. The participants were given as much time as they needed to compile their lists orally.

Pretesting the translated question and instructions

Since the participants of this study could not write or read, the interview instructions and questions were translated from English to Maa. These translated instructions and questions were then pretested using a panel of two peers and a co-

investigator, all of whom are native Maa speakers and knowledgeable about traditional medicinal plants. This step was important to ensure that the questions and instructions were clear. The panel was asked to ascertain the clarity of each question and instruction as well if there were important issues not addressed. The information gained from these peers and the co-investigator was used to refine the questions, followed by a second review process; however, the panelists had no further suggestions.

Interview process

The data were collected between the months of June and August 2013 by the researcher in the Maasai language. To begin the session, the researcher first explained the study and read the informed consent statement to the participants, asking each if they agreed to participate. After agreeing, the participants were asked two demographic questions, one about their gender and the second about the name of their village. These demographic questions were followed by the oral free-recall exercise that involved asking the participants to orally freelist the medicinal plants in the order in which they were remembered. The researcher wrote down their responses in the Maasai language in the order they were given. The exercise was also recorded using a recording device to allow the researcher to verify the hand-written information.

Figure 1.1. The researcher and the study participants during the interview session

After the oral free-recall exercise, the researcher read the freelist from each participant, asking each the uses of the medicinal plants they had listed. These were also both written down by the researcher and recorded using the recording device. Creating rapport with participants as seen in Figure 1.1 to elicit comprehensive data was easy for the researcher as she is a Maasai.

DATA ANALYSIS

Freelisting analysis

Freelisting analysis was based on two primary assumptions: people tend to list the most familiar things first and second, those with more knowledge will produce a longer list than those with less (Romney & D'Andrade, 1964). To begin this analysis, the researcher verified the written information by listening to the recorded data from each study participant, making the necessary corrections on the hard copies. This was done to

ensure all the plants mentioned by all the participants during the interview process were captured. This step was followed by a second verification process that involved sharing of the hardcopies and the data recordings with the native co-investigator and a native peer. The corrections from the co-investigator and the peer were incorporated, and a soft copy that could be read by ANTHROPAC 4.983 was created.

The data were run through the ANTHROPAC 4.983 software (Borgatti, 1996) for analysis. This software is appropriate for this study as it reads a freelist dataset. For this research it was used to count the number of times each plants was listed (i.e., frequency), determine the percentage of participants who mentioned each medicinal plant (i.e., the response percentage), record the ranking of each plant on each freelist as well determine the average rank for each plant mentioned (i.e., the average ranking), and using the frequency and rank, produce the Smith's S score. The researcher referred to the ANTHROPAC manual for detailed instructions on using this software (Borgatti, 1996).

Scientific names

Scientific names for the plants were obtained from earlier published literature, which included scientific journals, articles and books. Some of the publication reviewed included Sindiga et al. (1995), Kiringe (2005), Bussmann et al. (2006), Bussmann (2006), Fratkin (1996), and Maundu et al. (2001). The scientific names when known or found were written in the appropriate column for a particular plant; those that could not be found were referred to by their Maa names.

Identification of the most salient medicinal plants

To identify the salient plants from the ANTHROPAC 4.983 output, two methods were used; frequency, the number of times they were mentioned, is an indication of consensus and common knowledge (Quinlan, 2005). The second method used was Smith's S (Smith 1993), which is based on the frequency and average rank (Quinlan, 2005). The two methods used to identify the most salient medicinal plants (frequency and Smith's S) (Smith 1993) are further supported by the cultural consensus theory which states that "The more informants there are who agree (when questioned independently) on an answer the more likely it is to be the correct cultural response" (Romney, Weller, & Batchelder, 1986).

To determine the salient plants for both methods, the data output were ordered from highest to lowest. This ordering identified an "elbow" point where frequency and Smith's S drop dramatically (Puri & Vogl, 2005). For the frequency, this break occurred between the medicinal plants with the highest difference in terms of frequency of mention between them, i.e., for this research between *Olkiloriti* and *Oloirien* as shown by the arrows in the graph in Figure 1.2. For Smith's S, the break occurred between the medicinal plants with the highest difference in Smith'S score, between *Osokonoi* and *Oseketeki* as indicated by the arrows in Figure 1.3.

RESULTS

The freelists obtained from the participants mentioned a total of 475 medicinal plants representing 70 species. The complete list can be found in Appendix 1. From the frequency analysis, a total of six (6) plants were identified as the most salient as seen in Table 1.0, while for Smith's S, a total nine (9) plants were identified as the most salient as shown in Table 1.1.

All plants, with the exception of Oloirien (*Olea europaea L spp. Africana*), Osokonoi (*Warburgia salutaris)* and Oleperelengo, were identified as salient on both lists, confirming the reliability of the plants identified as the most salient.

The three additional plants on Smiths' S list, Oloirien (*Olea europaea*), Osokonoi (*Warburgia salutaris),* and Oleperelengo had a low frequency but a high ranking, resulting in a high Smith's S score (Smith, 1993). These results are supported by de Munck & Sobo (1998); (Quinlan, 2005) and Puri & Vogl (2005) who asserted that the placement of plants in the list influence the Smith's S score. The plants identified using the two methods were combined to form the complete list of the salient medicinal plants of the Loita Maasai seen in Table 1.2.

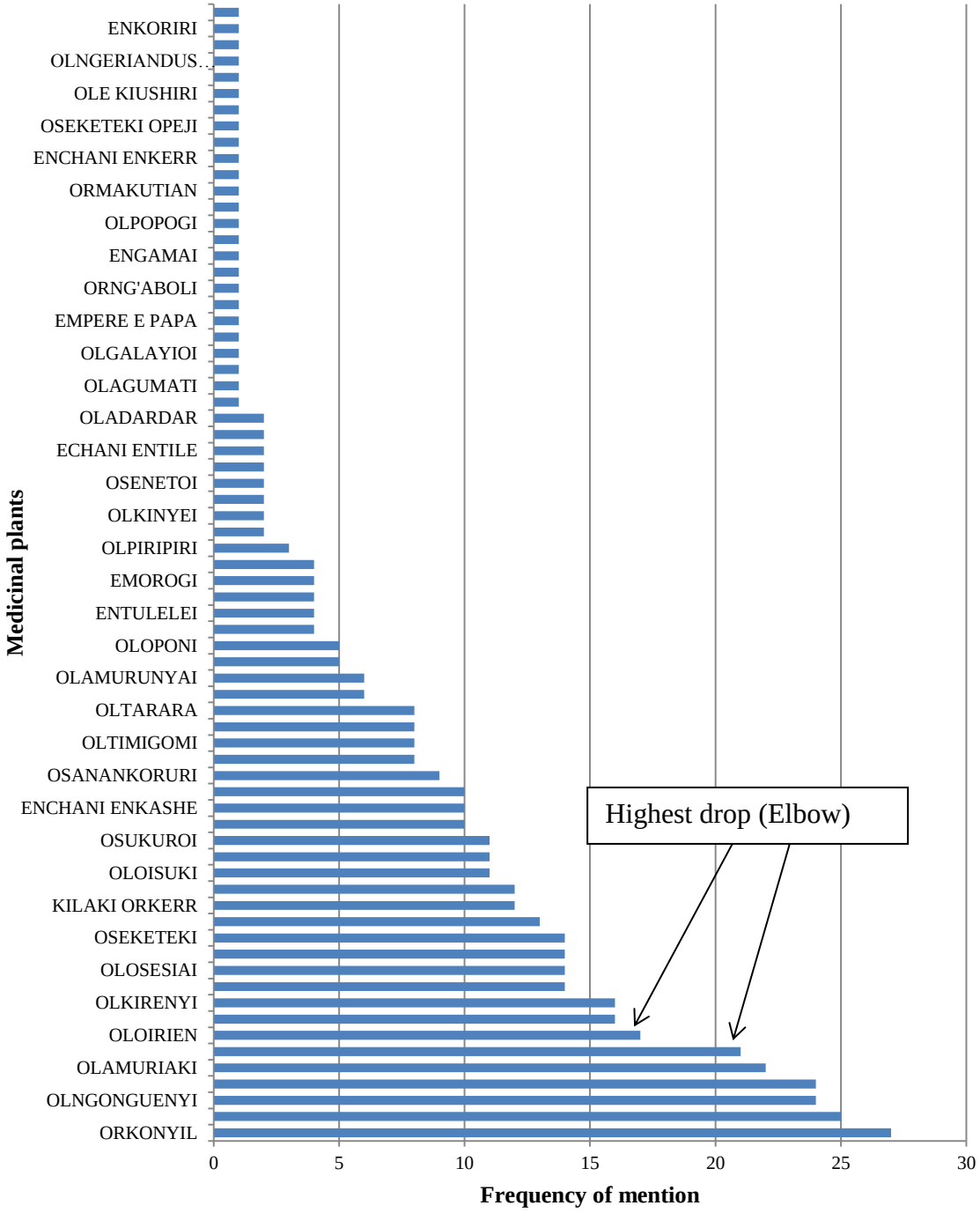

Figure 1.2. The frequency of the medicinal plants freelisted.

