Medicinal Plant Sales: A Case Study in Northern Zululand

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I **Busisiwe Gude Ndawonde** declare that the dissertation for the degree of **Masters in Environmental Education** at the University of Zululand hereby submitted, has not previously been submitted by me for a degree at this or any other university, that it is my own work in design and execution and all material contained herein has been duly acknowledged.

BG Ndawonde.....

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Introduction

Most tribes in South Africa still make use of traditional medicines and use prescriptions of herbs and other natural materials (Matsiliza and Barker 2001). Medicinal plants from Northern KwaZulu-Natal (KZN), particularly areas such as Ulundi, Empangeni, Eshowe Mtubatuba and Nongoma are no exception and are a constituent of a traditional culture. The informal trade in indigenous plants for medicinal use (*umuthi*) is growing constantly (Mander, 1998). There are many reasons for this, including an expanding population coupled with modernisation of society that is hastened by the development of roads, improved communication methods and the migration of people from villages to cities. The prohibitive cost of modern medicines, together with the high rate of unemployment is forcing many people to revert to traditional medicines and even to gather and sell medicinal plants as a living. This results in over-exploitation of some plant species, sometimes to the brink of extinction (Matsiliza and Barker 2001). This study aims at investigating the implications of plant harvests that are sold at bus ranks in northern KwaZulu-Natal, and at identifying target species for threatened plant programmes with the help of data gathered via direct interviews with medicinal plant sellers. It also aims at identifying and remedying knowledge gaps that may exist among plant gatherers about propagation techniques applicable to the medicinal plants they harvest.

1.1. Motivation for the Study

Increasing sales figures and profits seem to be more important for herbal medicine sellers than the survival of scarce medicinal plants for future use. In the light of the present poor management of medicinal plant species, it is difficult to believe that enough plants will survive to sustain the livelihoods of plant gatherers and traditional healers for very long unless new strategies are devised for sustainable consumption. Existing measures for sustainable usage are limited to the few medicinal gardens that have been established at Esikhawini, Mthunzini, Sundumbili, Ntuzi, Boulder Hill (Crouch and Hutchings 1998) and KwaHlabisa. However, these gardens have been earmarked for traditional healers, and not for bulk plant gatherers. According to Crouch and

Hutchings (1998), a three-day horticultural training course for traditional healers was held at the Silver Glen Medicinal Plant Nursery in Durban in recent times in order to empower traditional healers to grow umuthi, and hence to make a contribution to conservation. Most of the traditional healers do not harvest medicinal plants in bulk since they use traditional medicine for specific purposes. Medicinal plant sellers, however, harvest medicinal plants in bulk for selling purposes and often cut down the whole tree, or ring bark the tree in order to harvest its bark – thereby causing the tree to die. No studies are known to have targeted the environmental consequences of such plant harvest practices by medicinal plant gatherers.

It is hoped that by making people aware of the importance of the medicinal plants that they harvest, many others will come to learn about and appreciate indigenous plants and the value that they hold with regard to the livelihoods of different communities. It is also hoped that education about sustainable harvesting of plants will help to reinforce the links between the community and the environment. Such links are essential if sustainable utilisation of natural resources is to be realised.

1.2. Problem Statement

The main problem in the medicinal plant selling business is lack of sustainable development practices. The reason is that the primary aim of medicinal plant sellers is for immediate needs fulfillment. They collect a lot of medicinal plants material from the field and sell at a low prices i.e R5.00 per medicinal plant material. In spite of the amount of energy the medicinal plant sellers spent in collecting the medicinal plants and dangers they face of being bitten by snakes and other wild animals, the plants sellers gain very little profit in selling the plants. Trees are stripped off their bark and in some instances roots or bulbs are being removed from some areas by unscrupulous gatherers who are unconcerned about availability of medicinal plants for future generations. That is not sustainable and lends itself into a serious problem that must be addressed.

Another problem is that extinction or severe genetic loss of medicinal plants is due to the lack of detailed information in this regard (Martsiza and Barker 2001). With most of the endangered species, there is little evidence of conservation action. Furthermore, ethno-botanical information is not always passed down from generation to generation among indigenous people. Unlike

scientists who publicise new findings, in indigenous knowledge new findings are held secret, not to be disseminated indiscriminately. Such knowledge and wisdom is passed on only to those family members perceived to be favoured by ancestors. These are issues that should be discussed and shared by those who are educated. There is a great opportunity of becoming from indigenous knowledge wisdom bearers.

Another issue that contributes to the depletion of medicinal plants is the loss of natural habitats. The fast development of towns is the main reason for chopping down of vegetation. Contributory activities include deforestation or ground clearance for agriculture, afforestation of grasslands, uncontrolled burning of fields and livestock overgrazing (Cunningham 1998, Mander 1998 and KZN Wild Life). For instances, in some places such as Richards bay more vegetation is cleared for industrial development. That results in the decrease of indigenous medicinal plants. All of these activities contribute to the extinction of flora including the medicinal plants. Among the genetic resources that are depleted are medicinal plant species that are gathered from the wild. Conservation of medicinal plants, especially endangered ones, depend largely on the conservation of the ecosystem in which they occur (KZN Wild Life). In addition, the supply of medicine by plant gatherers is affected by competing resource uses, such as timber logging, commercial harvesting for export, extraction of pharmaceuticals and use for building materials and fuels (Canningham 1998). These practices cause shortages of medicinal plants that are in high demand by medicinal plant users.

The shortages of supply of medicinal plants versus the high demands of the plants are also a major issue. Indigenous plants are not only used as an alternate health option and a source of employment, but also to meet the growing urban demand for traditional medicine. However, the increase of human population increases the need for certain plants. For instance, there is presently a great demand for the African potato, which is believed to boost the immune systems of HIV and AIDS infected people. Incorrect ways of harvesting the plants and competition with other forms of land use have led to a decrease in the availability of these wild plant resources. In addition, although the value of medicinal plants is widely recognized by both rural and urban dwellers in Africa, none of the researchers had introduced appropriate strategies that may have led to the efficient utilization and management of the medicinal plants that are commonly used by

the communities (Mander). That need for taking action through research to try to decrease the loss and extinction of medicinal plants before it is too late to correct the situation. Therefore the study is an attempt to address the problem of depleting medicinal plant species in the north of KwaZulu-Natal by recording different medicinal plant species sold in bus ranks, document their usage and share information with the plant sellers about appropriate management of their business to sustain the medicinal plant selling business.

1.3. The Purpose of the study

Indigenous plants underpin traditional healing practices, and accordingly they are extensively harvested and traded in urban markets, in traditional medicine (muthi) shops and by the traditional healers themselves (Crouch and Hutchings 1998). The most popular and effective species are also the most vulnerable to over-exploitation as they are in high demand. The demise of plant species relates to the loss of biodiversity, which dates far back as the nomadic era (EEASA Monograph no.3 1999). During earlier times the exploitation of plants and other species was not as devastating because human populations were smaller and the industries and technologies fewer.

Due to urbanisation and an increase of commercialisation in South Africa, the demand for traditional medicines has resulted in substitution with other indigenous plants that are now also becoming scarcer. According to the pharmacopoeia Monograph Project (1999), it sometimes happens that superficially similar but botanical unrelated species are included with the genuine herbs that are prescribed traditionally.

Even though the traditional practitioners are taught how to use medicinal plants in a sustainable way, as Crouch and Hutchings (1998) are still doing in the Richards Bay municipality areas, there is no evidence that traditional healers practice what they were taught. As it is a fact that few studies of this nature have been conducted in KwaZulu-Natal, it is hoped that the present study will contribute to the knowledge pool about sustainable harvesting of medicinal plants by plant sellers and that it will make a meaningful contribution to the reduction of knowledge gaps that may exist with regard to the propagation of certain scarce plant species.

1.4. Objectives of the study

The objectives of this study are as follows:

- To identify the types of medicinal plants that are used frequently in Northern Zululand and to establish what they are used for.
- To investigate whether the plants that are sold by medicinal plant sellers are indigenous or alien species.
- To find out whether there are any knowledge gabs among the plant traders with regard to the propagation of the medicinal plants that they harvest.
- To educate and share knowledge about scientific and indigenous methods of plant propagation of the species that the medicinal plant sellers usually harvest.

1.5. Definitions of the Major Concepts Used in the Study

In order to facilitate understanding of certain issues in this research project, it is important to clarify some of the terms that are used in the study.

Afforestation: The establishment of forests by natural succession or by the planting of trees on land where they did not grow formerly (biology.usgs.gov/s+t/SNT/noframe/zy198.htm).

Biodiversity: Used as an umbrella term for the degree of nature variety (Furze, Delacy and Birckhead 1997). It encompasses all species of plants, animals and microorganism as well as the ecosystems and ecological processes of which they are a part.

Conservation: In aic.stanford.edu/geninfo/defin.html it is stated that conservation activities include examination, documentation, treatment, and preventive care, supported by research and education.

Ethnobotany: According to Nigro, Makunga, and Grace (2004), ethnobotany is a study of useful plants prior to their commercial exploitation and eventual domestication.

Environmental education (EE): This is the process of recognizing values and clarifying concepts in order to develop skills and attitudes necessary to understand and appreciate the interrelatedness among humankind, its culture and biophysical surroundings. EE also entails practice in decision-making and self-formulation of a code of behaviour about issues concerning environmental quality (International Union for the Conservation of Nature -IUCN 1971).

Indigenous knowledge: The word "indigenous" has been used to refer to specific groups of people defined by the criteria of ancestral territory, collective cultural configuration, and historical location in relation to western expansion (Furze, De Lacy, and Birckhead 1997). However, the term has evolved beyond its specific empirical reference. Combined with the term knowledge, it has come to signify a social science perspective as well as a philosophical and ideological position that rests on recognition of the role of knowledge in the power relations with the effect of westernisation.

Umuthi (*Umuthi)*: In the context of this study, it is a noun that refers to traditional medicine.

Sustainability: Amongst other definitions of sustainability, according to Brundtland (1987), sustainability is the ability of keeping resources in equilibrium so that they would be available for use by future generations. Another way of defining sustainability, according to Kirk and Okozawa-Rey (1998), is to view it as the ability of an ecologically sound economy to sustain itself by using renewable resources and generating low or non-accululating levels of pollution. A more sustainable future means rethinking and radically changing correct production processes as well as the materialism as consumerism that support excessive production.

Chapter 2

Literature Review

The collection and selling of medicinal plants has become a highly commercial venture that is carried out by plant gatherers (Crouch and Hutchings 1998). This is more apparent when entering the *umuthi* markets, where one is faced with large volumes of bulbs, bark, roots and mixtures of chopped plant material. According to KZN Wild Life, the value of the medicinal plant trade alone is conservatively estimated at 62 million rand per annum and is rising as the demand increases.

Approximately 450 plant species are sold in markets in KwaZulu-Natal (KZN Wild Life). The amount of plant material traded in KZN is estimated to be 500 tons per year, and most of this material is traded in informal street markets. Mander (1998) tabulates the following costs for medicinal plants in KwaZulu-Natal.

Table 1: Estimates of the amount of priority species traded annually in KwaZulu-Natal

Scientific name	Tonnes	RG*	Street*	S/H*
Scilla natalensis	95.5	R1.89	R6.50	R6.80
Eucomis autumnalis	73.17	?	R6.20	R10.6
Boweia volubilis	43.0	R11.7	R14.0	R27.8
Alepidea amtymbica	31.23	R11.7	R16,0	R17.8
Ocotea bullata	25.25	?	R6.67	R27.7
Curtisia dentata	23.9	R3.28	R7.61	R23.8
Haworthia limifolia	22.5	?	R30.7	R69.2
Warburgia salutaris	17.2	R8.52	R16.9	R31.0
Siphonochilus aethiopicus	1.9	?	R140	R450

RG* = Price obtained by rural gatherer

Street* = Price obtained by street gatherer

S, H* = Price obtained by shops or healers

Two thirds of the population in this province rely on traditional medicine for their primary health care needs. Medicinal plants are also used in large amounts in other parts of South Africa for health purposes (Martiliza and Barker 2001).

With 70-80% of African populations relying on traditional medicines, the importance of medicinal plants in the healthcare system is enormous (Cunningham 1998). Medicinal plants are now given more attention, as evidenced by the recommendations provided by the World Health Organisation (1970). In Cunningham (1998) it is stated that proven traditional remedies should be incorporated within national drug policies, as is already evidenced by recent moves towards a greater professionalism within African medicine. Cunningham conducted a study on surveys, entered into correspondence with other researchers, and conducted field visits in order to establish contact with Traditional Medicinal Practitioners (TMPs) and herbalists in Malawi, Mozambique, Swaziland, Zambia and Zimbabwe in 1990 (Cunningham 1998). The main issue in the study was whether or nor plant species were threatened. Cunningham (1998) categorized the following plant species as being in a danger zone in South Africa.

Extinct in the Wild

Siphonochilis natalensis

Endangered

Warburgia saluteris

Siphonochilus aethiopicus

Vulnerable and Declining

Species that are considered to be vulnerable and declining include the following: *Dioscorea sylvatica, Bersama tysoniana, Ocotea bullata,Ocotea kenyensis, Curtisia dentanae, Pleurostylia capensis, Faurea macnaughtonii, Loxostylis alata, Mystacidium millarii* and *Ledebouria hypoxidoides.*

The most vulnerable species are popular, slow growing or slow to reproduce (Cunningham 1998). The species tabulated below (Table 2) are scarce, but in high demand for medicinal usage.

Table 2: The top 15 medicinal plant species nominated as becoming scarce by herb traders in South Africa (Cunningham 1998).

Species	Zulu name	% (n =44)
Warburgia salutaris	isibhaha	90
Boweia volubilis	ugibisila	84
Siphonochilus aethiopicus	indungulo	68
Eucomis species	umathunga	64
Ocotea bullta	unukani	61
Haworthia limifolia	umathithibala	55
Synaptolepis kirkii	uvuma-omhlophe	52
Scilla natalensis	inguduza	36
Eucomis species	imbola	34
Erthrophleum lasianthum	umkhwangu	32
?	uvuma obomvu	32
Curtisia dentata	umlalheni	27
?	uphindemuva	27
Asclepias cucullata	udelunina	27
Cinnamomum camphora	uroselina	25
Begoniam honymma	idlula	25

Among the key issues of sustainability is the over-exploitation of particular plant species in South Africa in order to satisfy customer demand. Cunningham (1998) has also tabulated figures of the most popular species sold in larger quantities in KwaZulu-Natal (Table 3). Refer to the table hereunder.

Table 3: The top 15 medicinal plant species nominated by rural herbalists as becoming scarce in South Africa (Cunningham 1998)

Species	Zulu name	%(n=44)
Ocotea bullata	unukani	90
Warburgia salutaris	isibhaha	85
Boweia volubilis	ugibisila	70
Scilla natalensis	inguduza	65
Helichrysum species	impepho	60
Eucomis species	umathunga	55
Haworthia limifolia	umathithibala	55
Cassine transvaalensis	ingwavuma	55
Alepidia amatymbica	ikhathazo	50
Pimpinella caffra	ibheka	45
Acacia xenonthophloea	umkhanyakude	45
Curtisa dentata	umlahleni	45
Gunnera perpensa	ugobho	45
Cassine papillosa	isehlelamanye	45
Eucomis species	imbola	34
Erthrophleum lasianthum	umkhwangu	32
?	Uvuma obomvu	32
Curtisia dentata	umlalheni	27
?	uphindemuva	27
Asclepias cucullata	udelunina	27
Cinnamomum camphora	uroselina	25
Begoniam honymma	idlula	25

Out of all the plants recorded, 92% were considered to be non-threatened or scarce, for example *Tetradenia riparia.* Five percent of the recorded plants were listed as vulnerable and one percent was listed as rare. Some of the taxa, such as *Lantana camera* and *Melia azedarah*, have been declared alien invaders. KwaZulu-Natal Wildlife has reported that 22 000 tons of medicinal plant material is sourced from grassland and savanna biomes. The potential of the area to supply medicinal plants is, however, far larger than forest regions. It is reported that numerous grassland

medicinal plant species are declining in numbers, as shown by the effort required by gatherers to find adequate stock. The report revealed that plant gatherers use chain saws to remove *Ocotea bullata* and to strip its bark for the medicinal plant trade. Such a method of harvesting is completely unsuitable, since it causes the stems of the plants dry out, which results in the death of the plant.

Crouch and Hutchings (1998) state that although efforts have been made towards the conservation of medicinal plants, such efforts were mostly aimed at the conservation of trees from which plant traders normally harvest roots or stem-barks. Table 4 (refer to Page 80) shows the quantities of medicinal plants sold by medicinal plant sellers and the income generated by this activity. The sellers were not asked whether they left some of the bulbs for further growth of the plants or whether they painted the trees with glue so that the stems of the plants left behind do not dry out. Mander (1998) and Cunningham (1998) recorded the popularity and extensive utilisation of tree products. It is reported in Mander (1998) that barks and roots accounted for 54% of the plants traded in KwaZulu-Natal.

2.1. The Importance of Medicinal Plants

Nearly all cultures, from ancient times to today, have used plants as a source of medicine. In many developing countries, traditional medicine is still the mainstay of health care, and most of the drugs and cures used come from plants (Aggrawal 1998). In developed countries, many people are turning to herbal remedies, especially for minor ailments. Modern scientific medicine also depends on plants and the knowledge gained from plants for the development of certain essential drugs. The widespread usage of plants is usually accompanied by the assumption that those that have been identified as having medicinal properties will be available on a continuing basis (Aggrawal 1998). However, no concerted effort has thus far been made to ensure this, and in the face of the threats of increasing demand, a vastly increasing human population and extensive destruction of plant-rich habitats such as the tropical forests, there can be no guarantee that we will continue to benefit indefinitely from this valuable resource provided by medicinal plants.

The populations of developing countries worldwide continue to rely heavily on the use of traditional medicine as their primary source of health care (Cunningham 1998 and Martsiliza and Barker 2001). According to Cunningham (1998), ethnobotanical studies throughout Africa confirm that native plants are the main constituents of traditional African medicine. Medicinal plants play an important role in both western medicine and in traditional healing. Higher plants, some of which are threatened with extinction, are used as a resource for pharmaceutical ingredients and traditional medicines (Martsiliza and Barker 2001). The compounds contained in medicinal plants may serve as templates for synthetic drugs. Herbalism is not only practiced as an alternate health option, but also as a measure to meet the growing urban demand for traditional medicine.

2.2. Sustainable Use and Conservation of Medicinal Plants

According to Cunningham (1998), there are three main areas of conservation of medicinal plants, namely *in-situ* and *ex-situ* conservation, education and training, and research. Martiliza and Barker (2001) were responsible for further studies on the sustainable use of medicinal plants in South Africa. They found that although traditional healers were adamant that they followed sustainable usage practices with regard to medicinal plants, there was increasing evidence of ring barking, especially among trees such as the *Araucaria heterophyta* found around Grahamstown. Ring barking is basically the removal of bark surrounding the stem of a tree. This damages the epidermis of the plant and results in its stem becoming desiccated – which eventually results in plant death.

2.2.1. *In-situ* and *ex-situ* conservation

In-situ (or "On-site") work occurs at the plant's habitat (home in the wild). *In-situ* conservation efforts protect and enhance a plant's habitat. Protection of these areas can be as simple as putting up small fences to protect plants from being eaten by domestic animals such as pigs, cows or goats. More active measures to restore habitat could include weed removal or restoring fire to an area that, historically, would be subjected to a controlled burn.

In order to ensure the successful establishment of *in-situ* conservation systems, it is recommended by Cunningham (1998) that the identification and effective protection of

vegetation association be done in areas or regions with a high density of vulnerable medicinal species, such as Swaziland, South Africa and Kenya.

Off-site (or *ex situ*) work takes place away from the plant's habitat. *Ex situ* conservation includes seed banking and the growing of plants at botanic gardens – either in the garden itself or in laboratory test tubes. In some cases this may be difficult, as certain species may be especially vulnerable, for example *Faurea macnaughtonii* and *Podocarpus facatus*, where the removal of patches of bark for local medicinal purposes initiates fungal and borer attack and stem heart rot.

These programmes should not be seen as a replacement for the conservation of wild plants and wild areas. Rather, they are intended to support habitat-based conservation efforts. Together, *in situ* and *ex situ* methods are part of a more inclusive effort, called "Integrated Conservation Strategies," in which off-site efforts are seen as a valuable support tool for habitat-based conservation efforts. Both methods work to increase the plant's chances of survival in the wild.

2.2.2. Education and Training

The conservation of medicinal plants is by necessity a long-term project requiring the development of trained staff supported by organisations and a general public that is aware of the issues at stake. Improvement in national education standards is the key factor in the conservation issue, which will come about only as a result of economic development in the African nations (Cunningham 1998). Sound policy decisions, which would influence the levels of education available, are also important in prioritizing sustainability. The following recommendations were made by Cunningham (1998) and KZN Wildlife (2004) with a view to increasing public awareness of the value of medicinal plant resources:

- Instituting campaigns that promote medicinal plant conservation and encouraging the cultivation of medicinal plants. Target groups would include rural communities, government and decision-makers.
- Implementation of media campaigns through national radio networks to publicize information on the scarcity of popular medicinal plants and the possibility of them becoming extinct.

- Developing an information programme for senior decision-makers in African governments to link public health with medicinal plant conservation issues.
- Developing well-informed campaigns targeting companies that export African wild plant material for production of pharmaceuticals.
- Studies and research information should be simplified, demystified and written in language that can be understood by ordinary people from rural areas.
- Information relating to adverse toxic properties in medicinal plants should be circulated particularly among Traditional Medical Practitioners (TMPs) and trainees in primary healthcare.

2.2.3. Research and Monitoring

Research into the identification of areas of high biological diversity at the micro scale and research into the properties and usage of specific plants at a micro-scale should employ the complementary skills of TMPs and conservation biologists (Cunningham 1998). Conservation efforts and checking of plant status could be coordinated where plants are being conserved for uses other than for medicinal purposes. Specific recommendations by Cunningham (1998) include:

The initiation of a series of interactive discussions involving TMPs, commercial gathers and market-based traders to discover the perceived scarcity of species, as well as the perceived problems and solutions.

The initial focus should be on heavily populated regions where plant scarcities are likely to occur. Action research projects at pilot-study level should be set up in selected countries to access the economic viability and social acceptability of large-scale production.

An experienced African-based coordinator should be appointed to implement damage assessments for the following scarce species: *Okoubaka aubreville, Garcinia afzellii* and *Warburgia salutaris*. A research project, similar to the IUCN study of the international bulb trade, should be initiated.

According to Martsiliza and Barker (2001), commercial gatherers, unlike traditional healers, do not adhere to conservation practices with regard to medicinal plants. Crouch and Hutchings (1998) found that some traditional healers had re-planted the plants that they used most in their backyards. In addition to this, traditional healers were taught in the course of their studies to cultivate medicinal plant species in the gardens made by Crouch and Huthchings (1998).

Medicinal plants are harvested in large quantities but sold at low prices, as shown in Table 4. Domestication may be one of the means of achieving medicinal plant conservation by reducing the exploitation pressure exerted on naturally occurring plant species. This protects plants that are being threatened in their natural habitats. Other measures and/or plant properties help to conserve medicinal plant species in Africa. These include cultural practices and taboos as well as religious and spiritual beliefs (Aggrawal, 1998).

Writing in "Strand weaving: Southern African dreams of development education and sustainability," van Rensburg (1997) argues that indigenous or traditional ecological or local knowledge should be encouraged in recognition of marginalized ways of knowing, which carry with them some sustainable ways of dealing with the environment. It was for this reason that the medicinal plant sellers were asked to share their successful methods of propagating different plants.

It is interesting to note that Marmot (2005), in dealing with social environment and health, rates environmental matters as important for human health. This is because social and environmental conditions affect health. He argues that rates of mortality and illness differ markedly from area to area. Just knowing which medicinal plants are used in large quantities within a certain geographical area, might give an indication of the diseases that are prevalent in that area. If we know what diseases are prevalent in certain areas, we could then investigate environmental influences that promote illnesses and seek corrective measures. Sometimes illnesses are caused by cultural and social practices that are not conducive to good health.

2.3. Biodiversity and Conservation of Medicinal plants

Biodiversity, specifically biological biodiversity, is important in that individual species provide raw materials for many human activities. For example, biodiversity provides medicinal resources and traditional medicines based on plant and animal species from the bases of health care for 80% of the world's population. In many nations prescribed medicines contain active ingredients derived from plants (Furze *et al* 1997).

2.4. The Implication of Indigenous Knowledge in Sustainable Use of Medicinal Plants

In the past, sustainable use of medicinal plants was facilitated by several inadvertent or indirect controls, as well as by certain international management initiatives (Cunningham 1998). Taboos, seasonal and social restrictions on gathering medicinal plants and the nature of plant gathering equipment all served to limit medicinal plant harvesting. In South Africa, for example, before metal machetes and axes were widely available, plants were collected with a pointed wooden digging stick or a stone axe, which tended to limit the quantity of bark or roots to be gathered. For example, traditional subsistence harvesting of *Cassine papillosa* bark causes little damage to the tree. Pressure of medicinal plant resources has remained low in remote areas and countries such as Mozambique and Zambia, where the commercial trade in traditional medicines has only developed to a limited extent due to the small size of major urban centres. According to Cunningham (1998), examples of factors which have limited pressure on species that would otherwise have been vulnerable to over-exploitation, include the following:

- Taboos against the collection of medicinal plants by menstruating women in South Africa and Swaziland; it is believed that this would reduce the healing power of plants.
- The tendency of southern African women to practice as diviners, while men practice as herbalists. This limits the number of resource users.
- The perceived toxicity of some medicinal species that reduced their use in the past: the level of toxicity is sometimes given mythical proportions. *Synadenium cupulare* for example, is considered to be so toxic that birds flying over the tree are killed; special ritual preparations are made in West Africa before the bark of *Okoubaka aubrevellei* is removed. The traditional use of wooden batons for removal of bark from *Okoubaka aubrevellei.* Under no circumstances may a machete or other implement be used. In addition to these measures, as pointed out in EEASA

monography no. 3 (1999), other sustainable methods were used by indigenous people in the collection of medicinal herbs. According to van Rensburg (1997) indigenous or traditional ecological knowledge must be given recognition. Other ways of knowing should not be marginalized in their contexts, particularly, if they carry with them other ways of interacting with environments in a sustainable manner.

2.4.1. Collection of bark

It was traditionally believed that bark from a tree should only be collected for medicinal purposes from the east and west-facing parts of the trunk. For instance, barks from *Acacia xanothophloea* are taken from east and west faces since it is believed that these are the areas where the sun strikes, which makes the medicine more active as a lucky charm. Bark taken from the north and south faces were believed to be ineffective for curative purposes. This method ensured that the plant, although ring-barked, was not killed and could be collected again in the future.

2.4.2. Collection of roots

When roots were collected for medicinal use in earlier times, some of them were left to ensure the plant's survival. It was also believed that if part of a plant was collected for medicinal use and the plant perished as a result, then the patient being treated by that medicine would also die.

2.4.3. Use of plants that have already been collected

The collection of bark, roots, branches, leaves and other plant parts from a plant that showed signs of having been collected by another traditional healer was prohibited. It was believed that when a traditional healer used a plant to treat a patient, the patient's disease was transferred into the plant. When another traditional healer subsequently used the same plant to treat a patient, the disease of the previous patient would be transferred to the patient. This belief ensured that plants recovered from the effect of collection.

2.4.4. Use of annuals

Whenever a traditional healer collected annual plants for medicinal use, they had to leave behind some individuals of the species at the collection site. It was a belief that if a species were completely destroyed in a particular area, then the patient to whom the medicine from the species

was administered would also die. By leaving behind some representatives of the collected species, localized rare species were protected from extinction.

2.4.5. Use of seeds

Seeds were rarely used for medicinal purposes. When they were used, it was usually as a lucky charm placed in a pocket or hung around the neck. For instance, the seeds of a medical plant called U*msinsi* are believed to be kept in a wallet since they are believe to increase money in the bag – but only one seed per bag was thought to be enough. This limited the use of seeds and allowed the perpetuation of plant species through seedlings.