Table 1.0. The salient medicinal plants of the Loita Maasai identified by frequency, their scientific names and number of mentions

Maasai Names	**Scientific name***	**Frequency**
ORKONYIL	*Rhamnus prinoides*	27
OLEPARMUNYO	*Toddalia asiatica*	25
OLNGONGUENYI	*Acacia kirkii* *Oliv.spp. kirkii*	24
OLMISIGIYIOI	*Rhus natalensis* *Rhus sp*	24
OLAMURIAKI	*Carissa edulis*	22
OLKILORITI	*Acacia nilotica*	21

*Scientific names were obtained from Maundu et al., 2001

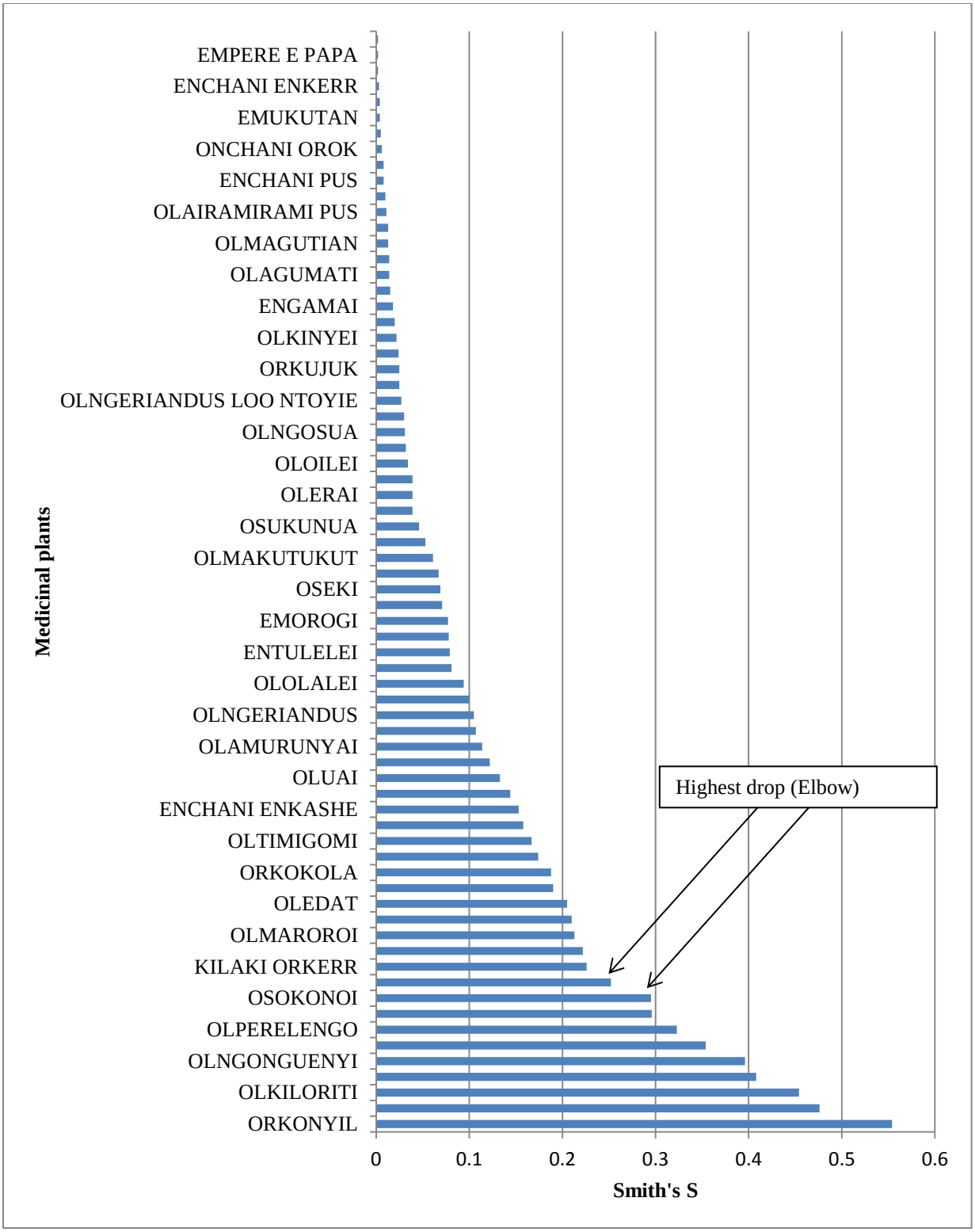

Figure 1.3. The Smith's S of the medicinal plants freelisted

Table 1.1. The salient medicinal plants of the Loita Maasai identified using Smith's S, their scientific names and their Smith's S scores

Maasai Name	**Scientific names***	**Smith's S**
ORKONYIL	*Rhamnus prinoides*	0.55
OLEPARMUNYO	*Toddalia asiatica*	0.48
OLKILORITI	*Acacia nilotica*	0.44
OLAMURIAKI	*Carissa edulis*	0.41
OLNGONGUENYI	*Acacia kirkii* *Oliv.spp. kirkii*	0.40
OLMISIGIYIOI	*Rhus natalensis* *Rhus sp*	0.35
OLPERELENGO		0.32
OLOIRIEN	*Olea europaea*	0.30
OSOKONOI	*Warburgia salutaris*	0.30

*Scientific names were obtained from Maundu et al., 2001

Table 1.2. A combined salient medicinal plant list of the Loita Maasai obtained from frequency and Smith's S, their scientific names and uses.

Maasai Name	**Scientific names***	**Uses**
ORKONYIL	*Rhamnus prinoides*	Sexually transmitted disease, backache
OLEPARMUNYO	*Toddalia asiatica*	Fever, respiratory diseases, common cold
OLKILORITI	*Acacia nilotica*	Chronic chest pains
OLAMURIAKI	*Carissa edulis*	Digestion during pregnancy, pelvic pain, backache, sexually transmitted disease
OLNGONGUENYI	*Acacia kirkii* *Oliv.spp. kirkii*	Expulsion of the afterbirth, cleansing of the uterus
OLMISIGIYIOI	*Rhus natalensis* *Rhus sp*	Cleansing of teeth for bad breath, stomach upset
OLPERELENGO		Muscle and body building for the Moran (warriors), indigestion, smooth baby skin and softens baby feces
OLOIRIEN	*Olea europaea*	Stomach pain, malaria, deworming
OSOKONOI	*Warburgia salutaris*	Cleansing of the uterus, common cold, aid in healing after delivery, stomach pains

*Scientific names were obtained from Maundu et al., 2001

DISCUSSION

Although we do not know the total number of plants species in Loita, the freelist reveals that 70 plant species are used in the study area for medicinal purposes and most of which are found in Loita *Naimina Enkiyo* forest.

Uses of medicinal plants

For indigenous tribes such as the Maasai, traditional medicinal plants are believed to be safe (Jacobsson et al., 2009) and not only desirable but also "necessary for treating a range of health problems that western medicine does not treat adequately" (Mander et al., 2007). Medicinal plants can be used to treat more than one human health problem; for instance, *Warburgia salutaris* is used to treat four (4) human health problems in the study area, specifically cleansing of the uterus after birth, aid in healing after delivery, common cold and stomach pains. In addition, in some cases, the same plant may have multiple uses depending on the part of the plant; for example, leaves, roots, and bark, either alone or in some combination, from the same species or different species may be used to make a medicinal tonic or cream (Kokwaro, 2009).

The belief that medicinal plants can be used effectively in the treatment of chronic diseases and for self-care management has also contributed to their increasingly widespread use across the globe (Thorne et al., 2002), especially in developing countries (Bussmann, 2006). In Peru, for example, 84% of the local population prefers to use medicinal plants to modern medicine (Njoronge et al., 2010). Out of an estimated 420,000 species of seed plants reported from the world (Govaerts, 2001), more than 50,000 are used for medicinal purposes (Schippmann et al., 2002). The Maasai also

depend heavily on traditional medicinal plants; furthermore, their use is deeply rooted in their culture (Kiringe, 2005), a situation also true of the Loita Maasai.