2.5. Implications of Environmental Education in the Conservation of Medicinal Plants

Public awareness of the value of botanical conservatories, arboretums, parks, reserves and gardens needs to be raised in order to develop an appreciation for their role and to develop a plant conservation ethic amongst our communities. It seems as if people are not concerned with the conservation of indigenous fauna and flora unless they realize their value. If this value is not appreciated, all our efforts will be undermined by the activities of surrounding communities. Case studies in which education, communication and public awareness have been successful in promoting conservation should be documented and widely disseminated. According to KZN Wild Life, numerous programmes are in place to facilitate the cultivation of medicinal plants. The staff of KZN Wild Life is involved in raising awareness among traders at Durban markets and in enforcing permit conditions.

It is necessary to communicate the link between protected conservation areas and local communities. Mass media is a strong communication tool in society. However, most environmental issues of concern, including the plight of protected areas, do not usually find themselves in popular media channels such as radio and TV (http://www.conserveafrica.org.uk/nat_products.html). As a result, conservation issues remain to a large extent the domains of conservation scientists. There is a need to reach the public through popular media channels. To this end, the mass media (both print and electronic) should be involved actively in environmental education. KZN Wild Life is involved in formulating species recovery plans for all priority medicinal plant species. These plans are species specific and

include aspects of artificial propagation for re-introduction into the wild as well the formulation of strategies for sustainable wildlife harvesting.

We need to have a co-operative model that allows indigenous healers and modern medicine practitioners to co-exist as two independent sectors, each representing its own uniqueness. Mutual referral may be promoted as a good strategy, but its success depends upon the two modes of healing respecting each other's uniqueness and competency. Equally important is the element of training, particularly at tertiary level. Healers from both fields need to be trained to understand each other's mode of care. This type of knowledge could help in improving quality patient care. Health professionals have a daunting challenge of including indigenous healing as a field of medicine at nursing schools, technikons and universities. This challenge becomes even more pressing with the introduction of the African Renaissance ideal. For a long time medical school curricula in South Africa were based on Western paradigms, a factor that robbed the African students of knowing and understanding their roots. Essentially, medical field curricula should be revamped to offer students a choice between indigenous knowledge, modern medicine or both. The major challenge is to integrate traditional medicine in both theory and in practice (EEASA Monography no. 3 of 1999).

Chapter 3

Methods and Materials

3.1. Introduction

This chapter explains how the research was conducted and the steps that were taken to ensure the validity and reliability of the study. The aims of the study, as stated in chapter one, was to identify the plants that are sold at bus ranks in northern Zululand; documentation of the usage of various plants; and an effort at filling knowledge gaps with regard to the propagation of medicinal plants that are used by the plant sellers.

3.2. Research Instrument

The research instruments that were used in the study were the questionnaire and semi-structured interviews that were held with the respondents. According to Spata (2003), the questionnaire and individual interview are the most common instruments for data collection in survey research. In the empirical investigation of this study the semi- structured interview was employed as a tool for collecting data. Semi-structured interviews were conducted since they allow probing to questions where desired.

The interview is a direct method of obtaining information in a face-to-face situation. The interview is used in research, personnel selection, counselling, vocational guidance, and in medical and psychiatric diagnosis. In this study, however, we were concerned only with the research interview.

3.3. Eclectic Approach to Research

Two forms of research were employed in the study, namely qualitative and quantitative research. Furze, De Lacy and Birckhead (1997) explain the distinction between qualitative and quantitative forms of knowledge in terms of the conceptual aspect and the methods used. In the conceptual sphere qualitative research is concerned with an understanding of human behaviour, from the perspective of those people involved. Qualitative research assumes dynamic and negotiated reality. In contrast, quantitative research is conceptually concerned with discovering facts about social phenomena, and assumes a fixed and measurable reality. This basically means, according to some researchers, that it is important to recognize that people interpret their own lived realities

according to their social, economic, and political context-lives, experiences and surroundings. This belief underpins the theoretical framework of my research. Other researchers focus on facts as observable, measurable entities that can be assessed objectively and that have a meaning beyond their immediate social context. That is, they look for social laws that govern their human behaviour and interaction. Research methods also reflect this conceptual distinction. Because the research deals with numbers of plant sellers and the quantity of medicinal plant herbs that they harvest, the quantitative method was also useful in presenting accurate information.

Qualitative research information is collected by means of structured or semi-structured interviews and is analysed according to themes from descriptions supplied by respondents. Quantitative research, on the other hand, is collected by means of measuring things, using survey instruments, observation and structured interviews. It is analysed through numerical comparisons and statistical inferences, and is reported by means of statistics.

3.4. Qualitative method of collecting information

The research was conducted through semi-structured interviews with the respondents using a questionnaire (ref. Appendix 1). Information gathering included two types of information, namely demographic information (including where the seller lives, gender and the age of a plant seller), and plant distribution data (including where the plants were obtained; which part(s) of the plant were used; which plants were more in demand; which plants were inadequate; and what the plants were used for).

The demographic information supplied by the respondents showed where the sellers resided, their average age and the dominant gender among sellers of medicinal plants. The distribution of the plants revealed more information about their habitats (whether they originated from grasslands, wetlands or sub-tropical forests or even from dune forests). Such information helped to establish whether the medicinal plants were xerophilic, hydrophilic or whether they could be grown in rocky places. It was furthermore important to pinpoint the exact part of the plant that was used for medicinal purposes (i.e. seeds, leaves, stems, roots, fruits or even the whole plant).

Information about the usage of medicinal plants was collected in face-to-face interviews with medicinal plant sellers. This method of interviewing was used because it enabled the interviewer to establish rapport with the respondents while listening to them (Mugenda 1999). The interview permitted more complex questions to be asked than in other types of data collection, since it was easier to probe further if there was something that the researcher was not sure of. The interviews were conducted in Zulu and the information was translated into English. The plants sold by the medicinal plant sellers were given scientific names using Hutctings (1996), Pooley (1993 and 1998), Diederichs (2001), Diederichs, Mander, Crouch, Spring, McKean and Symmonds (1995) and Ngwenya (2003). The conservation status of the plants was checked using preliminary survey literature and the South Africa Red data list (Golding 2002).

3.5. Quantitative research method of collecting data

The quantitative research method was also employed in the study due to objectives that dealt with aspects that were quantifiable. Descriptive research is a kind of research where no attempt is made to change behaviour or condition; things are measured as they are. In the study I included the calculations for numbers of the respondents and the calculations of plant species obtained from each respondent and per sampling site. The kind of descriptive study used here is a case study, which is a type of descriptive study that is comprehensive and employs reports of data and subjects that are observed without intervening, unlike experimental measures whereby subjects are manipulated. A case study looks intensively at individuals or a group and only in that specific conext. Researchers do not focus on the discovering of an universal generalisable truth nor do they typically look for cause-effective relationship instead emphasis is placed on the exploration and description. The quantitative data obtained during the study include: geographical representation of the number of respondents, the age of respondents, distribution of plant patterns, the number of plants (obtained from plant sellers that employed propagation) and income generated by the medicinal plant sellers. The research questions formed as 'who sell the medicinal plants, what types of the plants they sell , where the medicinal plants were collected, how and how do the plant sellers collect the medicinal plants and why are the plant sellers sell the medicinal plants determine the relevant strategy to be used in this study. That leaded to the detailed, explanation and comprehensive analysis of results that is called a case study.

3.6 Case study

The study objectives were meant to address the question including what types of medicinal plants are being sold in bus ranks in northern KwaZulu-Natal, who sell the plants how the plants are collected and the reason for the medicinal plant sellers to sell the medicinal plants. To accomplish these aims a case study research methodology was employed. A case study is an intensive detailed description and analysis of a project or programme in relation to its context (Definition of a case study on the web http://www.cdcgov/tobaioncco/evaluation manual groglossary.html). It is an ideal methodology when a holistic, in depth investigation is needed. In http://www.anova.ed/ssss/QR/QR3-3/tellis2.html it is stated that case studies have been used in varied investigations, particularly in sociological studies, but increasing instruction. That includes other disciplines such as education, science and etc. Since 1950 cases have been used in the classrooms and lecture halls, either as a part of the course of the study or as the primarily focus of the course to which other teaching material is added (Armsted 1984). The basic purpose of the instituting the case study method was to transfer much of responsibility for learning from teacher on the student. In this study a case method was aimed to encourage medicinal plant sellers in order to use natural resources i.e. medicinal plants sustainably. According to Merseth (1991) in addition to the practical application and testing of scholarly knowledge case discussion can help students to prepare for real world problems, by providing an approximation of various profession environment i.e classroom court room and hospitals. This also applies to informal education system where by community members can discuss environmental issues though work, seminars and presentations.

There are specific types of case studies: exploratory, explanatory and descriptive cases studies (http://www.anova.ed/ssss/QR/QR3-3/tellis2.html). Exploratory cases are considered when the case study used to understand more than what is obvious to the observer. Explanatory case studies may be used in for doing casual investigation. They are sometimes considered as prelude to social research. On the other hand descriptive cases require a descriptive theory to be developed before starting a project. It can be used in education studies using pattern-matching procedure. In this research a descriptive case study was used since it involved a detailed description of the life-world of medicinal plant sellers which was accompanied by a detailed analysis of results. Today these methods are used by researchers and are developed and tested as

any in the scientific field. Case studies tend to be selective, focusing on one or two issues that are fundamental to the understanding the system being examined. The limitation of a case study is that they have no reporting format hence the experience of the investigator is a key factor. Some researchers use journal report format which are suitable for their study but not to other studies. The reason for the absence of fixed reporting format is that each case study is unique. Data collection, research questions and the unit of analysis cannot be placed into a fixed mold of experimental research. However, the case study is useful since they give a clear description of the issues examined and the reporting format must be concise and be in detailed, particularly when quantity is desired, in this case the quantity of medicinal plants sold by medicinal plant sellers A case study of the trade in medicinal plants in Eastern Cape Province documented a minimum of 166 plant taxa in trade (Dold and Cocks 2002). A case study of medicinal plant sold in northern KwaZulu-Natal revealed 163 medicinal plants sold. The results of this nature are descriptive, brief and concise to confirm the requirements of a case study.

3.7 Data collection

Sampling took place in six areas in the north of KwaZulu_Natal (Appendix 2). Dimensional sampling was employed in the study since it involves identification of factors of interest in a population as well as responses to every combination of factors. During sampling, the respondents were interviewed individually at each sampling station. The information per respondent and per site was recorded irrespective of ratio of males to females. All sellers that were willing to be interviewed were interviewed because the number of plant traders was small in the sampling areas. The number of sampling sites were then increased from four to six sites since the number of traders that were interviewed in the four site was insufficient, i.e. less than 50. It is recommended that the number of objects sampled should be targeted at 50, for statistical purposes (Spata 2003).

3.8. Data analysis

Information supplied by respondents to the questionnaires was analysed and tabulated in bar graphs representing raw data as supplied by respondents, such as the Zulu names of the plants, medicinal plant usage, including the parts that were utilised. The tables expressed in percentages the number of informants interviewed, their age ranges and the plant distribution patterns.

3.9. Statistical analysis

The data analysis took into account the fact that the data reflected neither densities nor replicates. The reason for not having replication is that it would be of no practical use to visit the bus ranks repeatedly since the information that would be obtained in each subsequent visit would be the same as that which was obtained in the first visit. The people interviewed would not change in terms of numbers – neither would the medicinal plants (or the quantities) that they sold. It would be impossible to measure the areas of the bus ranks; therefore the densities in the data were not calculated.

Likewise, the research project did not make use of a statistical analysis approach. An ecological statistical test in Playmount Routines, in multivariate Ecological Research (PRIMER), uses statistical packages that give 'stress' values instead of *p* values. The 'stress' value is interpreted in almost the same way as a *p* value. Spata (2003) states that one has enough subjects, e.g. in a sampling size ≥ 50, for the sampling error (*p*), for the effect to be less than 0.05. Therefore, the smallest effect would make a difference to the subjects or the interpretation of the results. This basically means that a valid conclusion can be drawn from the results.

In this study a **multivariate analysis** based on hierarchical clustering analysis followed by non-metric Multi-dimensional Scaling (MDS) in Playmount Routines in multivariate Ecological Research (PRIMER) were employed. In these methods similar samples are grouped and plotted closer to each other, while least similar groups are plotted further apart (Clarke and Warwick 1994). According to Clarke and Warwick (1994) there is a need for data to be normalized before any statistical analysis is performed. The employment of different transformations in PRIMER accomplished such a normalisation. The transformations included the 4^{th} root, $\log_x$ and square root transformations. The 4^{th} root is highly recommended for ecological community data, especially when spatial and temporal variations are considered. The log transform [log (1+y)] method was used, as it down-weights the very important abundant species and always has a positive value. The information gathered was based on only spatial variations rather than on both spatial and temporal variations. The reason why the data was normalised is that the obtained data from different numbers of respondents per site was based on counts or actual numbers rather than

on densities. Only one factor was sought, namely the spatial variation (i.e. the sampling site analysis, not the duration).

The **square root transformation,** which calculates the counts in terms of square numbers, was also used because it makes a high variation between high weights and low weights. The drawback of this transformation is that it is relatively weaker in transforming data since it makes high variations in terms of large and small counts. The data was subjected to Kolmogorov-Smirnov test to conform for any normality before it was analysed using DIVERSE routine methods in PRIMER. This was done in order to show how medicinal plant species differed from site to site. Hierarchical clustering using Bray-Curtis similarity Classification and MDS ordination was used to observe spatial variation in medicinal plant data and to delineate sampling locations for distinct species. This was done on site, using all species in which multivariate routines were performed in order to allow analysis of spatial variations in medicinal plant species. MDS at 10 runs was undertaken in order to obtain the potential useful ordination and to find the global minimum. This means that the runs were done until two solutions with the same stress values were achieved (Clarke and Warwick 1994).

Diversity indexes such as the Shannon-Weiner diversity index [H'=Σpi (log pi)] and Margalef's index of species richness [d=(S-1)/LogN] are mathematical expressions of benthic data (Clarke and Warwick 1994). These can be used to reflex the responses of benthic community to their environment. However, they can also be used for any ecological data (Mr. Vivier pers.comm.). For the purposes of the study only S, which is the number of species, and N, which is the sum of individuals, were used.

3.10. Workshop Organisation

An informal education workshop was held in order to share knowledge with plant traders with regard to endangered plants, harvesting patterns and plant usage.

Informal education takes the form of an organised educational activity outside the established formal system. It focuses on encouraging the inclusion of environmental components in all relevant training and extension programmes, including accredited vacation courses, on-the-job training, literacy and adult basic education, informal agricultural extension work, and community

development programmes. Non-formal education was used since it is an area of environmental education that deals with educating communities.

The study involved an action type of research interaction with the community. An action research method links theories of change with practical action in addressing a problem. The study involved local community representatives to address the issue of medicinal plant gathering. It was developed primarily to empower people with skills and knowledge of environmental education in order to address environmental problems that they encounter in their environment. According to Guidelines for Environmental Education Policy and Strategy Processes in the SADC States (1999), in action research everybody participates, including adults, children or any member of the society. This approach influences the nature of partnership within communities, in this case to ensure the preservation of local biodiversity and to monitor the sustainable harvesting of natural resources. One of the subjects that is best suited to achieve such partnership with communities is environmental education. According to the World Conservation Union (1999), cooperation and coordination are vital for effective and efficient implementation of environmental education; so too is cooperation and coordination with other partners in environmental education.

The respondents attended a workshop that was held at the University of Zululand, where they were shown how to use, yet conserve plants in a sustainable way in order to propagate the plant species. The workshop was based on information sharing between the researcher and the participants. The participants were given a slot in which they could suggest how plants could be cultivated and propagated in a sustainable manner. Following this, the researcher presented her approach to plant propagation and cultivation, which was based on the following:

- The different soil types preferred by medicinal plants.
- Habitat: e.g. in grasslands, forests or in between the rocks.
- The percentage of shade needed for optimum growth.
- The required amount of water to irrigate per day.

The study was carried out in collaboration with different departments at the University of Zululand, including Botany, Comparative and Science Education and the Department of

Agriculture and Environmental Affairs. The Department of Botany assisted with regard to taxonomic knowledge of the plants and their botanical names, while the Department of Comparative and Science Education contributed to the education component of the project and in developing environmental awareness among the participants. The Department of Agriculture and Environmental Affairs helped in addressing the plant gatherers, since they are already involved in the sustainable usage of medicinal plants.

3.11. Ethical issues

Mugenda (1999) defines ethics as the branch of philosophy that deals with the researcher's conduct, and serves as a guide to behaviour in this regard. Researchers adhere to certain ethical guidelines and laws that govern their work in order to guard against unethical practices, such as research plagiarism and fraud. Plagiarism refers to situation where a researcher refers to another person's work without acknowledging the author. According to Mugenda (1999), ethical issues that concern the research subjects include the following:

3.11.1. Confidentiality and privacy

Information given in confidence should be kept confidential, especially if confidentiality has been promised in order to protect respondents. While this study was in progress, some of the respondents expressed concern about the confidentiality of information given with regard to the location and usage of plant material. The researcher therefore sought permission from the informants to use the information that they supplied with regard to medicinal plants in a confidential way and they were assured that such information would not be used for generating income.

Initially, it was clear that the respondents did not trust the researcher. In addition to this, traditional healing is, in cultural terms, a confidential matter. After explaining that the information that was required was not for healing practices but for purposes of sustainable usage of plant material, some of the respondents, particularly the females, were willing to provide information on what they sold and what was it was used for. In order to access the information and gain the sellers' attention, the researchers had to first buy medicinal plants. The sellers were

then ready to tell them more about the names of plants and their uses. It was also necessary to buy samples in order to take pictures in the laboratory and to compile a species list.

3.11.2. Anonymity

Anonymity refers to the identity of individuals being protected, either by using numbers, third parties or pseudo names. A researcher could disclose information about a particular individual but still protect the identity and privacy of the individual in question. During the study, the respondents' permission was obtained with regard to the taking of photographs and the usage of names. Some of them agreed to photographs being taken, while others disagreed. The respondents were reassured that the research had nothing to do with them as individuals, and on such terms they were requested to participate in the research.

3.11.3. Voluntary and informed consent

Research must conform to the principle of voluntary and informed consent, so that the respondents willingly participate in the research project in question. During the study of medicinal plants, only those who were willing to participate were interviewed, while those who did not want to do so were not forced to give information. According to Mugenda (1999) it is unethical for a researcher hide the real purpose of the research fearing the subject's refusal to participate.

The benefits of voluntary and informed consent included a spirit of openness in which a workshop could be offered for the participants, with benefits for both parties: the researcher and the respondents. The researcher benefited in that she obtained information about medicinal plant sales at the bus ranks, while the respondents gained important information on the propagation of medicinal plants as well as tips concerning medicinal plant sales, pricing and the sustainable usage of the plants. The workshop also presented a forum where the medicinal plant sellers could discuss issues of mutual interest.

3.11.4. Reasons for conducting the study

This study was deemed necessary since an estimated 80% of South Africans regularly use traditional medicines derived from indigenous plant species common to the region of northern

Zululand. These medicines may be obtained on prescription from traditional healers, purchased from herb sellers or gathered in the wild for self-medication. The northern Zululand region was chosen since it is within easy reach of the University of Zululand, where the study was launched.

3.11.5. Who benefited from the study?

Both the researcher and the medicinal plant traders benefited from the research since both parties were not only expected to provide information on the propagation of medicinal plants, but they were also empowered with information about medicinal plants, especially in areas where knowledge gaps exist. At the same time they were empowered by business tips, e.g. in revisiting the costs of medicinal plants they were taught to think about ways of making medicinal plant selling a more viable business.

3.11.6. Problems encountered

Problems experienced during the study included certain respondents who would not provide information since they believed that they would be prohibited from selling plants in future. Some of them chose to provide incorrect information about the use of medicinal plants and other gave incorrect names for the plants. Certain medicinal plant sellers were concerned that their information could be exploited and used for private gain by the researcher. However, the interaction was good with most of the respondents, since a common language, iSiZulu, was used and it was also easier for a female researcher to interact with females. The males were more careful about giving away information easily.

Chapter 4

Data Presentation and Interpretation

4.1. Distribution patterns of medicinal plants

This chapter discusses and analyses research results obtained by means of questions based on direct interviews with the plant sellers. It is divided into two sections, namely section (4.1.1) containing sociographic data of the respondents and section (4.1.2), which deals with medicinal plant distribution patterns.

4.1.1. Sociographic data of the Respondents

4.1.1.1. Number of Respondents

The number of male and female respondents from sampling sites is given in Figure 1.

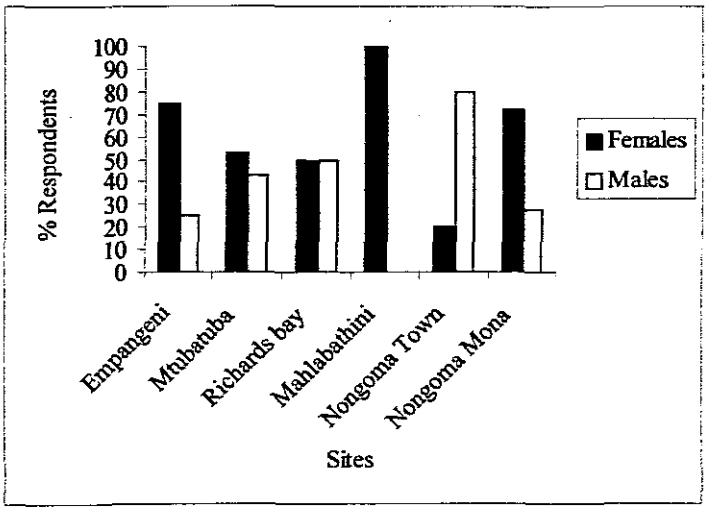

Figure 1: Percentage of Medicinal Plant Sellers in Northern Zululand (n=63)

The total number of medicinal plant gatherers sampled in the study was 63. Out of the 63 respondents, 77% were females and 23% were males. This gender pattern may be due to the fact that men are mostly occupied in other jobs, including those in industry, whereas females more often spend their time in jobs that are home-based or close to their homes, which would include the selling of medicinal plants. Another reason may be that rural southern African women traditionally practice as diviners, while men practice as herbalists (Cunningham 1998). This

could be a reason for the smaller number of males who are medicinal plant sellers, since the herbalists are not supposed to work in the streets but to perform their work at their homesteads. Another reason may be that females tend to share information, knowledge and skills. This may the reason why it was easier to interact with them during the study.

Figure 1 shows that in Empangeni there were 75% female medicinal plant sellers whereas 25% were men. The reason for the larger percentage of female traders is that Empangeni is a central junction and one of the busiest towns in the area. It includes rural areas such as kwesakwaMthethwa. Many medicinal gatherers said they were from the areas such as Sangoyana and KwaNgwanase, which are close to Empangeni and this could account for the large number of medicinal plant traders that plied their trade in this busy, central point of sale. At Mtubatuba, 53% of the plant sellers were women and 47% male medicinal plant traders. At Richards Bay there was an equal number of traders in terms of gender, namely 50% males and 50% females. This may be due to the fact that Mtubatuba seems to be under-developed, and as a result, many people still rely on traditional selling for their income. The men may be working in the mines and therefore families are mostly headed by women: hence the larger percentage of women traders in Mtubatuba in contrast to Richards Bay, where the area is developed and industrial in nature. It is possible that people get jobs more easily in Richards Bay, or that they rely on more profitable means than that of selling traditional medicine for their livelihood.

Eshowe had no medicinal plant sellers. This may be due to the fact that it is close to an indigenous forest, the Dlinza forest, from which traditional healers and local people could obtain medicinal plants directly, without relying on sellers of such materials.

At Mahlabathini there were no males found selling medicinal plants, so only females were interviewed. Mathabathini is nearby Ulundi, where there is a cluster of governmental departments such as Education, Health, works and others. These departments offer job opportunities more readily to males, which may account for the fact that medicinal plants are exclusively sold by females in the area. It would also seem that government seems to marginalise women and is still offering well-paying jobs mostly to the men.

The trend of female medicinal plant traders being dominant in terms of numbers did not hold true at Nongoma, where their was a larger proportion of male plant traders (80%), as compared to females (20%). It is possible that males at this station rely on Mona as a source of medicinal plants, since it is close by. As a result they may seldom buy plants from other places, thereby saving in transport fees and gaining in terms of profit. Mona, which is a depot for medicinal plants, had more females (72%) than males (28%). People from different areas gather at Mona in order to sell and buy medicinal plants at the auctions, which are held almost twice a month. Most of the people who were selling medicinal plants were from deep northern Zululand, and especially from Mseleni and surroundings areas, e.g. KwaNgwanase, KwaMajola, Obonjeni, and Mkhuze. Mona seems to be a sampling station, where plant gatherers who know very little about the plants, sell their wares to the buyers, who are typically traditional healers who have a deep knowledge of indigenous plants and simply point out the plants that they want to buy. An issue that arises from a situation where the sellers do not know exactly what they are selling, is the possibility of them giving a wrong medicinal herb to a client who is as inexperienced in plant lore as themselves. This could have serious implications, especially if the plant material in question turned out to be poisonous.

4.1.1.2 Age of the Medicinal Plants Gatherers

The ages of medicinal plant gatherers are given in Figure 2.

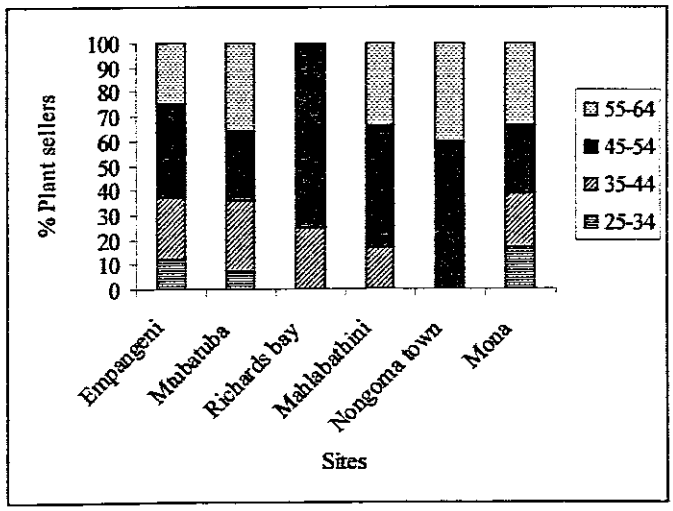

Figure 2: Ages of Medicinal Plant Gatherers

None of the respondents were found within the age range of 15-24 years. This could be due to the fact that young people are still attending school and do not have time to sell medicinal plants at bus ranks. It could also be that they are not inspired by mundane jobs such as plant selling. The majority of the plant sellers' ages ranged from 45 to 54 at all the sites. At Mona, 10% of the respondents fell within this range. It may be that this is considered to be a responsible age. Most of the women were desperately in need of money to educate their children. There were few sellers in the age group 55-64 and none of the traders fell in the category of 65 and above. The reason for this may be that people of this age, and especially the women, are pensioners and elders. Their money for subsistence comes from pensions. However, the percentage of sellers increase as the age ranges increase (Figure 2). In the age group 34-45, there were 6-8% of respondents in Empangeni as well as Mona. This indicates that more plant sellers are elderly people, with only a few young ones. The reason is that elders have knowledge of medicinal plants. This was confirmed by Zobolo and Mkhabela (2006), from which it becomes clear that the older females have a greater knowledge of medicinal plants than girls. In traditional knowledge there is a sense of privacy and certain reluctance in passing information from adults to children. The difference between scientific and indigenous knowledge is that, in the case of indigenous knowledge, elders want to die with it, whereas scientific knowledge is passed from one generation to another (Dr. Dlamini: personal communication). This was also confirmed by the study of indigenous plants in EEASA Monograph N0. 3 of (1999), where it is shown that the elders had a superior knowledge of plants in comparison to that of young people.

4.1.2. Medicinal Plant Distribution Patterns

The taxanomic composition of medicinal plants is given in Table 5 (Refer to page 69). Table5 lists 164 medicinal plant species with an average of 4001 from 63 respondents from the sampling areas (Appendix 2)). The dominant plant species from each site is given in Figures 3, 4, 5, 6, 7 and 8. The plant species sold most by plant sellers (70% and above) is obviously the species that is mostly in demand for the healing of various aliments. The medicinal plant distribution at Empangeni is given in Figure 3.

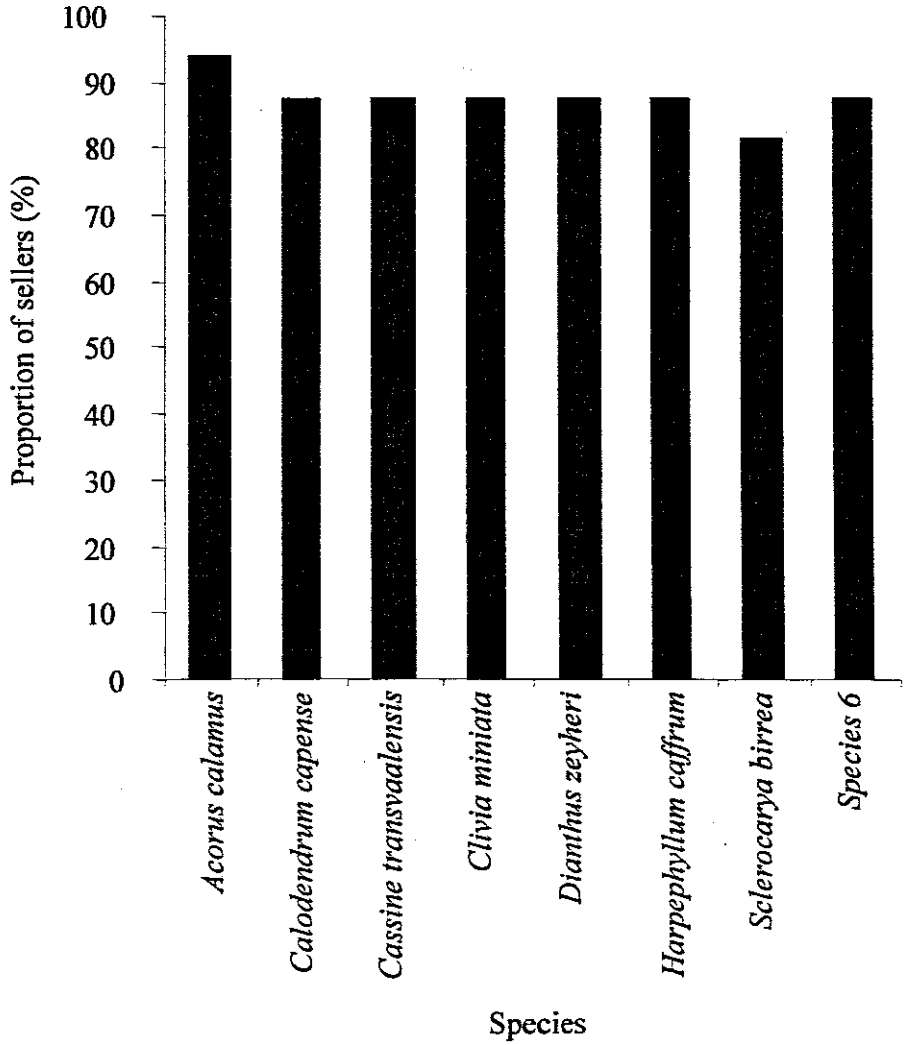

Figure 3: Medicinal plant distribution at Empangeni for species that were dominant (from 70% and above). That also applies to Figures 4 – 8.

Dominant species of medicinal plants collected from plant sellers in Empangeni are presented in Figure 3. From the graph it is shown that the species that had high sales at Empangeni were *Acorus calamus, Adenia gummifera, Hypoxis gerrardii, Hypoxis hemerocallidae and Sarcophyte sanguinea.* The dominant medicinal plants at Richards Bay, which is close to Empangeni, is given in Figure 4.

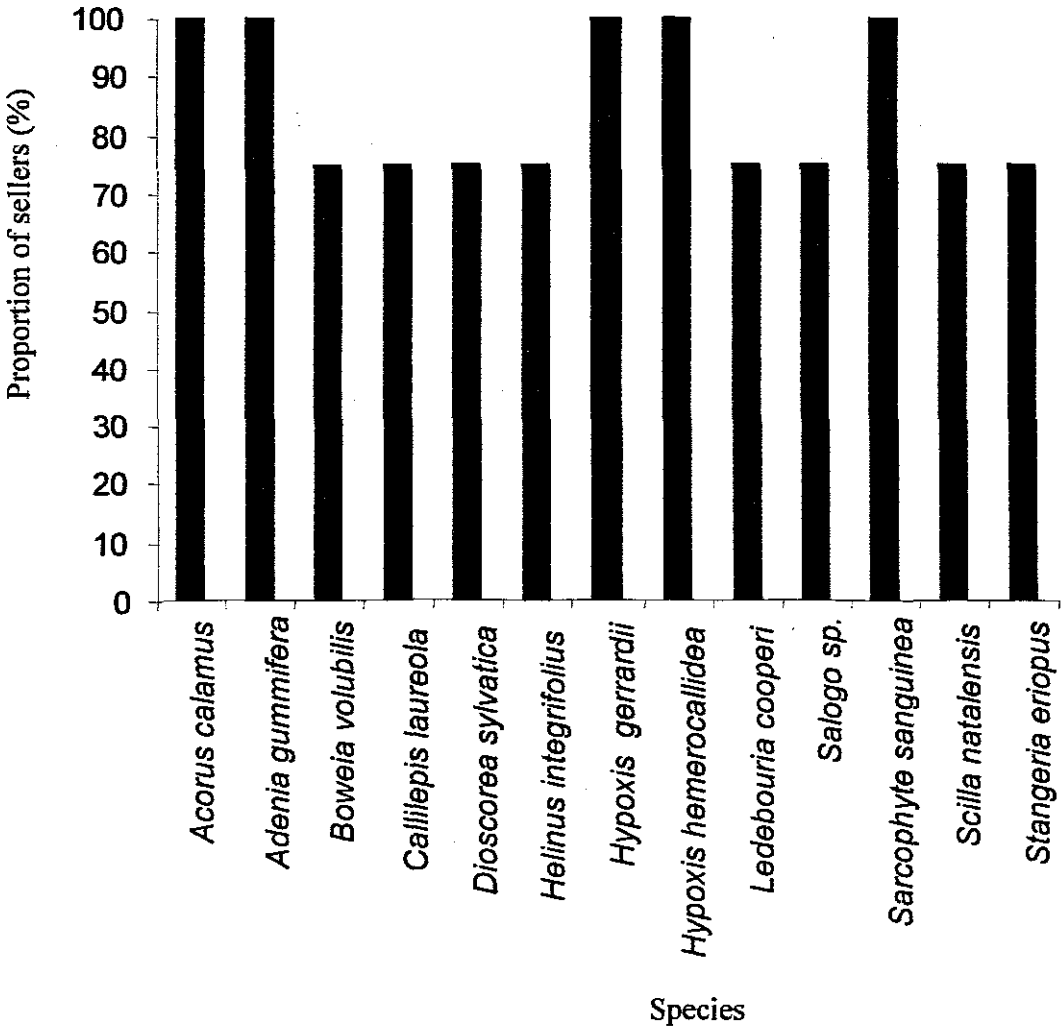

Figure 4: Medicinal Plant Distribution at Richards Bay

Richards Bay has the same dominant species that were obtained at Empangeni. The reason could be that people at Richards Bay and Empangeni have the same sicknesses and therefore need similar traditional medicines for treatment of their sicknesses. A dominant medicinal plant at Richards Bay was *Sarcophyte sanguinea*. The taxon is used in order to obtain luck, particularly in getting a new job. Richards Bay is an industrial area with industries such as Alusaf – which is an aluminum producing company, Mondi (paper manufacturers) and others. The desire to work at these industries could motivate people to favour this medicinal plant within the region.

The dominant medicinal plant species obtained from Mtubatuba are given in Figure 5.

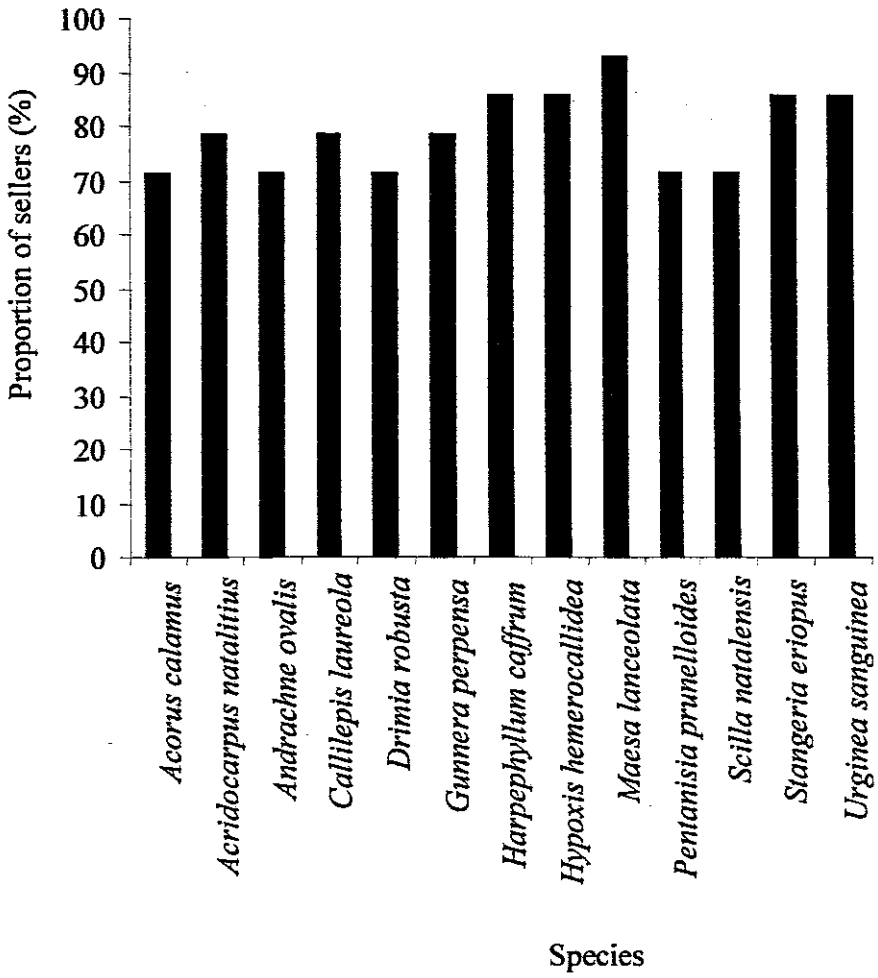

Figure 5: Medicinal Plant Distribution at Mtubatuba

At Mtubatuba the species that had highest sales was *Maesa lanseolata* (93%). The dominant species at Mtubatuba were different from the species recorded at Richards Bay and Empangeni. Mtubatuba is further from the two stations. It is about 89 kilometres away from Empangeni. Diseases that prevail at Mtubatuba could be different from the other sites. This may explain why medicinal plant sellers in different locations sell different medicinal plants. A demand for a certain medicine is based on the need for a specific cure, according to the different diseases found in different areas.

The dominant species sampled from Mahlabathini are given in Figure 6.

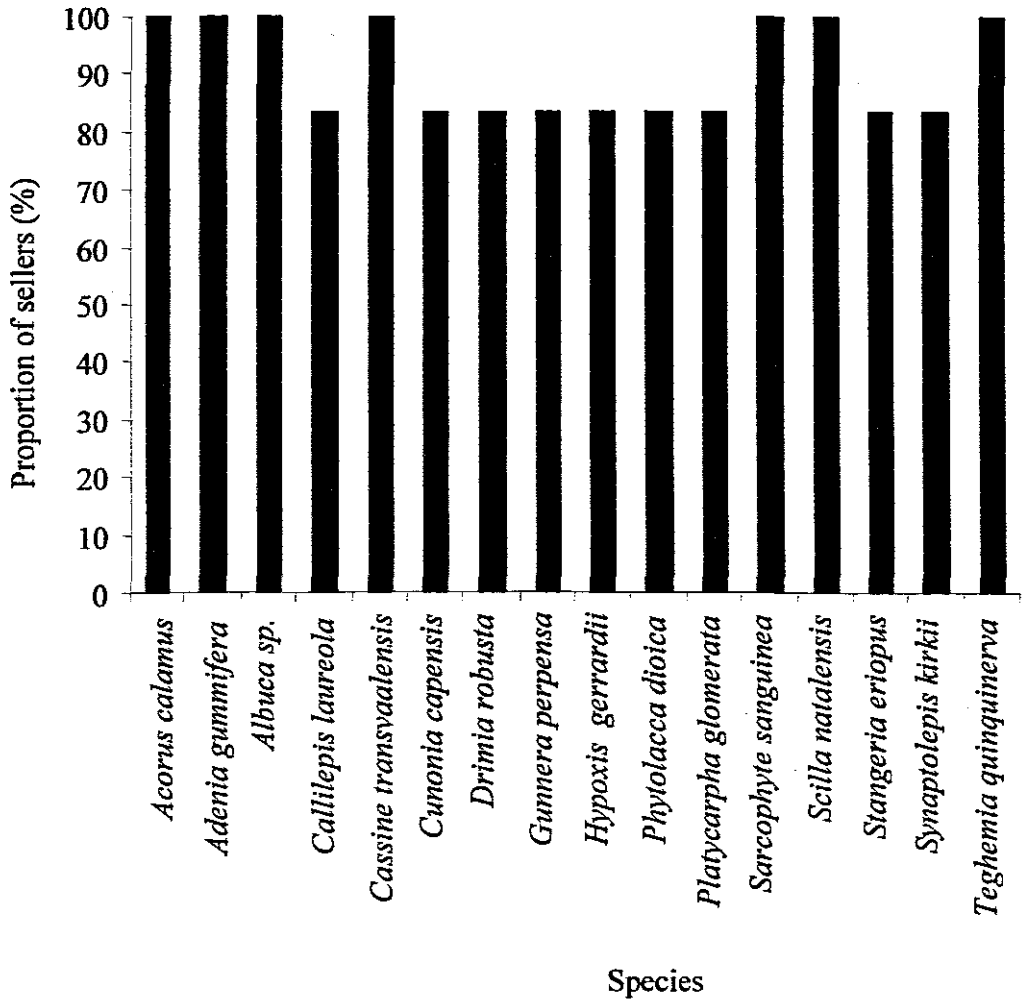

Figure 6: Medicinal Plant Distribution at Mahlabathini

Mahlabathini had the same species that were dominant at Richards bay and Empangeni. However, there were other species, such as *Albuca, Scilla natalensis* and *Teghemia quinquinorva.* There were more dominant species at Mahlabathini than at the other three sites mentioned above. The reason could be that Mahlabathini is a deep rural area and there is evidence of less vegetation removal for industrial buildings and other infrastructures in the area.

Figure 7 and 8 shows the medicinal plant species recorded at Nongoma Town and at Mona. Mona is a small area in KwaNongoma where there is a depot for medicinal plants. The sampling stations had higher species diversity than the other five sampling stations. In non-developed areas like Nongoma and also at Mahlabathini, very little vegetation has been destroyed for industrial expansion.

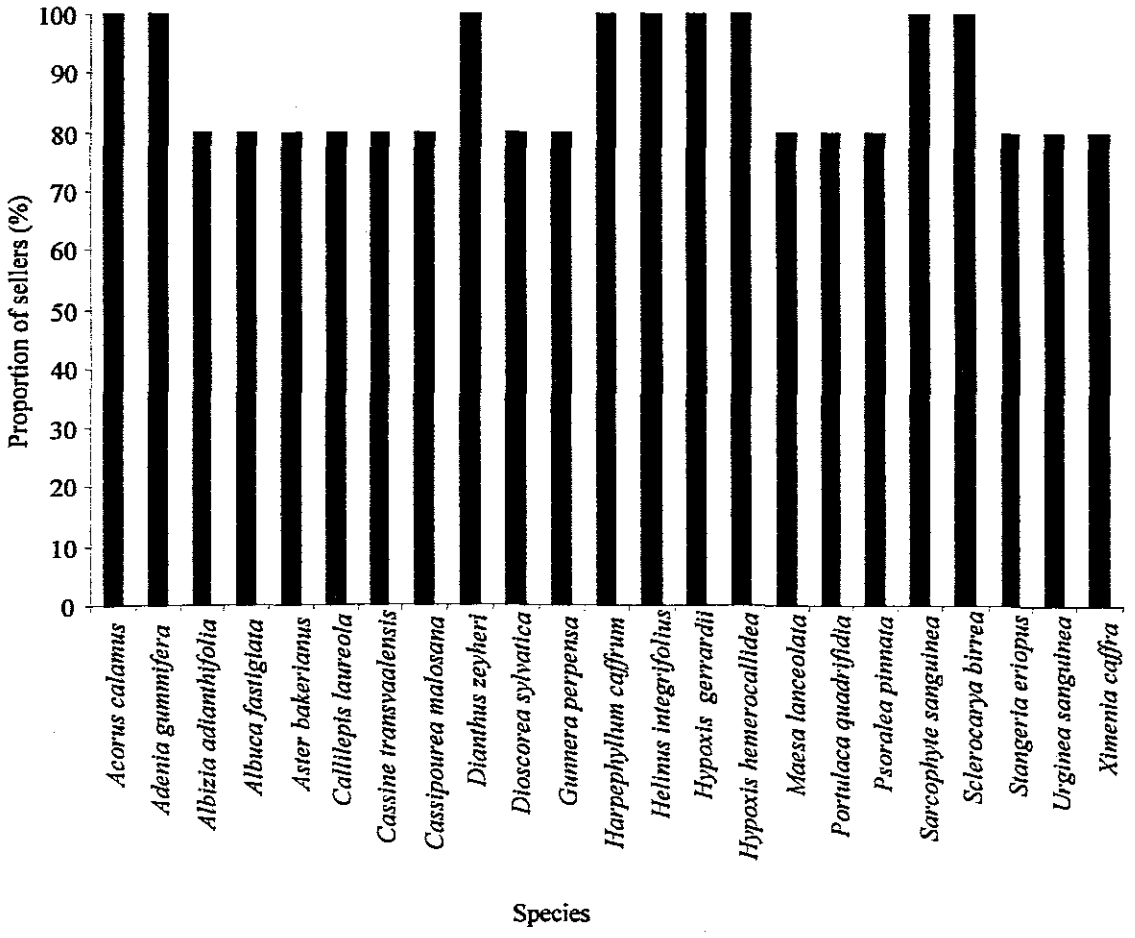

Figure 7: Medicinal Plant Distribution at Nongoma

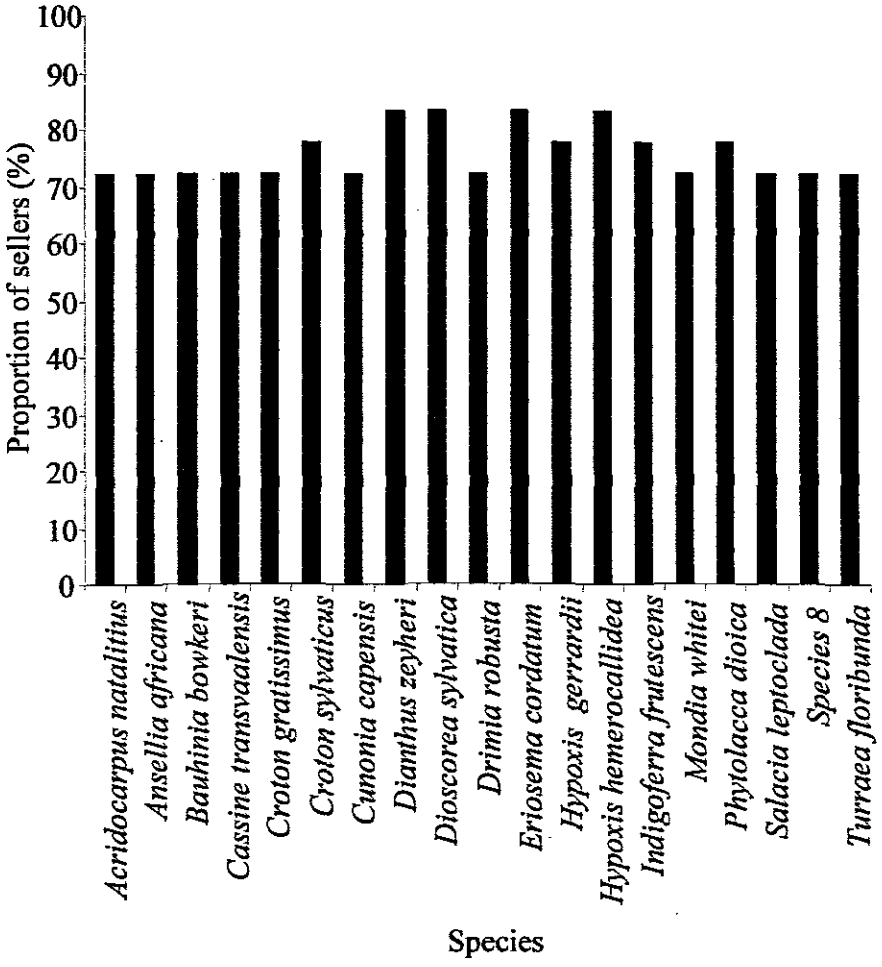

Figure 8: Medicinal Plant Distribution at Mona

The results show that *Hypoxis hermerocallidae* was the most popular species in almost all the sampling sites. This could be due to the fact that the plant is believed to decrease the symptoms of HIV/AIDS infection. This indicates that sometimes plants are demanded according to the diseases that prevail at a certain time.

It can be deduced from the data collected that sometimes the demand for a particular medicinal plant species is regional. For instance, Empangeni and Richards Bay showed more similarity in demand for a certain medicinal plant species. This means that medicinal plant sales can be indicators of the types of diseases that prevail in a particular area.

4.2. Statistical Analysis

For the purposes of the study only S, which is the number of species, and N, which is the sum of individuals, were used.

Table 6: Number of medicinal plant species (S) and sum of the species per site (N) sampled in northern KwaZulu-Natal.

	Sites	S	N
1	Empangeni	92	586
2	Mtubatuba	89	514
3	Richards Bay	51	96
4	Mahlabathini	65	198
5	Nongoma Town	98	220
6	Nongoma Mona	147	1189

From Table 6 it can be seen that site six had highest number of species (147) and largest counts (1189). The reason for this is that the site is Mona, Nongoma, where there is a depot for medicinal plants. The sampling site that had the lowest number of medicinal plants (51) and the lowest counts (96) was Richards Bay. Nongoma town also had the largest number of individual species, followed by Empangeni – but the total number of species in these sites differed vastly (220 and 589 respectively). The reason for this is that the total number of respondents at that particular site influenced the total number of species sold. For example, at Nongoma Town there were five respondents and Empangeni had 14 respondents (Table 5). In terms of total counts, Empangeni (589) and Mtubatuba (514) were not too different from each other. On the other hand, Nongoma town and Mahlabathini were not far different in terms of the medicinal species counts (220 and 198) respectively.

4.2.1 Multivariate Dimension and Scanning analysis

The calculation of the MDS algorithm is an interactive process, involving a number of random starts in order to obtain the best two-dimensional configuration. The adequacy of MDS representation is given as the 'stress' or 'goodness of fit'. Generally, stress increases with reducing dimensionality and increasing the quantity (Mackay 1996). Clarke and Warwick (1994) recommend a stress of 0.05 and below, as it gives an excellent representation with no

misinterpretation. In the study, the results gave a stress of 0.01 (Figure 9) – a result that was taken as being sufficiently valid for conclusions to be made.

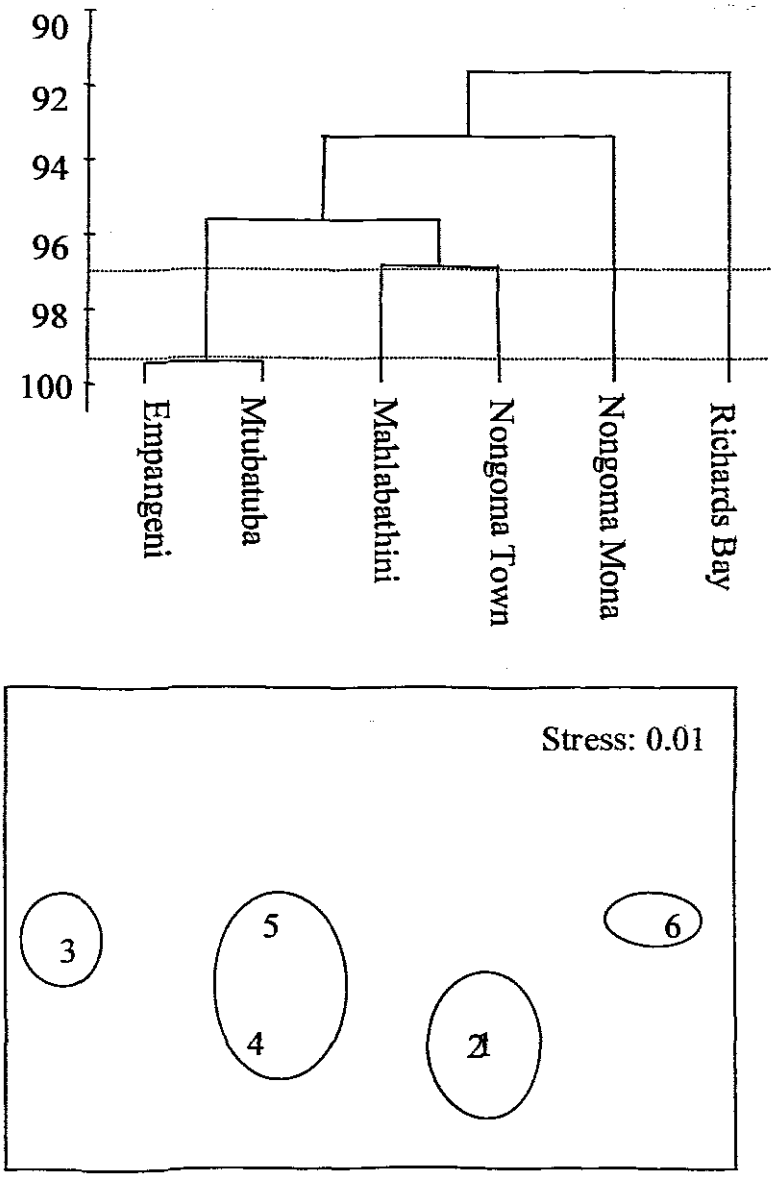

Figure 9 a) Bray-Curtis classification and MDS ordination b) The $\log_x$ transformed (Stress = 0.01) medicinal plant species collected in six areas in northern Zululand

Figure 9 shows that site 3, which is Richards Bay, is independently grouped and distinct from the other sampling sites. Reasons for this could be that there are far less medicinal plant species (a total of 96) in this area when compared to other sites, and that there seems to be a much lower demand for medicinal plants at Richards Bay since the town is situated in a well-developed industrial area, employing many people, of which the majority rely on pharmacies and medical doctors, backed by medical aid facilities, for their medical needs. The level of literacy and sophistication among the people seems to be high, with the result that they do not believe in medicines that fight evil spirits and bring luck. Instead, they depend on security guards and alarm systems to protect their homes.

The second sampling area that was distinct from other sites was Mona, in the Nongoma area (Figure 9). Mona could be expected to be grouped with Nongoma town, since they are in the same area – yet this was not the case. At Mona, the medicinal plants species were available in very high counts (1189) and the number of respondents (18) surpassed all other regions. For this reason it could not be grouped with the other stations. This could be due to the fact that Mona is a kind of depot, or wholesale area, for medicinal plants, which would explain the high species diversity when compared with other sites. Mona's high yield of plants and respondents also supplies a reason why the two-dimensional MDS shows a marked difference between Richards bay and site six, namely Mona. It is clear that Mona had the highest counts of medicinal plants and respondents during the course of the study, whereas Richards Bay had the lowest.

Figure 9 shows that Mahlabathini and Nongoma Town are close in terms of ranking. Nongoma and Mahlabathini are situated in similar geographical locations (Appendix 2). This may account for the fact that medicinal plant species sold at these sites were almost identical. The closest sites ranked by MDS were Mtubatuba and Empangeni. The sites were very similar, at a similarity percentage of 98.8% (Figure 9). This is illustrated by a comparison between the total numbers of medicinal plants sold at these two stations, namely 514 and 589 respectively.

The choice of statistical method that needs to be employed depends on the type of data that must be processed and on that which needs to be achieved. It is therefore important to first think through the method of how the data needs to be analysed. Spata (2003) state that multivariate

statistical methods allow the analysis of patterns in biotic data (species attributes, sites and times). It also allows the researcher to relate biotic patterns to a spatial or temporal environment. The data for this study was analyzed using multivariate methods, which analyses data as a whole, rather than selecting several 'respective species' and then analysing their importance in determining the community structure, as in the case of an univariate approach.