Traditional knowledge of medicinal plants

The study participants listed medicinal plants they knew with ease, and each person interviewed could remember an average of 15 plants, suggesting that the Maasai of Loita are knowledgeable of the medicinal plants available to them and their healthcare uses. More importantly, this knowledge is part of the entire community as supported by Quinlain (2005) who concludes that "the frequently mentioned items among individual lists indicate common knowledge". In this study, for example, 87% of the participants mentioned Orkonyil (*Rhamnus prinoides*), suggesting the extent of the common knowledge of this species.

In addition, this knowledge is passed from one generation to the next through informal education, primarily along gender lines. This knowledge, thus, resides with most members of the community; however, in cases where the health problem becomes complicated or does not improve, a specialist is consulted, most probably the *Oloiboni*, who is the overall expert herbalist in the community, (Burford et al., 2001).

The Maasai traditional medicinal plants expertise is a result of their way of life, which is interwoven with their environment (Bussmann et al., 2006). Through their experience and observations, the Maasai have become eco-literate, meaning they are able to identify local plants and use their ecological knowledge in their conservation (Pilgrim, 2007).

The results of this study support and extend earlier research in this area, for example that of Kiringe, (2006). In his study, he reported 41 different plants used by the Maasai in Kajiado County in Kenya to treat human ailments. He also observed that the majority of the people in the area relied on medicinal plants for their health care needs, with 73% reporting that they prefer medicinal plants to western medicine (Kiringe, 2006). Similarly, a study conducted by Bussmann et al. (2006) found that 25% of the plants collected in Sekenani in the Maasai Mara area have medicinal value.

CONCLUSION

Despite relocation and the influence of globalization and modernization, the Maasai have kept their traditional medicinal knowledge intact (Kiringe, 2005). This study found that the Loita Maasai have an enormous amount of knowledge about the medicinal plants found in their locality. Of the 70 species orally freelisted during the interviews, nine (9) were found to be the most salient as shown in Table 1.2, meaning that they are the most commonly used and the most important in the community. Since the Loita Maasai use medicinal plants for their daily healthcare needs, most community members have some knowledge of them, their use being influenced by their strong culture and their close relationship with the environment. To them, the *Naimina Enkiyo* Forest is their pharmacy for obtaining the medicinal plants for their health needs.

These traditional medicinal plants function as the Maasai first line of medication. Knowledge of them, including their names, locations, and uses, is acquired through their culture and is passed from generation to generation. Although this knowledge is not

formally taught or written, many members of the community have some understanding of the medicinal uses.

In addition to this medicinal plant knowledge, the Loita Maasai use their traditional ecological knowledge to manage their natural resources, information obtained through daily observations and their close relationship and dependence on their natural environment that has enabled them to protect their plants and ecosystem. While the protection of the environment and the medicinal plants are the responsibility of every member of the community, the Council of Elders and its chairperson, the *Oloibon,* are tasked with the overall duty of protecting their natural resources. The *Oloiboni*, in particular, is considered an expert in the matters of medicinal plants and is consulted by the community before any decisions are made.

IMPLICATIONS AND FUTURE WORK

The nine (9) species identified by this research are the most commonly used and most important in the study area. While others may also be used, these have been identified here as the most salient. For this reason, they potentially have a higher collection pressure compared to the others freelisted. Therefore, future research should be directed towards establishing sustainability measures to ensure that these plants are not threatened by extinction due to their widespread use. For long-term sustainability, studies should be conducted investigating the possibility of cultivating the salient species either on farms or in the villages. In addition, studies should also be conducted to determine their abundance and harvesting patterns with the aim of establishing an available stock of these species and to investigate whether the current harvesting strategies are sustainable.

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CHAPTER 3. THE TRADITIONAL CONSERVATION STRATEGIES USED BY THE LOITA MAASAI, OF KENYA TO PROTECT MEDICINAL PLANTS

ABSTRACT

Approximately 80% of the rural population in developing countries relies on traditional medicinal plants for their health care needs. Because of this high demand and its impact on their sustainability, it is crucial to understand the traditional conservation strategies used to protect them. To investigate these strategies, this study explored the traditional conservation methods used by the Loita Maasai to protect their medicinal plants in an effort to document the traditional conservation strategies used in the study area.

The participants in this research included 31 women and men 18 years or older from the three villages in Loita of Ilkerin, Inkopon and Entasekera, identified through purposive sampling and snowball sampling. The data were collected through face-to-face freelisting interviews, followed by specific questions on location, perception of availability and the traditional conservation strategies, if any, put in place by the community members to ensure the sustainability of the medicinal plants. The data were analyzed using an inductive thematic analysis approach.

The results revealed that the Loita Maasai use their traditional ecological knowledge to protect their medicinal plants. The primary traditional conservation strategies identified included; (1) sustainable harvesting, (2) collective monitoring, and (3) a community structure known as the Council of Elders, who are tasked with the responsibility of overseeing the management of the natural resources. However, despite these adaptive

management strategies, 68% of the study participants reported that it was easier to find medicinal plants in past than it is now. They reported the following as the major reasons for this change in availability: deforestation (38%), drought (33%), changes in lifestyle (19%) and an increase in population (10%).

INTRODUCTION AND LITERATURE REVIEW

The World Health Organization (WHO) estimates that approximately 80% of the rural population in developing countries relies on medicinal plants for their health care needs, this high demand leading to their overexploitation resulting in their loss across the globe. For this reason, it is crucial to understand people's interactions with the environment and the strategies used for conserving natural resources (Berkes & Davidson-Hunt, 2006). According to Article 8(j) of the United Nations Convention on Biological Diversity, the indigenous knowledge of biodiversity conservation is an excellent source that should be cultivated to facilitate sustainable use of natural resources (Multilateral, 1993)

Indigenous people have an extensive knowledge of their environment (Brookfield & Padoch 1994; Turner et al., 2000) acquired through many years of interacting with biodiversity (Njoronge et al., 2010) that can benefit the current generation. To investigate this knowledge, this study explores the traditional conservation strategies used by the Loita Maasai to protect their medicinal plants, an important area of study as researchers have found that traditional ecological knowledge can contribute to biodiversity conservation (Berkes et al., 2000; Folke et al., 1998; Gadgil et al., 1993; Pierptti & Wildcat, 2000; Turner et al., 2000).

For the purposes of this research, traditional ecological knowledge (TEK) 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 the environment" (Berkes et al., 2000). These traditional practices include, for example, secession management, landscape patchiness, multiple species management and resource rotation, all of which have widely been used in biodiversity conservation (Berkes et al., 2000; Gadgil et al., 1993). In addition, rotational grazing and farming, i.e., leaving a piece of land at rest for a period of time or alternating crops with species, help to maintain soil fertility (Berkes et al., 2000).

The Maasai have traditionally had a special attachment and respect for their environment. This passion for their land and their surroundings is attributed to their dependence on the natural resources for their survival and that of their animals. For instance, they depend on the rains to provide water and pasture for their livestock. If the rains do not come as expected, they believe that the gods are punishing them, and to apologize, they sacrifice a spotless ram to Mother Earth (Seno, 1998). The Maasai have traditional knowledge of the seasons that over time has enabled them to cope with environmental changes. For instance, during the dry season they move to other areas including neighboring countries like Uganda and Tanzania in search of pastures and water. This seasonal migration allows for the recovery of the resources they rely on (Berkes et al., 2000). In addition, during the rainy season the elders of the community evaluate the grass productivity, and depending on availability of pastures, they may

restrict the grazing in some areas. This restriction allows for the regeneration of the pasture, which can then serve as a "bank" during the dry season (Berkes et al., 2000).

The current change in the lifestyle of the Maasai from pastoralism to a sedentary lifestyle could have a critical impact on the environment and the natural resources (Seno & Shaw, 2002; Okello, 2005). For instance, the shift from the communal land ownership of the past to private land ownership has been reported to contribute to species loss and extinction (Kiringe, 2005; Lamprey & Reid, 2004). Other consequences include the deforestation and destruction of the habitats that support plants species (Etkin, 1998; Kiringe, 2005). Therefore, to ensure sustainability, conservation strategies integrating both scientific and traditional conservation are urgently needed, particularly concerning traditional medicinal plants that are so important to the rural population in developing countries. Understanding this use of traditional ecological knowledge in managing medicinal plants can help solve some of the concerns facing this resource (Rout et al., 2005). In addition, this knowledge is important because to be successful, conservation strategies should engage the local communities in resource sustainability projects (Etkin, 1998).

Due to the high dependence on medicinal plants, scholars such as Rout et al. (2005) have proposed the following long- and short- term strategies to protect against their overexploitation: (1) the development of a list of the medicinal plants found in the area, (2) an assessment of the harvesting of plants with medicinal value, (3) the development of such conservation strategies as harvesting plants in their proper seasons, and (4) the development of area specific models. Other measures for protecting medicinal

plants to ensure long-term sustainability include the cultivation of commonly used medicinal plants. For example, the Bhotiya, a tribal community in India, is reported to cultivate twelve (12) medicinal plants species on their agricultural fields (Silori & Badola, 2000). Additionally, Kala (2000) proposes the establishment of medicinal plants conservation areas with support from local community involvement in the decision-making and the encouragement of profitable uses of the resources by the communities.