4.3 Income generated versus quantity of plant material and medicinal plant usage

The income generated by medicinal plant traders is given in Table 7, while the uses of medicinal plants recorded from plant sellers in northern KZN are given in Table 8.

A survey on the collection of the prices of medicinal plants sold in standard 50kg and 25kg maize bags was conducted at Mona in Nongoma, medicinal plants were sold in large quantities, since it is a wholesale facility for medicinal plants. The survey was done by recording the prices of the plant materials that were packed in the bags – although some of the species could not be verified by opening the bags, since it was said that they were ready to be exported to other regions and markets, such as Durban and Gauteng. The sub-samples of the species collected at bus ranks that were found in the bags at Mona were measured in the laboratory in grams in order to find out how much profit could be generated by medicinal plant sellers per sub-sample of the plant material. The results are given Table 7 (Refer to table hereunder).

Table 7: The quantities of certain herbal medicines sold in Nongoma (Mona bulk sale) in Northern KwaZulu-Natal region and income generated by traders in standard 50kg maize bags.

Scientific name	Part used	Sub-sample (g)	Price (R)	50kg and 25kg size maize bags	Price (R)
Acorus calamus	rhizomes	207.09	5.00	25	60.00
Acridocarpus natalitus	leaves	694.62	5.00	50	120.00
Aptenia cordifolia	bark	65.72	5.00	25	30.00
Callilepis laureola	bark	295.27	5.00	50	100.00
Calodendrum capense	bark	235.52	5.00	25	60.00
Capparis tementosa	bark	127.79	5.00	25	40.00
Chlorophytum modestum	roots	562.40	5.00	25	50.00
Cliva minnata	Whole plant	194.49	5.00	50	70.00
Conia capensis	Whole plant	146.21	5.00	50	100.00
Drimia robusta	bulb	207.09	5.00	25	60.00
Erythrophyleum lasianthum	roots	350.94	5.00	50	100.00
Hypoxis hermellocallidae	bulb	694.62	5.00	50	120.00
Mondia whitei	Bark/roots	14.10	5.00	50	140.00
Ocotea bullata	bark	296.27	5.00	50	70.00
Olinia radifolia	roots	146.11	5.00	50	80.00
Sarcophyte sanguinea	roots	282.07	5.00	50	140.00
Urginea sanguinea	roots	138.08	5.00	50	70.00

It would appear that the medicinal plant gatherers harvested the plants at low returns and that they made little profit. Large quantities of plants that are red data listed (Table 9) were being sold in large quantities at Mona. The most important consideration for the plant sellers seemed to be the satisfaction of their immediate needs – a situation that is clearly unsustainable. For this reason, a future study aimed at making the plant sellers' trade more viable, seems to be indicated. It was found that two full hands of medicinal plant material cost R5.00. It is obvious that the hands of the sellers are not equal in size and that they need a standard unit of measurement. One seller can therefore sell more merchandise at a higher price whereas another with bigger hands would sell more material at the same price. If the transportation fee, time, work effort (in

chopping up the plant material) and the risk of collecting the plants in the veld is considered, a maximum price of R140.00 per 50kg maize bag would not be yield sufficient profit. Williams, Balkwel, and Witkowski (2000) show that large quantities of medicinal plants are sold in Durban's Faraday Street markets. Some 36.3% of the indigenous plants could have been harvested from areas other than KwaZulu-Natal. The plants in Table 9 are all indigenous plants but their market value, as charged by plant sellers, is far too low. For instance, a price of R30, 00 per measure of *Aptenia cordifolia* is ludicrously low. Apart from the sale of non-indigenous species grown and harvested in southern Africa, e.g.*Cinnamomum camphora,* species imported from India are present in the market. Asian herb traders usually import the plants as substitutes for scarce indigenous species or as new medicines.

4.3 Medicinal Plant Usage

Table 8 shows most of the medicinal plant uses and the parts used in the case of each medicinal plant sample (refer to page 73). Table 8 shows that some of the medicinal plants named by traders corresponded with those dealt with in the literature. For instance, in the case of *Gardenia thunbergii,* Hutchings (1996) reports that the roots of the medicine are used to make excellent emetics against fever and are widely used in South Africa for skin lesions caused by leprosy. Fruit is used for earache and twigs are burned as a protective charm against sorcery. The plant sellers said that the medicinal plant is used as a sprinkling charm and is used to chase away evil spirits. Roots of *Kniphofia uvaria* are used for itchiness during menstruation. Crushed rhizomes are used in enemas (Hutchings 1996), but in the study it was found that the taxon is also used as a lucky charm.

According to Hutchings (1996) bark of *Acacia robusta* is used as an enema and for sore throats and colds. A person who feels disliked inhales vapours from hot decoctions of this plant in order to prevent others from feeling this way about them. However the plants sellers said that the medicinal use of the species was to fight against evil spirits. Cunningham (1998) states that, in South Africa, traditional plant material is believed to bring luck in various situations, such as finding employment, as a medicine against jealousy, as a love charm and as an aphrodisiac to keep girlfriends or wives happy.

It was found that sometimes the names of the medicines reflect its usage, for instance umabopha (*tie with*), umusa omkhulu (*great mercy),* inhlanhlemhlophe (*white luck*) and uvelabahleke (*make them smile*). Therefore in some instances the medicinal use can be noted by knowing the name of the medicinal plant.

4.4 Workshop on Medicinal Plant Sales Awareness

In the conference on higher education in the 21st century held by UNESCO in Paris (1998), the delegates declared, among other things, that education is a fundamental pillar of human rights, democracy, sustainable development and peace. It was therefore agreed that education should be accessible to all throughout life and that measures were required to ensure co-ordination and co-operation. Among the types of education that are necessary in life, is environmental education, which helps citizens to understand how to use natural and man-made resources in a sustainable way.

Environmental education, basically, means a process that develops awareness, knowledge and understanding of the environment, as well as positive and balanced attitudes towards it, and skills that enable individuals to participate in assessing the state of the environment (Environmental education policy for schools 2001). It prepares individuals for an ecologically sustainable future. It also empowers individuals to restore the Earth's natural resources and to foster support for the well being of future generations by promoting sustainable life styles. According to the World Conservation Union (1999), environmental education is based on formal, informal and non-formal education.

Formal education: is a structured, chronologically graded 'education system', running from primary school through the university and including, in addition to general academic studies, a variety of specialised programmes and institutions for full-time technical and professional training. One of the projects we are running at the University of Zululand is to help Intermediate Phase educators to integrate environmental education into Natural Science.

Informal education: is a truly lifelong process whereby every individual acquires attitudes, values, skills and knowledge from daily experience and the educative influences and resources in

his or her environment - from family and neighbours, from work and play, from the market place, the library and the mass media.

Non-formal education: is an organised educational activity outside the established formal system. It may focus on encouraging the inclusion of environmental components in all relevant training and extension programmes, including accredited vacation courses, on-the-job training, literacy and adult basic education, informal agricultural extension work, and community development programmes. It is concerned with making government and private funding routes and processes more accessible to community-based agencies actively engaged in education for sustainability. This type of education occurs when herbal medicine sellers teach their children what kinds of plants are sold for herbal medicine and they are used for. This study is based on non-informal education for plant sellers in order to bridge gaps of knowledge in connection with medicinal plant sustainability.

After the analysis of the results it appeared that although plant traders have knowledge of the cultivation and propagation of plants, some of them do not have that knowledge. Even among some of the traders who knew how to propagate the plant species that they used, very few realised the importance of planting new plants after harvesting what they needed. Therefore, a need was felt to conduct a workshop with plant gatherers in order to fill in the gaps of knowledge that existed among them about medicinal plant propagation and also to discuss any other relevant issues that affect them in their trade. Among other definitions, the Webster dictionary states that a workshop is a seminar emphasizing free discussion, exchange of ideas, demonstration of methods of practical application of skills and principles. It is a set of activities designed to promote learning, which includes discussion and feedback about the topic or event. The workshop was held on the 4th of December at University of Zululand's Resource Centre. The plant sellers indicated that Sunday was a good day for them because they rested on this day and attending a workshop on a Sunday would not disturb their selling business.

Among the problems faced while conducting this study, was that some of the traders did not develop adequate trust in the researcher. Some of them that did not attend the workshop seemed to believe that it was some kind of trap and that the researcher wanted to prevent them from

selling medicinal plants. They were also concerned about the possibility that their knowledge would be stolen. This was an important issue, because giant pharmaceutical companies have in the past stolen the intellectual knowledge of indigenous people who did not benefit when effective medicines that generated a lot of money were eventually made. However, a measure of trust developed because of the samples of medicinal plants that were bought in order to name the plants on sale for medicinal purposes and to discover their uses. This paved the way for an exchange of information between the researcher and the sellers of medicinal plants.

Race, gender and the geographical status of researchers counted, in the light of the fact that there were many more females (77%) selling medicinal plants than males (23%). The issue of the majority of plant sellers being females is an economic one. Men are able to access jobs in town more easily than females. Females have to stay at home and look after the children. Sometimes males are gone for long periods of time and some men do not support their wives and children. Women therefore resort to the selling of medicinal plants, which brings in a very low income. The fact that females were in the majority also made it easy for the researcher to establish interaction with the respondents since the researcher is also a female. It was easy to share information with the females since females find sharing and mutual support of one another easier than males. There was also an easy interaction in terms of language, since the medicinal plant sellers were from rural areas and the researcher was also from the same geographical area.

The study was conducted in a partnership between the Department of Agriculture and Environmental Affairs, the University of Zululand's Science and Education Faculties and the communities in question. The University took part in the collection of information and in the analysis of results as well in the interpretation of data. The community helped by providing the information needed in the research. There was a feeling that people from Environmental Affairs and Agriculture should be invited to participate in the workshop since the department is involved in the propagation of medicinal plants and in addressing environmental issues.

The director for the Department of Agriculture and Environmental Affairs, Mr. Mngoma, was invited to address the sellers on medicinal plant cultivation and subsistence harvesting of the plants (Appendix 6). Because directors are busy people, another person from the department was

invited to stand in for the director, when he was not able to participate. Therefore Mrs. P. N. Mhlongo, who is a regional manager for the department in the Mtubatuba region, was invited in writing (refer to Appendix 6) and was requested to prepare a speech, which she would deliver if the director could not do so due to government assignments.

4.4.1 Presentation of the workshop results

The workshop was meant to empower medicinal plant traders with regard to the propagation and cultivation of medicinal plants and related skills. However, it also helped by giving business tips to the plant traders. This kind of workshop is in line with the goals of environmental justice as cited by Kirk and Okazawa-Rey (1998), especially with regard to the statement that environmental justice calls for the education of present and future generations, especially with regard to the preservation of their natural heritage. The results showed that the plant gatherers harvested medicinal plants in bulk, but sold them at the lowest prices – even for as little as R5, 00 for a large plant sample or mixture. While the medicinal plant sellers charge very little for the plants, the traditional plant healers who consult with patients gain more than 100% in profit. For instance, while the traditional healer may buy a handful of plant material for R5.00, he can charge the patient between R60.00 and R100.00 per prescription. The medicinal plant sellers seem satisfied to make a little amount of money per day to feed their children, but this practice is not sustainable. They live from the hand to the mouth, as they make almost no profit. For this reason Dr. Zobolo, the plant taxonomy specialist, emphasized that the traders must revisit their selling prices as they are earning very little while causing a great deal of harm to the environment.

Mrs. Mhlongo, a regional manager of Environmental Affairs and Agriculture, gave an interesting talk about the gathering and selling of medicinal plants in her speech. She made the following points:

The differences between indigenous and alien plants can be distinguished in the features of the plant groups. Indigenous plants are often dark green in colour – a darker hue than the invading plants. That darkish green colour is due to the fact that indigenous plants obtained the indigenous nutrients that they are supposed to get in the own growing places, as opposed to the invaders that

grow on foreign soil. Alien plants are best in flowering and they yield brighter coloured flowers than the indigenous plants. Alien plants also grow in large quantities in order to win the competition against indigenous plants and they also grow faster than indigenous plants. Mrs. Mhlongo also mentioned the negative impact of invading plants on indigenous plants. She said that plant invaders turn to suppress the proper growth of indigenous plants and as a result the indigenous plants become depleted. She also emphasised the same point raised by Dr. Zobolo, namely that little profit is gained by traders in spite of the many plants that they harvested, due to indiscriminate harvesting and incorrect pricing methods.

Another issue mentioned by Mrs. Mhlongo was the importance of indigenous knowledge. According to EESA Monograph N0. 3 (1999), a broad view of the environment encompasses interacting biophysical, economical, political and social concerns. In the case of this study, indigenous knowledge can be used for empowerment, since indigenous knowledge within environmental education processes is crucial to restore the confidence required to address environmental concerns. Indigenous knowledge also has a place in the school curriculum and environmental teaching should be based in the context of the learners' backgrounds (Monograph N0. 3 of 1999). At present, learners are taught about plants such as conifers, in other people's contexts, rather than about plants that are familiar in the learners' own contexts. Monograph No. 3 of 1999, points out that a rich heritage is available in the form of indigenous knowledge in the local communities. It is readily available to teachers as a valuable teaching resource. Indigenous knowledge is also a valuable resource in the communities, particularly for traditional healers and plant sellers, since they can live out their traditional knowledge in the plants that they sell.

Indigenous knowledge, as opposed to scientific knowledge, is not passed on from one generation to another. This was confirmed during the workshop, since a male participant testified that although there is likelihood that indigenous knowledge would be passed on to children, it must, in particular, be passed on to one child who possesses a natural talent and a calling to take up this traditional career. A female participant emphasised that there is a sense of confidentiality in traditional careers and that information may even be withheld from family members who have not been identified by the ancestors to require access to the sacred knowledge. She emphasized that her father died with knowledge of healing people, using a certain plant that needed to be

talked to when one passed it. Failure to do so resulted in allergy that affected the whole body. The issue of teaching young ones about traditional medicinal plants highlighted the importance of passing knowledge on to family members who have not been identified by ancestors to require access to the knowledge. If this is not done, the present knowledge in traditional healing will not be available to future generations.

Doctor Dlamini, an environmental education specialist, assured the participants that there was a need for the healers or traders to place this vital knowledge on permanent record for future generations. She said that a lot indigenous knowledge is lost because it is not documented. Documented knowledge becomes the property of those who generated it.

She emphasized that the name of the person who owns the knowledge would have his/her name appearing next to the information and would get his/her payment for the contribution, if the document was published or if generated any money.

4.4.2. Plant demonstration by the researcher

The researcher collected plant samples from the gatherers and planted them at the botany department nursery. The plants grew well, except for one plant called *Ansella gigantea* (iMfe-yenkawu). The plants were demonstrated to the participants and the plant sellers agreed and disagreed among themselves as to whether the correct method was followed in planting this particular species. It was found that all the participants could identify the plants on display, with the exception of *Bulbine frutescens*, which was said to represent an incorrect example of the species. This confirmed that the researcher had bought an incorrect medicinal plant, which had been named incorrectly by the sellers. The plant sellers immediately recognised the incorrect naming of the plant. This raised ethical issues in that it was possible for people who acted both as plant sellers and healers to sometimes give incorrect names to plants, particularly when they stood in for qualified staff. The participants, who are also healers, said this was wrong, unethical and spoiled their business because a supply of wrong medicine will not have the essential ingredients to heal their clients. Another medicinal plant that was incorrectly sampled was *Prunus africana* (iNyezangoma). The medicinal plant gatherers said there is no plant that is given the specific name of *iNyezangoma,* since this name is given only to medicine that is collected

from plants that died as a result of floods. They said the plant in question could instead be iNyezangoma elimhlophe, which is a synonym of the plant called uMthathe (*Ptaeroxylon obliquum*). The traders said that the name of the dead plant is not even known. It is the black dead part of the plant that makes the medicine and as a result the medicine is called *Prunus africana* (iNyezangoma elimnyama). This opposes the research by Hutchings (1996), who states that the fruit of the tree used is poisonous.

After the demonstration slot, there was a presentation on the cultivation of medicinal plants that are in the red data list. The presentation was divided into two sections. Medicinal plant traders presented the first section, while Mrs. B. G. Nene dealt with the second.

This was seen as a beneficial exchange of information, as common problems were discussed. For example, problems in growing the *Ansella gigantea* were discussed, but no reasons could be unearthed for its poor growth. Some of the participants were of the opinion that the plant was an epiphyte, and should be planted on the stem of another plant, which is then covered with cow dung.

4.4.3. Plant propagation demonstration by the participants

Local communities, who have proved to be able to manage their environment successfully, obviously possessed relevant knowledge of the local environment. During the workshop, the respondents were given a slot in which to give a presentation on cultivation techniques used with selected medicinal plants (Table 9) hereunder.

Table 9: Propagation of the medicinal plants – information by plant gatherers

Name of the participant	Name of the plants	Method of propagation
Mr. Nxumalo	*Alepidea amatymbica, Bulbine frutescens,*	*Alepidia amatymbica* grows well in damp soil and is planted by its bulb. *Bulbine* is planted using the roots and grows well in any soil types
Mr. Hlabisa	*Alepidea amatymbica, Dioscorea dreageana, Dioscorea syivatica*	*Alepidia species* is planted the same as above. *Dioscorea dreageana and Dioscorea syivatica* are planted using bulbs and they grow well in any soil types. It takes only ten days for the plants to grow
Sisi Thembeni	*Haworthia limifolia, Hypoxis hemerocallidea*	Both are planted in fertile soil. *Haworthia* must be planted in a dead container or a dish since its roots are shallow. *Hypoxis* is planted in the soil by the tuber or any part of the tuber that has a shoot.
Mr. Vilane	A new plant called uNdabingehlele	The stem or a branch is cut both sides and a jelly substance is pasted at the ends of a branch. The plant is planted in the soil of a dead plant stick and must be planted next to another plant to give a support.
Other participants	*Ansella gigantea, Mondia whitei*	The plant is planted on other plant branches and cattle manure serves as a growing substrate. A connection between the *Ansella* and the tree branch. *Mondia* is planted using the roots and if it is harvested the roots give rise to other plants.

After the presentation by plant traders, Mrs. Nene did the presentation on the propagation of medicinal plants obtained from the literature. The plants selected were those that appeared in the red data records, of which there were 15. The plants were prioritized since they were endangered and vulnerable and therefore needed immediate propagation. Some of them are critically endangered, such as *Warburgia salutaris*. In addition to the plants that were reported to be dying

out, according to the literature, but in high demand by medicinal plant customers, the participants gave the following list of plants that they said are very difficult to find. These included: *Ornithogalatum longibacteatum, Bersama swinnyi, Hypericum aethiopicum, Berchemia discolor, Cellilepis laureola, Helichyrsum species* (Diederichs 2001) and unidentified species called uThovane. The presentation was done in iSiZulu (appendix 4). ISiZulu was chosen to make the information accessible to the audience and to make them fully part of the discussions. The English version is given in appendix 3.

This was a session where indigenous knowledge was compared to scientific knowledge. There was interesting debate on plant sellers' opinions of alternative methods for and quicker methods of planting.

It appeared that information on plant propagation was different from data supplied in the literature. For example, it is recommended that species such as *Haworthia limifolia* should be planted in river sand, while the traders said there is no need for sand; ordinary soil is also suitable for the plant to grow. The traders said that the importance of shaded planting trays is unnecessary for the planting of the medicinal plants. Obviously, poverty would not allow the participants to have access to planting trays. The traders said that the organic fertilizers are prohibited in the planting of medicinal plants since this resulted in loss of quality in the plants.

4.4.4. Open session for plant sellers

During open time, the plant sellers reacted to their invitation to the workshop. It was remarkable that their attitudes had changed for the better by then. They no longer saw the workshop as a trap and found themselves free to express their feelings. They were very thankful for the workshop and said that they felt like real students because workshop bags, ballpoint pens and exercise books were given to them. Photostats of Appendix 8 on plant propagation was also given to them.

The participants recommended active involvement in the establishment of medicinal plant gardens. As a result, a temporary committee of seven members was elected by means of voting. The committee members are the following:

Mr. Vilane from Mtubatuba

Mr. Nxumalo from RichardsBay
Mr. Nxumalo from Empamgeni
Mr. Hlabisa from Empangeni
Sis Thembeni from Mtubatuba
Mrs Mkhize from Empangeni
Ms. Sizakele from Empangeni

The participants appreciated the fact that they were told about the dangers of harvesting the medicinal plants to the point of extinction, while neglecting to plant new plants. It was recommended medicinal plant gardens be established at the University of Zululand. After the plants had grown well, the garden would be a source of seedlings for the stakeholders, i.e. plant sellers, who would then start small gardens near their homes or communities.

Towards the end of the workshop, Mr. Mngoma, the director of Agriculture and Environmental Education in Empangeni, joined the workshop. He emphasised the importance of medicinal plants. Mr. Mngoma reiterated what Dr. Dlamini had said, namely that the participants could publish their knowledge and that this knowledge could be protected as their own intellectual contribution in northern KwaZulu- Natal.

He said that the department would support the establishment of medicinal plant gardens and he promised financial support for the project as well as support in the form of access to an agriculture specialist.

Positive results of the workshop included the fact that the participants had come to realise that they also had a responsibility towards harvesting medicinal plants in a sustainable way. It was a fact that the plant gatherers took a great deal of time and effort in obtaining medicinal plants and that the activity involved a lot of risk, including the risk of being bitten by snakes and other dangerous animals. In spite of this, the cost of medicinal plants is very low, while the sellers inflict a lot of damage on the environment without any reasonable income for their effort. An article in Monograph no. 3 (1999) states that during earlier times the exploitation of plants and other species was not as severe as is presently the case, due to small populations and fewer

industries and technologies. Damage to the environment is very much a result of human lack of restraint and demand for resources that are far in excess of real biological needs. This is exacerbated by our lack of positive action in planting new plants to replace the ones that we destroy, thereby placing our own limited interests far ahead of our broader responsibilities. In the case of some plant sellers, it seems as if they sell medicinal plants only to satisfy their immediate needs while not harmonizing their needs with the requirements of the environment. Such practices are not sustainable.

Chapter 5

General discussion

The World Health Organisation (WHO) has described traditional medicine as one of the surest means to achieve total health care coverage of the world's population (Rukangia 2001). That may be due to the fact that traditional medicine is the basic primary health care system and that it is, relatively speaking, the cheapest option. As a result, the demand for medicinal plants is very high, particularly in African counties. This has resulted in some of the medicinal plant species becoming endangered, and even extinct. It is necessary to introduce the systematic cultivation of medicinal plants in order to conserve biodiversity and protect threatened species (Hugo 2004). The trend towards increased commercialization of medicinal plants in South Africa has resulted in over-harvesting and, in some cases, near extinction of some valued indigenous plants (Williams, Balkwel, and Witkowski 2000). Factors such as rapid growth of population, urbanization of Blacks, an estimated 80% of whom rely on traditional medicine, coupled to high unemployment rates and a low level of formal education, especially in rural areas, results in commercial over-harvesting of medicinal plants by sellers for income. When entering *umuthi* markets, one is faced with large amounts of bulbs, bark, roots and mixtures of chopped plant materials that are sold by medicinal plant gatherers. This clearly illustrates the exploitation of economically viable plants.

Almost 50% (approximately 2107 tonnes of medicinal plant material) is traded annually in KwaZulu-Natal (KZN). This is sourced from the forests (KZN Wild life report 2004). Approximately 700 *Harworthia* plants worth R4000.00 are traded in the province. Gatherers have been apprehended in the Karkloof area in possession of numerous bags of *Ocotea bullata* and *Scilla natalensis* bulbs. This is unsustainable and is also illegal since the mentioned medicinal plants are protected. The high demand of traditional medicine in KZN is probably the result of the fact that most of the Black populations live in this province.

The environmental research conducted in northern Zululand has revealed that the livelihood of most of the black people, particularly women (77%) in rural areas in northern KwaZulu-Natal is dependent on the selling of medicinal plants. It was found that the medicinal plant sellers are selling the plants in order to satisfy their immediate basic needs, for instance, buying food. The

problem is that they harvest the medicinal plants without planting new ones. That would be a problem in a long run since the medicinal plants that they sell will soon be depleted or extinct. The research also confirms that some of the plants are in high demand by medicinal plant buyers whereas they grow in inadequate numbers in the veld. These plants are listed in Table 10.

Table 10: Endangered medicinal plant species that were reported by plant sellers as in need of propagation in the northern Zululand

Taxa	Conservation Status	Legal Status	Part Used	%
Alepidia amatymbica	VU	Not protected	Root	67
Ansella gigantea	VU	Protected	Whole tree	72
Boweia volubilis	EN	Protected	Bulb/Tuber	61
Bulbine frutescens	EN	Not protected	Leaves	06
Dioscorea dregeana	DD	Not protected	Tuber	9
Diascorea sylvatica	LR	Not protected	Tuber	54
Eriospermum mackeni	RL-ic	Not protected	Tuber	33
Haworthia limifolia	LR-nt	Protected	Whole Plant	05
Hypoxis hemerocallidea	DD	Not Protected	Tuber	89
Mondia whitei	VU	Not Protected	Root	44
Ocotea bullata	VU	Specially Protected	Bark	60
Prunus africana	LR-lc	Protected	Bark	25
Scilla natalensis	DD	Protected	Root/Bulb	59
Stangeria eriopus	VU	Protected	Rhyzome	68
uThovane	-	-	Whole plant	19
Ledebouria cooperi	-	Protected	Tuber	19
Dianthus zeyheri	-	Not protected	Whole tree	19
Berchemia dioscolor	-	Protected	Roots	19
Bersama swinnyi	-	Protected	Bark	19
Hypericum aethopicum,	-	Not protected	Whole plant	19
Eucomis automnalis	-	Protected	Tuber	19
Cassine transvaalensis	-	Not protected	Roots	19
Warbugia salutaris	CR	Specially protected	Bark, Stem, Roots and Leaves	03

Legal status and uses are from Diederichs (2001) and Diederichs, Mander, Crouch, Spring, Mackean and Symmonds (2002) respectively. Conservation status of the plants was given by Golding (2002)

Golding 2002 gave the following descriptive keys to the medicinal plants in terms of their conservation status:

Extinct (Ex) - when there is no reasonable doubt that the last individual has died

Extinct in the wild (EXW) - when it is known only to survive in cultivation

Critically Endangered (CR)- when a taxon is facing extremely high risk of extinction in the wild in immediate future.

Endangered (EN) - when a taxon is not critically endangered but is facing a very high risk of extinction in the wild in immediate future.

Venerable (VU) - when a taxon is not critically endangered or endangered but is facing a high risk of extinction in the wild in medium-term future.

Lower Risk (LR) - when a taxon has been evaluated, does not satisfy the criteria of any of the categories mentioned above.

Lower Risk – Near threatened (LR-nt) -when taxa do not qualify for Conservation Department, but which are close to qualify for vulnerable

Lower risk – Least Concern (LR-Lc) -when taxa do not qualify for Conservation Department or near threatened

DD- Data Deficient: When there is inadequate information to make a direct or indirect assessment of its risk of extinction based on its distribution and/or population status. Listing taxa in this category indicates that more information is required and that future research will show that threatened classification is appropriate.

Out of 63 respondents, 15 taxa are recorded in the red data book of South Africa (Table 10). There were five taxa that were recorded as vulnerable. Two medicinal plant taxa were endangered or threatened and four were recorded as they were in a lower risk category. Three taxa were listed as data deficient pertaining to their status. The taxon that was critically endangered was *Warburgia salutaris*. In Cunningham (1998) the taxon was recorded as extinct in the wild. The records of the other taxa such as *Alepidea amatymbica, Boweia volubilis, Bulbine frutescens, Dioscorea dregeana, Diascorea sylvatica, Ocotea bullata and Warbugia salutaris* are confirmed by Cunningham (2001) as medicinal plant taxa that are sold in larger quantities in Kwa-Zulu Natal (Table 4). In Table 2, the taxa are also included as being scarce by herb traders.

The medicinal plants also are among that in Table 3 that are recorded as becoming scarce by rural herbalist in South Africa (Cunnningham 1998). This is also confirmed in the study: the percentage of knowledge of species such *Bulbine frutescens* and *Haworthia limifolia,* was five. The taxon -*Warbugia salutaris* (3%) was even lower. Although in demand, it was so scarce that it could not be found in the course of the study. It is highly protected (Table 10) and is critically endangered. Other species such as *Hypoxis hermerocallidae, Dioscorea dregeana, Ocotea bullata* and *Stangeria eriopus* were found to be dominant species (Table 5) in the study even though red data listed. This means they are still tremendously harvested due to their demand regardless whether they will be available for generations to come, or not. In the literature it is stated that taxa such as *Ocotea bullata* and *Stangeria eriopus* are protected but they are found to be dominant taxa that are sold at bus ranks. This seem as if regardless whether the species is recorded in red data book, if it is still demanded and found in a particular region, it may be harvested till it becomes extinct. Table 10 reveals that all the species that are listed in the data list are threatened. This may be due to intensive harvesting which could be due to their demand, since most of these taxa have more than one usage.

It is also a fact some of these plants are not legally protected and yet they are documented as being scarce. The main problem is that they are intensively harvested and yet very cheap to buy. This means there is a lot of environmental degradation for low profit. Most of the plants can be bought for R5.00 per medicinal plant or a mixture from the sellers, with the exception of respondent five at KwaNongoma, who said his plants cost R10.00 per plant. This is different from findings by Mander (1998) who states that the plant's price corresponds to the availability and importance of the plant, as in the case of *Haworthia limifolia* and *Warburgia salutaris* (Table 1).

The percentage of knowledge of the red data listed taxa in Table 10 showed that out of the 63 respondents, *Boweia volubilis, Diascorea sylvatica, Hpypoxis hermocallidae, Ocotea bullata, Scilla natalensis,* and *Stangeria eriopus* were known by plant traders since they scored more than 50. But other species such as *Alepidea amatymbica, Ansella gigantea, Dioscorea dregeana, Eriospermum mackeni, Mondia whitei* and *Prunus africana* were not known by plant gatherers, as borne out by their low score percentage of less than 50. The lowest percent (≤5%) in terms of

knowledge were in terms of knowledge about *Bulbine frutescens, Haworthia limifolia,* and *Warbugia salutaris.* The species were found in table 5 as having sales less that 10%. Among those that scored the lowest percentages was *Warbugia salutaris,* which is recorded as becoming extinct in the wild. This implies that there is a need to fill the knowledge gaps about plant cultivation and led to the organisation of the environmental education workshop on how to cultivate and propagate medicinal plant species. Appendix 3 gives the cultivation method and propagation technique for each species in the red data list, according to the duration and the soil types they prefer to grow in. The ways in which they usually grow are described in Appendix 5. The plant sellers will be shown how to cultivate the plants and also how to propagate them in gardens at their homesteads so that the plants may be available for them to sell – also for future generations. Some of the plants are not red data listed but they seem to be scarce due to over-exploitation such as *Acarcia xenthophloea and Synaptolepis kirkii.* Some of these are becoming extinct locally, due to bark damage (Cunningham 1998). In addition to the species that were found in the red data book, the workshop participants gave the following species as highly demanded by medicinal plant buyers, but inadequate in the field: *Ornithogalatum logibacteatum, Bersama swinnyi, Hypericum aethopicum, Berchemia dioscolor, Callilepis laureola, Helichrysum species* and an unidentified species called uThovane.

The extinction of medicinal plants is a distinct possibility if they are continually harvested without re-planting new ones. Therefore, the sellers were empowered with knowledge of how to cultivate and propagate medicinal plant species. However, the workshop not only empowered the sellers with regard to propagation techniques, but also gave them tips on how to improve their medicinal plant selling businesses.

Diederichs, Mander, Crouch, Spring, Mckean and Symmonds gave the tabulated techniques of propagating and cultivating medicinal plants (Appendix 3). However, during the workshop the participants suggested other methods of propagating medicinal plants (Table 9). These included planting the medicinal plant directly in the soil, without using cultivation trays. The participants said that their methods were faster and cheaper than using trays. The reason why they avoided using trays could be because they couldn't afford them. Although the participant did not know how to propagate other plant species, such as *Warburgia salutari,* they contributed a great deal to

the workshop. They taught the researcher some the easiest methods of propagating other species such as *Ansella gigantea*. The participants explained that the plant is an epiphyte and is planted on other tree branch, using cow dung. The workshop was not only beneficial to the participants, but also to the researcher.

All of the plants in table 5 are indigenous medicinal plant species, except for the two species that were identified by Diederichs (2001) as alien species (Appendix 7). Invasive species are organisms (usually transported by humans) which successfully establish themselves and then overcome otherwise intact pre-existing native ecosystems. Biologists are still trying to characterise this capability to invade in the hope that invasives can be predicted and stopped. Factors may include an organism that has been relieved of the pressures of the predators of its native country. Alien plants are considered a highly important threat to natural ecosystems. The problem is growing severely in geographic extent as volumes of international trade and travel increases. During the workshop Mrs. Mhlongo, the Mananger of Environmental Affairs and the Agriculture Department, explained that indigenous plants grow slowly. It is also confirmed by Cunningham (1993) that some of the endangered plants in South Africa, such as *Ocotea bullata,* needs special protection since they are slow growing plants.

The research was a in the form of action research and aimed to be in line with government policies that state that any research conducted must be of benefit to the community as well. The participants were empowered during the workshop and the workshop was arranged in such a way that the community felt free to express themselves in terms of language. The projector leader, Dr. E.T Dlamini, gave the participants holder for their stationery and printouts of the researchers' presentation prepared in iSiZulu (Appendix 4). The research was done in collaboration with the Department of Agriculture and Environmental Affairs at Empangeni, and the University of Zululand's Science and Education faculties. The participants had the opportunity to speak to the Director and the Manager of the department. The workshop participants were encouraged to speak with Dr. Dlamini – the Education project leader, who emphasized the importance of documented knowledge of medicinal plants. Doctor Dlamini conveyed an awareness of the fact that if people contributed to the knowledge pool, their contribution is marked as their own property so that any incentives pertaining to their contribution would accrue directly to the

owners of the knowledge. The participants were also pleased to gain empowerment from Dr. Zobolo, the co-supervisor of the research project, who gave them business tips with regard to the selling of medicinal plants. Doctor Zobolo emphasized the importance of reviewing the selling price of medicinal plants. The participant not only gained with regard to the techniques of cultivating medicinal plants but they were also empowered with business skills. However, all the stakeholders, i.e. project leaders, directors and managers of Environmental Education and Agriculture, the University of Zululand in collaboration with the Education and Science faculties, the researchers and the participants, mutually contributed to the research.

Limitations of the Study

The study was confined to northern Zululand, which limited its scope. A much broader picture of medicinal plant sales at bus ranks would have emerged had it included the whole Zululand area.

It is therefore recommended that further studies be conducted to cover the whole Zululand region and that field studies should include examination of sites where plant gatherers obtain their medicines in order to observe methods of harvesting the medicinal plants. Useful observations could include examples where only parts of the plants are gathered, leaving the rest of the plant to regenerate, or instances in which the whole plant is removed, without leaving a seedling or remnant to regenerate. It is also suggested that further studies should include visits to the homesteads of those medicinal plant gatherers who claimed to have medicinal gardens in their backyards.

Due to financial and time restraints, the workshop component of the present study excluded respondents from KwaNgwanase, Nongoma and Mahlabathini. Residents of these areas should ideally be included in such a workshop, which is an integrated part of the study that imparts an awareness of the need for conservation. Further studies should not only include respondents from these areas, but from the whole Zululand region since all the residents need to be empowered by the environmental education workshop.

It is believed that the study would have been "too technical," had the sampling been standardized in terms of densities to facilitate comparison. As it is, it was already difficult to express the sizes

of the bus ranks, for example, in terms of densities. The relatively small numbers of plant sellers at sampling stations also made it difficult to sample in terms of male and female ratios. Further research should endeavour to work on numbers expressed in terms of densities.

Delimitation of the study

This study was presented in the form of a mini thesis, in partial fulfillment of the requirements for a Masters degree. It provides information about the selling of medicinal plants in the context of sustainable usage and conservation. The sampling size (63) was statistically recommended in terms of sampling areas and the whole of northern Zululand was covered. The Masters programme included coursework, yet enough time was allocated for research, albeit a limited timeframe. The research work included aspects of both education and science, which made it more interesting to the researcher, especially in terms of combining the findings simultaneously.

The significance of the study

The study was community based, which gave it more significance in the light of certain recommendations found in the South African policy of higher education research. Local communities have to be empowered with knowledge about sustainable usage of medicinal plants. The findings of the study have already been publicized and presented at national and international conferences, for instance in Botswana, Hungary and Penang in Malaysia. The study was in the form of action research, which fulfils the aims of environmental education, which emphasises the importance for environmental research to lead to solutions by taking action.

Conclusions and Recommendations

The natural resources of South Africa constitutes a national asset which is essential for the economic welfare of present and future generations in the country, both urban and rural, who use and benefit from these resources and are custodians of these resources (Koro 2005). South Africa's new Constitution provides, within its Bill of Rights chapter 24 section 2, sub-sections a and b, that every South African citizen has a right for the environment to be protected for present and future generations, through reasonable legislation and other measures to:-

a) Prevent pollution and ecological degradation.

b) Promote conservation, and secure ecologically sustainable development and use of natural resources, while promoting justifiable economic and social development.

However, wild populations are decreasing. KZN Wildlife (2004) states that the decline in plant resources represents a significant loss to the economical and social welfare of the people. The medicinal plants are extensively wild-harvested and are sold in urban markets, muthi shops and by traditional healers themselves. The concern is whether the value of medicinal plants will be appreciated by the future generations. It is shown in the study and confirmed by Rukangia (2001) that most of the South African Black women derive their income from harvesting and selling medicinal plants at various urban markets. It is estimated that 4000 tonnes of plant material are used annually for medicinal plant purposes. But the country is losing some of the valuable medicinal plant species such as *Warburgia salutaris*. In order to conserve these species in the long term, their value needs to be recognized by every citizen of South Africa and everyone should be encouraged to propagate priority species and use natural occurring medicinal plant populations in a sustainable way. There is a need for government and non-government institutions to empower communities about the sustainability of medicinal plants. There is also a need to recognize the policies that pertain to prices paid for habitat destruction, including the loss of medicinal plant resources and the reduced quality of health care.

Public awareness of the value of botanical conservatories, arboretums, parks, reserves and gardens needs to be raised in order to develop an appreciation for their role and to develop a plant conservation ethic amongst our communities. Case studies in which education, communication and public awareness have been successful in promoting conservation should be documented and widely disseminated. According to KZN Wild Life, numerous programmes are in place to facilitate the cultivation of medicinal plants. The staff of KZN Wild Life is involved in raising awareness among traders at Durban markets and in enforcing permit conditions.

It is necessary to communicate the link between protected conservation areas and local communities. Mass media is a strong communication tool in society. However, the major challenge is that environmental issues concerning conservation of medicinal plants, including the plight of protected areas, do not usually find themselves in popular media channels such as radio and TV (http://www.conserveafrica.org.uk/nat_products.html). As a result, conservation issues

remain to a large extent the domain of conservation scientists. There is a need to reach the public through popular media channels. To this end, the mass media (both print and electronic) should be involved actively in environmental education.

Another challenge that is facing South Africa in medicinal plant sustainability is that South Africa was in the past ruled by an apartheid government for many years. That had to do with issues including knowledge that was claimed to belong to a certain group of people, particularly those with high income levels. The lower income groups were exploited in different ways. The plant gathers have been amongst the victims. Their knowledge and medicines were exploited since the beginning of this century (Rukangia 2001). Exploitation of knowledge and medicines of traditional healers took various forms. Many academics interviewed traditional healers and published their results of such interviews without acknowledging the sources of information. Some of the modern medical scientists also interviewed and observed traditional healers at work and then passed on their results and other investigations to the established pharmaceutical companies. Traditional healers did not receive any income. Past explanation of medicinal plant sellers presented a major constraint to the research, since some of the medicinal plant sellers did not want to be interviewed. They said that they felt insecure and afraid of being persecuted for selling indigenous medicinal plants. Others said that they thought their knowledge would be exploited. However, trust eventually developed as the study continued since the researcher had to buy medicinal plant samples from the sellers. All the traders (but also the researcher) were Zulu-speaking people. It was emphasised at the workshop that the knowledge of the traditional healer remains his or her own property. If the owner of knowledge wants the knowledge to be published, he/she qualifies for all the incentives that may accrue in this regard.

We need to have a co-operative model that allows indigenous healers and modern medicine practitioners to co-exist as two independent sectors, each representing its own uniqueness. Mutual referral may be promoted as a good strategy, but its success depends upon the two modes of healing respecting each other's uniqueness and competency. Equally important is the element of training, particularly at tertiary level. Healers from both fields need to be trained to understand each other's mode of care. This type of knowledge could help in improving quality patient care. Health professionals have a daunting challenge of including indigenous healing as a field of

medicine at nursing schools, technikons and universities. This challenge becomes even more pressing with the introduction of the African Renaissance ideal. For a long time medical school curricula in South Africa were based on Western paradigms, a factor that robbed the African students of knowing and understanding their roots. Essentially, medical field curricula should be revamped to offer students a choice between indigenous knowledge, modern medicine or both. The major challenge is to integrate traditional medicine in both theory and in practice (EEASA Monography no. 3 of 1999).

In the past, sustainable use of medicinal plants was facilitated by several inadvertent or indirect controls, as well as by certain international management initiatives (Cunningham 1998). Taboos, seasonal and social restrictions on gathering medicinal plants and the nature of plant gathering equipment all served to limit medicinal plant harvesting. In South Africa, for example, before metal machetes and axes were widely available, plants were collected with a pointed wooden digging stick or a stone axe, which tended to limit the quantity of bark or roots to be gathered. For example, traditional subsistence harvesting of *Cassine papillosa* bark causes little damage to the tree. Pressure of medicinal plant resources has remained low in remote areas and countries such as Mozambique and Zambia, where the commercial trade in traditional medicines has only developed to a limited extent due to the small size of major urban centres. According to Cunningham (1998), examples of factors which have limited pressure on species that would otherwise have been vulnerable to over-exploitation, include the following:

- Taboos against the collection of medicinal plants by menstruating women in South Africa and Swaziland; it is believed that this would reduce the healing power of plants.
- The tendency of southern African women to practice as diviners, while men practice as herbalists. This limits the number of resource users.
- The perceived toxicity of some medicinal species that reduced their use in the past: the level of toxicity is sometimes given mythical proportions. *Synadenium cupulare* for example, is considered to be so toxic that birds flying over the tree are killed; special ritual preparations are made in West Africa before the bark of *Okoubaka aubrevellei* is removed. The traditional use of wooden batons for removal of bark from *Okoubaka aubrevellei.* Under no circumstances may a machete or other implement be used. In addition to these measures, as pointed out in EEASA

monography no. 3 (1999), other sustainable methods were used by indigenous people in the collection of medicinal herbs. According to van Rensburg (1997) indigenous or traditional ecological knowledge must be given recognition. Other ways of knowing should not be marginalized in their contexts, particularly, if they carry with them other ways of interacting with environments in a sustainable manner.

The research conducted at the University of Zululand in collaboration with the Education and Science faculties and the department of Environmental Education and Agriculture aimed at empowering medicinal plant sellers about the harvesting of the plant species in a sustainable way. The research seemed successful since the community, i.e. medicinal plant sellers, showed an interest in the research and were willing to participate in conservation of medicinal plant species. The research will not end in the binding of the dissertation which is then placed on the library's shelves, but it will hopefully achieved what the Director of Environmental Affairs and Agriculture (Empangeni), Mr. Mngoma said, that all the research conducted by environmental educators must be accompanied by action. Doctor Dlamini and Dr. Zobolo emphasized that the research would not end with the publication of the results but would ensure that medicinal plant gardens will be established for the different communities. Therefore the plants that were collected during sampling will be planted at the University of Zululand botany nursery and the seedlings from the nursery will be dispatched to community gardens to start their own gardens.

One of the objectives of the study was to make the business of the plant traders viable, so that sustainable sales of medicinal plants can be achieved in the long run. For instance, by increasing the selling price of medicinal plants, the demand will be sustained, while the living circumstances of the sellers would also be improved. It transpired from the workshop that the sellers were not only empowered with regard to the conservation of medicinal plants but also by the discussion about how to ensure the viability of their medicinal plant selling businesses. Therefore, it is important that they must recognise the importance of making a profit from their business of selling medicinal plants so that their work can be sustainable and bring some poverty alleviation. It is recommended that the sellers use a standard scale in selling medicinal plant material, and not their hands, since hands are not equal in size, or consistent for measuring purposes.

In the study it has been shown that the medicinal plant sellers are harvesting medicinal plants without planting new ones – a situation that will become a problem in the long run. Therefore, joint action research by the University of Zululand's Science and Education faculties and the Department of Agriculture and Environmental Affairs at Empangeni will try to mitigate the environmental crises. The workshop's aim was to encourage medicinal plant sellers to become informed and active participants in the preservation of all the plants they sell. They were introduced to the concept of sustainability, which was simply described as the wise usage of resources so that future generations could use them too. The workshop on propagating medicinal plants was an effort by the researcher to establish a partnership with a community that is using indigenous knowledge that universities should understand and support. For the participants the workshop was beneficial in that they will now have access to resources that will be supplied by the Department of Agriculture and Environmental Education. Secondly, the department officials offered credibility to the research project in that the plant sellers know that the government supports them. The workshop was also an effort in bringing about interaction between a higher education institution and the community, not only by teaching the community scientific methods of propagating plants, but by also learning about well proven and successful indigenous methods of propagating certain plants. Recent work by Binns (1995) acknowledges the relevance of local environmental knowledge passed on by local communities. These communities have successfully used such knowledge in order to manage the environment successfully.

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Table 4: **The quantities of the herbal medicine sold annually in the largest quantity (In standard 50kg size maize bags) by 54 herb traders in Natal region, South Africa**

Species	Zulu name	Part used	Quantity
General term	Lawu-ubu		1966
General term	Ntelezi,-I		1924
General term	Khubalo,-i		1883
General term	Mbiza,-i		1211
Scilla natalensis	Guduza,-in	bulb	774
Eucomis autumnalis	Mathunga,-u	bulb	581
Alepidia amatymbica	Khathazo,-i	root	519
Adenia gummifera	Fulwa,-im	stem	459
Albizia adianthifolia	Solo,-u	bark	424
Cilvia miniata	Mayime,-u	bulb	397
Cilvia nobilis	Mayime,-u	bulb	397
Pantanisia prunelloides	Cimamlilo,-i	Root(it)	343
Senecio serratuloides	Sukumbili,-in	Leaves/stem	340
Gunnera perpensa	Gobho,-u	root	340
Rapanea melanophloeos	Maphipha-khubalo,-u	bark	327
Dioscorea sylvatica	Ngwevu,-i	Whole plant	326
Warburgia salutaris	Bhaha.-isi	bark	315
*Bersama species**	Diyaza.-un	bark	295
Unidentified species	Bhadlangu,-u	root	288
Kalanchoe creneta	Mhongwe,-u	Leaves/stem	284
Boweia volubils	Gibisila,-i	Bulb	257
Trichilia emetica and T.dregeana	Khuhulu,-um	bark	252
Turbina oblongata	Bhoqo,-u	root	249
Rhoicissus	Nwazi,-isi	root	244
Bulbine latifolia	Bhucu,-i	bulb	240
Ocotea bullata	Nukani,-u	bark	234
Stangeria eriopus	Fingo, -im	root	233
Cryptocarya species	Khondweni, -um	bark	228
Anemone fanninii	Manzamnyama, -a	root	227
Eucomis sp.cf. bicolor	Mbola, -i	bulb	224
Rhus chirindensis	Yazangoma-embomvu	bark	222
Helinus intergrifolius	Bhubhubhu, -u	stem	222
Schotia brachyetela	Hluze, -i	Bark	220
Vernonia neocorymbosa	Hlunguhlungu, -um	Leaves/stem	216
Dioscorea dregeana	Dakwa, -isi	Whole plant	212
Ornithogalum longibracteatum	Mababaza, -um	bulb	208
Erythrophleum lasianthum	Mkhwangu, -um	bark	201
Solanum aculeastrum	Tuma,-in	fruit	198
Curtisa dentata	Lahleni, -um	bark	197

Table 5: Distribution of Medicinal Plants in Various Sites

KEY- Sampling sites **1-Empangeni (16), 2-Mtubatuba (14), 3-Richards Bay (4), 4-Mahlabathini (6), 5-Nongoma Town (5), 6-Mona (18)**

			Sites						
			1	2	3	4	5	6	Average
	Scientific Names	**Zulu Names**							
1	*Acacia caffra*	uZula azeayithole(uMthole)	6	0	0	0	0	0	**1**
2	*Acacia xanthophloea*	uMkhanyakude	25	57	25	0	60	39	**34**
3	*Acaia robusta*	uMngamazi	0	7	0	0	0	11	**3**
4	*Acalypha villicaulis*	uMpendulo	6	43	0	17	20	11	**15**
5	*Acorus calamus*	uKalumuzi	94	71	100	100	100	39	**84**
6	*Acridocarpus natalitius*	uMabopha	69	79	25	67	40	72	**59**
7	*Adenia gummifera*	iMpindamshaye	56	43	100	100	100	56	**76**
8	*Albizia adianthifolia*	uSolo	0	0	0	67	80	33	**30**
9	*Albuca fastigiata*	uMaphipha	44	14	25	33	80	61	**43**
10	*Albuca sp.*	iNgcino	0	50	50	100	0	33	**39**
11	*Alepidea amatymbica*	iKhathazo	0	50	50	0	0	67	**28**
12	*Aloe candelabrum*	iNkalane	0	0	0	17	0	0	**3**
13	*Aloe species*	iNhlaba	0	0	0	0	0	6	**1**
14	*Ammocharis coranica*	iNcama	0	50	0	50	20	67	**31**
15	*Andrachne ovalis*	uMembesa	19	71	0	50	40	67	**41**
16	*Anemone caffra*	uManzamnyama	6	43	0	0	0	0	**8**
17	*Annona senegalensis*	uMtelemba	0	0	0	17	0	0	**3**
18	*Ansellia africana*	iMfeyenkawu	0	14	0	33	60	72	**30**
19	*Anthospermum rigidum*	uMlomomnandi	0	0	0	17	0	6	**4**
20	*Aptenia cordifolia*	uNgcolosi	0	0	0	17	20	61	**16**
21	*Aster bakerianus*	uDlutshani	13	50	50	0	80	33	**38**
22	*Ballanites maughamii*	uMgobandlovu	44	0	0	0	0	50	**16**
23	*Bauhinia bowkeri*	uMdlandlovu	63	0	0	0	0	72	**22**
24	*Bersama swinnyi*	uMhlakaza	0	43	0	0	0	61	**17**
25	*Boerhavia diffusa*	iSilepe	0	0	0	0	0	17	**3**
26	*Boophane elisticha*	iNcotho	63	57	0	0	0	61	**30**
27	*Boweia volubilis*	uGibisila	44	50	75	33	40	61	**51**
28	*Bulbine frutescens*	iBhucu	0	0	0	0	40	6	**8**
29	*Callilepis laureola*	iMpila	50	79	75	83	80	11	**63**
30	*Calodendrum capense*	uMnemezi omhlophe	88	64	0	0	0	39	**32**
31	*Capparis brassii*	uMabusana	0	0	0	33	20	67	**20**
32	*Capparis tomentosa*	iQwaningi	0	0	0	33	20	67	**20**
33	*Cassine transvaalensis*	iNgwavuma	88	57	50	100	80	72	**74**
34	*Cassipourea gerrardii*	uMnemezi obomvu	19	21	0	0	0	39	**13**
35	*Cassipourea malosana*	uMnemezi	0	0	25	0	80	50	**26**

36	*Celosia trigyna*	uVelabahleke	13	0	25	50	20	50	**26**
37	*Cepharia humilis*	uMpikayiboni	38	43	0	50	40	44	**36**
38	*Cereus peruvianus*	iSinhlenhle	0	0	0	17	0	17	**6**
39	*Chlorophytum modestum*	iPhamba	56	14	0	0	20	56	**24**
40	*Cinnamomum camphora*	uLosilina	0	0	0	0	20	50	**12**
41	*Clerodendrum triphyllum*	uMathanjana	0	0	0	17	0	50	**11**
42	*Clivia miniata*	uMayime	88	64	50	67	60	39	**61**
43	*Combretum kraussii*	uMdubu	0	0	0	0	20	61	**14**
44	*Convolvulus farinosus*	uVimbukhalo	6	0	0	0	0	28	**6**
45	*Corchorus asplenifolius*	uBangalala	13	0	0	0	0	67	**13**
46	*Crinum macowanni*	uMnduze(uMduze)	0	0	0	0	20	61	**14**
47	*Crocosmia aurea*	uNdwendweni	0	0	25	0	20	39	**14**
48	*Croton gratissimus*	iNtumbadlozi	50	43	25	17	20	72	**38**
49	*Croton sylvaticus*	uMahlabekufeni	0	43	0	0	40	78	**27**
50	*Cryptocarya latifolia*	uMkhondweni	0	64	0	0	20	50	**22**
51	*Cucumis myriocarpus*	iSitho senja sangasese	6	0	0	0	0	17	**4**
52	*Cunonia capensis*	uMlulama	63	0	25	83	20	72	**44**
53	*Curtisia dentata*	uJundumlahleni (uMlahleni)	0	21	0	0	0	44	**11**
54	*Cyanotis speciosa*	iMpindemuva	50	43	0	17	60	44	**36**
55	*Cymbopogon marginatus*	iSiqungwa	0	0	0	0	20	17	**6**
56	*Cyperus sexangularis*	uMuzikawushi (uMuzi)	0	0	0	33	0	33	**11**
57	*Dianthus zeyheri*	uNingizimu	88	64	0	0	100	83	**56**
58	*Dioscorea degreana*	uDakwa	0	14	0	0	0	39	**9**
59	*Dioscorea sylvatica*	iNgwevu	19	64	75	0	80	83	**54**
60	*Dombeya rotundifolia*	uNhliziyonkulu	0	14	0	0	40	22	**13**
61	*Drimia robusta*	iSiklenama esibomvu	56	71	50	83	40	72	**62**
62	*Ekebergia capensis*	uMnyamathi	0	50	0	0	0	33	**14**
63	*Elephantorrhiza elephantina*	uMdabu	0	0	0	0	20	6	**4**
64	*Encephalartos altensteinii*	uMhungulo	56	0	0	0	60	44	**27**
65	*Encephalartos spieces*	iSigqikisomkhovu	0	0	0	0	20	17	**6**
66	*Eragrostis plana*	uMvithi	44	0	0	0	0	28	**12**
67	*Eriosema cordatum*	uMvusankunzi/uQonsi	0	0	0	0	0	83	**14**
68	*Eroispermum mackenii*	iNsulansula	13	57	0	67	60	17	**35**
69	*Erythrophleum lasianthum*	uMkhwangu	44	29	25	67	40	67	**45**
70	*Eucomis autumnalis*	uMathunga	63	0	50	17	20	22	**29**
71	*Eucomis sp. Cf. Bicolor*	uMayisaka	44	0	0	33	0	67	**24**
72	*Eulophia petersii*	iSaha	6	0	0	0	0	28	**6**
73	*Euphobia cooperi*	uMnhlonhlo	0	0	0	17	20	61	**16**
74	*Faurea salinga*	iSisefo	0	0	0	0	20	11	**5**
75	*Gardenia thunbergii*	uMvalesangweni	13	0	0	0	0	67	**13**
76	*Gnidia burchellii*	iSidikili	56	14	50	33	60	56	**45**
77	*Gnidia kraussiana*	uMsilawengwe	0	7	0	0	0	0	**1**
78	*Gunnera perpensa*	uGobho	44	79	50	83	80	61	**66**
79	*Haemanthus albiflos*	uZeneke	0	0	0	0	0	44	**7**
80	*Harpephyllum caffrum*	uMgxamu	88	86	25	50	100	33	**64**
81	*Haworthia limifolia*	uMathithibala	6	0	0	0	0	11	**3**