The importance of traditional ecological knowledge in natural resources management.

The Promotion of Ecologically Sustainable Behavior

According to the Kaiser et al. (1999), personal and community moral values significantly contribute to environmental attitudes, which occasionally can be measured by a society's knowledge of the environment. In addition, research has found that there is a relationship between environmental attitudes and ecological behavior (Hines et al., 1987). Therefore, the TEK of an individual or society, which is largely guided by their morals, can influence their attitudes and behavior towards the conservation and protection of their natural resources, and hence, their sustainable behavior.

Natural Resource Management

TEK can contribute to the sustainable management of natural resources, providing insight for their effective management (Berkes, 1999). In addition, traditional knowledge of natural resource management plays a role in how these resources should be used and managed (Berkes, 1999; Ticktin & Johns, 2002). For example, because of a local

population's experience and daily observation acquired from a close relationship with their environment (Njoronge et al., 2010), community members are able to detect changes in the availability of natural resources and take appropriate action. Some of these management strategies include the restriction of the use of some resources to allow a species under intense collection pressure to "rest" (Berkes et al., 2002; Berkes, 1999), resulting in improved management of natural resources. Furthermore, the restriction of the harvesting of a species for a specified period of time contributes to its restoration (Gadgil et al., 1993; Berkes, 1993). This restriction can be applied not only to plants but also to animals, one example being the prohibition against catching of lobsters with eggs in the Maine fisheries (Acheson et al., 1998).

Social Mechanisms behind Natural Resources Management

The respect for nature and the sustainable use of natural resources are attributed to the strong belief of indigenous people that human beings are a part of the natural world (Gadgil et al., 1993). Through their knowledge obtained primarily from observation (Njoronge et al., 2010), indigenous communities have designed a local management system used for monitoring their environment. They have a governing body composed of community representatives, who, in most cases, are knowledgeable about natural resource management and, thus, are entrusted with the responsibility of overseeing the utilization of these resources (Berkes et al., 2000). Like many indigenous communities, the Maasai have both a structure and traditional laws governing their natural resources (Alcorn, 1993). In Loita, the governing body is the Council of Elders seen in Figure 2.0,

which is tasked with the responsibility of managing natural resources on behalf of the community (Seno & Shaw, 2002).

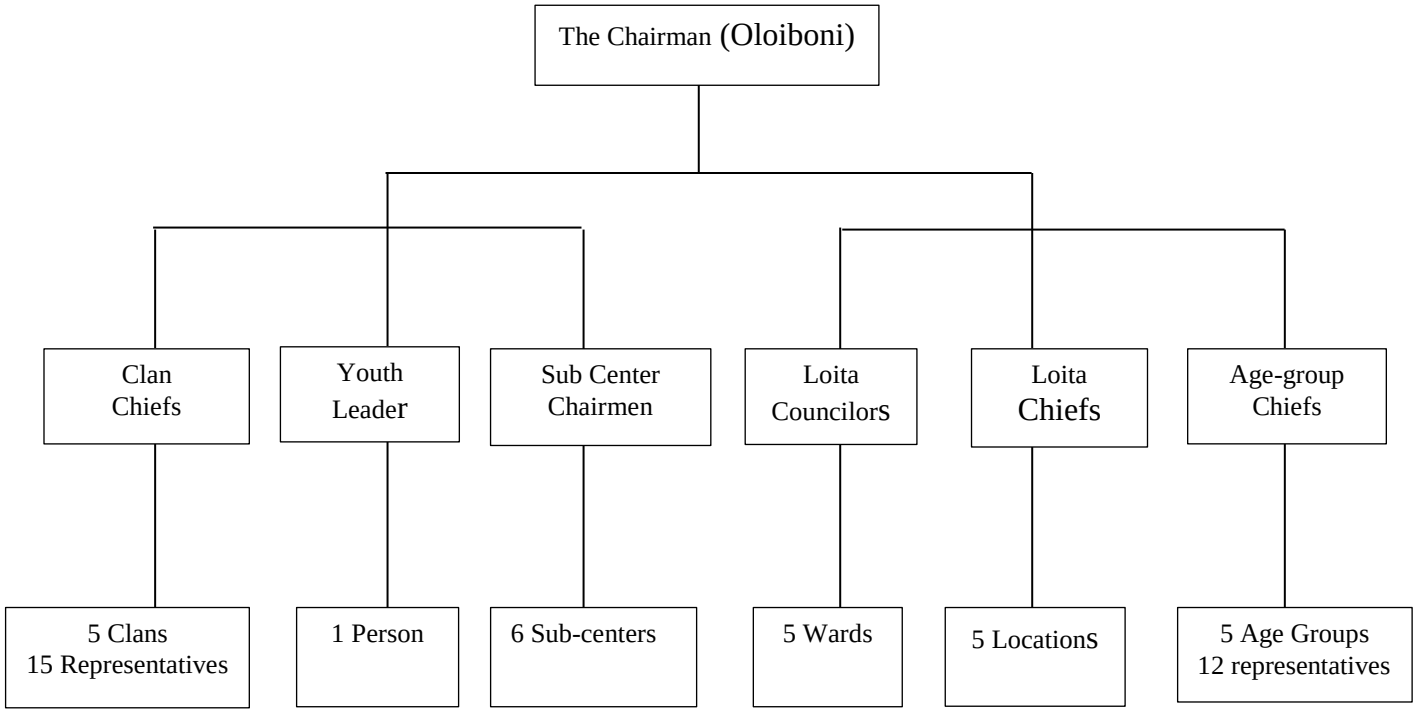

Figure 2.0. The organization structure of the Loita Maasai Council of Elders (Adapted from Karanja et al., 2002)

This structure incorporates all age groups, including the youth who are represented by a youth leader, and the government, represented by the Loita Chiefs, who are appointed through the Office of the President. All decisions about the use of natural resources, for example obtaining timber for commercial purposes in the Loita *Naimina Enkiyo* Forest, are made by the Council of Elders (Seno & Shaw, 2002), who are seen as the custodians of the forest and who play an important role in protecting it with the help of the people they represent.

METHODS

Description of the study area

This study focused on Loita, the geographical region between the Nkurumani-Magadi escarpment and the Maasai Mara National Game Reserve and home to the *Naimina Enkiyo* Forest, which is owned and managed by the local Maasai. This area is characterized by three types of vegetation, the savanna lowlands, the evergreen bush land and the upland dry forest. It receives an annual rainfall ranging from 600-700 mm to 1270 mm in some parts of the forest, with the wet season occurring in April and May and the driest in September and October. The temperatures range from 20-30°C in the rangelands to 17-20°C in the forest, with the latter fluctuating to approximately 10°C during the cold season (Saitabau, 2011)

The *Naimina Enkiyo* Forest, meaning Forest of the Lost Child, covers an area of 33,000 hectares. It borders the Nkurumani-Magadi escarpment in Kajiado County on the east, Tanzania to the south, and the Maasai Mara National Game Reserve to the west, at an altitude of 2,300 feet above sea level. The only remaining closed canopy, truly indigenous forest in Kenya (Ongugo et al., 2011), it is owned by the Loita Maasai who use their traditional ecological knowledge and unwritten customary laws to manage and conserve it. The forest is an important source of the tribe's livelihood, serving as a source of water, medicinal plants, firewood, edible fruits and pasture for their livestock. In addition, the forest has further cultural significance to the community as its traditional ceremonies are held there.

It is estimated that Loita is home to 24,000 people, with an average population density of 10 people / km, most of who are located on the open western edge of the forest (Maundu et al., 2001). Grazing and the collection of the firewood is open to all the community members who, as a result, are responsible for utilizing forest resources sustainably. The Loita Maasai speak the Maa language; their location is far off from urban towns hence, minimum interaction with other none Maasai communities. As a result, they are perceived to have maintained their cultural values (Maundu el al., 2001).

A map of the study area is shown below (Figure 2.1).