82	*Helinus integrifolius*	uBhubhubhu	63	64	75	67	100	67	**73**
83	*Hermannia depressa*	uMphumputho	0	7	0	0	0	0	**1**
84	*Hippobromus pauciflorus*	uQhume	0	21	0	17	40	67	**24**
85	*Huernia spp.*	iLilo	0	0	0	17	0	28	**7**
86	*Hybanthus enneaspermus*	uNgqengendlela	0	7	0	0	0	0	**1**
87	*Hydrost sp.*	iPhophoma	44	0	0	0	0	22	**11**
88	*Hypoxis gerrardii*	iNkomfe	0	14	100	83	100	78	**63**
89	*Hypoxis hemerocallidea*	iLabatheka	81	86	100	83	100	83	**89**
90	*Indigoferra frutescens*	uMnukambiba/uMsanka	31	0	25	0	20	78	**26**
91	*Justica flava*	iKhokhela	69	36	0	67	60	67	**50**
92	*Kniphofia uvaria*	iCacane	0	0	0	0	0	44	**7**
93	*Knowltonia bracteata*	uMvuthuza	56	21	0	0	40	17	**22**
94	*Lagenaria sphaerica*	uSelwalwamakhosi/uThangazana	13	7	0	0	0	50	**12**
95	*Ledebouria cooperi*	uCucudwana	13	57	75	0	40	50	**39**
96	*Loranthus quinquenervius*	iPhakama eliphansi	0	21	0	0	0	28	**8**
97	*Lotononis corymbosa*	uMusa	0	0	0	0	20	11	**5**
98	*Loxostylis alata*	iFutho	0	14	0	0	0	50	**11**
99	*Maesa lanceolata*	uMaguqu/uMashwila	13	93	25	0	80	56	**44**
100	*Maytenus undata*	iNdabulaluvalo	19	0	0	0	20	83	**20**
101	*Monanthotaxis caffra*	uMgogi-wezinhlanya	44	7	25	0	40	67	**30**
102	*Mondia whitei*	uMondi	56	21	25	0	40	72	**36**
103	*Myrothamnus flabellifolious*	uVukakwabafile	56	0	0	0	40	17	**19**
104	*Nymphaea nouchali*	iZibu	0	0	0	17	20	33	**12**
105	*Ocotea bullata*	uNukani	38	64	25	67	60	83	**56**
106	*Olinia radiata*	uMzaneno/Mhlanukelwa	0	0	0	17	0	50	**11**
107	*Olinia ventosa*	iNgobamakhosi	6	29	0	0	0	67	**17**
108	*Pentanisia prunelloides*	iCishamlilo	0	71	0	0	0	33	**17**
109	*Phytolacca dioica*	uMzimuka	0	0	0	83	0	78	**27**
110	*Platycarpha glomerata*	iMbozisa	6	21	50	83	20	39	**37**
111	*Plectranthus hadiensis*	uMbola	0	0	0	17	0	33	**8**
112	*Podocarpus falcatus*	aBangqongqozi	6	0	0	0	20	44	**12**
113	*Portulaca quadrifidia*	uShisizwe	38	0	0	17	80	22	**26**
114	*Printzia pyrifolia*	uHlunguhlungu	69	36	0	33	60	33	**39**
115	*Protorhus longifolia*	uNhlangothi	0	21	0	0	20	44	**14**
116	*Prunus africana*	iNyezangoma elimnyama	0	0	0	0	0	6	**1**
117	*Psoralea pinnata*	uMhlonishwa	56	43	25	50	80	44	**50**
118	*Ptaeroxylon obliquum*	uMthathe	63	43	0	0	40	11	**26**
119	*Pterocelastrus echinatus*	iSehlulamanye	50	0	25	50	60	61	**41**
120	*Pyrenacanthia scandens*	uNginakile	13	0	0	0	0	56	**11**
121	*Ranunculus multifidus*	uXhaphozi	69	29	25	0	0	11	**22**
122	*Rauvolfia caffra*	uMhlambamanzi	0	0	0	17	0	56	**12**
123	*Ricinus communis*	uMhlakuva	0	0	0	0	0	6	**1**
124	*Rubia cordifolia*	iNtwalalubombo	38	14	0	0	40	56	**25**
125	*Salacia leptoclada*	uMampunzana	13	50	0	0	20	72	**26**
126	*Salogo sp.*	uMhlabelo	6	0	75	0	20	39	**23**
127	*Sarcophyte sanguinea*	uMavumbuka/ihlule	94	93	100	100	100	44	**89**

128	*Scabiosa columbaria*	uBhekaminangedwa (iBheka)	0	57	0	17	20	33	**21**
129	*Scilla natalensis*	iNguduza	31	71	75	100	20	67	**61**
130	*Sclerocarya birrea*	uMganu	81	64	25	50	100	28	**58**
131	*Secamone gerrardii*	uGobandlovu	19	0	50	0	20	33	**20**
132	*Senecio serratuliodes*	uNsukumbili	25	21	0	0	20	50	**19**
133	*Senecio speciosus*	iBohlololo	0	0	0	17	0	0	**3**
134	*Solanum aculeastrum*	iNtuma	19	7	25	67	0	33	**25**
135	*Species 1*	uGina	0	7	0	0	0	0	**1**
136	*Species 9*	uNgazini	6	0	0	0	0	0	**1**
137	*Species 13*	uThwalitshe	0	7	0	0	0	28	**6**
138	*Species 11*	iNtelezi yesilwane/Xoshisilwane	6	0	0	0	0	0	**1**
139	*Species 2*	uMabohla	0	0	0	0	0	33	**6**
140	*Species 3*	uMalilisa	0	7	0	0	0	0	**1**
141	*Species 4*	uMgunya	6	0	0	0	0	0	**1**
142	*Species 5*	uMhlahlandlela	0	0	0	0	0	11	**2**
143	*Species 6*	uMhlamvu	88	64	0	0	40	11	**34**
144	*Species 7*	uMndawe	44	50	0	0	20	44	**26**
145	*Species 12*	uQeduhlobo	0	6	0	0	0	0	**1**
146	*Species 10*	uNokhungwa	0	6	0	0	0	0	**1**
147	*Species 8*	iNdlabathakathi/iNdlabaloyi	0	14	0	17	20	72	**21**
148	*Species 14*	uVulakuvaliwe	6	0	0	17	20	11	**9**
149	*Stangeria eriopus*	iMfingo	44	86	75	83	80	67	**72**
150	*Strychnos spinosa*	uMhlala	0	0	0	0	20	6	**4**
151	*Sutherlandia frutescens*	uMnwele	0	0	0	0	0	33	**6**
152	*Synaptolepis kirkii*	uVuma omhlophe	25	7	25	83	20	11	**29**
153	*Talinum caffrum*	uPhunyukabemphethe (uMpunyu)	13	64	25	0	40	22	**27**
154	*Tighemia quinquinerva*	iPhakama	25	0	50	100	60	0	**39**
155	*Tulbahia ludwigiana*	uMphesheya/uMawela	0	14	0	0	20	33	**11**
156	*Turraea floribunda*	uMadlozana	63	50	50	0	20	72	**42**
157	*Tylophora flanaganii*	iNhlanhlemhlophe (iNhlanhla)	6	14	0	0	20	44	**14**
158	*Urginea physodes*	iSiklenama esimhlophe	44	0	0	67	0	50	**27**
159	*Urginea sanguinea*	iSiklenama/uMahlanganisa	38	86	50	0	80	50	**51**
160	*Vernonia odoensis*	iNyathelo	0	43	0	0	40	67	**25**
161	*Warburgia salutaris*	iSibhaha	0	0	0	0	20	6	**4**
162	*Xerophyta retinervis*	iSiphemba	0	0	0	67	0	0	**11**
163	*Ximenia caffra*	uMgwenya	50	0	25	0	80	61	**36**
164	*Ziziphus mucronata*	uMphafa/uMlahlankosi	50	21	25	0	20	39	**26**

Table 8: Medicinal Plant Uses

	Scientific Name	Part used	Usage (in isiZulu)	Usage (in English)
1	*Acacia caffra*	Bark	Owukufuna umsebenzi	To make it possible to get a job
2	*Acacia xanthophloea*	Bark	Owenhlanhla	Is a lucky charm
3	*Acaia sieberiana/robusta*	Bark	Ususa izithunzi ezimbi	To fight against evil spirits
4	*Acalypa villilcaulis*	Root	Uphendula izidalwa	To bring back ancestors
5	*Acorus calamus*	Roots	Welapha umkhuhlane	Acts as an anti-dote for fever
6	*Acridocarpus natalitius*	Root	Uqeda isigwebo kumuntu owenze okubi	To avert anger when fault has been committed.
7	*Adenia gummifera*	Climber	Intelezi yokuchela	Is a sprinkling charm
8	*Albizia adiantifolia*	Root	Ususa izthunzi ezimbi	To chase evil spirits
9	*Albuca fastigiata*	Tuber	Intelezi yokuchela	To sprinkle around homestead, particularly for protection
10	*Albuca sp.*	Tuber	Owentando/ usiza umntwana uma enesithakathi	Love charm
11	*Alepidea amatymbica*	Root	Uthaka izintelezi/ Ulapha umkhuhlane	Sprinkling charm Treatment of 'flu-like symptoms
12	*Aloe candelabrum*	Whole plant	Uthaka imbiza yomhlume	Enema for umhlume-a projection in the private part thought to be caused by sexual transmitted diseases
13	*Aloe species*	Leaves	Iqeda isifo senhliziyo	Treatment of heart diseases
14	*Ammocharis coranica*	Root	Uqeda ukucanuzela kwenhliziyo. Ukhipha izilwane esiswini ezinganeni, amankonyane kanye nezimvu	Taken for nausea, eliminates worms from children, calves and sheep
15	*Andrachne ovalis*	Root	Uqugudwa uma uya ecaleni/ ulapha isichitho sezintwala	Used for the sake of winning a trial Treatment of lice
16	*Anemone caffra*	Root	Owokwenza ukuthi kungababikhona ophumelela emndenini/	Sorcery
17	*Annona senegalensis*	Root	Ivusa isitho sangasese sowesilisa	Induces erection in males
18	*Ansella africana/* *Ansella gigantea*	Shooting	Ubulala izintwala	Treatment of lice
19	*Anthospermum rigidum*	Root	Wenza owesifazane athandeke kumnyeni wakhe	Love charm
20	*Aptenia cordifolia*	Whole plant	Uqeda isichitho	Is used to stop isichitho, is a spell that cast on an individual or couple and causes estrangement
21	*Aster bakeramus*	Rhizomes	Ukhipha inyongo	To treat leaking of bile
22	*Ballanites maughamii*	Root	Uvusa isitho sangasese sowesilisa	Used for erection problems in males

	Scientific Name	Part used	Usage (in isiZulu)	Usage (in English)
23	*Bauhinia bowkeri*	Bark	Uthaka igobongo	Is a mixture of plant parts that is used for the spirits called amandiki and amandawe and amadlozi (ancestors), emetic, steaming and bathing
24	*Bersama swinnyi*	Bark	Ulapha izibhobo	Sprinkling charm
25	*Boerhavia diffusa*	Root	Uthaka intelezi yokugquma	Steaming
26	*Boophane elisticha*	Tuber	Uthaka intelezi	Sprinkling charm
27	*Boweia volubilis*	Tuber	Uthaka isihlambezo sokubeletha	Facilitate child birth
28	*Bulbine frutescens*	Root/ Leaves	Welapha izilonda Uqeda ukopha	Treatment of wounds Stops bleeding in women
29	*Callilepis laureola*	Tuber	Ixosha izithunzi ezimbi/ iqeda isishozi enganeni	Used to chase away evil spirits
30	*Callodendrum capense*	Bark	Owokukhilima	Cosmetic
31	*Capparis brassii*	Stem	Welapha isisu	stomachache
32	*Capparis tomentosa*	Roots	Ulapha isifuba/ Uqeda isigwebedla	Chest diseases
33	*Cassine transvaalensis*	Bark	Uyagquma	Steaming especially for luckiness
34	*Cassipourea gerradii*	Bark	Owokugquma	Steaming in order to get luck
35	*Cassipourea malosana*	Bark	Owokukhilima	Cosmetic to lighten skin colour
36	*Celosia trigyna*	Inner part of a stem	Owenhlanhla/ Uthaka amagobongo	Lucky charm
37	*Cepharia attenuata/humilis*	Root	Uthaka intelezi yokuchela	Sprinkling charm
38	*Cereus peruvianus*	Whole tree	Imbiza yomhlume	Used as a decoction to treat a projection in the private parts of the body that is thought to be caused by sexual transmitted diseases.
39	*Chlorophytum modestum*	Root	Owegobongo	Is a mixture of plant parts that is used for the spirits called amandiki and amandawe and amadlozi (ancestors) It is used to induce vomiting, steaming and bathing. It is said igobongo elimhlophe is for indiki whereas the red one is for umndawe
40	*Cinnamomum camphora*	Whole tree	Owenhlanhla	Bark is used in love charm emetics
41	*Clerodendrum triphylum*	Root	Imbiza eqeda isifo samathambo	Decoction to treat bone diseases

	Scientific Name	Part used	Usage (in isiZulu)	Usage (in English)
42	*Clivia miniata*	Whole tree	Owentelezi	Sprinkling charm
43	*Combretum heroense*	Root	Uthaka ikhambi lesisu	Treatment of stomachache
44	*Convovulus farinosus*	Root	Imbiza yeqolo	Treatment of back pain
45	*Corchorus asplenifolius*	Roots	Wenza abantu bakuthande	Love charm.
46	*Crinum macowanii*	Tuber	Wenza ubisi kubaantu abancelisayo nasezinkomeni	To stimulate milk production in women and cows
47	*Crocosmia aerea*	Tuber	Imbiza yokuchatha	Enema
48	*Croton gratissimus*	Root	Ubiyisa idlozi	It brings a relationship with ancestors
49	*Croton sylvaticus*	Bark/Stem	Uthaka imbiza kazifozonke	Enema to boost immune system
50	*Crytocarya latifolia*	Roots	Isikhafulo	To attract an attention of somebody by taking a mouthful of a traditional medicine mixture and spit it out while calling a person's name in order to take his or attention
51	*Cucumis myriocarpus*	Fruit	Owokuchatha	Enema believed to clean the alimentary canal
52	*Cunonia capensis*	Root	Ususa izthunzi ezimbi	Used to fight evil spirits
53	*Curtisia dentata*	Bark	Ususa isinyama entombazaneni	To remove unluckiness from girls.
54	*Curtanthus breviflorus*	Tuber	Owenhlanhla	Is a lucky charm
55	*Cyanotis speciosa*	Rhizome	Uthakwa nompindamshaye ukuze uma umuntu ethakathwa kubuyele kuloyo othakathayo	The whole plant is mixed with *Adenia gummifera* to make concoction that is used to return the ailment to the witchcraft
56	*Cymbogon marginatus*	Grass	Silapha umkhuhlane. Sisusa izithunzi ezimbi	Treatment of 'flu Chases evil spirits
57	*Cyperus sexangularis*	Root	Uxosha izinyoka	Snake expellant
58	*Dianthus zeyheri*	Whole plant	Ucacisa amaphupho / Owemimoya-amandiki namandawo	Interpretation of dreams
59	*Dioscorea degreana*	Tuber	Intelezi echelwa uma kuzobanomcimbi. Yenza abantu baziphathe kahle emcimbini. Wenza isibhocobhoco kumuntu angafuni ikusebenzisa umuthi bese ayalala ukuze kusetshenziswe kuye imithi lleyo	Sprinkling charm around the homestead before a function so that the guests behave themselves. Anaesthetic

	Scientific Name	Part used	Usage (in isiZulu)	Usage (in English)
60	*Dioscorea sylvatica*	Tuber	Imbiza yezilonda	Treatment of wounds
61	*Dombeya rotundifolia*	Bark	Uqeda inhliziyo encane Welapha isifo sokufuna ukuzibulala	To treat short temperedness
62	*Drimia robusta*	Tuber	Ukhipha idliso	Removal of traditional poison
63	*Ekebergia capensis*	Bark	Ususa izithunzi ezimbi	Used to chase away evil spirits
64	*Elephantorrhiza elephantina*	Bark	Ulapha ibhande	Treatment of shingles
65	*Encephalartos altensteinii*	Root	Uthaka imithi yentando	Love charms
66	*Encephalartos species*	Tuber	Usebenza njengesikhonkwane sokuvikela izithunzi ezimbi	Protective agent against evil spirits
67	*Eragrostis plana*	Root & Leaves	Ushunqiswa uma izulu liduma	Protection against lightning
68	*Eriosema cordatum /Carissa bispinosa*	Root	Wenza isitho sangasese kowesilisa siqine	Induces erection in males
69	*Erospermum mackenii*	Roots	Ukhipha ibhadi	To treat unluckiness
70	*Erythrophleum lasianthum*	Root	Uthaka insizi yombhemiso	Mixture that is snorted to treat headaches through sneezing
71	*Eucomis autumnalis*	Tuber	Imbiza yokuchatha	Enema
72	*Eucomis sp.*	Root	Welapha izilonda	It treats wounds
73	*Eulophia petersii*	Whole plant	Uthaka imbiza yesifuba	Treatment of chest problems
74	*Euphobia cooperi*	Whole tree	Ulapha isistshopi	Treatment of swelling in appendages as a result of being bewitched
75	*Faurea salinga*	Bark	Uqeda isifo sohudo	Stops diarrhea
76	*Gardenia thunbergii*	Fruit	Owokuchela-Ubalakisa izithunzi ezimbi	Sprinkling charm and is used to chase evil spirits
77	*Gnidia burchellii*		Owokubethela	Protective charm
78	*Gnidia kraussiana*	Bark	Uthaka insizi yokuncinda	Is a process of healing by rapidly dipping fingertips into muthi boiling over hot coals and drinking the medicine
79	*Gunnera perpensa*	Root	Ukhipha amanzi emzimbeni	To remove the excess water in the body
80	*Haemanthus albifos or H. coccineus or H deformis*	Bulb	Uthakatha owesifazane avume ukuya ocansini nowesilisa abe engaqondile	To bewitch females into sexual intercourse
81	*Herpephyllum caffrum*	Bark	Ususa izithunzi ezimbi	Used to chase evil spirits
82	*Haworthia limifolia*	Root	Owokubethela	Protective charm in a homestead

	Scientific Name	Part used	Usage (in isiZulu)	Usage (in English)
83	*Helinus intergrifolus*	Roots	Wakha igobongo	To call spirits called amandiki and amandawe and amadlozi (forefathers) Induces vomiting and steaming
84	*Hermannia depressa*	Bark	Uqeda isishozi enganeni	Treatment of severe 'flu-like symptoms caused by internal disorders in children
85	*Hippobromus pauciflorus*	Bark	Owenhlanhla	Lucky charm
86	*Huemia sp.*	Shooting	Wenza intelezi yokuchela omoya ababi/ uthaka imbiza yomhlume	Sprinkling charm
87	*Hybanthus enneaspermus*	Shooting	Owenhlanhla	Lucky charm
88	*Hydrost sp.*	Root	Uthaka igobongo elimhlophe	To call spirits called amandiki and amandawe and amadlozi (forefathers) Induces vomiting, bathing and steaming
89	*Hpoxis gerrardii*	Tuber	Upholisa inkaba yengane encane	Healing of navel of an infant
90	*Hypoxis hemerocallidae*	Tuber	Welabapha izifo ezithathelana ngocansi	To treat sexual transmitted infections and HIV/AIDS related infections
91	*Indigoferra frutescens*	Root & Bark	Uthaka ikhambi lokwelapha isisu	Treatment of stomach ache
92	*Justica flava*	Leaves	Isiphunge-Abantu Bathande ukuthenga okudayisayo	To attract the attention and buying of customers to what a person is selling.
93	*Kniphofia uvaria*	Root	Lenza izinto umuntu afisa ukuzenza zikhanye/Lithaka igobongo elimhlophe	Lucky charm
94	*Knowltonia bracteata*	Shooting	Welapha izintwala	Treatment of lice.
95	*Lagenaria sphaerica*	Fruit	Kugezwa ngawo umndeni wasebukhosini uma kushone inkosi	Fruit used in succession ceremonies after the death of a chief.
96	*Ledebouria cooperi*	Tuber	Owokuchatha izingane/ Ukhipha izilwane esiswini senkomo/ Uthaka imbiza yomhlume	Bulbs are used in enemas to children Worm expellant in cattle Treatment of genital warts
97	*Loranthus quinquenervius*	Stem & Leaves	Lithaka imbiza eqeda ukopha emzimbeni	Treatment of unstopped menstruation
98	*Loxostylis corymbosa*	Root	Owenhlanhla	Lucky charm
99	*Loxostylis alata*	Bark	Owokugquma	Used for steaming, in most cases for luckiness
100	*Maesa lanceolata*	Root	Ulungisa idlozi	To bring good relationship with the ancestors
101	*Maytenus undata*	Bark	Yenza indoda noma umfazi ashaywe uvalo uma ecabanga ngomunye uma bengahlali ndawonye, ukuze aziphathe kahle	Used to keep people living far away from their spouses faithful by inducing paranoia

	Scientific Name	Part used	Usage (in isiZulu)	Usage (in English)
102	*Monanthotaxis caffra*	Root	Ulapha umdikheyi	Treatment of mental disorders
103	*Mondia whitei*	Root/Bark	Uyaqugudwa uvula inhliziyo	To increase appetite
104	*Myrothamus flabellifolious*	Whole plant	Owenhlanhla	Lucky charm
105	*Nymphaea nouchali*	Root	Owesichitho	Spell used to dissolve relationships
106	*Ocotea bullata*	Bark	Amakha esidwaba	Perfume used to combat bad smells on traditional (hide) skirts
107	*Olinia radiata*	Root	Isihlanzi	Emetic
108	*Olinia ventosa*	Root	Owokugqaba	Is rubbed on the forehead for a person in order to gain respect and dignity
109	*Pentanisia prunelloides*	Whole tree	Liqeda umkhuhlane/ Ligcotshwa esilondeni uma ushile	Treatment of 'flu-like symptoms and burns
110	*Phytolacca dioica*	Tuber	Ukhipha amanzi uma uvuvukile emzimbeni	Treatment of oedema
111	*Platycarpha glomerata*	Stem & Leaves	Welapha umkhuhlane/ Ubolisa idliso	Treatment of 'flu-like symptoms
112	*Plectranthus hadiensis*	Bulb	Ubolisa idliso	Anti venom for orally ingested traditional poisons
113	*Podocarpus falcatus*	Bark	Uthaka izintelezi/ Usebenza njengesikhafulo	Sprinkling charm. Love spell
114	*Portulaca quadrifidia*	Root	Ulapha isichitho sezintwala	Treatment of lice
115	*Printzia pyrifolia*	Whole tree	Lithaka igobongo elimhlophe	Calling of spirits called amandiki and amandawe and amadlozi (ancestors) Emetic, steaming and bathing
116	*Protorhus longifera*	Whole tree	Uthaka izinsizi namakhambi	Preparation of other medicines and enemas
117	*Prunus africana*	Bark	Ikhubalo/Owenhlanhla	Lucky charm
118	*Psoralea pinnata*	Leaves	Owenhlanhla. Wenza ube nesithunzi emsebenzini	Lucky charm. To gain professional integrity
119	*Paeroxylon obliquum*	Bulb	Isikhafulo	Love spell
120	*Pterocelastrus rostrus*	Bark	Ucupha ilumbo-isifo esiphatha umuntu wesilisa akasithola entombini esicushwa isoka laleyo ntombi	Used to bewitch a girlfriend so that other males engaging in sexual intercourse with her may get sick
121	*Pyrenacanthia scandens*	Climber	Owentando	Love charm
122	*Ranunculus multifidus*	Climber	Uthaka imbiza yomhlume	Enema for genital warts
123	*Rauvolfia caffra*	Bark	Uthaka imbiza/uyakhothwa	Used as a mixture in decoctions and licked if a person has a certain illness
124	*Ricinus communis*	Fruit or Seed	Usebenza ukuthoba inkonyane ume ingafuni ukuncela	Is administered as purgative for calves refusing to suckle.
125	*Rubia cordifolia*	Root	Uqeda ukopha kowesifazane	It stops bleeding in women

	Scientific Name	Part used	Usage (in isiZulu)	Usage (in English)
126	*Salacia leptoclada*	Root	Owenhlanhla	Luck charm
127	*Salogo sp.*	Tuber	Uthoba amanxeba uma ulimela	Used to neutralize wounds in the body. This is done by dipping a cloth in a boiling decoction and placing that cloth in a wound
128	*Sarcophyte sanguinea*	Root	Imbiza yezinduna	Acne treatment
129	*Scabiosa columbaria*	Root	Yenza ukuthi uthandeke kakhulu	Induces favoritism
130	*Scilla natalensis*	Bulb	Owentelezi	Sprinkling charm
131	*Sclerocarya birrea*	Bark	Owenhlanhla	Love charm
132	*Secamone gerrardii*	Root	Uthaka imbiza yokuchatha	Enema
133	*Senecio serratuliodes*	Shooting	Uqeda izilonda	Treatment of wounds
134	*Senecio speciosus*	Whole plant	Uqeda ukuvuvuka	Treatment of oedema
135	*Solanum aculeastrum*	Fruit	Ilapha amazinyo	Treatment teeth and gum diseases
136	*Species1*	Bark	Uyagquma	Steaming charm
137	*Species 2*	Whole tree	Welapha idliso	Anti venom for orally ingested traditional poisons
138	*Species 3*	Whole plant	Uthaka intelezi	Sprinkling charm
139	*Species 4*	Bark	Ulungisa idlozi	Makes a good relationship with the forefathers
140	*Species 5*	Bark	Owegobongo uma uphothula ukuphehlelwa	Is a mixture of plant parts that is used for the spirits when a diviner is finishing his or her training
141	*Species 6*	Root	Wenza ukuthi uma umuntu ezala uhlobo olulodwa lwezingane akwazi ukuthola olunye uhlobo- uma ethola bafana uyakwazi ukuthi ayilamanise ngentombazane	Makes it possible to choose the sex of the next child
142	*Species 7*	Root	Owegobongo elibomvu	Emetic, steaming and bathing.
143	*Species 8*	Root	Owokubethela	Protective charm
144	*Species 9*	Bark	Uqeda ukopha kowesifazane	Stops bleeding in females
145	*Species 10*	Bark	Uqeda ibhadi intombazane igcacge	Marriage spell for women.
146	*Species 11*	Bark	Owokubethela	Protective charm in a homestead
147	*Species 12*	Fruit	Ucupha ithuna	Protect a grave from witchcraft
148	*Species 13*	Bark	Intelezi yokuchela	Sprinkling charm
149	*Species 14*	Root	Owecala	Win charges laid against a person for crime
150	*Stangeria eriopus*	Tuber	Ixosha izithunzi ezimbi ekhaya. Eyokubethela	Used to chase away evil spirit Sprinkling charm
151	*Strychnos spinosa*	Bark	Usebenza ukuthaka ishlungu sezinyoka	Treatment of snakebites

	Scientific Name	Part used	Usage (in isiZulu)	Usage (in English)
152	*Sutherlandia frutescens /Stoeba vulgaris*	Whole plant	Uthaka insizi yombhemiso Uqeda umkhuhlane	Mixture that is snorted to treat headaches through sneezing
153	*Synaptolepis kirki*	Root	Uphalaza izinsizwaa ziyoshela	Emetic for successful marriage proposals for men
154	*Talinum caffrum*	Root	Uqeda isilonda/ isishozi enganeni	Treatment of wounds
155	*Tighemia quinquenervia*	Root	Lelapha izilonda	Treatment of wounds
156	*Tulbahia ludwigiana*	Tuber	Owokugadla	Used in witch craft
157	*Turraea floribunda*	Root	Owegobongo elimhlophe	Is a mixture of plant parts that is used for the spirits called amandiki and amandawe and amadlozi (ancestors) Emetic, steaming and bathing
158	*Tylophora flanaganii*	Inner root	Owenhlanhla	Lucky charm
159	*Urginea phyodes*	Roots	Ukhipha izilwane ezinkomeni	Treatment of worms in cattle
160	*Vernonia odoensis*	Root	Uqeda izibhobo/ Owenhlanhla	Lucky charm
161	*Warburgia salutaris*	Bark	Owenhlanhla	Lucky charm
162	*Xerophyta retinervis*	Root	Uxosha umbani/ Bethela izulu	Protection against lightning
163	*Ximenia cafra (Cuuningham 1998) Harpphylum caffrum*	Bark	Owenhlanhla	Love charm
164	*Zizipus macronata /Cryptocarya latifolia*	Bark	Ulungisa idlozi	It brings a good relationship with ancestors

Uses from Hutchings (1996) and Ngwenya (2003)

Appendix 1: Questionnaire on medicinal Plants Sales in northern Zululand

A Questionnaire

On

Medicinal Plant Sales: A Case Study in Northern Zululand

By

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QUESTIONNAIRE FOR MEDICINAL PLANT SALE AND USE

The objectives of the study are a) to investigate the impact of indigenous plant harvesting by traders on the conservation status of selected species B) to identify if they are knowledge gabs that exists in the traders about the propagation techniques and thereafter educate plant trades on recent propagation techniques of certain species.