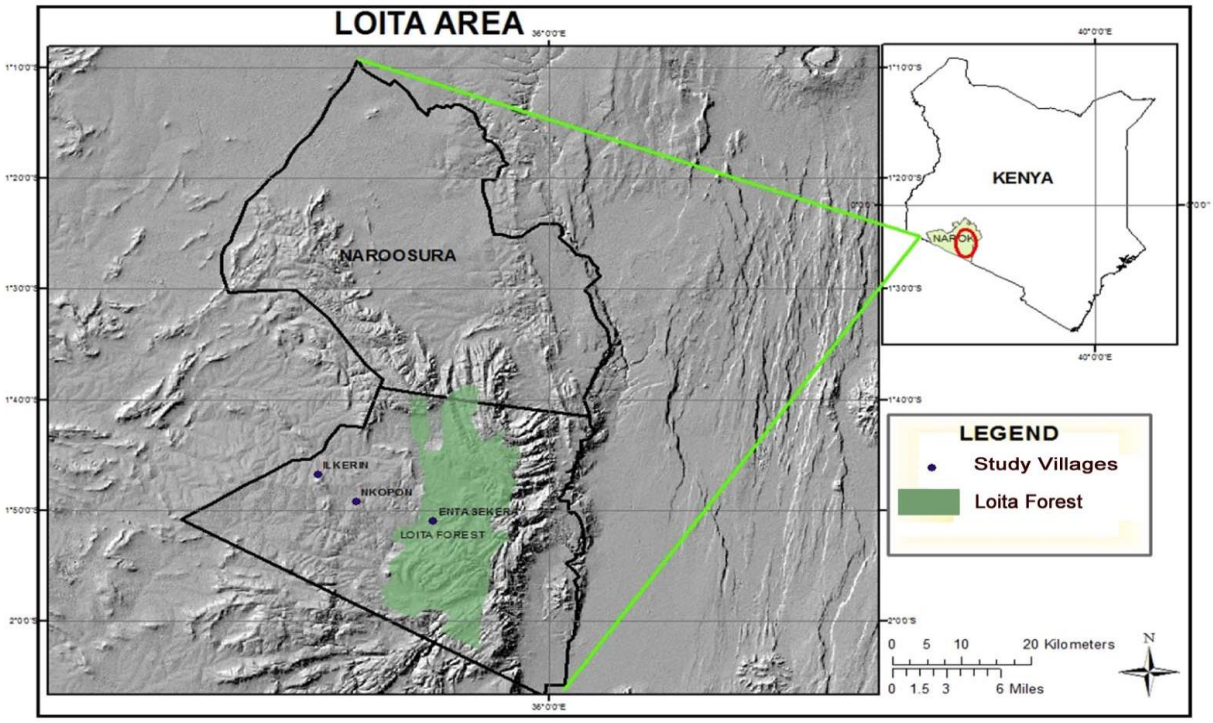

Figure 2.1 Study area

Sample size and sample selection

The participants for this study included 31 women and men from Loita, all 18 years of age and older. According to Creswell (2007), a sample size of 20-30 participants is adequate for an ethnographic study, a size supported by Weller & Romney (1988) as the minimum number of participants appropriate for freelisting interviews. The researcher used the Maasai language for interviewing these participants who were identified through purposive sampling and snowball sampling, a qualitative technique used to select new participants based on recommendations from the ones already interviewed (Babbie, 2010).

Purposive sampling was used to identify the *Oloiboni*, the Maasai leader of the Loita community and the three villages – Ikerin, Inkopon and Entasekera – included in this research. As the first participant, he recommended one elder from each village to participate in the study. The researcher then visited each of these elders, requesting their participation. After agreeing to participate, they were interviewed and asked to recommend another participant from the same village. Using this snowball sampling technique, each individual interviewed was asked to recommend an additional person until no new names were proposed for interviews. A total of ten (10) participants from each of the three villages were interviewed, for a total of 31 participants including the *Oloiboni*.

Freelisting

Freelisting is a data collection technique used to elicit data from members of culture on a given domain (Ryan & Nolan, 2000) and then to identify the cultural salient

item from this domain of interest (Quinlan, 2005). This technique involves asking the participants to list all the members in the domain of interest that they know (Puri & Vogl, 2005). For this study, the participants were asked to list the traditional medicinal plants that they know; they were given as much time as they needed to compile their lists orally.

Pretesting freelisting questions

The freelisting questions designed to guide the interview process were pretested using a panel of three peers, all of whom are native Maa speakers and knowledgeable about traditional medicinal plants. This step was important to ensure that the questions about the domain were clear. The panel was asked to ascertain the clarity, importance and content of each question, as well if there were important issues not addressed. Information gained from these peers was used to refine the questions, followed by a second review process; however, the panelists had no further suggestions.

DATA COLLECTION

To conduct these interview sessions, the researcher first obtained Institutional Review Board (IRB) approval, number IRB2013-149 from Clemson University. The researcher then developed a consent form for the participants, explaining the confidentiality safeguards, the benefits of participating in the research and the rights to withdraw. Ethical research procedures involving confidentiality, informed consent, anonymity and the rights of withdrawal were followed.

Interview process

The data were collected from June to August 2013 by the researcher in the Maasai language. To begin the session, the researcher first explained the study and read the

informed consent statement to the participants, asking each if they agreed to participate. After agreeing, the participants were asked two (2**)** demographic questions, followed by a free-recall task interview that involved asking them to freelist the medicinal plants in the order in which they were remembered.

After a list of the traditional medicinal plants was generated, the researcher followed up with specific questions on their locations and the perception of their availability. Those who indicated that medicinal plants are harder to find now than before were asked to list the primary threats facing the plants in the area. In addition, the participants were asked the traditional conservation strategies, if any, put in place by the community members to ensure the sustainability of the plants.

All the responses were written down and recorded using a recording device to allow the researcher to check the transcriptions. Creating rapport with participants to elicit comprehensive data was easy for this researcher as she is a Maasai. A typical interview session is shown below (Figure 2.2).

Figure 2.2. The researcher and the respondents during the interview session

DATA ANALYSIS

Audio recordings

In order to increase validity and rigor in the data collection process, audio recordings were used to verify and clarify the handwritten notes and to provide accurate transcriptions of long responses to open-ended questions, for example, the discussion of the conservation strategies used to protect the medicinal plants. All the transcripts from the audio interview recordings were examined for accuracy by a co-investigator to ensure an accurate translation. It was generally agreed that the initial translations were accurate, and very few corrections were required.

Thematic analysis

Thematic analysis is a method for identifying, analyzing and reporting patterns or themes in data (Braun & Clarke, 2006). For this study, an inductive approach, also known as bottom-up coding (Galman 2007), was used for coding and theme development. This approach was suitable for this study because the process is data driven (Braun & Clarke,

2006) and the themes developed are strongly linked to the data themselves (Patton, 1990). The specific procedure used here, which was adopted from Braun & Clarke (2006), is shown in Table 2.0.

Table 2.0. Steps in themes development (Braun & Clarke, 2006)

Phase	**Description of Process**
1. Familiarization with the data	Transcribing, reading and re-reading and noting initial ideas
2. Generation of the initial code	Producing initial codes from the data manually by writing notes for each person interviewed using a highlighter
3. Search for themes	Sorting the codes already identified into potential themes by identifying potential relationship between them
4. Review of themes	Refining the initial themes by ensuring a relationship to the codes. This step could lead to either merging or splitting of themes.
5. Defining and naming of the themes	Generating clear names and definitions of the themes to be used to tell the story

The themes and their corresponding definitions were developed by reviewing the documents as well as moving back and forth across the data. In addition, according to Creswell (2008), writing memos is important as it ensures that the meaning of the themes does not change during the coding process. For this reason, the researcher wrote memos

about the themes and their definitions. The process of theme development continued until no new themes emerged.

RESULTS

This section details the findings of the study based on the interview questions and the responses from the participants. The resulting themes are supported by respondents' statements and the personal observation and experience of the researcher.