Date.....

Respondent N0.....

Name of the Interviewee.....

1. PARTICULARS OF THE AREA

Name of the bus rank.....

Name of the Location .....

2. SOCIOGRAPHIC DATA

Gender

Male	
Female	

Age

15-54	
25-34	
35-44	
45-54	
55-64	
0ver 60	

3. COLLECTING PLANTS

Where are the plants collected?

Are the plants indigenous or alien?

Is it of any concern to you where there are any seedling or not, of plants are harvesting?

Do you obtain plants from someone else who sells them to you in bulk? Yes/ no

If you obtain your plants from other people, give the ff:

Name.....

Place of residence.....

Do you discard plants after being kept for a long time without being bought (Is there a shelf life for plants in your shop?) Yes/No.

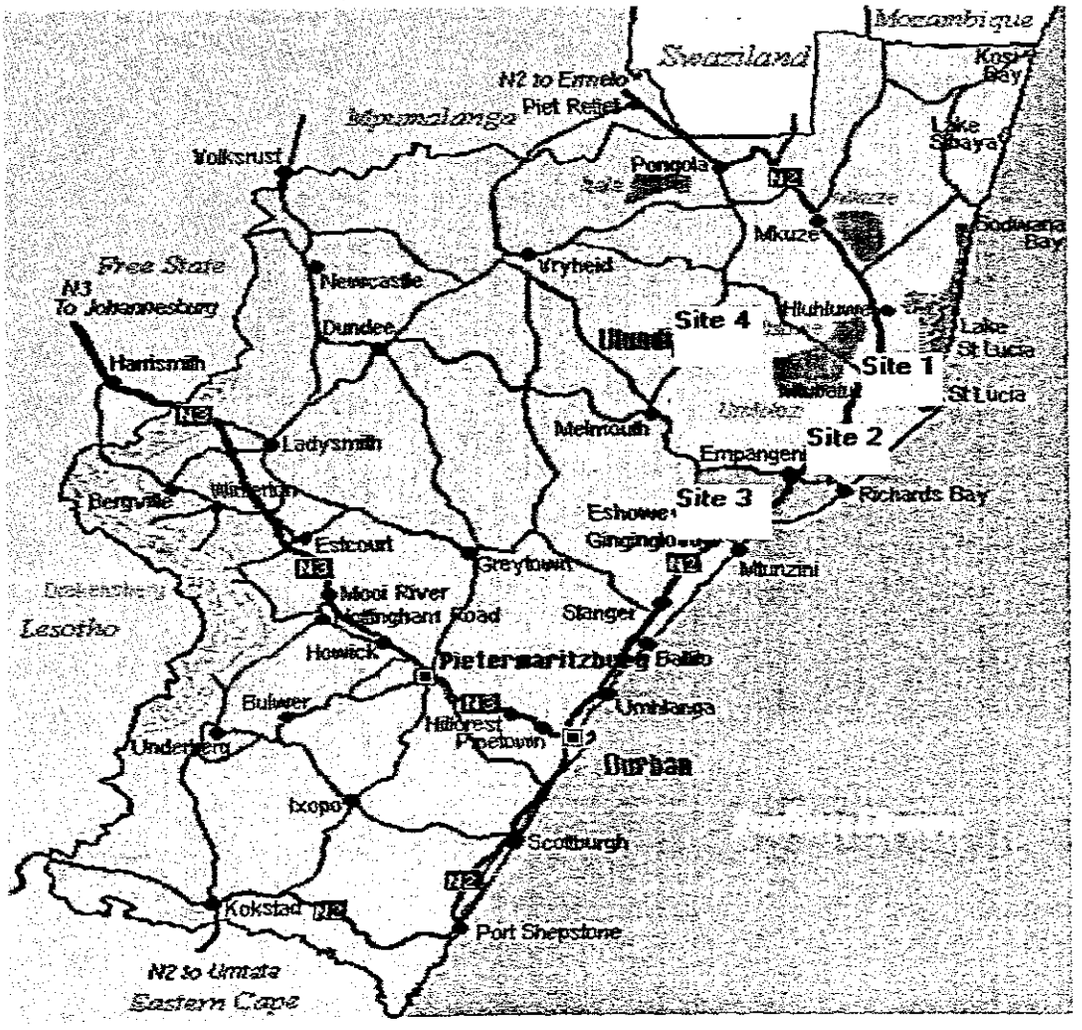
4.PRODUCTIVITY OF THE MARKET

From the above list, which specimens are dominant and not available in your shop?.

Table 1: Plant Usage

Zulu name	Part Used	Uses

Appendix 2: Study Area



Appendix 3: Cultivation and Propagation of Northern Zululand Red Data Listed Medicinal Plants

Taxa	Methods of cultivation and propagation
Alepidea amatymbica	**Propagation** From Seed: Propagation from seeds, which have a pleasant scent when rubbers colour from green to purple, then brown as they ripen and should be collected between January and May. Plant fresh seeds in a mixture of river sand and I part of bark or compost. Fresh seed germinate well starting in 2 weeks. Eight percent (80%) of seeds germinate with 9 weeks. Seedling must be watered daily, not over-fertilized. Once the two-leafed stage is reached, transfer seedlings into beds, ½ litre bags or larger frays. Vegetative: Plant that produces multiple crowns can be split and transplanted. Cultivation: seedlings do not really tolerate replanting and are easily drought stressed. Space seedlings 20cm apart in a warm place with well-drained soils and much. Provision of shade should be 30%. Water daily. Seedlings can be planted in tyres or in moisture retentive soils (e.g. with a medium high clay content). Once plants are established they are more drought tolerant, but for better production should be regularly watered. If plant shows signs of heat (yellow of leaves) apply increased shade, water and much. Organic fertilizers should be avoided, as these plants are prone to terminate activity, which can lead to ring barking and death of the plant. The plants flower after two years.
Ansella gigantea	**Propagation** Vegetative: the stem may be divided at the base and strapped to the fork of a tree. Similarly a semi-shaded deadwood trellis could be made to hold a number of plants in accessible positions. Tissue culture: plants have been produced from tissue culture using seed tissue.
Bulbine frutescens	**Propagation**

	From seed: Cut a few maturing seed-heads and hang then above a paper-lined container or place in a large paper bag. As the seeds ripen they will fall out of the seed-heads. Mix 2 parts sand and 1 part compost and place in tray. Spread the ripe seed quite sparsely over the surface of the soil. Sieve some of the soil mix through shade cloth or another sieve to lightly cover the seed. Provide about 35% shade, and water the seeds with a fine sprayer, taking care not to disturb them. Germination will start in 2to3 week, and about 80%of the seeds will grow. Seedlings grow rapidly and need to be transferred to large seedling trays with the same soil mix, or they can be planted out. Vegetative: Sometimes the fleshy leaves will divide root and stem merge. Lift plants from the ground, separate at the point where the stem and roots merge using a clean sharp blade, ensuring that each plant portion has root. Replant directly into the ground or bag in a potting soil mix [river sand and compost in equal proportion] until the plants are again firmly root. It is not advised to attempt leaf cutting of this succulent plant as these rot very quickly. Cultivation: *Bulbine* is very prone to leaf rot and infections in areas where temperatures and humidity are high. The plant is best cultivated in cooler inland regions where there is no frost. The plants should be cultivated in a deep, well-drained soil, high in organic matter. New seedlings should be planted into beds with 35% shade. Water every day for first 2 weeks. Watering can then be decreased to once every 2 days. Plants may be placed in full sun six weeks after being planted out. The leaves turn yellow when the plant is water stressed. Plant will produce seed within a year. Removing dead flower/seed-head is known to encourage flowering.
Boweia volubilis	**Propagation** From Seed: The tiny yellow-green flowers develop into a swollen 'fruit' towards the end of flowering season. These fruit turn yellow and brown as they mature and should be harvested when the fruit have turned

	yellow. A plastic sheet could be placed under the shoot when the fruits start to turn brown. As they split open tiny black seeds fall out and can be collected from the sheet. Before sowing, the soft, black seed coat and brown under layer should be removed by rubbing the seeds between your fingers until the white part is exposed. Only a small percentage of seed will germinate, so make sure you have a lot of seeds before sowing. Fresh seeds should be scattered onto the growing medium and sprinkled lightly with sand. This will help prevent the roots from pushing the plant out of the soil. Fresh seeds take about seven days to germinate. Vegetative: Bulb scales may be broken off from large bulbs at the end of the growing season (i.e. the autumn or winter) and inserted upright into sand. Bulb is will form along the base should be transplanted when large enough to handle. Cultivation: Bulbs should be planted with the top ¼ exposed above soil. A stake should be planted next to the bulb for the shoot to climb up and be supported on, or a wire trellis could be put for a number of bulbs in a cultivation plot. The bulbs should not be mulched or they will not receive light to grow and may rot. If the bulbs are planted in an open plot, the soil should not be mechanically turned over before planting, as these soil conditions result in the bulb dying out too quickly. The bulbs grow well in tyres, as the soil moisture content can be kept high enough so that the bulbs do not dry out, but not so wet that they rot.
Dioscorea dregeana	**Propagation** Collect the seed and sow it into well-drained mixture of soil and compost, and cover lightly with soil. Germination takes place about 10 days.
Diascorea sylvatica	**Propagation** From Seed: Collect the seed and remove the outer covering. Sow into a well-drained mixture of soil and compost and cover lightly with soil. Germination takes about 10 days. Leave the seedlings for a season, or until the plants are large enough to handle.

Eriospermum mackeni	**Propagation** From Seed: Collect the seeds before capsules have opened. Cut a few flower stalks with closed seeds attached. Sow seeds in trays containing two parts of sand and one part of compost. Lightly sieve some soil over seedlings. Water with fine sprayer and place in 35% shade. When seeds have germinated and seedlings have two leaves, replace in ½ litre bags containing two parts of sand and one part compost.
Haworthia limifolia	**Propagation** From Seed: A dry-off period in autumn will stress the plants slightly and stimulate the flowering process. Seeds should be harvested as soon as capsules turn a straw colour and split. Mix equal amounts of sand and vermiculite, and sprinkle the seeds over the soil surface. The seedling trays should be watered from the base to minimize disturbances, at least until the seeds have started to grow. The seeds should be planted fresh and will germinate within 7 days. Seeds are 100% viable during the first 3 weeks, thereafter viability decreases rapidly. If bottom-heated (25) nursery mist beds are available, this is the most effective way to germinate the seeds. Young seedlings appear as shiny green translucent matchheads after about 4 weeks. The roots grow quickly, and the plants reach thumb-size within a year under optimal growing conditions. Vegetative: Some form of *Haworthia* species produce long offsets. The vigorous forms should be collected for vegetative propagation. The offsets can be separated and planted out in spring. If the offsets lack roots then allow them to dry out for 3 days before planting. The new plants will produce more offsets within 2-3 years. New plants may also be grown from leaf cuttings, if these have a piece of stem attached. Water the plant from which you are going to take a cutting well. Typically, plants should be soaked once to twice a week (with watering halted over a 3-month winter-flowering rest period). Make tiny cuts into the thick skin of the stem on either side of leaf to be removed, and then carefully twist it off. Enough of the stem should still be attached to the torn off leaf

	to ensure that it roots properly. If you have access to chemicals, apply harmone powder and flowers of sulfur to the torn leaf surface (and sulfur to the mother plant). Place the leaf in a dry, shady spot for 5 days. Fill a container to ⅓ with sterilized coarse organic peat. Leave it in a warm, shay spot (80%shade) and spray once daily with a mist spray in which a little fungicide has been added. Cultivation: the plants reach the flowering size after approximately four years and grow best in bright shaded sunlight. Leaf sunburn may develop following prolonged exposure to full sun. The diameter of the leaf rosette can be expected to increase by 1cm per year with weekly watering and nutrient feeding in the spring. Plants respond well to fertilization.
Hypoxis hemerocallidea	**Propagation** From Seed: after flowering, seed capsules develop with a top cap that is released to shower out the rough, shiny dark brown seeds. Collect the seed just before the capsules open to get maximum seed from each plant. If necessary seeds should be stored in a cool, dry place (with fungicidal powder if possible, if not, use a powdered wood fire ash.) in the highveld sow the seeds in early spring (August to September). Fresh seed may be sown at any time of year in milder climes such as coastal Zululand Kwa-Zulu Natal. Viable seeds should be tested with floating in water whereby viable seeds sink. Mix two parts of sand to one part of compost (or1: 1:1 mix of quartz-rich granite gravel: coarse sand: leaf mould: compost/100% pine bark milled to ¼ inch) and put into small seed trays or open beds under cover. Place seeds in freshly boiled water, remove when cool to room temperature and sow. Bury seeds 1mm deep and cover with fine grass compost. Keep the soil moist but not wet, good ventilation and low humidity. Up to 75% germination can be expected with 3 to 8 weeks. Vegetative: the fibrous rhizomes may be lifted in late winter and cut longitudinally into two before replanting. The wound becomes covered

	by resin that seals it off from infection, although an additional dusting with 'flower of sulfur' is recommended. Cultivation: older tubers do not transplant as well as younger tubers, and are prone to insect and fungal attack. Small and medium sized bulbs grow relatively faster than large bulbs, so these smaller sizes should be planted as they yield higher returns per hectare over time.
Mondia whitei	**Propagation** From seed: this creeper is easy to grow from and can become a weed in plant nurseries. Plants should be given plenty growing space.
Ocotea bullata	**Propagation** From seed: The egg-shaped seeds must be removed from a corn-like fruit. The seeds are recalcitrant and so cannot be stored dry. Fill seedling trays with equal amounts of sand and compost. Press the seeds into the soil until flush with the soil surface. Sprinkle with soil mix until the seeds are no longer visible. Place trays in 35% shade over a heated cutting bed and water daily with fine sprayer. About 70% of the seeds will germinate within six weeks. After six months replant the seedlings into ½litre bags packed with equal amounts of sand and compost. Keep in 35% shade and replant into six litre bags the following spring. Exposure the saplings to ore sun harden them off. Two seasons later, or when the plants are 1m tall, they can be planted out. Vegetative: Take stem cutting in August and dip into rooting hormone. Place up to 8 together in a 120cm high culture pot containing lightweight aggregate stones of 2-4mm coarseness. Place the culture pot in a round tin [16cm diameter] filled to a height of 9cm with ordinary tap water [pH8.5]. Cover the tin culture pot with a protective cover to keep humidity high; and leave on the southern side of a greenhouse. Do not provide bottom heating. Change the daily. White root shoots should have developed along the stems after 10 weeks. Thereafter replace the water weekly. By November, some of the root shoots will have developed into

	roots while others turn black and stop growing. At the end of December, replant rooted cutting into ½Litre bags packed with equal amounts of sharp river sand a mix of 98% pine bark with 2% washed river sand. Return the plants to the cover for a month to acclimatize. Then move to 60% shade for a few weeks, followed by 35% shade. Investigation have shown that 'Rockwool' may be used as a viable rooting medium, with cuttings rooting after only 60days, This has been attributed to the high water-retaining properties of Rockwool,
Prunus africana	**Propagation** From seed: The fruit should be collected from the crown of the tree, or from the ground, between September and November. The seeds should be used fresh. Soak the seeds in water for 24 hours, and then wash them to remove the outer pulpy covering. Spread the washed seeds in a thin layer in an airy, shaded place to dry for no more than four hours. Fill standard seedling trays with two parts sand and one part compost. Press the seeds into the soil until flush with the surface. Sprinkle lightly with some of the soil mix until the seeds are no longer visible. Place trays in 35% shade in well aerated place (e.g. over pebbles) and water with fine sprayer. Seeds take about 4 to 6 weeks to germinate. And about 60% of the seeds will grow. Remove the seedlings after 4 to 6 months and plant into ½ litre bags packed with equal amounts of sand and compost. In the fourth year plants should have reached a height of 1m, and can then be planted out. Vegetative: Shoot-tip cuttings comprising the top 10cm of a shoot (about three nodes) should be taken in spring or summer. Remove all but ⅓ of the leaves, and cut the remaining leaves in ½. Place the cuttings in mist-house in cutting beds with underbed heating. Cuttings take 4 to 6 months to grow callus and roots. Leaves rooted planted in positions in one year reducing the amount of aerial misting as the root system develops. After this period, plant into 1½-ltre bags packed with 2 parts sand and 1 part compost. Place in 35% shade and water regularly. Expose the sapling to

	more sun to harden them off. When they reach 1cm height, they can be planted out.
Scilla natalensis	**Propagation** From seed: ripe seeds should be sawn as soon as they become available (November to January) and will germinate with 7 days. If fresh, bulbs may be divided at the base. Keep bulbs dry during winter.
Stangeria eriopus	**Propagation** From Seed: Seeds should be soaked in water overnight the outer-coated seeds. Scatter the woody seed over seedlings trays packed with a mixture of two parts of coarse sand and one part of compost. Water with fine sprayer. Place in 35% shade. Some seeds can germinate within 35 day, but other take up to 10 months. The seedlings can be transplanted into larger bags containing equal amounts of sand and compost when large enough to handle. Vegetative: the underground stem may branch into separate sections, and it is possible to split these into new plantlets. Each separate section split off must have some roots attached. These plantlets can be placed just under the soil in½ litre bags filed with equal amounts of sand and compost and then watered well.

Warbugia salutaris	**Propagation** From Seed: Soak the fruit in cold water overnight, then rub them against wire mesh to remove the hard waxy black/brown seed from the fruit, Place seeds in trays on a mixture of equal parts of sieved compost and river sand, cover lightly with the soil mix. The seeds germinate readily and start growing after about 21days. 80% of freshly collected and sown seed should grow within 2months of sowing Storage of seeds is not advised as they dry out and die. Seedling should be left in the trays until they reach 5cm in height, or the 2-leaf stage, When they may be repotted into 1½ litre bags with 1part river sand and 2parts compost, and later into six litre bags. Vegetative: Take long shoot-tip cuttings, consisting of the top 15cm length of new apical shoots, in the early morning and keep them in a bucket of water, Depending on the time of the year that the shoot-tip cuttings are taken, the tip types will vary from semi-hardwood to softwood. The harder tip cuttings work best Trim smaller cuttings (3-4nodes; 8-10cm) from the original 15cm-long tip and strip them of their lower leaves. Cut the remaining leaves in half. Place the cutting in to 5-second sprays at 10-minute intervals. It take 3to 4 months for the cuttings to take roots, About half of them will take roots. Thereafter replant them into 1½ litre bags containing 1 part river sand and 2 parts compost. Place in 35% shade and water regularly. Leaves to grow to 3 years, replanting into larger bags as needed. Place the plants in successively sunnier places to harden then off. When the saplings are 1m tall they can be planted out, The rooting period can be reduced if rooting hormones are applies, or stricter environmental control (e.g. temperature, mist-drift) is exercise at the mist bed site. The best rooting response has been noticed in March and August.

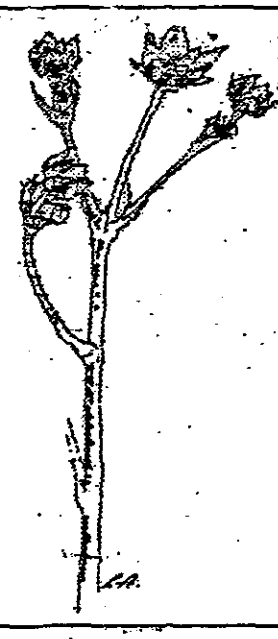
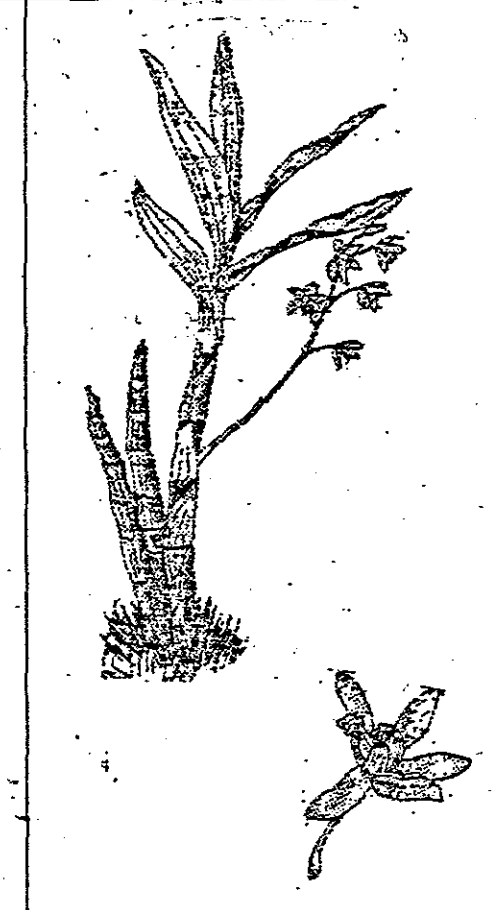
Appendix 4: Cultivation of the Medicinal Plant Species Translated in iSiZulu

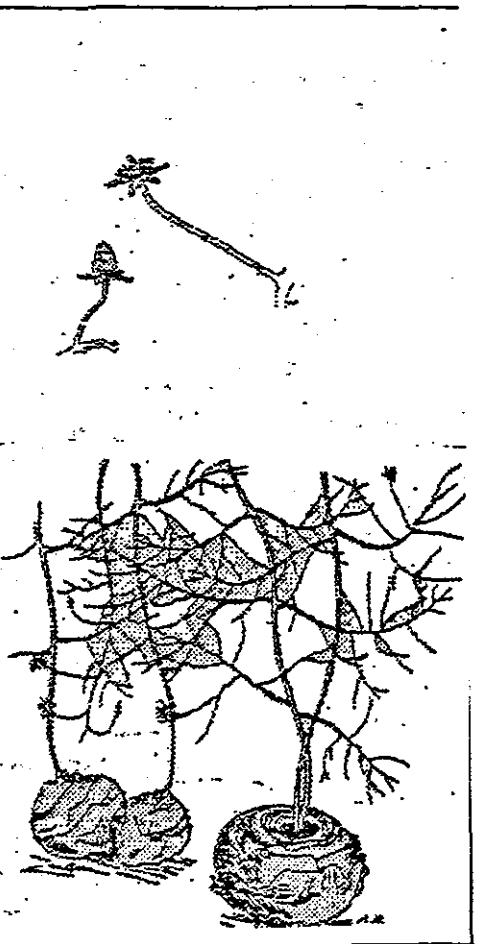
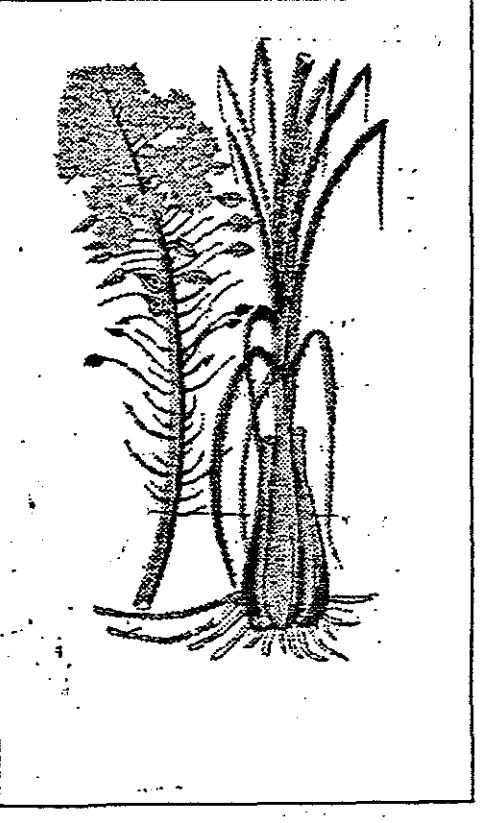
Igama lesiZulu	**Indlela yokutshala**
iKhathazo	Izinhlamvana ezibonizi Imbewu ibonakala ngokubansundu uma sezivuthiwe kumele ziqoqwe ngoMasingana. Zidinga ukutshalwa emhlabathini oyingxubevange yesihlabathi sasemfuleni nesivundisi Izinhlamvu ziqala ukuqhuma emuva kwamasonto amabili. Inani elingamashumi ayisishagalombili ayisishagalombili nanhlanu. Kufane ziniselwe zonke izinsuku bese kuqikekelwa ukuthi azifakwa kakhulu izivundisi. Uma sekuqala kuvela okungamaqabungana amabili, kumele uzitszifakwe emibhedeni noma mathileyi amakhudlwana. Noma kulabopulasitiki abangu uhhafu welitha. Singatshaleka futhi lesisihlahla ngokutshala izithombo emhlabathini owadedelayo amanzi. Shiya izikhala ezingamacentimitha angamashumi amabili ngaphakathi kwezithombo. Vumela ithunzi eliyinani elingamashumi amathathu. Uma ngabe izihlahla zikhombisa ukubaphuzi, nyusa izinga lethunzi namanzi. Ungawufaka umanyolo. Isihlahla siqhakaza emuva kweminyaka emibili
iMfe-yenkawu	Uyatshaleka ngesiqu. Uyasishoka ngezihlahlana ezomile ukuze singawi.
iBhucu	Wendlala izinhlamvu esezivuthiwe maphezulu nomhlabathi bese wemboza ngomhlabathi kancane. Lokhu ungakwenza ngokusefa inhlabathi phezu kwezinhlamvana. Beka ethunzini elingamazinga angamashumi amathathu nanhlanu. Nisela ngesipreyi esincana ugade zingaphazamiseki izithombo.Emuva kwamasonto amabili kuya kwamathathu zizoba sezimilile izithombo inani elingamashumi ayisishagalombili. As Kwesinye iskhathi singatshlwa lesisimila ngokubheka phakathi kwamaqabunga lapho kuvela khona isiqwana. Phakamisa isihlahla phezu komhlabathi bese usika lesisiqu uqikele ukuthi sisikeka nempande ngereza ebukhali. Buya usitshale sesizimele emhlabathini ohlanganiswe nesihlabathi nomanyolo. Zingasthaleka futhi izithombo emhlabathini onothile. Zibeke elangeni ngokuphele kuze kube ngamasonto ayisithupha.
uGibisila	Izimbali ezindumbile ziyakhula ngokwanele emuva kwentwasahlobo. Zibonaka ngokushinstha zibe phuzi uma sezikhulile, lapho kusuke sekufanele zivunwe.

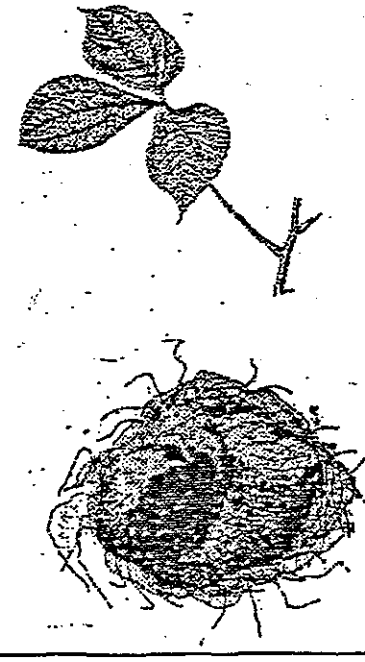
	Beka upulasitiki ngaphansi kwesimila. Uma ngabe seziqhuma, izinhlamvana ezimnyama ziyawa futhi zingaqoqeka kulowo pulasitiki okade ubekwe ngaphansi kwesihlahla. Ngaphambi kokuba kutshalwe lokhu okumbathise inhlamvu kufunaka kususwe. Zincane nokho izinhlamvu ezimilayo ngakho kumelwe zitshalwe zibe ningi. Kuthatha izinsuku eziyikhombisa ukuba izinhlamvu ziqhume Impande ingatshalwa ngokuyivelisa ikota yayo ngaphezu komhlabathi. Seka ngendukwana noma ngocingo ukuze isimila sikwazi ukukotela. Kumila kahle kumsokama ongekho manzi kakhulu futhi ongomile kakhulu.
uDakwa	Izinhlamvu zingatshalwa emhlabathini ovundile onomanyolo. Zimbozwe kancane ngenhlabathi. Ukumila kwazo kuthatha izinsuku eziyishumi.
iNgwevu	Kutshaleka ngezinhlamvu ezisuswe ikhava. Zitshalwa emhlabathini ofakwe umanyolo bese zembozwa kancane ngomhlabathi. Ukuqhuma kuthatha izinsuku eziyishumi.
uNsulansula	Tshala izinhlamvu ngaphambi kokuba imindumba ivuleke. Nquma imbali okumile kunye lemidumba. Tshala emathileyini anezingxenye ezimbili zomhlabathi engxenyeni eyodwa kamanyolo. Vuvuzela umhlabathi phezu kwezinhlamvu. Nisela ngesipreyi esinezimbobo ezincane. Beka emthunzini engamanani angamashumi amathathu nanhlanu. Uma sezimilile faka ezikhwameni ezinguhhafu welitha.
uMathithibala	Izinhlamvu zitshalwa emuva kokuba imidumbu isiqhumile. Hlanganisa isihlabathi sasemfuleni nesikhuthazo besi utshala izinhlamvu kokuzivuvuzela emhlabathini emathileyini. Nisela ngaphansi kwamathileyi ukuze zingaphazamiseki izinhlamvu kuze kube ziyamila. Ukuqhuma kuthatha izinsuku eziyisikhombisa..
iLabatheka	Qoqa izinhlamvu ngaphambi kokuba imidumbu ivuleke . ibonaka ukuthi isivuthiwe ngokuthi iveze amakepisi ngaphezulu. Izinhlamvu zona zibonakala ngokuthi zibe nsundu ngokuzothile. Tshala emathileyini ahlanganise ingxenye eyodwa yomhlabathi engengxenyeni eyodwa yesivundisi. Mboza ngotshani obuvundile bese unisela ngamanzi angemaningi. Kudinga indawo engenisa umoya nelanga. Ukumila kuthatha amasonto amathathu kuya kwamane.