To gain an understanding of medicinal plant conservation strategies, the following questions were asked. The participants were first asked about who was responsible for collecting medicinal plants; their responses are found in Figure 2.3 below:

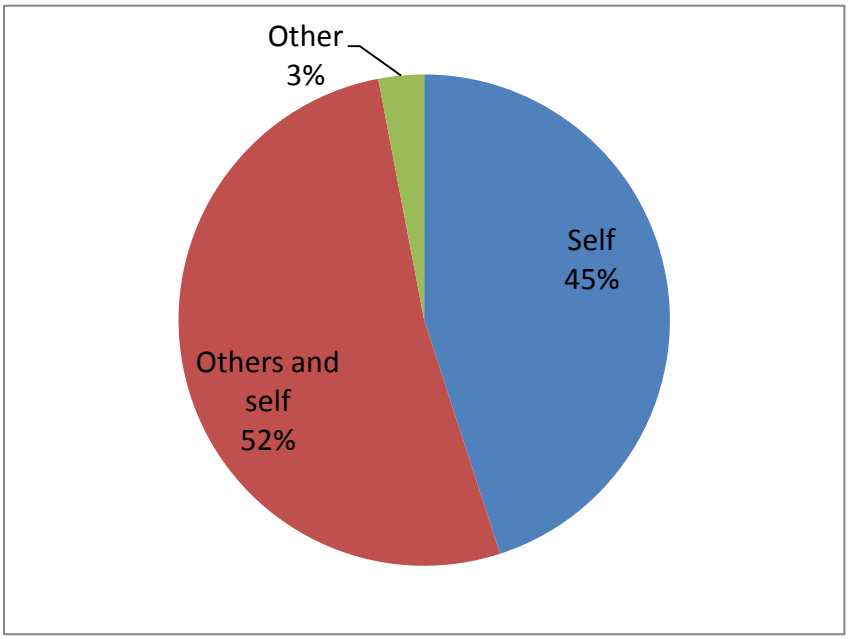

Figure 2.3. The parties responsible for the collection of the medicinal plants

The next question focused on the location of the medicinal plants collected; Table 2.1 below indicates the responses:

Table 2.1. Location of medicinal plants collected (N=31)

Location	**Mention (%)**
Around the village	96
On the farm	4
In the forest	100
Market	0

Next, the respondents were asked if they had seen a change in the availability of the medicinal plants; their responses can be seen in Table 2.2 below:

Table 2.2. Change in the availability of medicinal plants

Yes	68%
No	23%
Don't know	10%

The participants who said it was easier to find medicinal plants in the past than now (N=21) were asked to give the major reasons for their observation (Figure 2.4).

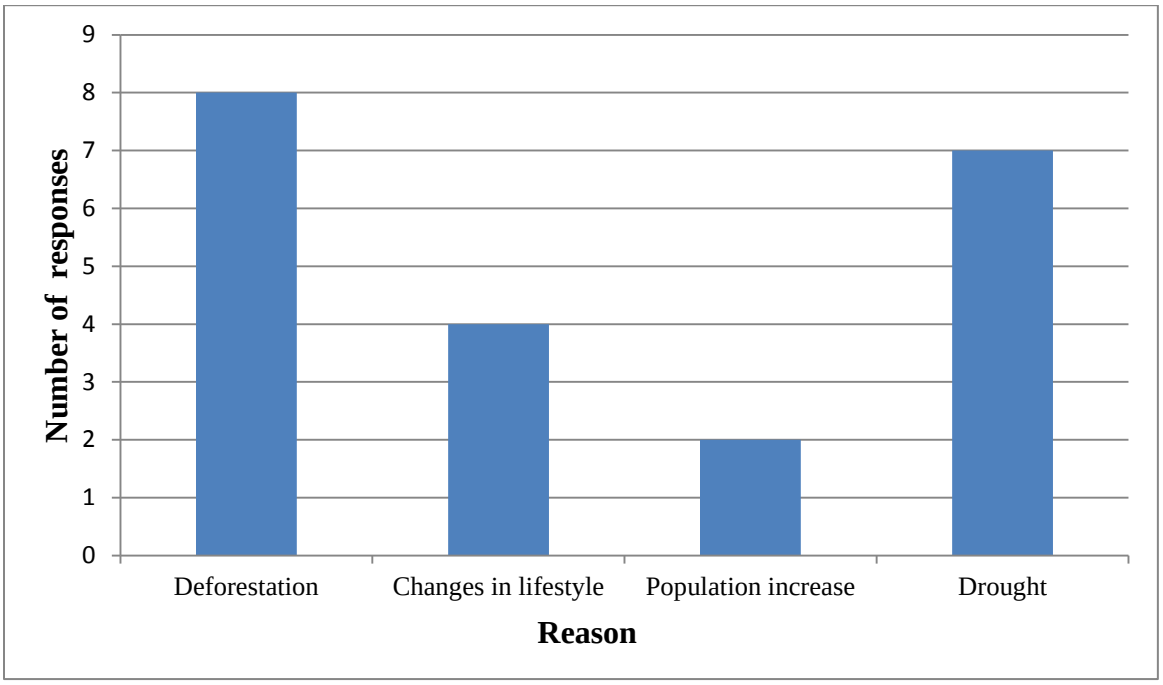

Figure 2.4. Reasons as mentioned by participants for the changes in availability of medicinal plants (N=21)

Based on the responses, the following three themes and accompanying strategies for protecting the medicinal plants in the study were determined:

Sustainable harvesting involves using techniques to harvest the medicinal plant in the study area without damaging the plants harvested from, thus ensuring their future availability.

- *"When collecting species whose bark is the primary material to be used, the tree should not be girdled or completely stripped of its bark; only longitudinal strips of the*

bark along one side of the tree should be cut and collected. This is to ensure that the plant is not killed and can be collected from again in the future."

- *"When collecting roots for medicinal use, not all of the plant's roots are collected /cut. The plant could therefore still feed from its remaining roots and survive."*
- *"For example, when collecting roots of trees and shrubs, the main roots should not be cut or dug up."*
- *"The collecting of bark, roots, branch etc. from a plant that shows signs of been collected from is not good. Such a plant should be left to enable it to recover from the effects of collection."*
- *"I don't harvest from a plant/ shrub that has been harvested by someone else; instead, I look for the same species in the forest."*
- *"I make sure I harvest from healthy plants/ species to avoid desiccation, thus the deterioration/ death of the plants."*
- *"I harvest the plants under the best temperatures."*
- *"I prefer harvesting early in the morning when the sun is not very hot or on cooler days to make sure the parts harvest from do not dry up especially if am cutting the leaves or the roots."*
- *"I only harvest from mature trees/plants, not from the young trees which are growing."*
- *"I teach my children how to collect medicinal plants without killing them."*
- *"I avoid any unnecessary damage to the plants. I exercise caution to enable the plants to re-grow."*

- *"I gather plants that are abundant in that area."*
- *"I make sure I leave a healthy population behind."*

The monitoring of medicinal plants is a conservation strategy involving the collective responsibility of the community, meaning that all of its members are responsible for protecting the medicinal plants in the study area.

- *"It is the duty of every person to monitor medicinal plants and report to the Council of Elders any species that appear to becoming rare."*
- *"It is the responsibility of every member of the Loita community to report any criminal activities done in the forest to the Council of Elders, for example, illegal logging or any suspicious activity in the forest such as poaching."*

A community structure is in place for resource management; the Council of Elders, composed of members elected by the community, is tasked with overseeing the management of natural resources in the study area.

- *"If I need large quantities of timber for construction, permission from the Council of Elders is required prior to collecting. In many cases, permission is normally granted, but I need to notify them first."*
- *"The Council of Elders can grant or deny permission to harvest depending on the condition of the species and the current demand for that species."*

- *"We elect our natural resources representatives to manage Naimina Enkiyo forest. The Council of Elders are the custodians and are in charge of all the decision pertaining the use of resources in the forest."*
- *"I attend all the meetings to discuss the use of natural resources. For example, sometimes we will not harvest from a certain section of the forest to allow the plants to re-grow due to excess harvesting. Some sections in the forest are extremely harvested from especially areas close by the villages, as people feel lazy to get the plants from deep in the forest. When a certain species is seen to be becoming scarce, a meeting is convened to discuss the way forward regarding that species."*
- *"I respect all the decision made by the Council of Elders. If they say we should not harvest a certain species, I don't because in case of a shortage, all of us are affected as we all depend on our medicinal plant resources for our survival."*

DISCUSSION

"Although these rules are not written anywhere, the participants seemed to take upon themselves to ensure sustainability" (Personal field notes).

The Maasai use of their traditional medicine for their health care needs and for their livestock (Ole-Miaron, 2003) is rooted in their culture as evidenced by the local word for their medicinal plants, *Olchani* (Seno, 1998). This knowledge is passed from one generation to the next along gender lines, with the older community members educating the children and the youth on natural resource management and transferring their skills on the best and most effective ways to protect the environment. Because of

this process, every adult in the community has some knowledge of natural resources and the medicinal plants in their area.

In this study, when the participants were asked who collects their medicinal plants, 45% reported that they collect for themselves, while 52% said they collect for themselves unless they are busy; then they ask a family member or a friend to collect for them. The remaining 3% said others collect for them. The response to this question indicates that almost all (97%) of the community members possess some knowledge of medicinal plants. This knowledge of their natural resources is supported by the number of plants freelisted during the interview.

The participants were then asked about the location of their medicinal plants, with 100% reporting that they collect them from the nearby Loita *Naimina Enkiyo* Forest, an indigenous community-owned forest that is managed through the use of traditional ecological knowledge. While this forest is their primary pharmacy, 96% of the participants reported they also obtained medicinal plants in the area surrounding their villages and 4% obtained them from farms. Since the Loita Maasai do not plant/cultivate medicinal plants on their farms, those found there grow naturally. Interestingly, no one reported buying the plants in the market, indicating that they are not commercial items bought and sold in the study area. The possible reason for these results could be the close proximity of the people to the forest, to which the community members have free access. Thus, they can obtain their plants easily as can be seen in the map in Figure 2.1.