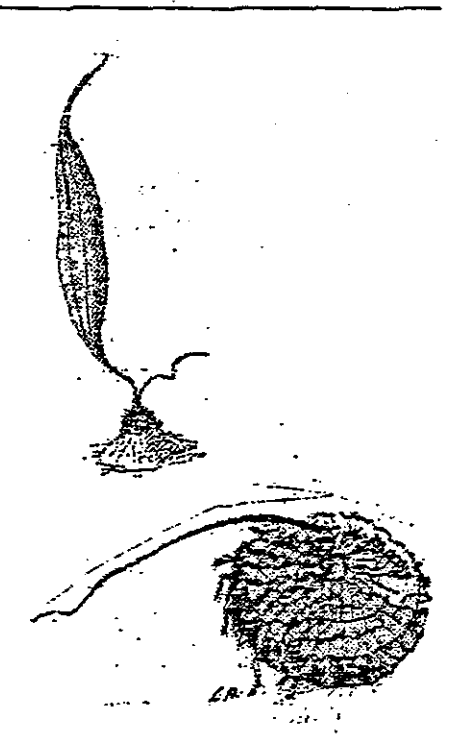
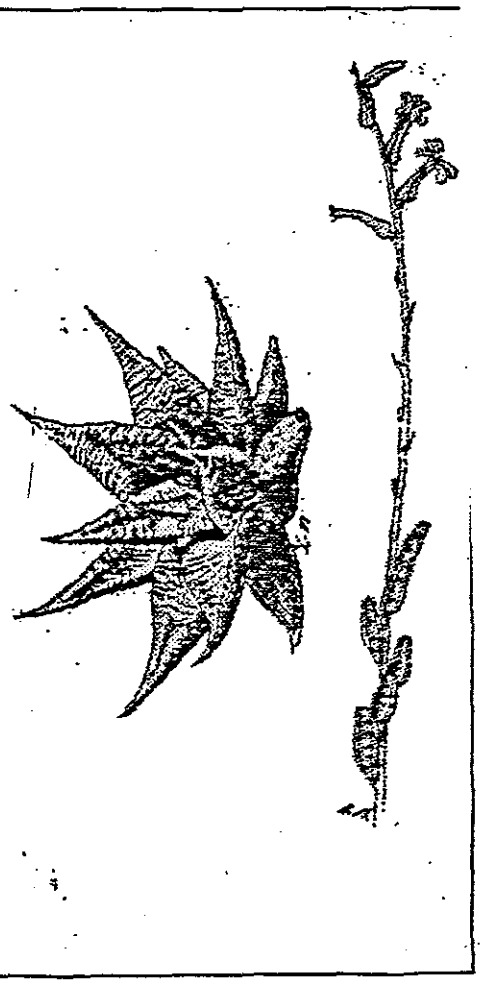
uMondi	Simila ngokutshalwa usebenzisa izinhlamvu. Sidinga indawo enkulu yokutshala.
uNukani	Izinhlamvu zikhishwa esithelweni. Gcinazela izinhlamvu emhlabathini emathileyini zize zingaveli emhlabathini. Nisela nsukuzonke ngesipuleyi esincane bese ubeka ethunzini elingamanai angamashumi amathathu nanhlanu. Kufanele isiqu sibe sesevela emasontweni ayishumi. Singatshalwa ngokusebenzisa isiqu, ngokunquma indukwana bese ifakwa emhlabathini noma kumahomoni. Nisela ngokuphelele.
iNyezangoma - elimnyama	Isithelo sitholakala esihlahleni noma emhlabathini phakathi kukaMfumfu noLwezi. Cwilisa izinhlamvu emanzini amahora angamashumi amabili nane. Susa ikhava. Zomise izinhlamvu kungaze kweqe amahora amane. Faka emathileyini ngokugcinazela izinhlamvu zize zimbozwe umhlabathi. Beka endaweni ethola umoya ngokwanele. Beka ethunzini eliyinani elingamashumi amathathu nanhlanu. Nisela ngesipreyi esincane. Kuthatha amasonto amane kuya kwayisithupha ukuze zimile.
iNguduza	Izinhlamvu ezivuthiwe zitshalwa phakathi kukaLwezi kuya kuMasingana. Ukumila kuthatha izinsuku eziyisikhombisa. Zingatshaleka futhi ngokutshala impande. Izimpande kufanele zomiswe ebusika.
iMfingo	Izinhlamvu zicwiliswa emanzini ubusuku. Ikhava kumele isuswe ngaphambi kokuba zitshalwe. Hlwanela izinhlamvu emathileyini afakwe izingxenye ezimbili zesihlabathi nengxenye eyodwa yesivundisi. Nisele ngesipreyi esincane. Beka ethunzini elingamanani angamashumi amathathu nanhlanu. Ezinye zezinhlamvu zimila ezinsukwini ezingamashumi amathathu nanhlanu kodwa ezinye zithatha izinya kuya kweziyishumi ukumila. Siyatshalwa futhi nangesiqu. Kodwa uqikele ukuthi leyongxenye yesiqu inezimpande.
iSibhaha	Cwilisa isithelo emanzini abandayo ubusuku. Sivule bese ukhipha izinhlamvu ezibonakala ngokuthi zibensundu ngokumnyama. Faka izinhlamvu emathileyini afakwe engxenyeni elinganayo yesihlabathi nesivundisi. Izinhlamvu ziqhuma ezinsukwini ezingamashumi amabili nanye. Siyatshaleka ngesithombo nangesiqu ngokusika indukwana uyitshale emhlabathini bese uyeseka.

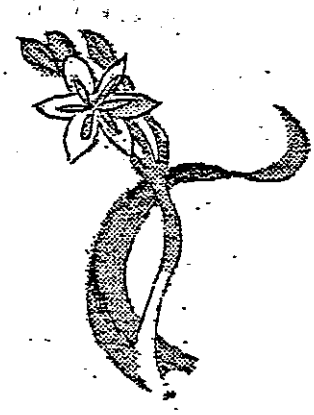
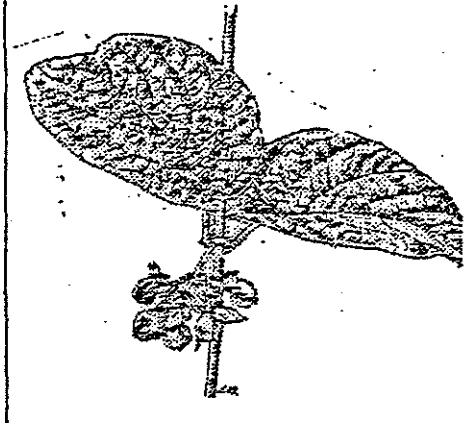
Appendix 5: Description of Medicinal that Need propagation

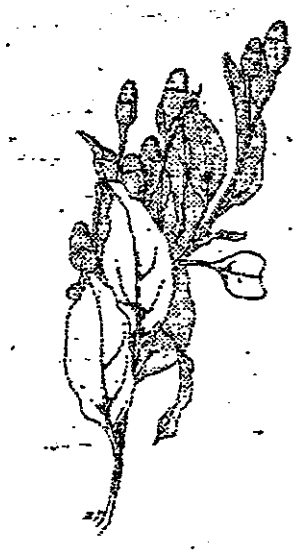
Family	Taxa	Description	Habitat	Slide/Picture
Apiaceae	*Alepedea amtymbica*	Is a small, leafy, low-growing herb (up to 2m tall). Leaf margins are hairy. The rhizome is large and dark coloured. Stems are strong grooved. While star-like flowers are produced on long stalks between December and April. The crushed plant has a carrot –like smell and will stain hands a brown-orange colour.	Found in grasslands near streams throughout KwaZulu-Natal	
Orchidaceae	*Ansella gigantea*	Is a large epiphytic orchid with curved sugarcane –like stem that are 30-60cm long. The grass-like leaves are broad and leathery. The roots point upwards at the base. Attractive arching sprays of yellow flowers (each flower is 5cm across) are produced during winter. Grows aerially on tree branches in sunny places	In warm, humid bushveld regions	

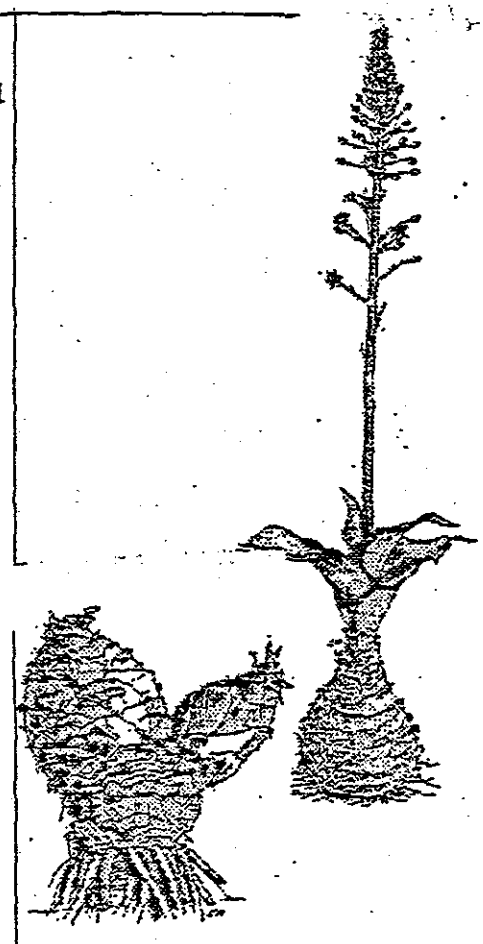
Hyacinthaceae	*Boweia volubilis*	A leafless aerial shoot emerges from the bulb and divides repeatedly, reaching a length of 2 to 3m during summer. Small yellow-green, star shaped flowers develop towards the ends of the shoot branches. The shoot dies back in winter. Black, angular, shiny seeds are formed in January and February. The only leaves produced are the bulb scales, and the climbing shoots are actually flower stalks.	In grassland, thickest forest or forest edges, often among rocks.	
Asphodelaceae	*Bulbine frutescens*	The stem branch at the base and the leaves are green and either long, narrow and cylindrical or filiform and filled with a clear gel, or they thick and fleshy, tapering to narrow tip. Clusters of golden-yellow flowers are produced on flower stalks up to 60cm tall throughout the year.	In grasslands, often on rocky slopes, thriving in both full sun and shade.	

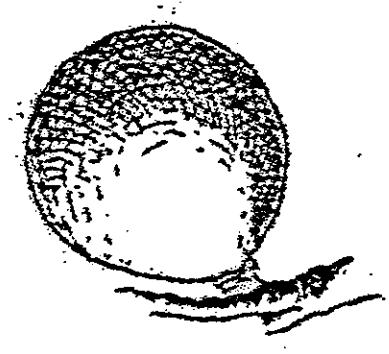
Dioscaoreaceae	*Dioscorea dregeana*	It is a creeper with green, prickly stems and three-lobed leaves. The underground tuber is large, dark and outside with a covering of fine roots. A slice into a tuber reveals a pale flesh. The male flowers are green and produced in a much-branched inflorescence. The female flowers are white and are produced on a less branched inflorescence. The plant flower from October to January. The fruit (about 40 by 25mm) is velvety and winged.	In coastal and midland forest, especially along forest margins.	
Dioscoreaceae	*Diascorea sylvatica*	Annual twining vines grow from an underground or party exposed tuber. The tuber is rough and tortoise-shell-like. The leaves are heart-shaped and taper to a thread-like tip. The small, pa-le yellow male and female flowers are found in separate flower spikes and are produced between December and April. The fruits are a characteristic yellowish-green three-winged capsule edged with a reddish-brown colour.	Coastal bush and bushveld	

Eriospermaceae	*Eriospermum mackeni*	Plants are 30-40cm tall. The tuber is round, with pink flesh. Leaves are leathery and oval, dark glossy green above, pale glossy below and deep red at the base. Yellow flower stalks are produced between October and February with yellow flowers at the top. The seeds are covered in long white hairs.	In damp grassland	
Asphodelaceae	*Haworthia limifolia*	The leaves form into a rosette and are dull green to coppery coloured, with small white raised spots. The pink flowers are produced on long stalks from the middle of the leaf rosette mainly during winter, or at any time of the year.		

Hypoxidaceae	*Hypoxis hemerocallidea*	The long, narrow, hairy leaves are clustered into three sections, and the plant can reach up 40cm high. The bulb can grow to 25-70 mm in diameter, and is covered with bristly hairs. A slice into the bulb reveals yellow flesh, which turns brown on exposure to the air. The yellow, star- shaped flowers are produced in spring to autumn. Up to 16 flowers are produced per flower stalk, which open at first light and close at midday.		
Periplocaceae	*Mondia whitei*	The creeper has a twining stem, which exudes a milky substance when cut. The leaves are large with stiff, four-pronged stipules between opposite pairs. The roots are aromatic, smelling of vanilla. Flowers are produced in branched inflorescence between November and February. The flowers are purple red inside with purple, horn-like appendage arising from the middle. The seedpods are characteristic – looking like crab's open pincers.	In forest and riverine woodland	 

Lauraceae	*Ocotea bullata*	A tall evergreen tree (10-20m). Young bark is smooth and grey, beautifully marked with pink mauve. Mature bark is dark brown and scaly. The large, glossy, dark, green leaves are irregularly shaped and aromatic. Two or more raised hallow' pockets' occur in the axils of the veins under the leaf. Small bunched sprays of yellow-green flowers are produced near the tips of the branches between January and May. The green fruit look like miniature acorns (10-20mm long)., turning purple when ripe (February to June). The seeds are eaten by insects, birds and animals and so can be hard to find. The Plant coppice if the main stem is damaged, producing a sheath of young shoots around the old dead trunk	In moist evergreen forest	
Rosaceae	*Prunus africana*	An evergreen tree with a weeping form, up to 20m tall. The bark is rough, dark-brown and smells bitter when crushed. The leaves are smooth shiny with pink stalks. Trees mature about seven years of age, thereafter producing small, green-white like, fragrant flowers in short sprays through summer and autumn. The fruit is produced during spring and round (10mm diameter),	Found in evergreen forest	

Hyacinthaceae	*Scilla natalensis*	Fast growing bulbous plant with a tall (1m) arching stalk. In its natural habitat the bulbs are often at the least half exposed revealing the papery dark brown bulb scales. Bulbs range from 100-200mm in diameter, with only few broad to rapidly tapering, erect grey-green leaves. Attractive blue flowers appear on the long flower stalks from September to December, normally before the leaves are fully-grown.	On clifs near water, near water falls and rocky out crops. Occassionally found in coastal grassland.	
Stangeriaceae	*Stangeria eriopus*	Newly sprouting leaves are covered in velvety hair. The stem is underground with large elongated tuberous roots. Separate male and female seed cones are produced. Female cones are longer and larger the male cones, and bear rounded red seeds.	Grassland and forest	

Cannellaceae	*Warbugia salutaris*	A shrub to medium-sized tree (4-8m). The main stem is short. The bark is shiny, brown and with rough, longitudinal marks, becoming cracked and darker brown with age. There are long, lax branchlets with raised, corky dots. The leaves are long and narrow with gland dots and an obvious yellow-green mid rib. Barks and leaves taste peppery/burry. Single cream-green flowers appear during April and May. Waxy green berry fruits are produced between October and December and turn purple on ripening. Plants are found in bushveld and forest in Zululand (KwaZulu-Natal). Also found in Gauteng and Mpumalanga, Swaziland, Mozambique and tropical Africa (where it can reach up to 43m high in forest). The various attentions of fruit files and monkeys make harvesting of viable seed extremely challenging. It may be necessary to cover the seeding trees with netting to prevent monkeys from eating the fruits.	. Plants are found in bushveld and forest in Zululand (KwaZulu-Natal). Also found in Gauteng and Mpumalanga, Swaziland, Mozambique and tropical Africa (where it can reach up to 43m high in forest).	 

Appendix 6: Planning of a Workshop
Programme of the Day

University of Zululand
Faculty of Education
Department of Comparative and Science Education

PROGRAMME OF THE DAY

Programme director:	Mrs B. G. Nene (the researcher)
Duration of the workshop:	6 hours
Words of Welcome and Welcome:	Dr. ET Dlamini (10 minutes)
Establishing common understanding of the workshop:	Dr. A Zobolo (10 minutes)
Keynote Speaker:	Mr.WL. Mngoma / Mrs. P. N. Mhlongo (30 minutes)

Topic: Sustainable harvesting of Medicinal Plants

Questions about plant propagation programmes:	Dr. E. T. Dlamini, Dr. A. Zobolo, Mrs Nene and the medicinal plant sellers (20 minutes)
Demonstration of medicinal plants using plants raised in the University of Zululand Botany nursery:	Mrs. Nene (30 minutes)

Tea Break (20 minutes)

Presentation about propagation techniques and cultivation:	Medicinal plant sellers (1h20) (each person 20 minutes.)
Presentation on how to propagate and cultivate samples of plant species:	Mrs. Nene (1hour).

Lunch (40 Minutes)

Recommendations and Way forward with the interviewees :	Mrs. Nene, Dr. ET Dlamini, Dr. A Zobolo, Mr. Mngoma and the medicinal plant sellers (30 Minutes)
Closure and word of thanks :	Dr. E. T. Dlamini and Dr. A. Zobolo (30 minutes)

Activities

1. Questions about cultivation, propagation of medicinal plants in a red data lists.
2. Demonstration of the plants by participants using plant samples or pictures.
3. A presentation on how to propagate and cultivate each plant species.
4. Recommendations and way forward

Budget

Transport

Unizul – Jozini (400km x R, 2,38)	=	952, 00
Unizul – Nongoma (390km X R, 2,38)	=	928, 20
		1, 880, 20
Tea – (30pple x R, 15.00)	=	450, 00
Lunch – (50people x R, 50.00)	=	1, 500, 00
Photocopying of learning material	=	250, 00
Hiring of video services	=	500, 00
Total	=	**4, 580, 00**

Solicitation of funds to run the workshop.

Introduction: To run a good workshop one needs funds in order to make sure that activities take place as planned. A motivation was written to the assistant vice rector community projects to the effect that as a researcher. I had established that there was unsustainable harvesting of medicinal plants as an ethically responsible researcher. I had a responsibility to run a workshop to discuss issues of sustainable harvesting of medicinal plants as well as the issue of assisting the medicinal plant sellers to think how they could transform their trade into a flourishing sustainable and profitable business. The budget below was submitted and honourred by the community projects committee. The workshop took on the 4th December 2005.

P. O. Box 30, internal mail
University of Zululand
Kwadlangezwa
3886
14 November 2005

Dear Sir

Re: Invitation to be a Guest Speaker in an Environmental Education Workshop (04/12/2005)

You are kindly invited to give a key note address to an environmental education workshop which will be held for medicinal plant sellers of northern Zululand.

The workshop is required as an aspect in the completion of a dissertation of environmental education masters programme by Ms. B. G. Ndawonde (student no.981486) at the University of Zululand. The title of the dissertation is **Medicinal Plant Sales: A case study in northern Zululand.** The programme is offered by Dr. E. T. Dlamini of University of Zululand, Department of Comparative and Science Education

The workshop will be based on discussion, sharing and exchange of information with medicinal plant traders about propagation of medicinal plant species and sustainability issues affecting their trade. You are requested to perform the task as they appear in the programme.

Kindly receive the following documents herein:-

1. Programme of the day
2. The copies of presentation

Yours Faithfully
B. G. Ndawonde

P. O. Box 30, internal mail
University of Zululand
Kwadlangezwa
3886
14 November 2005

Dear Madam

Re: Invitation to Participate in an Environmental Education Workshop (04/12/2005)

You are kindly invited to participate in an environmental education workshop which will be held for medicinal plant sellers of northern Zululand.

The workshop is required as an aspect in the completion of a dissertation of environmental education masters programme by Ms. B. G. Ndawonde (student no.981486) at the University of Zululand. The title of the dissertation *is* **Medicinal Plant Sales: A case study in northern Zululand.** The programme is offered by Dr. E. T. Dlamini of University of Zululand, Department of Comparative and Science Education

The workshop will be formally establishing partnership between the University of Zululand and the medicinal plant sellers of northern KwaZulu-Natal. There will also be also information sharing about propagation of medicinal plant species and sustainability issues affecting their trade. You are requested to perform the task as they appear in the programme.

Kindly receive the following documents herein:-

3. Programme of the day
4. The copies of presentation

Yours Faithfully
B. G. Ndawonde

Appendix 7: History of the Medicinal Plants of the north of KwaZulu-Natal, whether they are indigenous or alien plant species

	Scientific Names	Indigenous/Alien
1	*Acacia caffra*	√
2	*Acacia xanthophloea*	√
3	*Acaia robusta*	√
4	*Acorus calamus*	√
5	*Acridocarpus natalitius*	√
6	*Adenia gummifera*	√
7	*Albizia adianthifolia*	√
8	*Albuca fastigiata*	√
9	*Albuca sp.*	√
10	*Alepidea amatymbica*	√
11	*Aloe candelabrum*	√
12	*Aloe species*	√
13	*Ammocharis coranica*	√
14	*Andrachne ovalis*	√
15	*Anemone caffra*	√
16	*Annona senegalensis*	√
17	*Ansellia africana*	√
18	*Anthospermum rigidum*	√
19	*Aptenia cordifolia*	√
20	*Aster bakerianus*	√
21	*Ballanites maughamii*	√
22	*Bauhinia bowkeri*	√
23	*Bersama swinnyi*	√
24	*Boerhavia diffusa*	√
25	*Boophane elisticha*	√
26	*Boweia volubilis*	√
27	*Bulbine frutescens*	√
28	*Callilepis laureola*	√
29	*Calodendrum capense*	√
30	*Capparis brassii*	√
31	*Capparis tomentosa*	√
32	*Cassine transvaalensis*	√
33	*Cassipourea gerrardii*	√
34	*Cassipourea malosana*	√
35	*Celosia trigyna*	√
36	*Cepharia humilis*	√
37	*Cereus peruvianus*	√
38	*Chlorophytum modestum*	√

	Scientific Names	Indigenous/Alien
39	*Cinnamomum camphora*	X
40	*Clerodendrum triphyllum*	√
41	*Clivia miniata*	√
42	*Combretum kraussii*	√
43	*Convolvulus farinosus*	√
44	*Corchorus asplenifolius*	√
45	*Crinum macowanni*	√
46	*Crocosmia aurea*	√
47	*Croton gratissimus*	√
48	*Croton sylvaticus*	√
49	*Cryptocarya latifolia*	√
50	*Crytanthus breviflorus*	√
51	*Cucumis myriocarpus*	√
52	*Cunonia capensis*	√
53	*Curtisia dentata*	√
54	*Cyanotis speciosa*	√
55	*Cymbopogon marginatus*	√
56	*Cyperus sexangularis*	√
57	*Dianthus zeyheri*	√
58	*Dioscorea degreana*	√
59	*Dioscorea sylvatica*	√
60	*Dombeya rotundifolia*	√
61	*Drimia robusta*	√
62	*Ekebergia capensis*	√
63	*Elephantorrhiza elephantina*	√
64	*Encephalartos altensteinii*	√
65	*Encephalartos sp.*	√
66	*Eragrostis plana*	√
67	*Eriosema cordatum*	√
68	*Eroispermum mackenii*	√
69	*Erythrophleum lasianthum*	√
70	*Eucomis autumnalis*	√
71	*Eucomis sp. Cf. Bicolor*	√
72	*Eulophia petersii*	√
73	*Euphobia cooperi*	√
74	*Faurea salinga*	√
75	*Gardenia thunbergii*	√
76	*Gnidia burchellii*	√
77	*Gnidia kraussiana*	√
78	*Gunnera perpensa*	√
79	*Haemanthus albiflos*	√
80	*Harpephyllum caffrum*	√
81	*Haworthia limifolia*	√

	Scientific Names	Indigenous/Alien
82	*Helinus integrifolius*	√
83	*Hermannia depressa*	√
84	*Hippobromus pauciflorus*	√
85	*Huernia spp.*	√
86	*Hybanthus enneaspermus*	√
87	*Hydrost sp.*	√
88	*Hypoxis gerrardii*	√
89	*Hypoxis hemerocallidea*	√
90	*Indigoferra frutescens*	√
91	*Justica flava*	√
92	*Kniphofia uvaria*	√
93	*Knowltonia bracteata*	√
94	*Lagenaria sphaerica*	√
95	*Ledebouria cooperi*	√
96	*Loranthus quinquenervius*	√
97	*Lotononis corymbosa*	√
98	*Loxostylis alata*	√
99	*Maesa lanceolata*	√
100	*Maytenus undata*	√
101	*Monanthotaxis caffra*	√
102	*Mondia whitei*	√
103	*Myrothamnus flabellifolious*	√
104	*Myrothamnus flabellifolius*	√
105	*Nymphaea nouchali*	√
106	*Ocotea bullata*	√
107	*Olinia radiata*	√
108	*Olinia ventosa*	√
109	*Pentanisia prunelloides*	√
110	*Phytolacca dioica*	√
111	*Platycarpha glomerata*	√
112	*Plectranthus hadiensis*	√
113	*Podocarpus falcatus*	√
114	*Portulaca quadrifidia*	√
115	*Printzia pyrifolia*	√
116	*Protorhus longifolia*	√
117	*Psoralea pinnata*	√
118	*Ptaeroxylon obliquum*	√
119	*Pterocelastrus echinatus*	√
120	*Pyrenacanthia scandens*	√
121	*Ranunculus multifidus*	√
122	*Rauvolfia caffra*	√
123	*Ricinus communis*	X
124	*Rubia cordifolia*	√

	Scientific Names	Indigenous/Alien
125	*Salacia leptoclada*	√
126	*Salogo sp.*	√
127	*Sarcophyte sanguinea*	√
128	*Scabiosa columbaria*	√
129	*Scilla natalensis*	√
130	*Sclerocarya birrea*	√
131	*Secamone gerrardii*	√
132	*Senecio serratuliodes*	√
133	*Senecio speciosus*	√
134	*Solanum aculeastrum*	√
135	*Species 1*	√
136	*Species 9*	√
137	*Species 13*	√
138	*Species 11*	√
139	*Species 2*	√
140	*Species 3*	√
141	*Species 4*	√
142	*Species 5*	√
143	*Species 6*	√
144	*Species 7*	√
145	*Species 12*	√
146	*Species 10*	√
147	*Species 8*	√
148	*Stangeria eriopus*	√
149	*Strychnos spinosa*	√
150	*Sutherlandia frutescens*	√
151	*Synaptolepis kirkii*	√
152	*Talinum caffrum*	√
153	*Teghemia quinquinerva*	√
154	*Tulbahia ludwigiana*	√
155	*Turraea floribunda*	√
156	*Tylophora flanaganii*	√
157	*Urginea physodes*	√
158	*Urginea sanguinea*	√
159	*Vernonia odoensis*	√
160	*Warburgia salutaris*	√
161	*Xerophyta retinervis*	√
162	*Ximenia caffra*	√
163	*Ziziphus mucronata*	√

Key: **√-Indigenous**
X-Alien