Concerning the availability of medicinal plants, 68 % of the participants reported that it is more difficult to find them now than it was in the past, while 23% indicated that

medicinal plants are easier to find now and 10% could not tell if there has been any change in availability. The two-thirds responding that it is more difficult today were then asked to list the reasons for this change, with 38% mentioning deforestation, 19% changes in lifestyle, 33% drought, and 10% an increase in population as shown in Figure 4. These reasons support those reported by Kiringe (2005).

Before adopting a permanent lifestyle, the Maasai were pastoralist who moved from one region to another in search of pastures and water. Because of this transience, the Maasai did not build permanent structures nor did they stay in one area for long (Seno & Shaw, 2002). These seasonal movements enabled pastures and other resources to regenerate, reducing the pressure on the environment. In the regions they moved to, they built temporary structures made of a few poles and covered with a mixture of cow dung and mud (Seno & Shaw, 2002). These structures did not require cutting down of trees or the destruction of the land required by major constructions. Currently, the majority of Maasai have adopted a more settled lifestyle, one requiring the building of permanent structures (Seno & Shaw, 2002). This change in lifestyle is reported to have a negative impact on both the environment and the medicinal plants (Kiringe, 2005; Okello & Kiringe, 2004).

In addition, drought has been reported to be a major threat to the conservation of the medicinal plants in the study area. As a result of climate change, the rainfall has become irregular, with some regions experiencing a shortage for more than a year, resulting in prolonged, perennial droughts, leading to a loss of plant species. Studies conducted by Herren (1991) and Galaty (1992) confirm the significance of this lack of

rainfall, reporting that Maasai land is prone to frequent droughts which result in the loss of livestock.

Deforestation to allow for crop cultivation is also contributing to the extinction of medicinal plants. The change in lifestyle from pastoralist to farming has led to the clearing of forest land for farming activities (Okello, 2005). Similar findings have been reported by Seno & Shaw (2002), who found that the most significant threat to Maasai wildlife is land cultivation.

After obtaining this information on the collection and availability of and the threats to medicinal plants, the participants were asked to discuss the general strategies, if any, in place to conserve this important resource. Following the theme development procedure outlined in Table 2.0, three major themes were identified from their responses. While these themes reflect only what the study participants choose to share with the researcher, most participants made equal reference to most, if not all, of them discussed here.

Overarching themes

Sustainable harvesting involves using techniques to harvest the medicinal plant in the study area without damaging them, thus ensuring their future availability. This theme explains the measures in place to ensure that the community's natural resources are not depleted. The Loita Maasai obtain their medicinal plants primarily from the *Naimina Enkiyo* Forest. To them the forest is a medicine cabinet, and they use their traditional conservation strategies to protect it. For example, they harvest plants without killing the mother plant, damaging the plant's capacity to regenerate, or disrupting its growth. As

one participant said, “I avoid any unnecessary damage to the plant. For example, I exercise caution to enable the plant to re-grow.” When the roots are to be used, the entire tree is not cut down; instead the community cuts sustainably to ensure that it does not die as a result and they do not harvest from very young trees.

Selective harvesting has been used by many indigenous communities for both plants and animals (Colding & Folke, 2001). For example, to ensure sustainable harvesting, the Sami people in Northern Finland plan to harvest under the best possible conditions, for example during appropriate temperatures and seasons. In addition, before harvesting, the abundance and distribution of species is taken into consideration (Bjørklund, 1990); Ingold & Kurtilla, 2000).

The monitoring of medicinal plants is a conservation strategy involving the collective responsibility of the community, meaning that all of its members are responsible for protecting the medicinal plants in the study area. Monitoring is a common strategy among the Maasai, one that is well known and deeply rooted in the culture (Okello, 2005). They use their traditional ecological knowledge acquired through daily observation to monitor their resources (Njoronge et al., 2010).

The Loita Maasai have sophisticated systems and skills that enable them to tell if a certain species is becoming depleted. In addition, they are able to tell which areas have abundant medicinal plants and fresh pastures for their livestock. In other words, using their many years of experience, they are capable of recognizing if natural resources are near depletion. When they suspect an issue with a resource, the Council of Elders restricts the community members from harvesting it for a period of time to allow for regeneration.

As one participant indicated, "it is the duty of everybody to monitor medicinal plants and report to the Council of Elders any species that appears to becoming rare." To monitor the status of natural resources, the Loita Maasai observe the health of the pastures in the grazing area to determine if they can continue grazing their livestock there or not. In addition, they monitor the water levels in the swamps and rivers. Using their TEK, they can tell if they need to move to other areas.

Resource monitoring is a common strategy used by indigenous people to protect their environment. These monitoring skills are acquired through many years of living and interacting with their environment (Berkes et al., 2000). For example, the decision of the Sahel herders to move to a new grazing area is guided by their daily observations of the pastures (Niamir-Fuller, 1998).

When the Council of Elders restricts grazing on certain areas or the harvesting of certain medicinal plants for a certain period of time to allow the species to recover (Seno & Shaw, 2002), it imposes specified penalties for community members who do not abide by the decision. For example, if one is found harvesting prohibited plants, he/she can be fined a cow, a goat, or cash. In extreme cases, the person could be handed over to a local chief to face prosecution in a court of law.

Temporary restrictions in the harvesting of natural resources is a common practice not only used to protect medicinal plants but also applied to fish and wildlife management. For example, Canadian and American hunting, fishing, and trapping areas are periodically restricted for a certain period of time to allow time for regeneration, a period referred to as a "resting" period (Berkes, 1999)

A community structure is in place for resource management; the Council of Elders, composed of members elected by the community, is tasked with overseeing the management of natural resources in the study area. This theme describes the overall supervision of natural resources carried out by the Council of Elders who are appointed by the community members and tasked with the responsibility of overseeing the management of natural resources. The study participants strongly agreed that they abide by the decisions of the Council of Elders concerning the use of natural resources. Because medicinal plants are the only source of medical treatment for them and their livestock, they believe it is their responsibility to take care of their environment by following the rules and regulations set by the Council. The participants reported the importance of obtaining permission from the Council of Elders to collect from restricted areas. In addition, they also need permission to collect large quantities of medicinal plants or timber. The Council of Elders uses customary rules to oversee the management of natural resources and has the authority to restrict the harvesting of certain plant species at certain time of the year in light of collection pressure.

The community members are expected to follow such restrictions and a heavy penalty is imposed if they do not. The participants reported that it is their responsibility to be custodians of their natural resources, as they know they derive their livelihoods from their environment. Their dependence on natural resources has made them good custodians of their environment. As a result, they have taken upon themselves to protect their natural resources, including their medicinal plants. They know they cannot survive if the resources become exhausted.

The harvesting of natural resources is not a free-for-all collection as harvesting from the forest is permitted to members of the Loita community only. In other words, only the local community members have exclusive rights to harvest from the forest. This measure is to protect against unsustainable harvesting.

The protection strategies found in this this study agree with those in the literature. For instance, Olmsted & Alvarez Buylla (1995) and Turner et al., (2000) reported that the parts of the plants harvested determine the sustainability of species, and Nault & Gagnon (1993) reported that harvesting a high percentage of bulbs could result in a decline of certain species, leading either to extinction with limited ability to recover or requiring many years to recover due to environmental conditions and other factors (Rock et al., 2004; Ticktin & Nantel, 2004).

Similar studies by Ghimire et al. (2004), who documented the ethnoecological knowledge of resources uses and the local harvesting strategies of medicinal plants in Shey Phok Sundo National Park, found that medicinal plants were harvested only for local use and that the Amachi have an approach that ensures the plants harvested will regenerate. Their harvesting strategies are based on their ethnoecological knowledge. In addition, selective harvesting strategies are used to protect the plants, including the harvesting of mature plants only, harvesting during specific seasons and observing signs of overgrazing and overharvesting (Ghimire et al., 2004). These strategies are similar to those used by the Loita Maasai to protect their medicinal plants. In addition, the conservation strategies used by the Loita Maasai to protect their medicinal plants are

similar to the strategies used by the aboriginal people of North America as shown in Table 5.

Table 2.4. Plants harvesting strategies similarities between the Loita Maasai and the Aboriginal people of Northwest North America (Turner et al., 2000)

Parts of plant used	**Aboriginal sustainable harvesting methods**	**The Loita Maasai sustainable harvesting methods**
Bark	"Narrow strip cut from different trees, patch of bark removed, but trees not girdled"	"When collecting species whose bark is the primary material to be used, the tree should not be girdled or completely stripped of its bark; longitudinal strips of bark along one side of the tree should be cut and collected. This is to ensure that the plant is not killed and could be collected from again in the future."
Roots	"Only a few roots taken from each tree, harvested selectively by size"	"When collecting roots for medicinal use, not all the plant's roots were collected/ cut. The plant could therefore still feed from its remaining roots and survive." "For example, when collecting roots of trees and shrubs, the main roots should not be cut or dug up."
Leaves and branches	"Picked selectively in spring from patches, pruned from growing trees or bushes"	"I make sure I harvest from healthy plants/ species to avoid desiccation, thus deterioration/ death of the plant." "I harvest medicinal plants under the best possible temperatures."

CONCLUSION

The findings of this study extend those of other researchers in the area of ethnobotany and traditional ecological knowledge. This study revealed that the Loita Maasai have a wealth of knowledge about medicinal plant, significant because the well-being and livelihood of the community depend on these resources as does an estimated 80% of the population in developing counties (WHO). They know the geographic location of their plants, their names and uses. In addition, they have a Council of Elders who are tasked with the responsibility of overseeing the use and management of the natural resources. Since their livelihood is dependent on their natural resources, they have developed skills and cultural methods for protecting their medicinal plants. For instance, they use harvesting strategies aimed at protecting the plants against damage and overharvesting.

More specifically, this study found that Loita Maasai primarily use medicinal plants for their health care needs and the majority of the plants (100%) are collected in the forest. The extent of their knowledge is evidenced by the interviews in which 70 different species were freelisted.

The analysis reported here indicates that the participants are also knowledgeable about medicinal conservation and sustainability. They harvest using an approach that aims at sustaining the regeneration of plant populations. In addition, they move to other harvesting sites within the forest if need be. However, despite this adaptive management approach, 68% of the participants reported that is it easier to find medicinal plants earlier than it is now. When asked what they think could be the major cause for this change in

availability, 38% mentioned deforestation, 19% change in lifestyle, 10% population increase and 38% drought. These reasons support previous studies on the cause of plant extinction. A possible solution addressing this issue would be to establish medicinal plants conservation area in Loita. Doing so will ensure that this specialized knowledge of natural resource conservation is not lost and that it will continue to play a major role in sustaining both the medicinal plants and the Loita Maasai culture.

RECOMMENDATIONS

Based on its findings, this study makes the following recommendations.

1. Harvesting a large number of non-timber forest products (NTFP's) has been reported to be unsustainable (Pfab & Scholes, 2004) and can have a negative impact on the ecosystem at all levels, individual, population, species and landscape (Hall & Bawa, 1993; Ticktin, 2004); therefore, there is urgent need to ascertain the status of the medicinal plants in Loita to determine if the current conservation strategies can effectively ensure their sustainability.
2. Given the change in the lifestyle of the Loita from a pastoral to a sedentary one, it is recommended that the TEK be integrated into the science curriculum in the schools to ensure children are exposed to the indigenous ways to conserve their resources as well as learn the medicinal plants available in their environment.
3. Community education program should be developed to inform communities of the wealth they possess and the importance of the conservation of their biodiversity.
4. In an effort to protect plants against extinction, Kala (2000) suggests the establishment of medicinal plant conservation areas. The creation of such areas in

Loita, which can be used to enhance the current traditional conservation strategies, can be accomplished by setting aside a section of the forest for medicinal plants conservation. Creation of conservation areas is not a new concept in Kenya and in Maasailand; wildlife conservation areas (protected areas) have been established, and the same approach can be applied to medicinal plants.

5. To enhance the local conservation strategies of the study area, research should be conducted to establish harvest limits for medicinal plants in Loita. Doing so will help ensure the conservation of overharvested species.
6. The community should be encouraged to grow/cultivate medicinal plants in their home gardens on their farms. This approach will ease the collection pressure in the forest and will ensure a constant supply of medicinal plants even during the drought season.

STUDY LIMITATIONS AND FUTURE RESEARCH

As this study was limited to three villages in Loita, future research could include further interviews to collect and identify the salient medicinal plants identified in this areas. In addition, since the freelisting exercise did not include the collection of the plants and relied on published works for the scientific names, future research could address these limitations. Finally, additional research should be conducted to determine the intensity and the ecological impact of harvesting the salient medicinal plants identified in this study.

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APPENDIX A. ANTHROPAC Output

ANTHROPAC output

ITEM		FREQUENCY	RESP PCT	AVG RANK	Smith's S
1.	ORKONYIL	27	87	6.481	0.554
2.	OLEPARMUNYO	25	81	7.480	0.476
3.	OLNGONGUENYI	24	77	9.042	0.396
4.	OLMISIGIYIOI	24	77	10.125	0.354
5.	OLAMURIAKI	22	71	8.182	0.408
6.	OLKILORITI	21	68	6.762	0.454
7.	OLOIRIEN	17	55	8.882	0.296
8.	OSOKONOI	16	52	9.125	0.295
9.	OLKIRENYI	16	52	13.375	0.190
10.	OLMAROROI	14	45	10.714	0.213
11.	OLOSESIAI	14	45	11.214	0.210
12.	OLPERELENGO	14	45	5.500	0.323
13.	OSEKETEKI	14	45	8.786	0.252
14.	OLAMAI	13	42	9.462	0.222
15.	KILAKI ORKERR	12	39	8.500	0.226
16.	ORKOKOLA	12	39	9.917	0.188
17.	OLOISUKI	11	35	12.364	0.122
18.	OLEDAT	11	35	9.455	0.205
19.	OSUKUROI	11	35	9.273	0.174
20.	ENTARETOI	10	32	14.700	0.100
21.	ENCHANI ENKASHE	10	32	11.200	0.153
22.	OLOGUMATI	10	32	12.600	0.144
23.	OSANANKORURI	9	29	9.333	0.158
24.	OLNGERIANDUS	8	26	13.500	0.105
25.	OLTIMIGOMI	8	26	6.500	0.167
26.	OLUAI	8	26	10.625	0.133
27.	OLTARARA	8	26	11.875	0.107
28.	OLGILAI	6	19	12.667	0.078
29.	OLAMURUNYAI	6	19	11.167	0.114
30.	OLOLALEI	5	16	10.800	0.094
31.	OLOPONI	5	16	12.000	0.071
32.	OLMAKUTUKUT	4	13	14.500	0.061
33.	ENTULELEI	4	13	5.000	0.079
34.	OSEKI	4	13	8.500	0.069
35.	EMOROGI	4	13	9.500	0.077
36.	OLTIPILIKUA	4	13	6.750	0.081
37.	OLPIRIPIRI	3	10	7.333	0.067
38.	OLDUPAI	2	6	12.500	0.039
39.	OLKINYEI	2	6	15.500	0.022

continued…/

ANTHROPAC output

ITEM		FREQUENCY	RESP PCT	AVG RANK	Smith's S
40.	OLERAI	2	6	8.000	0.039
41.	OSENETOI	2	6	4.000	0.053
42.	OLOILEI	2	6	8.500	0.034
43.	ECHANI ENTILE	2	6	7.000	0.039
44.	OSUKUNUA	2	6	10.000	0.046
45.	OLADARDAR	2	6	13.000	0.020
46.	OSITETI	1	3	12.000	0.015
47.	OLAGUMATI	1	3	10.000	0.014
48.	OLETUROT	1	3	14.000	0.002
49.	OLGALAYIOI	1	3	5.000	0.025
50.	EMUKUTAN	1	3	15.000	0.004
51.	EMPERE E PAPA	1	3	19.000	0.002
52.	ENCHANI PUS	1	3	13.000	0.008
53.	ORNG'ABOLI	1	3	14.000	0.010
54.	ORKUJUK	1	3	8.000	0.025
55.	ENGAMAI	1	3	15.000	0.018
56.	OLMAGUTIAN	1	3	20.000	0.013
57.	OLPOPOGI	1	3	2.000	0.030
58.	ECHANI PUS	1	3	15.000	0.002
59.	ORMAKUTIAN	1	3	4.000	0.024
60.	ENCHANI-E-MBAE	1	3	11.000	0.005
61.	ENCHANI ENKERR	1	3	12.000	0.003
62.	OLAIRAMIRAMI PUS	1	3	13.000	0.011
63.	OSEKETEKI OPEJI	1	3	16.000	0.013
64.	ONCHANI OROK	1	3	21.000	0.006
65.	OLE KIUSHIRI	1	3	23.000	0.004
66.	OLNGOSUA	1	3	2.000	0.031
67.	OLNGERIANDUS LOO NTOYIE	1	3	6.000	0.027
68.	OLEMEDUGOKI	1	3	19.000	0.014
69.	ENKORIRI	1	3	25.000	0.008
70.	ORMUMUNYI	1	3	1.000	0.032
	Total/Average	**475**	**15.323**		